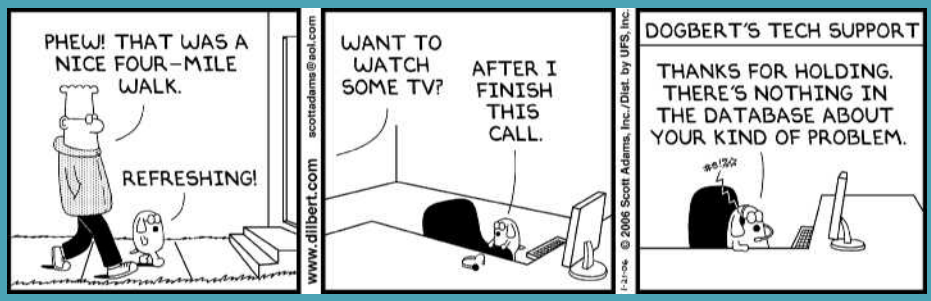
PHASE 5 SYSTEMS SUPPORT AND SECURITY

DELIVERABLE

An operational system that is properly maintained, supported, and secured

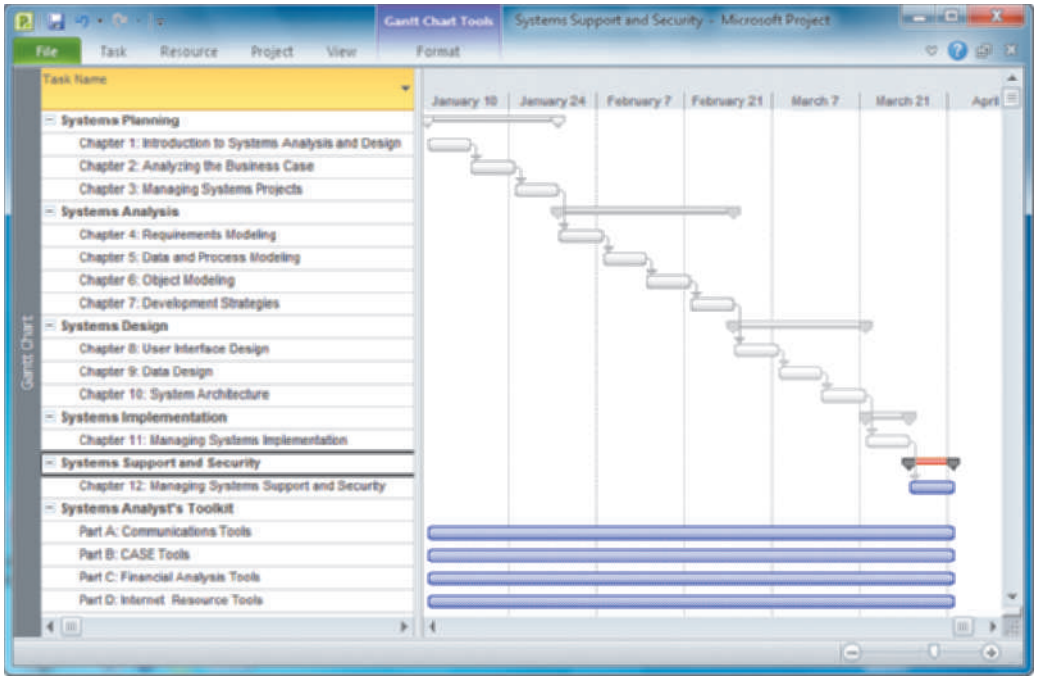
TOOLKIT SUPPORT

Primary tools: Communications, CASE, and financial analysis tools



As the Dilbert cartoon suggests, users want prompt support, but they might not always receive it. Unhappy users do not bode well for system success. You will learn more about effective user support in this phase.

Systems support and security is the final phase in the systems development life cycle. In the previous phase, systems implementation, you delivered a functioning system. Now, you will support and maintain the system, handle security issues, protect the integrity of the system and its data, and be alert to any signs of obsolescence. The deliverable for this phase is an operational system that is properly maintained, supported, and secured.



CHAPTER 12 Managing Systems Support and Security

Chapter 12 describes systems support and security tasks that continue throughout the useful life of the system. In addition to user support, this chapter discusses maintenance, security, backup and disaster recovery, performance measurement, and system obsolescence.

INTRODUCTION

OBJECTIVES

When you finish this chapter, you will be able to:

- Explain the systems support and security phase
- Describe user support activities, including user training and help desks
- Define the four types of maintenance
- Explain various techniques for managing systems maintenance and support
- Describe techniques for measuring, managing, and planning system performance
- Explain risk management concepts
- Assess system security at six levels: physical security, network security, application security, file security, user security, and procedural security
- Describe backup and disaster recovery
- List factors indicating that a system has reached the end of its useful life
- Assess future challenges and opportunities for IT professionals
- Develop a strategic plan for career advancement and strong IT credentials

Managing systems support and security involves three main concerns: user expectations, system performance, and security requirements.

A systems analyst is like an internal consultant who provides guidance, support, and training. Successful systems often need the most support because users want to learn the features, try all the capabilities, and discover how the system can help them perform their tasks. In most organizations, more than half of all IT department effort goes into supporting existing systems.

This chapter begins with a discussion of systems support, including user training and help desks. You will study the four main types of maintenance: corrective, adaptive, perfective, and preventive. You also will learn how the IT group uses maintenance teams, configuration management, and maintenance releases, and you will examine system performance issues and maintenance tools. You will analyze the security system at each of the six security levels: physical security, network security, application security, file security, user security, and procedural security. You will also learn about data backup and recovery issues. Finally, you will learn how to recognize system obsolescence, and about some of the challenges and opportunities you are likely to face as an IT professional.

Chapter Introduction Case: Mountain View College Bookstore

Background: Wendy Lee, manager of college services at Mountain View College, wants a new information system that will improve efficiency and customer service at the three college bookstores.

In this part of the case, Tina Allen (systems analyst) and David Conroe (student intern) are talking about operation, support, and security issues for the new system.

Participants: Tina and David
Location: Tina's office, Friday afternoon, March 30, 2012
Project status: Tina and David successfully implemented the bookstore information system. Now they will discuss strategies for supporting, maintaining, and securing the new system.
Discussion topics: Support activities, training, maintenance, techniques for managing systems operation, enhancing system performance and security, and detecting system obsolescence

Tina: Well, we finally made it. The system is up and running and the users seem satisfied. Now we focus on supporting the system, ensuring that it delivers its full potential, and is properly secured and protected.

David: *How do we do that?*

Tina: First, we need to set up specific procedures for handling system support and maintenance. We'll set up a help desk that will offer user training, answer technical questions, and enhance user productivity.

David: *Sounds good. I'll set up a training package for new users who missed the initial training sessions.*

Tina: That's fine. You also should learn about the four types of maintenance. Users typically ask for help that requires corrective maintenance to fix problems or adaptive maintenance to add new features. As IT staff, we will be responsible for perfective maintenance, which makes the system more efficient, and preventive maintenance to avoid problems.

David: *Anything else for us to do?*

Tina: Yes, we'll need a system for managing maintenance requests from users. Also, we'll need to handle configuration management, maintenance releases, and version control. These tools will help us keep the system current and reduce unnecessary maintenance costs.

David: *What about keeping tabs on system performance issues?*

Tina: That's important, along with capacity planning to be sure the system can handle future growth.

David: *What about system security?*

Tina: Good question. We'll look at physical security, network security, application security, file security, user security, and procedural security. We'll also look at backup and disaster recovery issues.

David: *Sounds like we'll be busy for quite a while.*

Tina: Well, that depends on the system itself and user expectations. Every system has a useful life, including this one. We'll try to get a good return on our investment, but we'll also watch for signs of obsolescence. Here are some tasks we can work on:

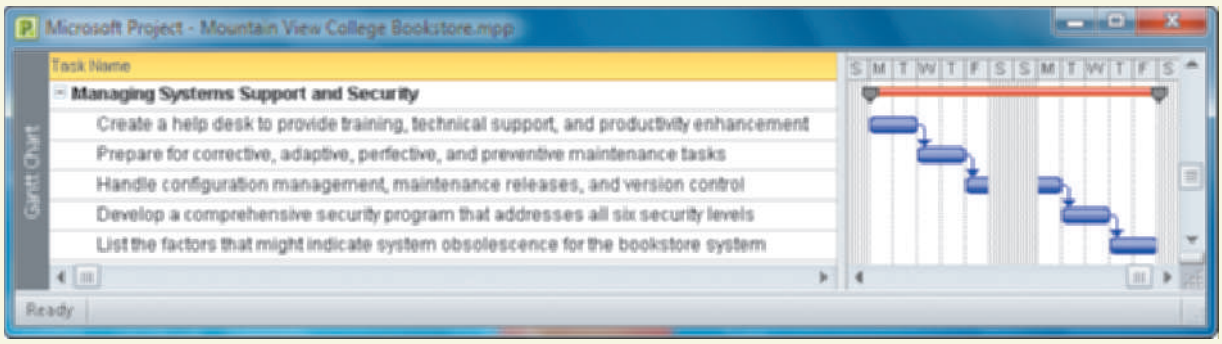


FIGURE 12-1 Typical systems support and security task list.

Overview

The systems support and security phase begins when a system becomes operational and continues until the system reaches the end of its useful life. Throughout the development process, the objective has been to create an information system that is efficient, easy to use, and affordable. After delivering the system, the IT team focuses on support and maintenance tasks.

The first part of this chapter covers four main topics. You will learn how to provide user support, maintain the system, manage the maintenance process, and handle system performance issues.

User Support

Companies provide user support in many forms, including user training and a help desk to provide technical support and assistance.

User Training

In Chapter 11, you learned about initial training that is performed when a new system is introduced. Additionally, new employees must be trained on the company's information systems. For example, a firm that produces electronic assemblies must train its new employees, as shown in Figure 12-2.

If significant changes take place in the existing system or if a new version is released, the IT department might develop a **user training package**. Depending on the nature of the changes, the package could include online support via e-mail, a special Web site, a revision to the user guide, a training manual supplement, or formal training sessions. Training users about system changes is similar to initial training. The main objective is to show users how the system can help them perform their jobs.

FIGURE 12-2 Whether a company is training manufacturing technicians, data entry personnel, or customer service representatives, employees need high-quality instruction to perform their jobs efficiently.

Help Desks

As systems and data structures become more complex, users need constant support and guidance. To make data more accessible and to empower users, many IT departments create help desks. A **help desk** is a centralized resource staffed by IT professionals who provide users with the support they need to do their jobs. A help desk has three main objectives: Show people how to use system resources more effectively, provide answers to technical or operational questions, and make users more productive by teaching them how to meet their own information needs. A help desk often is called an **information center** (**IC**) because it is the first place users turn when they need information or assistance.

A help desk does not replace traditional IT maintenance and support activities. Instead, help desks enhance productivity and improve utilization of a company's information resources.

Help desk representatives need strong interpersonal and technical skills plus a solid understanding of the business, because they interact with users in many departments.

ON THE WEB

To learn more about help desks, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for this chapter, and locate the Help Desk link.

A help desk should document carefully all inquiries, support tasks, and activity levels. The information can identify trends and common problems and can help build a technical support knowledge base.

A help desk can boost its productivity by using **remote control software**, which allows IT staff to take over a user's workstation and provide support and troubleshooting. Popular examples of remote control software include Microsoft System Center Configuration Manager and DameWare Mini Remote Control.

During a typical day, the help desk staff member shown in Figure 12-3 might have to perform the following tasks:

FIGURE 12-3 A help desk, also called an information center (IC), provides guidance and assistance to system users. When a user contacts a help desk, the response should be prompt and effective.

- Show a user how to create a data query or report that displays specific business information
- Resolve network access or password problems
- Demonstrate an advanced feature of a system or a commercial package
- Help a user recover damaged data
- Offer tips for better operation
- Explain an undocumented software feature
- Show a user how to use Web conferencing
- Explain how to access the company's intranet or the Internet
- Assist a user in developing a simple database to track time spent on various projects
- Answer questions about software licensing and upgrades
- Provide information about system specifications and the cost of new hardware or software
- Recommend a system solution that integrates data from different locations to solve a business problem
- Provide hardware support by installing or reconfiguring devices such as scanners, printers, network cards, wireless devices, optical drives, backup devices, and multimedia systems
- Show users how to maintain data consistency and integrity among a desktop computer, a notebook computer, and a handheld computer or smart phone
- Troubleshoot software issues via remote control utilities

In addition to functioning as a valuable link between IT staff and users, the help desk is a central contact point for all IT maintenance activities. The help desk is where users report system problems, ask for maintenance, or submit new systems requests. A help desk can utilize many types of automated support, just as outside vendors do, including e-mail responses, on-demand fax capability, an online knowledge base, frequently asked questions (FAQs), discussion groups, bulletin boards, and automated voice mail. Many vendors now provide a live chat feature for online visitors. For example, as shown in Figure 12-4 on the next page, Dell invites its customers to chat interactively with a tech support person.

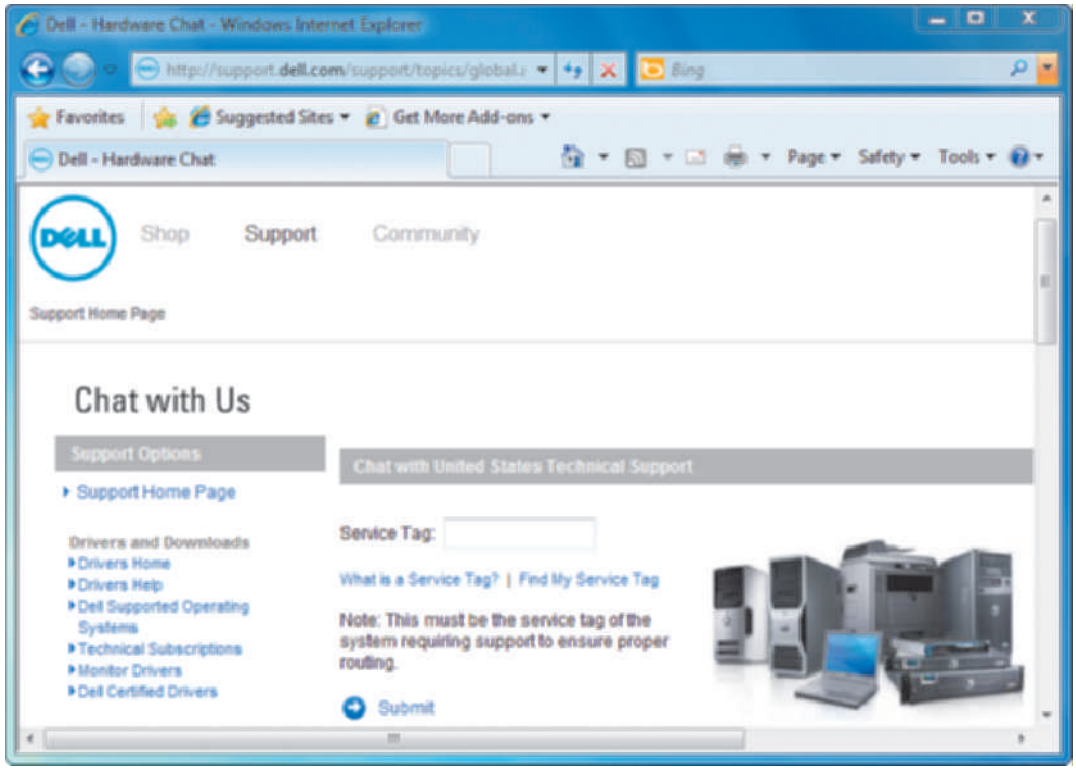


FIGURE 12-4 On its support site, Dell offers a variety of technical information and support options for customers.

Outsourcing Issues

As you learned in Chapter 7, many firms outsource various aspects of application development. This trend also includes outsourcing IT support and help desks. As with most business decisions, outsourcing has pros and cons. Typically, the main reason for outsourcing is cost reduction. Offshore call centers can trim expenses and free up valuable human resources for product development.

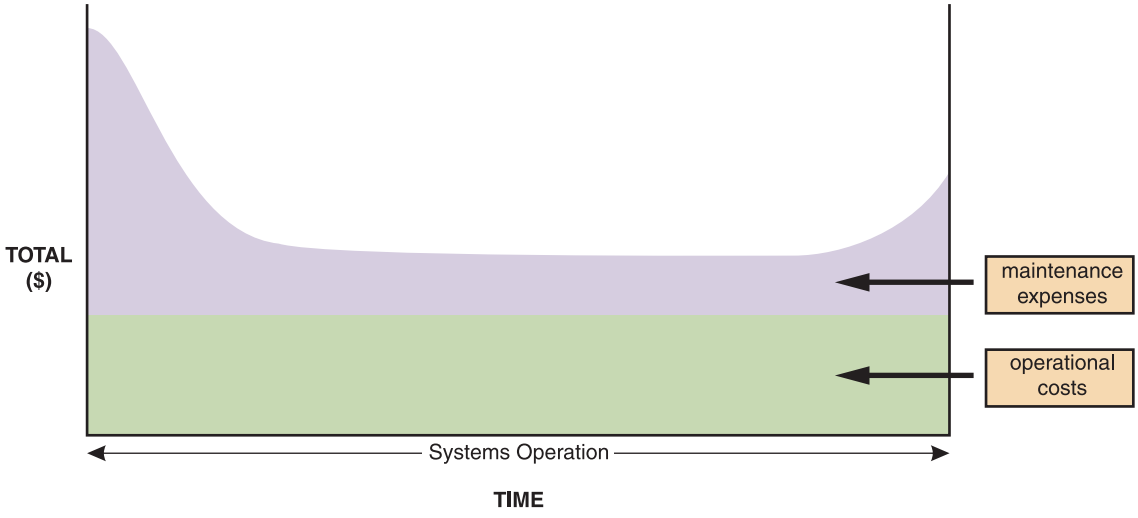
However, firms have learned that if tech support quality goes down, customers are likely to notice, and might shop elsewhere. Critical factors might include phone wait times, support staff performance, and online support tools. The real question is whether a company can achieve the desired savings without endangering its reputation and customer base. Risks can be limited, but only if a firm takes an active role in managing and monitoring support quality and consistency.

Maintenance Tasks

The systems support and security phase is an important component of TCO (total cost of ownership) because ongoing maintenance expenses can determine the economic life of a system.

Figure 12-5 shows a typical pattern of operational and maintenance expenses during the useful life of a system. **Operational costs** include items such as supplies, equipment rental, and software leases. Notice that the lower area shown in Figure 12-5 represents fixed operational expenses, while the upper area represents maintenance expenses.

Maintenance expenses vary significantly during the system's operational life and include spending to support maintenance activities. **Maintenance activities** include changing programs, procedures, or documentation to ensure correct system performance; adapting the system to changing requirements; and making the system operate more efficiently. Those needs are met by corrective, adaptive, perfective, and preventive maintenance.



TOOLKIT TIME

The Financial Analysis tools in Part C of the Systems Analyst's Toolkit can help you analyze and manage maintenance costs, and determine when a system is reaching the end of its useful life. To learn more about these tools, turn to Part C of the four-part Toolkit that follows Chapter 12.

FIGURE 12-5 The total cost of operating an information system includes operational and maintenance costs. Operational costs (green) are relatively constant, while maintenance expenses (purple) vary over time.

Although some overlap exists, four types of maintenance tasks can be identified, as shown by the examples in Figure 12-6. **Corrective maintenance** is performed to fix errors, **adaptive maintenance** adds new capability and enhancements, **perfective maintenance** improves efficiency, and **preventive maintenance** reduces the possibility of future system failure. Some analysts use the term *maintenance* to describe only corrective maintenance that fixes problems. It is helpful, however, to view the maintenance concept more broadly and identify the different types of tasks.

Maintenance expenses usually are high when a system is implemented because problems must be detected, investigated, and resolved by corrective maintenance. Once the system becomes stable, costs usually remain low and involve minor adaptive maintenance. Eventually, both adaptive and perfective maintenance activities increase in a dynamic business environment.

Near the end of a system's useful life, adaptive and corrective maintenance expenses increase rapidly, but perfective maintenance typically decreases when it becomes clear that the company plans to replace the system. Figure 12-7 on the next page shows the typical patterns for each of the four classifications of maintenance activities over a system's life span.

Examples of Maintenance Tasks

Corrective Maintenance
- Diagnose and fix logic errors
- Replace defective network cabling
- Restore proper configuration settings
- Debug program code
- Update drivers
- Install software patch

Adaptive Maintenance
- Add online capability
- Create new reports
- Add new data entry field to input screen
- Install links to Web site
- Create employee portal

Perfective Maintenance
- Install additional memory
- Write macros to handle repetitive tasks
- Compress system files
- Optimize user desktop settings
- Develop library for code reuse
- Install more powerful network server

Preventive Maintenance
- Install new antivirus software
- Develop standard backup schedule
- Implement regular defragmentation process
- Analyze problem report for patterns
- Tighten all cable connections

FIGURE 12-6 Corrective maintenance fixes errors and problems. Adaptive maintenance provides enhancements to a system. Perfective maintenance improves a system's efficiency, reliability, or maintainability. Preventive maintenance avoids future problems.

Corrective Maintenance

Corrective maintenance diagnoses and corrects errors in an operational system. To avoid introducing new problems, all maintenance work requires careful analysis before making changes. The best maintenance approach is a scaled-down version of the SDLC itself, where investigation, analysis, design, and testing are performed before implementing

	Immediately After Implementation	Early Operational Life	Middle Operational Life	Later Operational Life
Corrective Maintenance	High	Low	Low	High
Adaptive Maintenance (Minor Enhancements)	None	Medium	Medium	Medium
Adaptive Maintenance (Major Enhancements)	None	None	Medium to High	Medium to High
Perfective Maintenance	Low	Low to Medium	Medium	Low
Preventive Maintenance	Low	Medium	Medium	Low

FIGURE 12-7 Information systems maintenance depends on the type of maintenance and the age of the system.

any solution. Recall that in Chapter 11 you learned about the difference between a test environment and an operational environment. Any maintenance work that could affect the system must be performed first in the test environment, and then migrated to the operational system.

IT support staff respond to errors in various ways, depending on the nature and severity of the problem. Most organizations have standard procedures for minor errors, such as an incorrect report title or an improper format for a data element. In a typical procedure, a user submits a systems request that is evaluated, prioritized, and scheduled by the system administrator or the systems review committee. If the request is approved, the maintenance team designs, tests, documents, and implements a solution.

As you learned in Chapter 2, many organizations use a standard online form for systems requests. In smaller firms, the process might be an informal e-mail message. For more serious situations, such as incorrect report totals or inconsistent data, a user submits a systems request with supporting evidence. Those requests receive a high priority and a maintenance team begins work on the problem immediately.

The worst-case situation is a system failure. If an emergency occurs, the maintenance team bypasses the initial steps and tries to correct the problem immediately. This often requires a **patch**, which is a specially written software module that provides temporary repairs so operations can resume. Meanwhile, a written systems request is prepared by a user or a member of the IT department and added to the maintenance log. When the system is operational again, the maintenance team determines the cause, analyzes the problem, and designs a permanent solution. The IT response team updates the test data files, thoroughly tests the system, and prepares full documentation. Regardless of how the priorities are set, a standard ranking method can be helpful. For example, Figure 12-8 shows a three-level framework for IT support potential impact.

PRIORITY	IMPACT	TIMEFRAME
Level 1	Significant impact on IT operations, security, or business activity that requires immediate attention.	Implement patch as soon as possible.
Level 2	Some impact on IT operations, security, or business activity. Requires prompt attention, but operations can continue.	Patch as necessary and begin implementation prior to next release.
Level 3	Little or no impact on current IT operations, security, or business activity.	Implement in the next release.

FIGURE 12-8 This three-level ranking framework for IT support considers potential impact and response urgency.

The process of managing system support is described in more detail on page 578, including an overview of maintenance tasks and a procedural flowchart, which is shown in Figure 12-11 on page 581.

Adaptive Maintenance

Adaptive maintenance adds enhancements to an operational system and makes the system easier to use. An **enhancement** is a new feature or

capability. The need for adaptive maintenance usually arises from business environment changes such as new products or services, new manufacturing technology, or support for a new Web-based operation.

The procedure for minor adaptive maintenance is similar to routine corrective maintenance. A user submits a systems request that is evaluated and prioritized by the systems review committee. A maintenance team then analyzes, designs, tests, and implements the enhancement. Although the procedures for the two types of maintenance are alike, adaptive maintenance requires more IT department resources than minor corrective maintenance.

A major adaptive maintenance project is like a small-scale SDLC project because the development procedure is similar. Adaptive maintenance can be more difficult than new systems development because the enhancements must work within the constraints of an existing system.

Perfective Maintenance

Perfective maintenance involves changing an operational system to make it more efficient, reliable, or maintainable. Requests for corrective and adaptive maintenance normally come from users, while the IT department usually initiates perfective maintenance.

During system operation, changes in user activity or data patterns can cause a decline in efficiency, and perfective maintenance might be needed to restore performance. When users are concerned about performance, you should determine if a perfective maintenance project could improve response time and system efficiency.

Perfective maintenance also can improve system reliability. For example, input problems might cause a program to terminate abnormally. By modifying the data entry process, you can highlight errors and notify the users that they must enter proper data. When a system is easier to maintain, support is less costly and less risky. In many cases, you can simplify a complex program to improve maintainability.

In many organizations, perfective maintenance is not performed frequently enough. Companies with limited resources often consider new systems development, adaptive maintenance, and corrective maintenance more important than perfective maintenance. Managers and users constantly request new projects, so few resources are available for perfective maintenance work. As a practical matter, perfective maintenance can be performed as part of another project. For example, if a new function must be added to a program, you can include perfective maintenance in the adaptive maintenance project.

Perfective maintenance usually is cost effective during the middle of the system's operational life. Early in systems operation, perfective maintenance usually is not needed. Later, perfective maintenance might be necessary, but have a high cost. Perfective maintenance is less important if the company plans to discontinue the system.

When performing perfective maintenance, analysts often use a technique called software reengineering. **Software reengineering** uses analytical techniques to identify potential quality and performance improvements in an information system. In that sense, software reengineering is similar to business process reengineering, which seeks to simplify operations, reduce costs, and improve quality — as you learned in Chapter 1.

Programs that need a large number of maintenance changes usually are good candidates for reengineering. The more a program changes, the more likely it is to become inefficient and difficult to maintain. Detailed records of maintenance work can identify systems with a history of frequent corrective, adaptive, or perfective maintenance.

ON THE WEB

To learn more about software reengineering, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for this chapter, and locate the Software Reengineering link.

Preventive Maintenance

To avoid problems, preventive maintenance requires analysis of areas where trouble is likely to occur. Like perfective maintenance, the IT department normally initiates preventive

FIGURE 12-9 Regardless of the type of system, high-quality maintenance must be performed by trained professionals.

maintenance. Preventive maintenance often results in increased user satisfaction, decreased downtime, and reduced TCO. Preventive maintenance competes for IT resources along with other projects, and sometimes does not receive the high priority that it deserves.

Regardless of the type of maintenance, computer systems must be supported by trained professionals, just as the aircraft shown in Figure 12-9 must be serviced by skilled technicians. In both cases, the quality of the maintenance will directly affect the organization's success.

CASE IN POINT 12.1: OUTBACK OUTSOURCING, INC.

You are a systems analyst at Outback Outsourcing, a firm that handles payroll processing for many large companies. Outback Outsourcing uses a combination of payroll package programs and in-house developed software to deliver custom-made payroll solutions for its clients. Lately, users have flooded you with requests for more new features and Web-based capability to meet customer expectations. Your boss, the IT manager, comes to you with a question. She wants to know when to stop trying to enhance the old software and develop a totally new version better suited to the new marketplace. How would you answer her?

MAINTENANCE MANAGEMENT

System maintenance requires effective management, quality assurance, and cost control. To achieve these goals, companies use various strategies, such as a maintenance team, a maintenance management program, a configuration management process, and a maintenance release procedure. In addition, firms use version control and baselines to track system releases and analyze the system's life cycle. These concepts are described in the following sections.

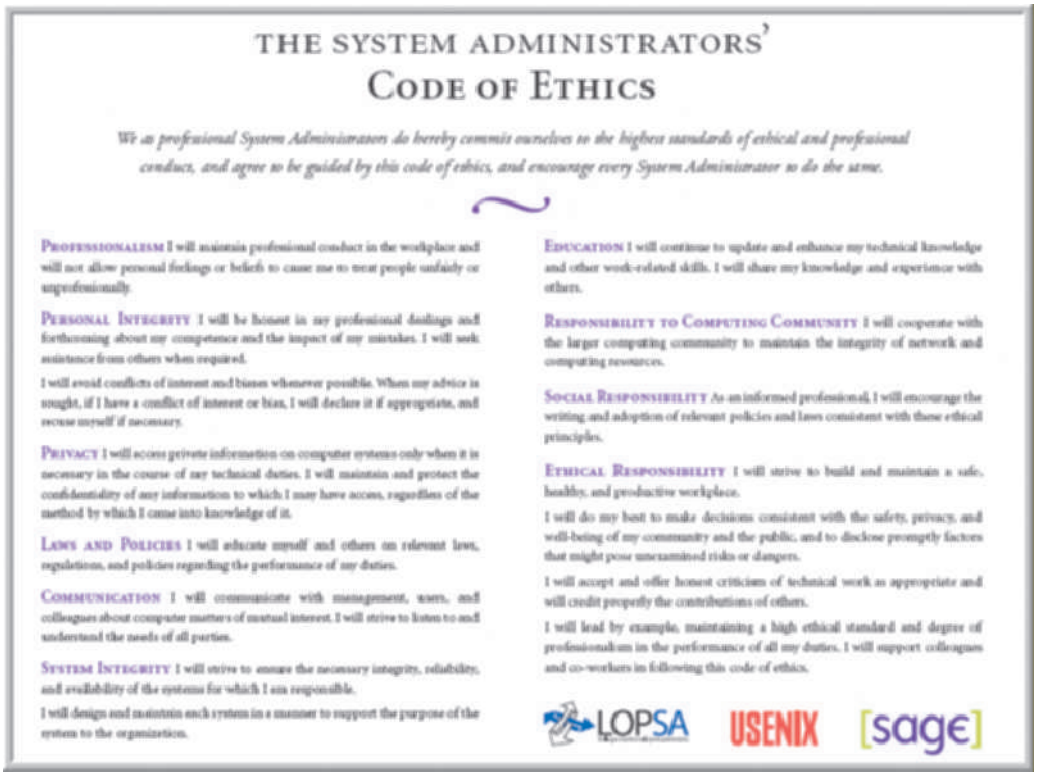
The Maintenance Team

A **maintenance team** includes a system administrator and one or more systems analysts and programmers. The system administrator should have solid technical expertise, and experience in troubleshooting and configuring operating systems and hardware. Successful analysts need a strong IT background, solid analytical abilities, good communication skills, and an overall understanding of business operations.

SYSTEM ADMINISTRATOR A **system administrator** manages computer and network systems. A system administrator must work well under pressure, have good organizational and communication skills, and be able to understand and resolve complex issues in a limited time frame. In most organizations, a system administrator has primary responsibility for the operation, configuration, and security of one or more systems. The system

administrator is responsible for routine maintenance, and usually is authorized to take preventive action to avoid an immediate emergency, such as a server crash, network outage, security incident, or hardware failure.

Systems administration is a vital function, and various professional associations, such as SAGE, which is shown in Figure 12-10, offer a wide variety of technical information and support for system administrators. Notice that SAGE members subscribe to a code of ethics that includes professionalism, integrity, privacy, and social responsibility, among other topics.



THE SYSTEM ADMINISTRATORS'
CODE OF ETHICS

We as professional System Administrators do hereby commit ourselves to the highest standards of ethical and professional conduct, and agree to be guided by this code of ethics, and encourage every System Administrator to do the same.

PROFESSIONALISM I will maintain professional conduct in the workplace and will not allow personal feelings or beliefs to cause me to treat people unfairly or unprofessionally.

PERSONAL INTEGRITY I will be honest in my professional dealings and forthcoming about my competence and the impact of my mistakes. I will seek assistance from others when required.

I will avoid conflicts of interest and biases whenever possible. When my advice is sought, if I have a conflict of interest or bias, I will declare it if appropriate, and recuse myself if necessary.

PRIVACY I will access private information on computer systems only when it is necessary in the course of my technical duties. I will maintain and protect the confidentiality of any information to which I may have access, regardless of the method by which I came into knowledge of it.

LAWS AND POLICIES I will educate myself and others on relevant laws, regulations, and policies regarding the performance of my duties.

COMMUNICATION I will communicate with management, users, and colleagues about computer matters of mutual interest. I will strive to listen to and understand the needs of all parties.

SYSTEM INTEGRITY I will strive to ensure the necessary integrity, reliability, and availability of the systems for which I am responsible.

I will design and maintain each system in a manner to support the purpose of the system to the organization.

EDUCATION I will continue to update and enhance my technical knowledge and other work-related skills. I will share my knowledge and experience with others.

RESPONSIBILITY TO COMPUTING COMMUNITY I will cooperate with the larger computing community to maintain the integrity of network and computing resources.

SOCIAL RESPONSIBILITY As an informed professional, I will encourage the writing and adoption of relevant policies and laws consistent with these ethical principles.

ETHICAL RESPONSIBILITY I will strive to build and maintain a safe, healthy, and productive workplace.

I will do my best to make decisions consistent with the safety, privacy, and well-being of my community and the public, and to disclose promptly factors that might pose unexamined risks or dangers.

I will accept and offer honest criticism of technical work as appropriate and will credit properly the contributions of others.

I will lead by example, maintaining a high ethical standard and degree of professionalism in the performance of all my duties. I will support colleagues and co-workers in following this code of ethics.

LOPSA USENIX [sage]

FIGURE 12-10 SAGE seeks to establish standards of professional excellence, improve the technical skills of its members, and promote a comprehensive code of ethics.

SYSTEMS ANALYSTS Systems analysts assigned to a maintenance team are like skilled detectives who investigate and rapidly locate the source of a problem by using analysis and synthesis skills. *Analysis* means examining the whole in order to learn about the individual elements, while *synthesis* involves studying the parts to understand the overall system. In addition to strong technical skills, an analyst must have a solid grasp of business operations and functions. Analysts also need effective interpersonal and communications skills and they must be creative, energetic, and eager for new knowledge.

PROGRAMMERS In a small organization, a programmer might be expected to handle a wide variety of tasks, but in larger firms, programming work tends to be more specialized. For example, typical job titles include an **applications programmer**, who works on new systems development and maintenance; a **systems programmer**, who concentrates on operating system software and utilities; and a **database programmer**, who focuses on creating and supporting large-scale database systems. Many IT departments also use a job title of **programmer/analyst** to designate positions that require a combination of systems analysis and programming skills.

ORGANIZATIONAL ISSUES IT managers often divide systems analysts and programmers into two groups: One group performs new system development, and the other group

handles maintenance. Some organizations use a more flexible approach and assign IT staff members to various projects as they occur. By integrating development and support work, the people developing the system assume responsibility for maintaining it. Because the team is familiar with the project, additional training or expense is unnecessary, and members are likely to have a sense of ownership from the onset.

Unfortunately, many analysts feel that maintenance is less interesting and creative than developing new systems. In addition, an analyst might find it challenging to troubleshoot and support someone else's work that might have been poorly documented and organized.

Some organizations that have separate maintenance and new systems groups rotate people from one assignment to the other. When analysts learn different skills, the organization is more versatile and people can shift to meet changing business needs. For instance, systems analysts working on maintenance projects learn why it is important to design easily maintainable systems. Similarly, analysts working on new systems get a better appreciation of the development process and the design compromises necessary to meet business objectives.

One disadvantage of rotation is that it increases overhead because time is lost when people move from one job to another. When systems analysts constantly shift between maintenance and new development, they have less opportunity to become highly skilled at any one job.

Newly hired and recently promoted IT staff members often are assigned to maintenance projects because their managers believe that the opportunity to study existing systems and documentation is a valuable experience. In addition, the mini-SDLC used in many adaptive maintenance projects is good training for the full-scale systems development life cycle. For a new systems analyst, however, maintenance work might be more difficult than systems development, and it might make sense to assign a new person to a development team where experienced analysts are available to provide training and guidance.

CASE IN POINT 12.2: BRIGHTSIDE INSURANCE, INC.

As IT manager at Brightside Insurance Company, you organized your IT staff into two separate groups — one team for maintenance projects and the other team for new systems work. That arrangement worked well in your last position at another company. Brightside, however, previously made systems assignments with no particular pattern.

At first, the systems analysts in your group did not comment about the team approach. Now, several of your best analysts have indicated that they enjoyed the mix of work and would not want to be assigned to a maintenance team. Before a problem develops, you have decided to rethink your organizational strategy. Should you go back to the way things were done previously at Brightside? Why or why not? Do other options exist? What are they?

Maintenance Requests

Typically, maintenance requests involve a series of steps, as shown in Figure 12-11. After a user submits a request, a system administrator determines whether immediate action is needed and whether the request is under a prescribed cost limit. In nonemergency requests that exceed the cost limit, a systems review committee assesses the request and either approves it, with a priority, or rejects it. The system administrator notifies affected users of the outcome.

Users submit most requests for corrective and adaptive maintenance when the system is not performing properly, or if they want new features. IT staff members usually initiate requests for perfective and preventive maintenance. To keep a complete maintenance log, all work must be covered by a specific request that users submit in writing or by e-mail.

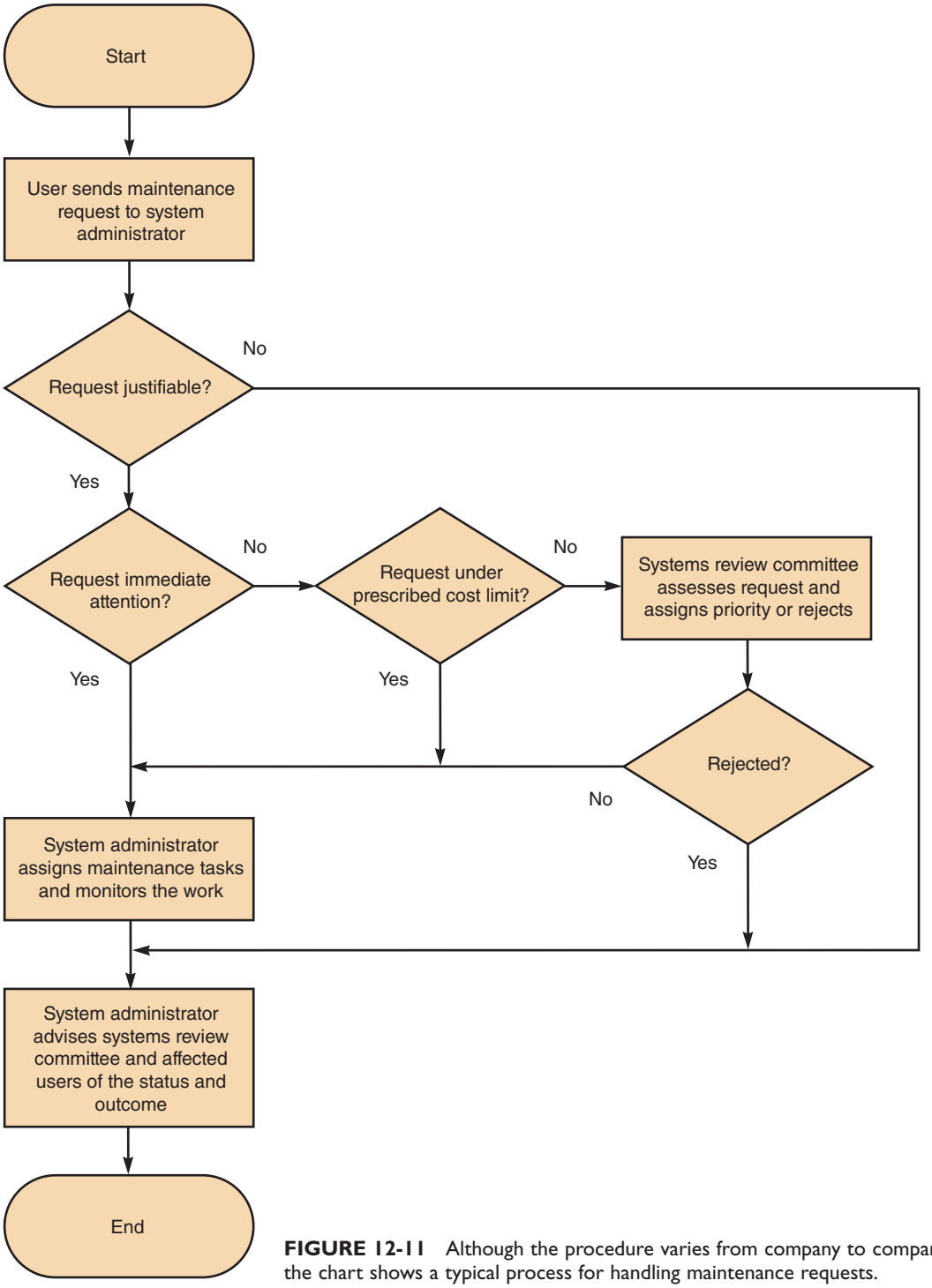


FIGURE 12-11 Although the procedure varies from company to company, the chart shows a typical process for handling maintenance requests.

INITIAL DETERMINATION When a user submits a maintenance request, the system administrator makes an initial determination. If the request is justifiable and involves a severe problem that requires immediate attention, the system administrator takes action at once. In justifiable, but noncritical, situations, the administrator determines whether the request can be performed within a preauthorized cost level. If so, he or she assigns the maintenance tasks and monitors the work.

THE SYSTEMS REVIEW COMMITTEE When a request exceeds a predetermined cost level or involves a major configuration change, the systems review committee either approves it and assigns a priority, or rejects it.

TASK COMPLETION The system administrator usually is responsible for assigning maintenance tasks to individuals or to a maintenance team. Depending on the situation and the company's policy, the system administrator might consider rotating assignments among the IT staff or limiting maintenance tasks to certain individuals or teams, as explained in the previous section.

USER NOTIFICATION Users who initiate maintenance requests expect a prompt response, especially if the situation directly affects their work. Even when corrective action cannot occur immediately, users appreciate feedback from the system administrator and should be kept informed of any decisions or actions that could affect them.

Establishing Priorities

ON THE WEB

To learn more about configuration management, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for this chapter, and locate the Configuration Management link.

In many companies, the systems review committee separates maintenance and new development requests when setting priorities. In other organizations, all requests are considered together, and the most important project gets top priority, whether it is maintenance or new development.

Some IT managers believe that evaluating all projects together leads to the best possible decisions because maintenance and new development require similar IT department resources. In IT departments where maintenance and new development are not integrated, it might be better to evaluate requests separately. Another advantage of a separate approach is that maintenance is more likely to receive a proportional share of IT department resources.

The most important objective is to have a procedure that balances new development and necessary maintenance work to provide the best support for business requirements and priorities.

FIGURE 12-12 CM Crossroads provides a source of information and resources for configuration management professionals.

Configuration Management

Configuration management (CM), sometimes referred to as **change control** (CC), is a process for controlling changes in system requirements during software development. Configuration management also is an important tool for managing system changes and costs after a system becomes operational. Most companies establish a specific process that describes how system changes must be requested and documented.

As enterprise-wide information systems grow more complex, configuration management becomes critical. Industry standards have emerged, and many vendors offer configuration management software and techniques, as shown in Figure 12-12.

CM is especially important if a system has multiple versions that run in different hardware and software environments. Configuration management also helps to organize and handle documentation. An operational system has extensive documentation that covers development, modification, and maintenance for all versions of the installed system. Most documentation material, including the initial systems request, project management data, end-of-phase reports, data dictionary, and the IT operations and user manuals, is stored in the IT department.

Keeping track of all documentation and ensuring that updates are distributed properly are important aspects of configuration management.

Maintenance Releases

Keeping track of maintenance changes and updates can be difficult, especially for a complex system. When a **maintenance release methodology** is used, all noncritical changes are held until they can be implemented at the same time. Each change is documented and installed as a new version of the system called a **maintenance release**.

For an in-house developed system, the time between releases usually depends on the level of maintenance activity. A new release to correct a critical error, however, might be implemented immediately rather than saved for the next scheduled release.

When a release method is used, a numbering pattern distinguishes the different releases. In a typical system, the initial version of the system is 1.0, and the release that includes the first set of maintenance changes is version 1.1. A change, for example, from version 1.4 to 1.5 indicates relatively minor enhancements, while whole number changes, such as from version 1.0 to 2.0 or from version 3.4 to 4.0, indicate a significant upgrade.

The release methodology offers several advantages, especially if two teams perform maintenance work on the same system. When a release methodology is used, all changes are tested together before a new system version is released. This approach results in fewer versions, less expense, and less interruption for users. Using a release methodology also reduces the documentation burden, because all changes are coordinated and become effective simultaneously.

A release methodology also has some potential disadvantages. Users expect a rapid response to their problems and requests, but with a release methodology, new features or upgrades are available less often. Even when changes would improve system efficiency or user productivity, the potential savings must wait until the next release, which might increase operational costs.

Commercial software suppliers also provide maintenance releases, often called **service packs**, as shown in Figure 12-13. As Microsoft explains, a service pack contains all the fixes and enhancements that have been made available since the last program version or service pack.

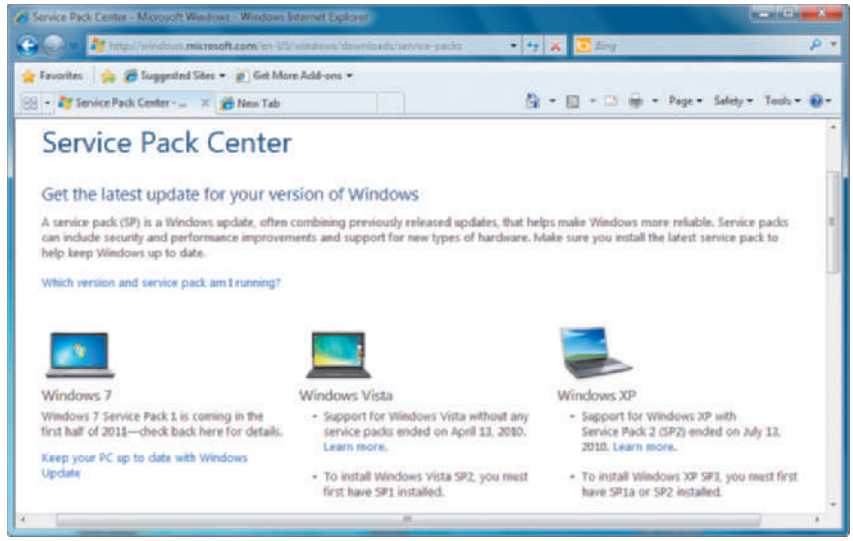


FIGURE 12-13 A Microsoft service pack provides access to up-to-date drivers, tools, security patches, and customer-requested product changes.

Version Control

Version control is the process of tracking system releases, or versions. When a new version of a system is installed, the prior release is **archived**, or stored. If a new version causes a system to fail, a company can reinstall the prior version to restore operations. In addition to tracking system versions, the IT staff is responsible for configuring systems that have several modules at various release stages. For example, an accounting system might have a one-year old accounts receivable module that must interface with a brand-new payroll module.

As systems grow more complex, version control becomes an essential part of system documentation. In addition to in-house version control procedures, companies can purchase software from vendors such as Serena, as shown in Figure 12-14 on the next page.

ON THE WEB

To learn more about version control, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for this chapter, and locate the Version Control link.

FIGURE 12-14 Serena offers software called PVCS Version Manager that developers can use to manage projects.

Baselines

A **baseline** is a formal reference point that measures system characteristics at a specific time. Systems analysts use baselines as yardsticks to document features and performance during the systems development process. The three types of baselines are functional, allocated, and product.

The **functional baseline** is the configuration of the system documented at the beginning of the project. It consists of all the necessary system requirements and design constraints.

The **allocated baseline** documents the system at the end of the design phase and identifies any changes since the functional baseline. The allocated baseline includes testing and verification of all system requirements and features.

The **product baseline** describes the system at the beginning of system operation. The product baseline incorporates any changes made since the allocated baseline and includes the results of performance and acceptance tests for the operational system.

System Performance Management

Years ago, when most firms used a central computer for processing data, it was relatively simple to manage a system and measure its efficiency. Today, companies use complex networks and client/server systems to support business needs. A user at a client

workstation often interacts with an information system that depends on other clients, servers, networks, and data located throughout the company. Rather than a single computer, it is the integration of all those components that determines the system's capability and performance. In many situations, IT managers use automated software and CASE tools to manage complex systems.

To ensure satisfactory support for business operations, the IT department must manage system faults and interruptions, measure system performance and workload, and anticipate future needs. The following sections discuss these topics.

Fault Management

No matter how well it is designed, every system will experience some problems, such as hardware failures, software errors, user mistakes, and power outages. A system administrator must detect and resolve operational problems as quickly as possible. That task, often called **fault management**, includes monitoring the system for signs of trouble, logging all system failures, diagnosing the problem, and applying corrective action.

The more complex the system, the more difficult it can be to analyze symptoms and isolate a cause. In addition to addressing the immediate problem, it is important to evaluate performance patterns and trends. Windows 7 and Vista include a built-in fault management feature called Resource Monitor, which is shown in Figure 12-15. Resource Monitor can evaluate CPU, memory, disk, and network activity in real time, and save the data in a log file. In addition to automated notification, fault management software can identify underlying causes, speed up response time, and reduce service outages.

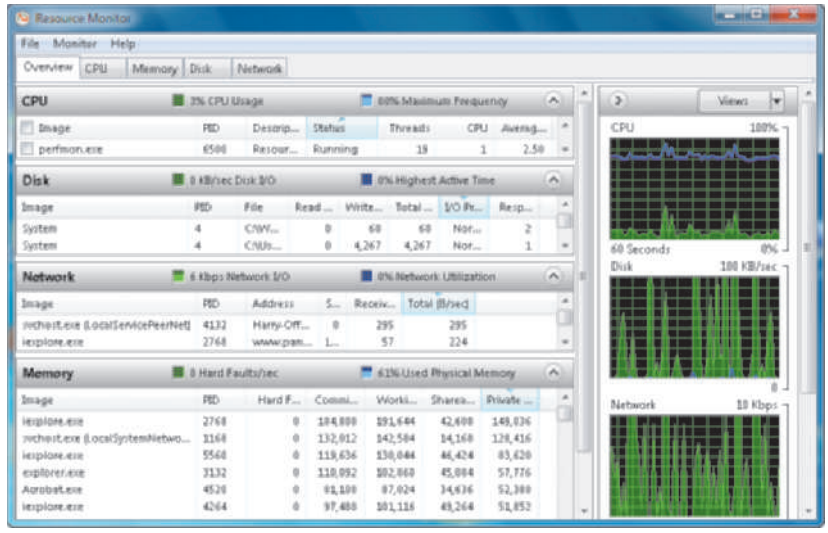


FIGURE 12-15 Windows Resource Monitor displays CPU, memory, disk, and network activity in real time.

Although system administrators must deal with system faults and interruptions as they arise, the best strategy is to prevent problems by monitoring system performance and workload.

Performance and Workload Measurement

In e-business, slow performance can be as devastating as no performance at all. Network delays and application bottlenecks affect customer satisfaction, user productivity, and business results. In fact, many IT managers believe that network delays do more damage than actual stoppages, because they occur more frequently and are difficult to predict, detect, and prevent. Customers expect reliable, fast response 24 hours a day, seven days a week. To support that level of service, companies use performance management software, such as Cisco Network Application Performance Analysis (NAPA), which is shown in Figure 12-16 on the next page.

To measure system performance, many firms use **benchmark testing**, which uses a set of standard tests to evaluate system performance and capacity. In addition to benchmark testing, performance measurements, called **metrics**, can monitor the number of transactions processed in a given time period, the number of records accessed, and the volume of online data. Network performance metrics include response time, bandwidth, throughput, and turnaround time, among others.

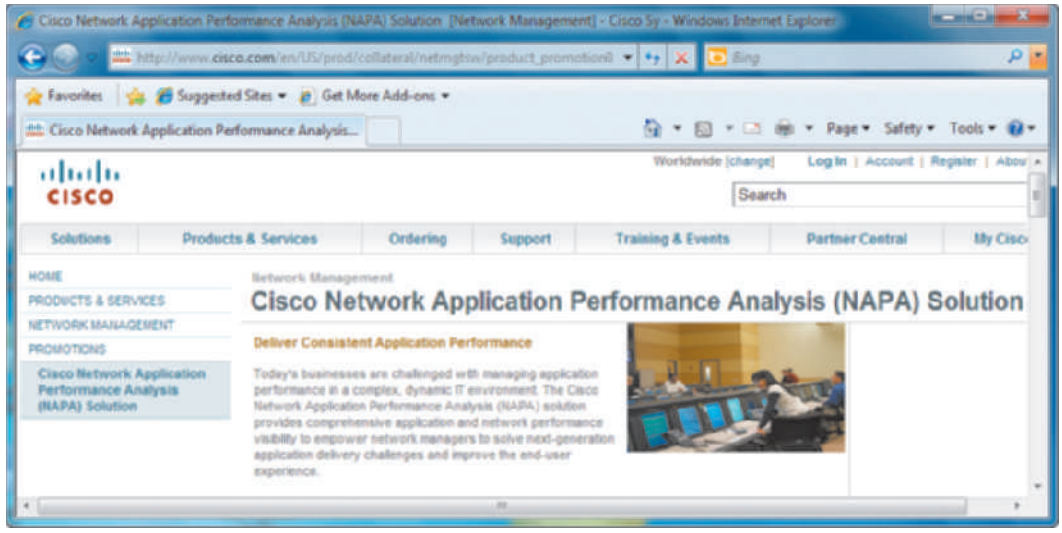


FIGURE 12-16 Network managers can use Cisco's NAPA to monitor performance and improve the end-user experience.

RESPONSE TIME **Response time** is the overall time between a request for system activity and the delivery of the response. In the typical online environment, response time is measured from the instant the user presses the ENTER key or clicks a mouse button until the requested screen display appears or printed output is ready. Response time is affected by the system design, capabilities, and processing methods. If the request involves network or Internet access, response time is affected by data communication factors.

Online users expect an immediate response, and they are frustrated by any apparent lag or delay. Of all performance measurements, response time is the one that users notice and complain about most.

BANDWIDTH AND THROUGHPUT Bandwidth and throughput are closely related terms, and many analysts use them interchangeably. **Bandwidth** describes the amount of data that the system can transfer in a fixed time period. Bandwidth requirements are expressed in bits per second. Depending on the system, you might measure bandwidth in **Kbps** (**kilobits per second**), **Mbps** (**megabits per second**), or **Gbps** (**gigabits per second**). Analyzing bandwidth is similar to forecasting the hourly number of vehicles that will use a highway in order to determine the number of lanes required.

Throughput measures actual system performance under specific circumstances and is affected by network loads and hardware efficiency. Throughput, like bandwidth, is expressed as a data transfer rate, such as Kbps, Mbps, or Gbps. Just as traffic jams delay highway traffic, throughput limitations can slow system performance and response time. That is especially true with graphics-intensive systems and Web-based systems that are subject to Internet-related conditions.

In addition to the performance metrics explained in the previous section, system administrators measure many other performance characteristics. Although no standard set of metrics exists, several typical examples are:

- Arrivals — The number of items that appear on a device during a given observation time.
- Busy — The time that a given resource is unavailable.
- Completions — The number of arrivals that are processed during a given observation period.
- Queue length — The number of requests pending for a service.
- Service time — The time it takes to process a given task once it reaches the front of the queue.

- Think time — The time it takes an application user to issue another request.
- Utilization — How much of a given resource was required to complete a task.
- Wait time — The time that requests must wait for a resource to become available.

The Computer Measurement Group (CMG®) maintains a site, shown in Figure 12-17, that provides support and assistance for IT professionals concerned with performance evaluation and capacity planning.

FIGURE 12-17 The Computer Measurement Group is a nonprofit organization that primarily is concerned with performance evaluation and capacity management.

TURNAROUND TIME **Turnaround time** applies to centralized batch processing operations, such as customer billing or credit card statement processing. Turnaround time measures the time between submitting a request for information and the fulfillment of the request. Turnaround time also can be used to measure the quality of IT support or services by measuring the time from a user request for help to the resolution of the problem.

The IT department often measures response time, bandwidth, throughput, and turnaround time to evaluate system performance both before and after changes to the system or business information requirements. Performance data also is used for cost-benefit analyses of proposed maintenance and to evaluate systems that are nearing the end of their economically useful lives.

Finally, management uses current performance and workload data as input for the capacity planning process.

Capacity Planning

Capacity planning is a process that monitors current activity and performance levels, anticipates future activity, and forecasts the resources needed to provide desired levels of service.

As the first step in capacity planning, you develop a current model based on the system's present workload and performance specifications. Then you project demand and user requirements over a one- to three-year time period and analyze the model to see what is needed to maintain satisfactory performance and meet requirements. To assist you in the process, you can use a technique called what-if analysis.

What-if analysis allows you to vary one or more elements in a model in order to measure the effect on other elements. For example, you might use what-if analysis to answer questions such as: How will response time be affected if we add more PC workstations to the network? Will our client/server system be able to handle the growth in sales from the new Web site? What will be the effect on server throughput if we add more memory?

Powerful spreadsheet tools also can assist you in performing what-if analysis. For example, Microsoft Excel contains a feature called Goal Seek that determines what changes are necessary in one value to produce a specific result for another value. In the example shown in Figure 12-18 on the next page, a capacity planning worksheet indicates that the system can handle 3,840 Web-based orders per day, at 22.5 seconds each. The user wants to know the effect on processing time if the number of transactions increases to 9,000. As the Goal Seek solution in the bottom figure shows, order processing will have to be performed in 9.6 seconds to achieve that goal.

ON THE WEB

To learn more about capacity planning, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com,** navigate to **On the Web Links** for this chapter, and locate the Capacity Planning link.

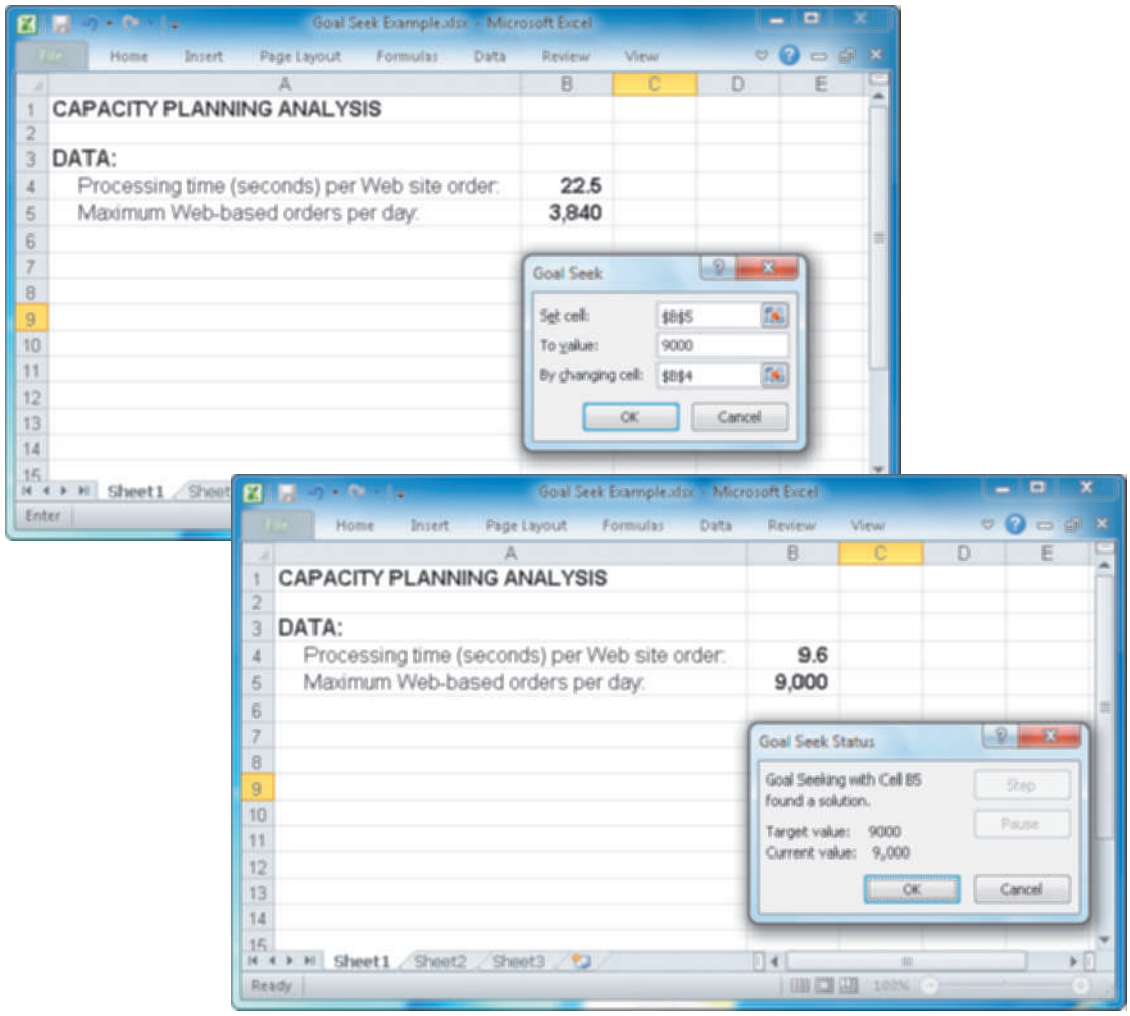


FIGURE 12-18 Microsoft Excel provides a Goal Seek feature that permits what-if analysis.

When you plan capacity, you need detailed information about the number of transactions; the daily, weekly, or monthly transaction patterns; the number of queries; and the number, type, and size of all generated reports. If the system involves a LAN, you need to estimate network traffic levels to determine whether or not the existing hardware and software can handle the load. If the system uses a client/server design, you need to examine performance and connectivity specifications for each platform.

Most important, you need an accurate forecast of future business activities. If new business functions or requirements are predicted, you should develop contingency plans based on input from users and management. The main objective is to ensure that the system meets all future demands and provides effective support for business operations. Some firms handle their own capacity planning, while others purchase software and services from companies such as Teamquest, shown in Figure 12-19.

TOOLKIT TIME

The CASE tools in Part B of the Systems Analyst's Toolkit can help you document business functions and processes, develop graphical models, and provide an overall framework for information system development. To learn more about these tools, turn to Part B of the four-part Toolkit that follows Chapter 12.

System Maintenance Tools

You can use automated tools that provide valuable assistance during the operation and support phase. Many CASE tools include system evaluation and maintenance features, including the following examples:

- Performance monitor that provides data on program execution times
- Program analyzer that scans source code, provides data element cross-reference information, and helps evaluate the impact of a program change

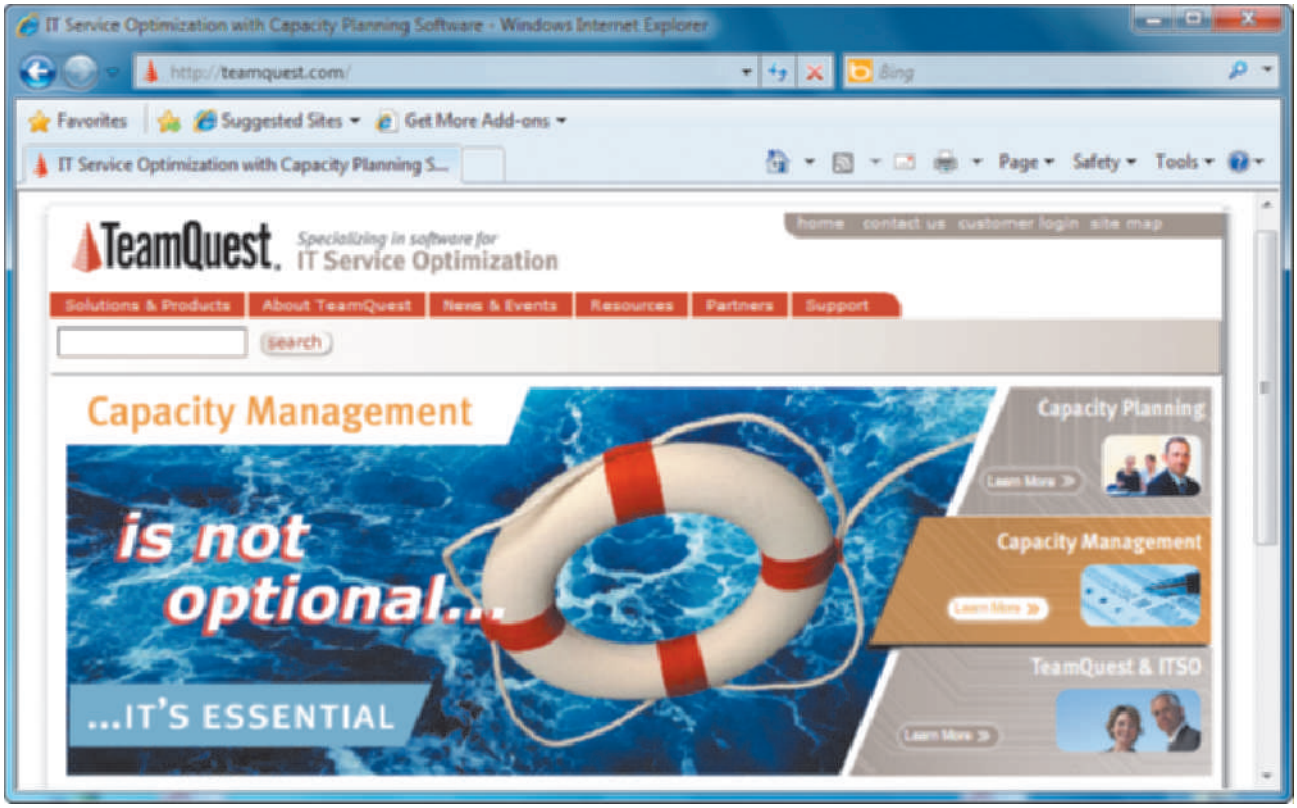


FIGURE 12-19 TeamQuest is an example of a firm that offers capacity planning software and services.

- Interactive debugging analyzer that locates the source of a programming error
- Reengineering tools
- Automated documentation
- Network activity monitor
- Workload forecasting tool

In addition to CASE tools, you also can use spreadsheet and presentation software to calculate trends, perform what-if analyses, and create attractive charts and graphs to display the results. Information technology planning is an essential part of the business planning process, and you probably will deliver presentations to management. You can review Part A of the Systems Analyst's Toolkit for more information on using spreadsheet and presentation software to help you communicate effectively.

System Security Overview

Security is a vital part of every information system. **Security** protects the system, and keeps it safe, free from danger, and reliable. In a global environment that includes many types of threats and attacks, security is more important than ever. This section includes a discussion of system security concepts, risk management, and common attacks against the system.

System Security Concepts

The **CIA triangle** in Figure 12-20 shows the three main elements of system security: confidentiality, integrity, and availability. **Confidentiality** protects information from unauthorized disclosure and safeguards privacy.

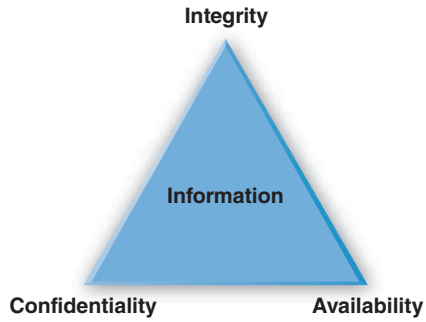


FIGURE 12-20 System security must provide information confidentiality, integrity, and availability.

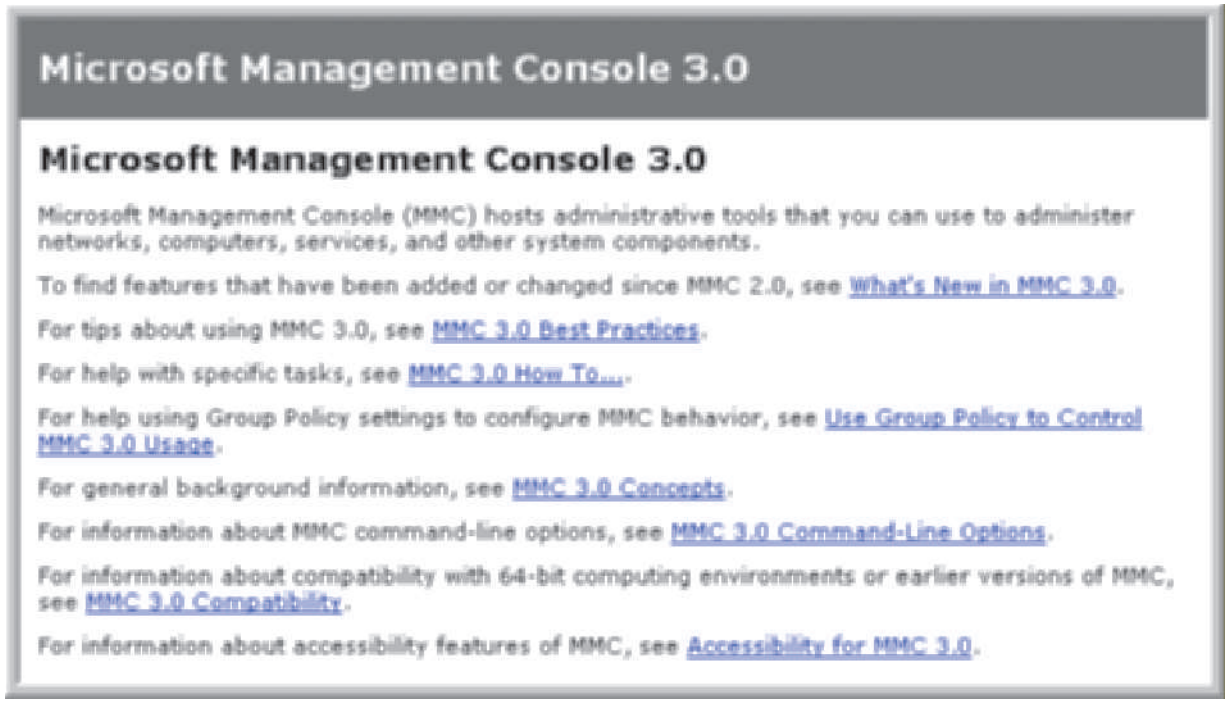


FIGURE 12-21 The Microsoft Management Console (MMC) includes built-in security tools, such as password and lockout policies, audit policies, user rights, and security configurations, among others.

Integrity prevents unauthorized users from creating, modifying, or deleting information. **Availability** ensures that authorized users have timely and reliable access to necessary information. The first step in managing IT security is to develop a **security policy** based on these three elements. Although it is beyond the scope of this chapter, the **Microsoft Management Console** (MMC) shown in Figure 12-21 is a portal to a broad array of built-in security tools and techniques.

FIGURE 12-22 Risk management requires continuous risk identification, assessment, and control.

Risk Management

In the real world, *absolute* security is not a realistic goal. Instead, managers must balance the value of the assets being protected, potential risks to the organization, and security costs. For example, it might not be worth installing an expensive video camera monitoring system to protect an empty warehouse. To achieve the best results, most firms use a **risk management** approach that involves constant attention to three interactive tasks: risk identification, risk assessment, and risk control, as shown in Figure 12-22.

Risk identification analyzes the organization's assets, threats, and vulnerabilities. **Risk assessment** measures risk likelihood and impact. **Risk control** develops safeguards that reduce risks and their impact.

RISK IDENTIFICATION The first step in risk identification is to list and classify business assets. An **asset** might include company hardware, software, data, networks, people, or procedures. For each asset, a risk manager rates the impact of an attack and analyzes possible threats. A **threat** is an internal or external entity that could endanger an asset. For example, threat categories might include natural disasters, software attacks, or theft, as shown in Figure 12-23.

Threat Categories and Examples

THREAT	CATEGORY
Extortion	Hacker steals trade secrets and threatens to release them if not paid.
Hardware and software failures	Router stops functioning, or software causes the application server to crash.
Human error or failure	Employee accidentally deletes a file.
Natural disasters	Flood destroys company building and networked systems.
Service failure	Electricity is disrupted and brings the entire system down for hours.
Software attack	A group plants destructive software, a virus, or a worm into a company network.
Technical obsolescence	Outdated software is slow, difficult to use, and vulnerable to attacks.
Theft of physical or intellectual property	Physical server is stolen, intellectual property is stolen or used without permission; may be physical or electronic.
Trespass and espionage	Employee enters unlocked server room and views the payroll data on a forbidden system.
Vandalism	Attacker defaces Web site logo, or destroys CEO's hard drive physically or electronically.

FIGURE 12-23 System threats can be grouped into several broad categories. Note the examples provided for each category.

ON THE WEB

To learn more about risk management, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for this chapter, and locate the Risk Management link.

Next, the risk manager identifies vulnerabilities and how they might be exploited. A **vulnerability** is a security weakness or soft spot, and an **exploit** is an attack that takes advantage of a vulnerability. To identify vulnerabilities, a risk manager might ask questions like these: *Could hackers break through the proxy server? Could employees retrieve sensitive files without proper authorization? Could people enter the computer room and sabotage our servers?* Each vulnerability is rated and assigned a value. The output of risk identification is a list of assets, vulnerabilities, and ratings.

RISK ASSESSMENT In IT security terms, a **risk** is the impact of an attack multiplied by the likelihood of a vulnerability being exploited. For example, an impact value of 2 and a vulnerability rating of 10 would produce a risk of 20. On the other hand, an impact value of 5 and a vulnerability rating of 5 would produce a risk of 25. When risks arecalculated and prioritized, **critical risks** will head the list. Although ratings can be subjective, the overall process provides a consistent approach and framework.

RISK CONTROL After risks are identified and assessed, they must be controlled. Control measures might include the following examples: *We could place a firewall on the proxy server; We could assign permissions to sensitive files; We could install biometric devices to guard the computer room.* Typically, management chooses one of four risk control strategies: avoidance, mitigation, transference, or acceptance. **Avoidance** eliminates the risk by adding protective safeguards. For example, to prevent unauthorized access to LAN computers, a secure firewall might be installed. **Mitigation** reduces the impact of a risk by careful planning and preparation. For example, a company can prepare a disaster recovery plan in case a natural disaster occurs. **Transference** shifts the risk to another asset or party, such as an insurance company. **Acceptance** means that nothing is done. Companies usually accept a risk only when the protection clearly is not worth the expense.

The risk management process is iterative — risks constantly are identified, assessed, and controlled. To be effective, risk managers need a combination of business knowledge, IT skills, and experience with security tools and techniques.

Attacker Profiles and Attacks

An **attack** is a hostile act that targets the system, or the company itself. Thus, an attack might be launched by a disgruntled employee, or a hacker who is 10,000 miles away. Attackers break into a system to cause damage, steal information, or gain recognition, among other reasons. Attackers can be grouped into categories, as shown in Figure 12-24, while Figure 12-25 describes some common types of attacks.

Attacker Characteristics

ATTACKER	DESCRIPTION	SKILL SET
Cyberterrorist	Attacks to advance political, social, or ideological goals.	High
Employee	Uses unauthorized information or privileges to break into computer systems, steal information, or cause damage.	Varies
Hacker	Uses advanced skills to attack computer systems with malicious intent (black hat) or to expose flaws and improve security (white hat).	High
Hacktivist	Attacks to further a social or political cause; often involves shutting down or defacing Web sites.	Varies
Script kiddie	Inexperienced or juvenile hacker who uses readily available malicious software to disrupt or damage computer systems, and gain recognition.	Low
Spy	Non-employee who breaks into computer systems to steal information and sell it.	High

FIGURE 12-24 IT security professionals have coined labels for various types of attackers.

Types of Attacks and Examples

ATTACK	EXAMPLES
Back door	Attacker finds vulnerability in software package and exploits it.
Denial of service or distributed denial of service	One or more computers send a stream of connection requests to disable a Web server.
DNS poisoning	False DNS (Domain Name Server) information steers the user to the attacker's Web site. Attackers trick users into thinking they are visiting a legitimate site, such as a bank site, then attempt to obtain bank account numbers, usernames, and passwords.
Dumpster diving	Attacker scours the trash for valuable information that can be used to compromise the system.
Mail bombing	Enormous volumes of e-mail are sent to a target address.
Malicious code	Attacker sends infected e-mail to the target system. Attackers may use viruses, worms, Trojan horses, keystroke loggers, spyware, or scripts to destroy data, bog down systems, spy on users, or assume control of infected systems.
Man in the middle	The attacker intercepts traffic and poses as the recipient, sending the data to the legitimate recipient but only after reading the traffic or modifying it.
Password cracking	Hacker attempts to discover a password to gain entry into a secured system. This can be a dictionary attack, where numerous words are tried, or a brute force attack, where every combination of characters is attempted.
Privilege escalation	Employee tricks a computer into raising his or her account to the administrator level.
Sniffing	Network traffic is intercepted and scanned for valuable information.
Social engineering	An attacker calls the help desk posing as a legitimate user and requests that his or her password be changed.
Spam	Unwanted, useless e-mail is sent continuously to business e-mail accounts, wasting time and decreasing productivity.
Spoofing	IP address is forged to match a trusted host, and similar content may be displayed to simulate the real site for unlawful purposes.

FIGURE 12-25 Attacks can take many forms, as this table shows. IT security managers must be able to detect these attacks and respond with suitable countermeasures.

The following sections discuss how companies combat security threats and challenges by using a multilevel strategy.

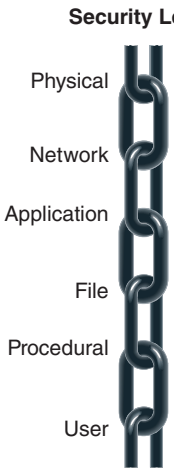


FIGURE 12-26
Each security link has a specific focus, and the overall chain is only as strong as the weakest link.

Security Levels

To provide system security, you must consider six separate but interrelated levels: physical security, network security, application security, file security, user security, and procedural security. Like the chain shown in Figure 12-26, system security is only as strong as the weakest link. The following sections describe these security levels, and the issues that must be addressed. Top management often makes the final strategic and budget decisions regarding security, but systems analysts should understand the overall picture in order to make informed recommendations.

Physical Security

The first level of system security concerns the physical environment, including IT resources and people throughout the company. Special attention must be paid to critical equipment located in operations centers, where servers, network hardware, and related equipment operate. Large companies usually have a dedicated room built specifically for IT operations. Smaller firms might use an office or storage area. Regardless of its size and shape, an operations center requires special protection from unwanted intrusion. In addition to centrally located equipment, all computers on the network must be secure, because each server or workstation can be a potential access point. Physical access to a computer represents an entry point into the system and must be controlled and protected.

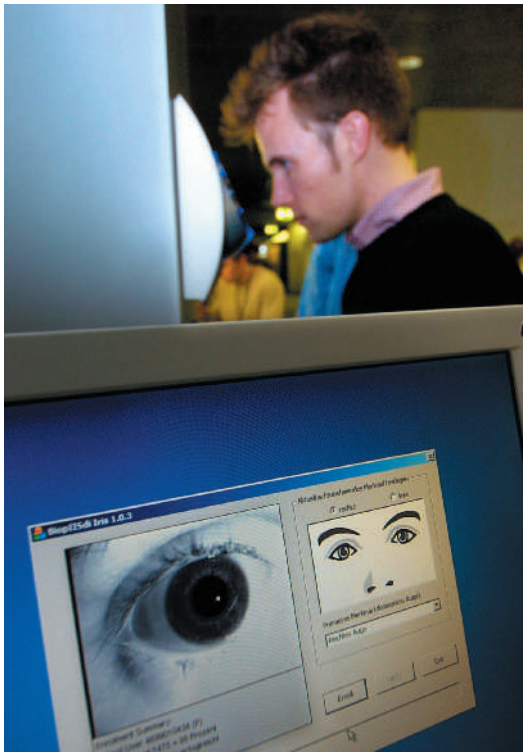


FIGURE 12-27 Companies use biometric scanning to analyze the features of the eye's iris, which has more than 200 points that can be measured and used for comparison.

OPERATIONS CENTER SECURITY Perimeter security is essential in any room or area where computer equipment is operated or maintained. Physical access must be controlled tightly, and each entrance must be equipped with a suitable security device. All access doors should have internal hinges and electromagnetic locks that are equipped with a battery backup system to provide standby power in the event of a power outage. When the battery power is exhausted, the doors should fail in a closed position, but it should be possible for someone locked inside the room to open the door with an emergency release.

To enhance security, many companies are installing **biometric scanning systems**, which map an individual's facial features, fingerprints, handprint, or eye characteristics, as shown in Figure 12-27. These hi-tech authentication systems replace magnetic identification badges, which can be lost, stolen, or altered.

Video cameras and motion sensors can be used to monitor computer room security and provide documentation of all physical activity in the area. A motion sensor uses infrared technology to detect movement, and can be configured to provide audible or silent alarms, and to send e-mail messages when it is triggered. Other types of sensors can monitor temperature and humidity in the computer room. Motion sensor alarms can be activated at times when there is no expected activity in the computer room, and authorized technicians should have codes to enable or disable the alarms.

SERVERS AND DESKTOP COMPUTERS If possible, server and desktop computer cases should be equipped with locks. This simple, but important, precaution might prevent an intruder from modifying the hardware configuration of a server, damaging the equipment, or removing a disk drive. Server racks should be locked, to avoid the unauthorized placement and retrieval of keystroke loggers. A **keystroke logger** is a device that can be inserted between a keyboard and a computer. Typically, the device resembles an ordinary cable plug, so it does not call attention to itself.

The device can record everything that is typed into the keyboard, including passwords, while the system continues to function normally. Keystroke loggers can be used legitimately to monitor, back up, and restore a system, but if placed by an intruder, a keystroke logger represents a serious security threat.

In addition to hardware devices, keystroke logging software also exists. A keystroke logging program can be disguised as legitimate software and downloaded from the Internet or a company network. The program remains invisible to the user as it records keystrokes and uploads the information to whoever installed the program. Such malicious software can be removed by antivirus and antispyware software, discussed later in the Application Security section.

Tamper-evident cases should be used where possible. A tamper-evident case is designed to show any attempt to open or unlock the case. In the event that a computer case has been opened, an indicator LED remains lit until it is cleared with a password. Tamper-evident cases do not prevent intrusion, but a security breach is more likely to be noticed. Many servers now are offered with tamper-evident cases as part of their standard configuration.

Monitor screen savers that hide the screen and require special passwords to clear should be used on any server or workstation that is left unattended. Locking the screen after a period of inactivity is another safeguard. Microsoft Windows 7 allows an administrator to include this feature in security policies. Also, you can use a **BIOS-level password**, also called a **boot-level password** or a **power-on password**, that must be entered before the computer can be started. A boot-level password can prevent an unauthorized person from booting a computer by using a CD-ROM or USB device.

Finally, companies must consider electric power issues. In mission-critical systems, large-scale backup power sources are essential to continue business operations. In other cases, computer systems and network devices should be plugged into an **uninterruptible power supply** (**UPS**) that includes battery backup with suitable capacity. The UPS should be able to handle short-term operations in order to permit an orderly backup and system shutdown.

NOTEBOOK COMPUTERS When assessing physical security issues, be sure to consider additional security provisions for notebook, laptop, and tablet computers. Because of their small size and high value, these computers are tempting targets for thieves and industrial spies. Although the following suggestions are intended as a checklist for notebook computer security, many of them also apply to desktop workstations.

- Select an operating system, such as Windows 7, that allows secure logons, BIOS-level passwords, and strong firewall protection. You can also select hardware that allows you to require BIOS-level passwords. Also, log on and work with a user account that has limited privileges rather than an administrator account, and mask the administrator account by giving it a different name that would be hard for a casual intruder to guess.
- Mark or engrave the computer's case with the company name and address, or attach a tamper-proof asset ID tag. Many hardware vendors allow corporate customers to add an asset ID tag in the BIOS. For example, after powering up, you might see the message: *Property of SCR Associates – Company Use Only*. These measures might not discourage a professional thief, but might deter a casual thief, or at least make your computer relatively less desirable because it would be more difficult to use or resell. Security experts also recommend that you use a generic carrying case, such as an attaché case, rather than a custom carrying case that calls attention to itself and its contents. Also be sure to complete and submit all manufacturer registration cards.
- Consider notebook models that have a built-in fingerprint reader, as shown in Figure 12-28.
- Many notebook computers have a **Universal Security Slot** (**USS**) that can be fastened to a cable lock or laptop alarm. Again, while these precautions might not deter professional thieves, they might discourage and deter casual thieves.

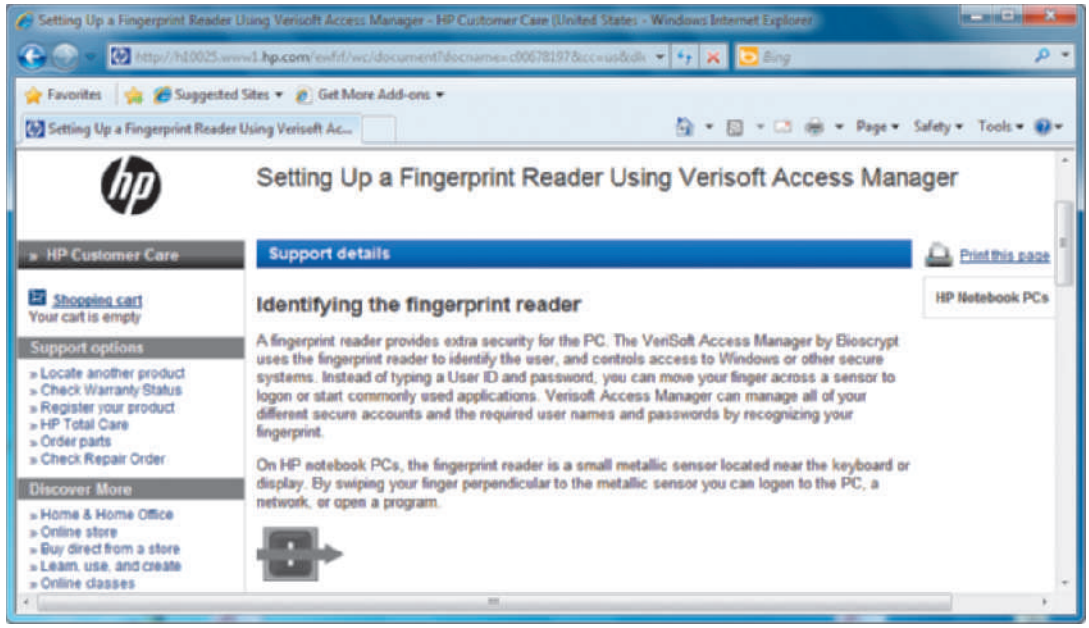


FIGURE 12-28 Some notebook computers feature a fingerprint reader, which is a small metallic sensor located near the keyboard or display.

- Back up all vital data before using the notebook computer outside the office. Also, instead of using your computer's hard drive, save and transport highly sensitive data on removable media, such as a flash memory device.
- Use tracking software that directs your laptop periodically to contact a security tracking center. If your notebook is stolen, the call-in identifies the computer and its physical location. Armed with this information, the security tracking center can alert law enforcement agencies and communications providers. As shown in Figure 12-29, Computrace sells a product called LoJack for Laptops, which offers call-in service, as well as a remote data erase capability. Some versions of the product even provide a payment if the firm does not recover your stolen laptop.

FIGURE 12-29 Many students use LoJack on their notebook computers. The product offers automated call-in identification and remote data erase capability.

- While traveling, try to be alert to potential high-risk situations, where a thief, or thieves, might attempt to distract your attention and snatch your computer. These situations often occur in crowded, noisy places like airport baggage claim areas, rental car counters, and security checkpoints. Also, when traveling by car, store your computer in a trunk or lockable compartment where it will not be visible.
- Establish stringent password protection policies that require minimum length and complexity, and set a limit on how many times an invalid password can be entered before the system locks itself down. In some situations, you might want to establish file encryption policies to protect extremely sensitive files.

CASE IN POINT 12.3: OUTER BANKS COUNTY

Outer Banks County is a 200-square-mile area in coastal North Carolina, and you are the IT manager. The county has about a hundred office employees who perform clerical tasks in various departments. A recent budget crisis has resulted in a wage and hiring freeze, and morale has declined. The county manager has asked you to install some type of keystroke logger to monitor employees and determine whether they are fully productive. After your conversation, you wonder whether there might be some potential privacy and security issues involved.

For example, does an employer have a duty to notify its employees that it is monitoring them? Should the employer notify them even if not required to do so? From a human resources viewpoint, what would be the best way to approach this issue? Also, does a potential security issue exist? If an unauthorized person gained possession of the keystroke log, he or she might be able to uncover passwords and other sensitive data.

What are your conclusions? Are these issues important, and how would you respond to the county manager's recommendation? Before you answer, you should go on the Internet and learn more about keystroke loggers generally, and specific products that currently are available.

Network Security

A **network** is defined as two or more devices that are connected for the purpose of sending, receiving, and sharing data, which is called network traffic. In order to connect to a network, a computer must have a **network interface**, which is a combination of hardware and software that allows the computer to interact with the network. To provide security for network traffic, data can be **encrypted**, which refers to a process of encoding the data so it cannot be accessed without authorization.

ENCRYPTING NETWORK TRAFFIC Network traffic can be intercepted and possibly altered, redirected, or recorded. For example, if an **unencrypted**, or **plain text**, password or credit card number is transmitted over a network connection, it can be stolen. When the traffic is encrypted, it still is visible, but its content and purpose are masked.

Figure 12-30 on the next page shows an example of encrypted traffic compared to plain text traffic. In the upper screen, the user has logged on to the SCR Associates case study, using a password of *sad9e*. Notice that anyone who gains access to this data easily could learn the user's password. In the lower screen, the user has logged on to an online bank account and used a password, but the encryption process has made it impossible to decipher the keystrokes.

Two commonly used encryption techniques are private key encryption and public key encryption. **Private key encryption** is symmetric, because a single key is used to encrypt and decrypt information. While this method is simple and fast, it poses a fundamental problem. To use symmetric encryption, both the sender and receiver must possess the same key beforehand, or it must be sent along with the message, which increases the risk of interception and disclosure.

In contrast, **public key encryption** (**PKE**) is asymmetric, because each user has a pair of keys: a public key and a private key, as shown in Figure 12-31 on the next page. Public keys are used to encrypt messages. Users can share their public keys freely, while keeping their private keys tightly guarded. Any message encrypted with a user's public key can only be decrypted with that user's private key. This method is commonly used in secure online shopping systems.

A recent Wikipedia article uses an interesting analogy for public key encryption. The article suggests that PKE is similar to a locked mailbox with a mail slot that is accessible to the public. The mailbox's location (street address) represents the public key. Anyone knowing the street address can drop a message through the slot. However, only a person with a key can open the box and read the message.

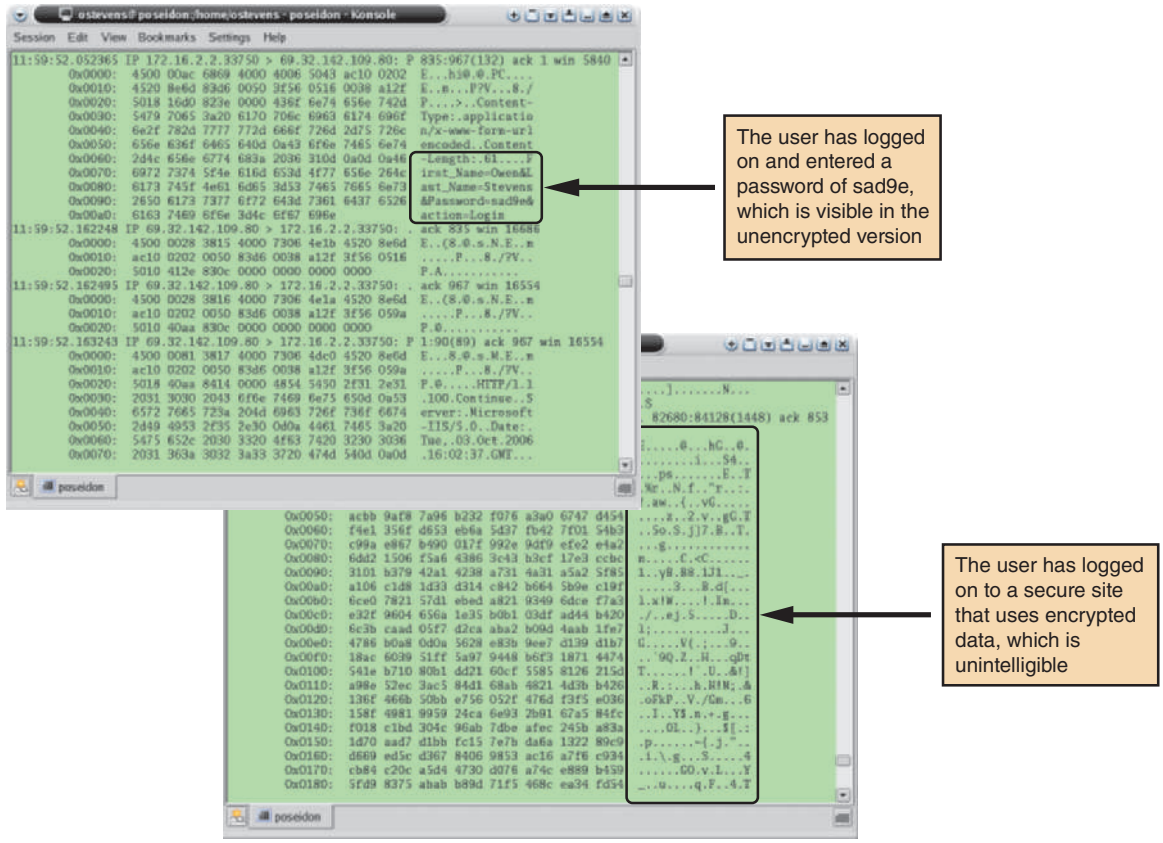


FIGURE 12-30 The upper screen shows an example of unencrypted text, which contains a visible password. In the lower screen, the encrypted text cannot be read.

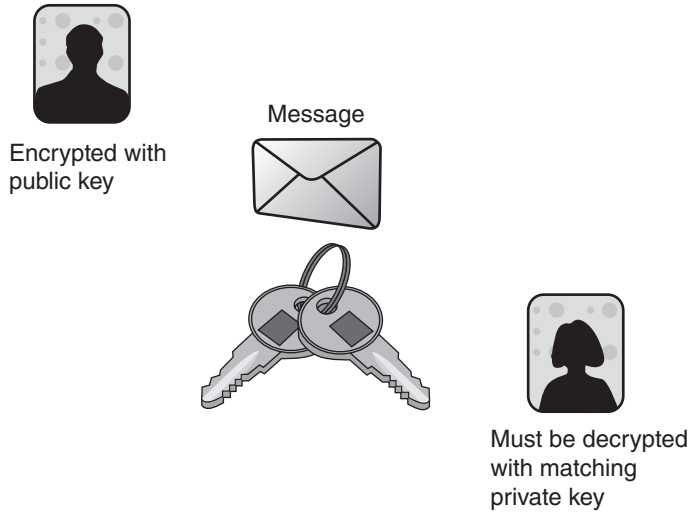


FIGURE 12-31 In a PKE environment, a message encrypted with a public key only can be decrypted with the matching private key.

WIRELESS NETWORKS As you learned in Chapter 10, wireless network security is a vital concern, because wireless transmission is much more vulnerable than traffic on a wired network. However, if wireless traffic is encrypted, any data that is intercepted by an unintended recipient will be useless to the intruder.

The earliest form of wireless security, called **Wired Equivalent Privacy (WEP)**, required each wireless client to use a special, preshared key. Although this method was used by many home and small office networks, it provided relatively weak protection.

WEP was replaced by **Wi-Fi Protected Access (WPA)**, which offered major security improvements based on protocols created by the Wi-Fi Alliance. The most recent wireless security enhancement, called **WPA2**, further strengthens the level of wireless protection. WPA2 is an extension of WPA based on a full implementation of the **IEEE 802.11i** standard. According to the WiFi Alliance, the WPA2 standard became mandatory for all new devices seeking Wi-Fi certification after 2006. WPA2 is compatible with WPA, so companies easily can migrate to the new security standard.

PRIVATE NETWORKS It is not always practical to secure all network traffic. Unfortunately, encrypting traffic increases the burden on a network, and can decrease network performance significantly. In situations where network speed is essential, such as a Web server linked to a database server, many firms use a private network to connect the computers. A **private network** is a dedicated connection, similar to a leased telephone line. Each computer on the private network must have a dedicated interface to the network, and no interface on the network should connect to any point outside the network. In this configuration, unencrypted traffic safely can be transmitted because it is not visible, and cannot be intercepted from outside the network.

VIRTUAL PRIVATE NETWORKS Private networks work well with a limited number of computers, but if a company wants to establish secure connections for a larger group, it can create a virtual private network (VPN). A **virtual private network (VPN)** uses a public network, such as the Internet or a company intranet, to connect remote users securely. Instead of using a dedicated connection, a VPN allows remote clients to use a special key exchange that must be authenticated by the VPN. Once authentication is complete, a secure network connection, called a **tunnel**, is established between the client and the access point of the local intranet. All traffic is encrypted through the VPN tunnel, which provides an additional level of encryption and security. As more companies allow employees to work from home, a VPN can provide acceptable levels of security and reliability.

PORTS AND SERVICES A **port**, which is identified by a number, is used to route incoming traffic to the correct application on a computer. In TCP/IP networks, such as the Internet, all traffic received by a computer contains a destination port. Because the destination port determines where the traffic will be routed, the computer sorts the traffic by port number, which is included in the transmitted data. An analogy might be a large apartment building with multiple mailboxes. Each mailbox has the same street address, but a different box number. Port security is critically important, because an attacker could use an open port to gain access to the system.

A **service** is an application that monitors, or listens on, a particular port. For example, a typical e-mail application listens on port 25. Any traffic received by that port is routed to the e-mail application. Services play an important role in computer security, and they can be affected by port scans and denial-of-service attacks.

- Port scans. **Port scans** attempt to detect the services running on a computer by trying to connect to various ports and recording the ports on which a connection was accepted. For example, the result of an open port 25 would indicate that a mail server is running. Port scans can be used to draw an accurate map of a network, and pinpoint possible weaknesses.
- Denial of service. A **denial of service (DoS)** attack occurs when an attacking computer makes repeated requests to a service or services running on certain ports. Because the target computer has to respond to each request, it can become bogged down and fail to respond to legitimate requests. A much more devastating attack based on this method is called a **distributed denial of service (DDoS)** attack. This attack involves multiple attacking computers that can synchronize DOS attacks and immobilize a server, as shown in Figure 12-32 on the next page. The seriousness of a DOS attack is evident in the National Cyber Alert System tip shown in Figure 12-33 on the next page.

FIREWALLS A **firewall** is the main line of defense between a local network, or intranet, and the Internet. A firewall must have at least one network interface with the Internet, and at least one network interface with a local network or intranet. Firewall software examines all network traffic sent to and from each network interface. Preset rules establish certain conditions that determine whether the firewall will allow the traffic to pass. When a

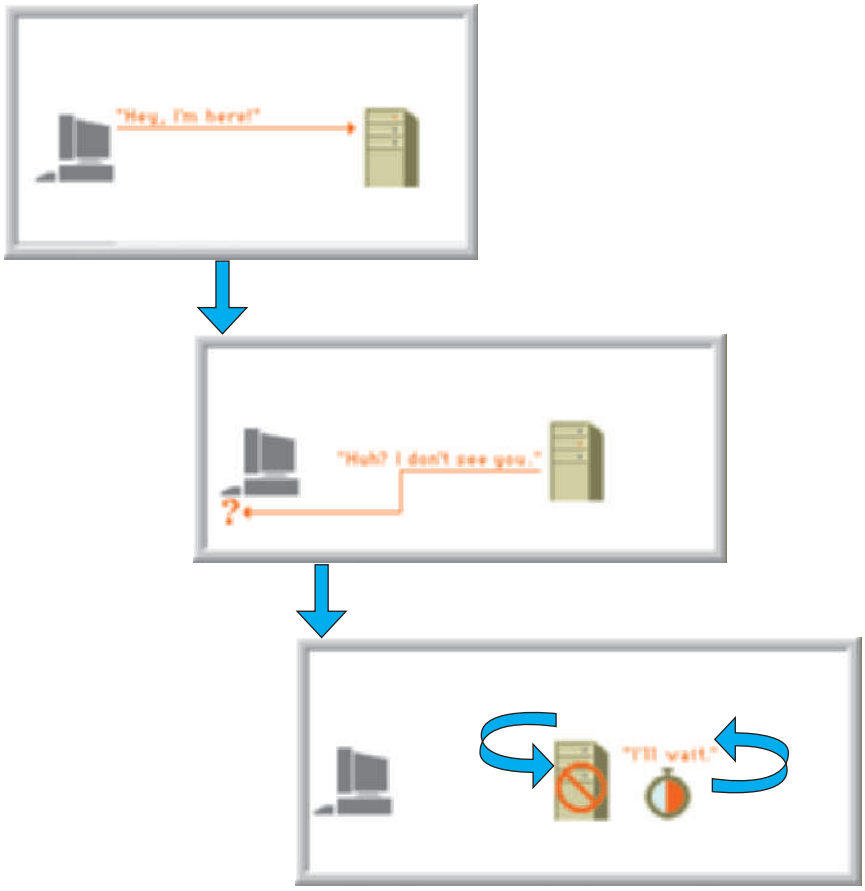


FIGURE 12-32 In a denial of service attack, an attacker sends numerous authentication requests with false return addresses. The server tries unsuccessfully to send authentication approval, and eventually is disabled by the flood of requests.

matching rule is found, the firewall automatically accepts, rejects, or drops the traffic. When a firewall rejects traffic, it sends a reply indicating that the traffic is not permissible. When a firewall drops traffic, no reply is sent. Firewalls can be configured to detect and respond to denial-of-service attacks, port scans, and other suspicious activity.

Figure 12-34 shows a basic set of firewall rules for a company that has a Web server and a mail server. In this example, the firewall would accept public Web server traffic only on ports 80 and 443, and public mail server traffic only on port 25. The firewall would allow private LAN traffic to any destination and port.

NETWORK INTRUSION DETECTION Suppose an intruder attempts to gain access to the system. Obviously, an intrusion alarm should be sounded when certain activity or known attack patterns are detected. A **network intrusion detection system** (NIDS) is like a burglar alarm that goes off when it detects a configuration violation. The NIDS also can alert the administrator when it detects suspicious network traffic patterns. A NIDS requires fine-tuning to detect the difference between legitimate network traffic and an

FIGURE 12-33 The United States Computer Emergency Readiness Team has published a security tip about DoS threats.

RULE	INTERFACE	SOURCE	DESTINATION	PORT	ACTION
1	Public	Any	Web Server	80	Accept
2	Public	Any	Web Server	443	Accept
3	Public	Any	Web Server	Any	Reject
4	Public	Any	Mail Server	25	Accept
5	Public	Any	Mail Server	Any	Reject
6	Public	Any	Any	Any	Drop
7	Private	LAN	Any	Any	Accept

FIGURE 12-34 Examples of rules that determine whether the firewall will allow traffic to pass.

attack. It is also important that a NIDS be placed on a switch or other network device that can monitor all network traffic. Although a NIDS requires some administrative overhead, it can be very helpful in documenting the efforts of attackers and analyzing network performance.

Application Security

In addition to securing the computer room and shielding network traffic, it is necessary to protect all server-based applications. To do so, you must analyze the application's functions, identify possible security concerns, and carefully study all available documentation. Application security requires an understanding of services, hardening, application permissions, input validation techniques, software patches and updates, and software logs.

SERVICES In the network security section, you learned that a service is an application that monitors, or listens, on a particular port. You can determine which services are running by using a port scan utility. If a particular application is not needed, it should be disabled. This will improve system security, performance, and reliability. An unnecessary or improperly configured service could create a vulnerability called a **security hole**. For example, if a loosely configured FTP (File Transfer Protocol) service is available to a hacker, he or she might be able to upload destructive code to the server.

HARDENING The **hardening** process makes a system more secure by removing unnecessary accounts, services, and features. Hardening is necessary because the default configuration of some software packages might create a vulnerability. For example, initial software settings might include relatively weak account permissions or file sharing controls. Hardening can be done manually or by using a configuration template, which speeds up the process in a large organization.

Hardening also includes additional protection such as antivirus and antispyware software. These programs can detect and remove **malware**, which is hostile software designed to infiltrate, damage, or deny service to a computer system. Malware includes worms, Trojan horses, keystroke loggers, and spyware, among others.

APPLICATION PERMISSIONS Typically, an application is configured to be run only by users who have specific rights. For example, an **administrator**, or **superuser** account, allows essentially unrestricted access. Other users might be allowed to enter data, but not to modify or delete existing data. To prevent unauthorized or destructive changes, the application should be configured so that nonprivileged users can access the program, but cannot make changes to built-in functions or configurations. **User rights**, also called **permissions**, are discussed in more detail in the file security section.

INPUT VALIDATION As you learned in Chapter 8, when designing the user interface, input validation can safeguard data integrity and security. For example, if an application requires a number from *1* to *10*, what happens if an alphabetic character or the number *31* is entered? If the application is designed properly, it will respond with an appropriate error message. Chapter 8 also explained data entry and validation checks, which are important techniques that can improve data integrity and quality. Failure to validate input data can result in output errors, increased maintenance expense, and erratic system behavior.

PATCHES AND UPDATES In an operational system, security holes or vulnerabilities might be discovered at any time. Patches can be used to repair these holes, reduce vulnerability, and update the system. Like any other new software, patches must be tested carefully. Before applying a patch, an effort should be made to determine the risks of *not* applying the patch, and the possibility that the patch might affect other areas of the system.

Many firms purchase software packages called **third-party software**. Patches released by third-party software vendors usually are safe, but any patch must be reviewed carefully before it is applied. Because researching and applying patches is time consuming and expensive, many software vendors offer an **automatic update service** that enables an application to contact the vendor's server and check for a needed patch or update. Depending on the configuration, available patches can be downloaded and installed without human intervention, or might require approval by IT managers. Although it is convenient, automatic updating carries substantial risks, and should be used only if changes can readily be undone if unexpected results or problems develop.

SOFTWARE LOGS Operating systems and applications typically maintain a **log** that documents all events, including dates, times, and other specific information. Logs can be important in understanding past attacks and preventing future intrusions. For example, a pattern of login errors might reveal the details of an intrusion attempt. A log also can include system error messages, login histories, file manipulation, and other information that could help track down unauthorized use. Software logs should be monitored constantly to determine if misuse or wrongdoing has occurred. As explained in the network security section, a network intrusion detection system (NIDS) can alert a system administrator whenever suspicious events occur. Windows Event Viewer, shown in Figure 12-35, is an example of a built-in software log.

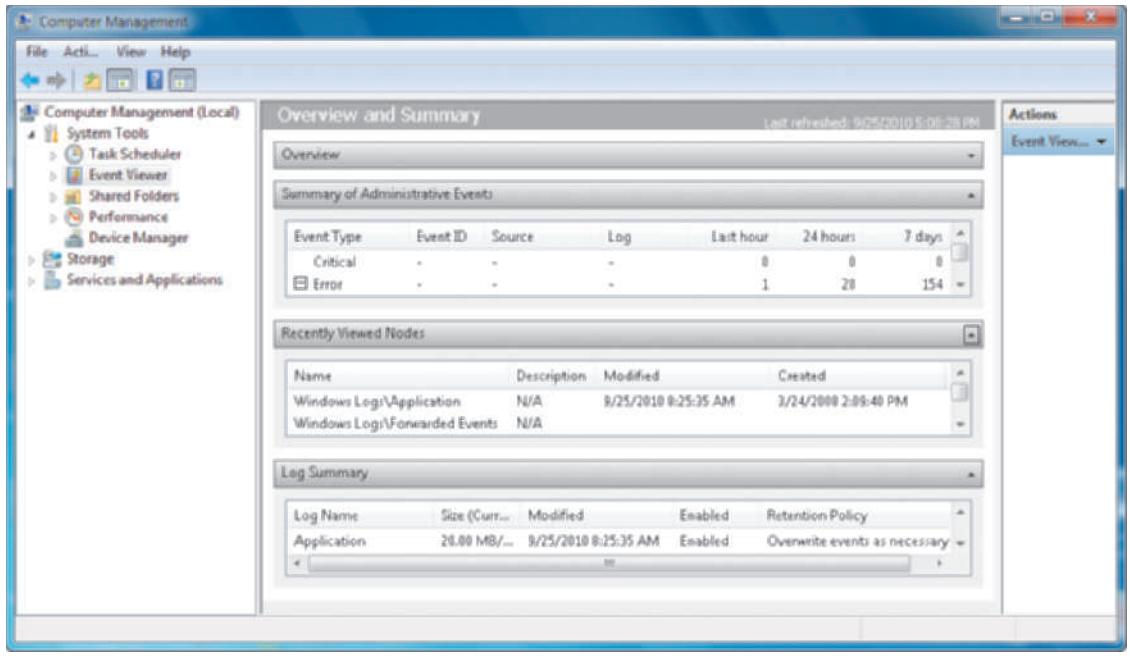


FIGURE 12-35 Windows Event Viewer can log application usage, security settings, and system changes.

File Security

Computer configuration settings, users' personal information, and other sensitive data are stored in files. The safety and protection of these files is a vital element in any computer security program, and a systems analyst needs to consider the importance of encryption, or encoding files to make them unreadable by unauthorized users, and permissions, which can be assigned to individual users or to user groups.

ENCRYPTION As you learned in the section on network security, encryption scrambles the contents of a file or document to protect it from unauthorized access. All corporate data must be protected, but encryption is especially important for sensitive material such as personnel or financial records. You can use the **Encrypting File System** (EFS), which is fully implemented on Windows 7 Professional, to encrypt and limit access to data. EFS can be enabled or disabled at the folder or the document level by simply changing the properties for that folder or document.

PERMISSIONS File security is based on establishing a set of permissions, which describe the rights a user has to a particular file or directory on a server. The most common permissions are read, write, and execute. Typical examples of permissions include the following:

- Read a file — The user can read the contents of the file.
- Write a file — The user can change the contents of the file.
- Execute a file — The user can run the file, if it is a program.
- Read a directory — The user can list the contents of the directory.
- Write a directory — The user can add and remove files in the directory.

When assigning file permissions, a system administrator should ensure that each user has only the minimum permissions necessary to perform his or her work — not more. In some firms, the system administrator has broad discretion in assigning these levels; in other companies, an appropriate level of management approval is required for any permissions above a standard user level. In any case, a well-documented and enforced permissions policy is necessary to promote file security and reduce system vulnerability.

USER GROUPS Individual users who need to collaborate and share files often request a higher level of permissions that would enable any of them to change file content. A better approach, from a system administrator's viewpoint, might be to create a user group, add specific users, and assign file permissions to the group, rather than to the individuals. Many firms use this approach, because it allows a user's rights to be determined by his or her work responsibilities, rather than by job title or rank. If a person is transferred, he or she leaves certain groups and joins others that reflect current job duties.

User Security

User security involves the identification of system users and consideration of user-related security issues. Regardless of other security precautions and features, security ultimately depends on system users and their habits, practices, and willingness to support security goals. Unfortunately, many system break-ins begin with a user account that is compromised in some way. Typically, an intruder accesses the system using the compromised account, and may attempt a **privilege escalation attack**, which is an unauthorized attempt to increase permission levels.

User security requires identity management, comprehensive password protection, defenses against social engineering, an effective means of overcoming user resistance, and consideration of new technologies. These topics are discussed in the following sections.

ON THE WEB

To learn more about identity management, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for this chapter, and locate the Identity Management link.

IDENTITY MANAGEMENT **Identity management** refers to controls and procedures necessary to identify legitimate users and system components. An identity management strategy must balance technology, security, privacy, cost, and user productivity. Identity management is an evolving technology that is being pursued intensively by corporations, IT associations, and governments.

The Burton Group, a leading IT security consultant, has described identity management as a "set of electronic records that represent … people, machines, devices, applications, and services." This definition suggests that not just users, but each component in a system, must have a verifiable identity that is based on unique characteristics. For example, user authentication might be based on a combination of a password, a Social Security number, an employee number, a job title, and a physical location.

Because of the devastating consequences of intrusion, IT managers are giving top priority to identity management strategies and solutions.

PASSWORD PROTECTION As the section on physical security points out, a secure system must have a password policy that requires minimum length, complexity, and a limit on invalid login attempts. Although passwords are a key element in any security program, users often choose passwords that are easy to recall, and they sometimes resent having to remember complex passwords. Even so, IT managers should insist on passwords that have a minimum length, require a combination of case-sensitive letters and numbers, and must be changed periodically. Unfortunately, any password can be compromised if a user writes it down and stores it in an easily accessible location such as a desk, a bulletin board, or under the keyboard.

During a recent U.S. election campaign, a hacker made global headlines by gaining access to the e-mail account of a vice-presidential candidate. The intruder signed on as the candidate, requested a new password, guessed the answers to the security questions, and was able to enter the account. These actions were totally illegal, and constituted a serious felony under federal law.

SOCIAL ENGINEERING Even if users are protecting and securing their passwords, an intruder might attempt to gain unauthorized access to a system using a tactic called **social engineering**. In a social engineering attack, an intruder uses social interaction to gain access to a computer system. For example, the intruder might pretend to be a new employee, an outside technician, or a journalist. Through a series of questions, the intruder tries to obtain the information that he or she needs to compromise the system. A common ploy is for the attacker to contact several people in the same organization, and use some information from one source to gain credibility and entry to another source.

An intruder also might contact a help desk and say: "Hi. This is Anna Dressler from accounting. I seem to have forgotten my password. Could you give me a new one?" Although this request might be legitimate, it also might be an attacker trying to access the system. A password never should be given based solely on this telephone call. The user should be required to provide further information to validate his or her identity, such as a Social Security number, employee ID, telephone extension, and company e-mail address.

One highly publicized form of social engineering is called **pretexting**, which is a method of obtaining personal information under false pretenses. Pretexting, which is described in the Federal Trade Commission statement shown in Figure 12-36, is a very real threat. The best way to combat social engineering attacks is with employee education, more training, and a high level of awareness during day-to-day operations.

FIGURE 12-36 As the Federal Trade Commission points out, pretexting involves obtaining your personal information under false pretenses.

USER RESISTANCE Many users, including some senior managers, dislike tight security measures because they can be inconvenient and time consuming. Systems analysts should remind users that the company owes the best possible security to its customers, who have entrusted personal information to the firm; to its employees, who also have personal information stored in company files; and to its shareholders, who expect the company to have a suitable, effective, and comprehensive security program that will safeguard company assets and resources. When users understand this overall commitment to security and feel that they are part of it, they are more likely to choose better passwords, be more alert to security issues, and contribute to the overall success of the company's security program.

NEW TECHNOLOGIES In addition to traditional measures and biometric devices, technology can enhance security and prevent unauthorized access. For example, a **security token** is a physical device that authenticates a legitimate user. The Wikipedia image in Figure 12-37 shows several types of security tokens. Some firms provide employees with security tokens that generate a numeric validation code, which the employee enters in addition to his or her normal password.

Unfortunately, new technology sometimes creates new risks. For example, Google offers a desktop-based search engine, Google Desktop, with a powerful indexing feature that scans all the files, documents, e-mails, chats, and stored Web pages on a user's computer. Although the program provides a convenient way for users to locate and retrieve their data, it also can make it easier for an

FIGURE 12-37 Security tokens, which come is various forms, can provide an additional level of security.

intruder to obtain private information, especially in a multiuser environment, because the program can recall and display almost anything stored on the computer. Also, if an intruder uses the term *password* in a search, the program might be able to find password reminders that are stored anywhere on the computer. According to Google, the search index resides on the user's computer and is never sent or made accessible to Google or anyone else without explicit consent. However, to maintain privacy for multiuser computers, Google strongly recommends that each user have a separate account, with individual usernames and passwords.

Google Desktop also offers a way for users to search across multiple computers, and this option has caused some concern among IT managers and privacy advocates. To perform a multi-computer search, it is necessary to store a user's data temporarily on Google's servers. Some observers feel that this makes the data more vulnerable and possibly subject to examination by third parties, including government agencies. Google states that if you choose to enable the *Search Across Computers* feature, your shared data is encrypted and treated as personal information, in accordance with the Google Privacy Policy. Software such as Google Desktop is powerful, convenient, and fun to use. However, you should understand the possible risks involved before installing this type of software on personal or business workstations.

Procedural Security

Procedural security, also called **operational security**, is concerned with managerial policies and controls that ensure secure operations. In fact, many IT professionals believe that security depends more on managerial issues than technology. Management must work to establish a corporate culture that stresses the importance of security to the firm and its people. Procedural security defines how particular tasks are to be performed, from large-scale data backups to everyday tasks such as storing e-mails or forms. Other procedures might spell out how to update firewall software or how security personnel should treat suspected attackers.

All employees should understand that they have a personal responsibility for security. For example, an employee handbook might require that users log out of their system accounts, clear their desks, and secure all documents before leaving for the day. These policies reduce the risk of **dumpster diving** attacks, in which an intruder raids desks or trash bins for valuable information. In addition, paper shredders should be used to destroy sensitive documents.

Procedural security also includes safeguarding certain procedures that would be valuable to an attacker. The most common approach is a *need-to-know* concept, where access is limited to employees who need the information to perform security-related tasks. Many firms also apply a set of classification levels for access to company documents. For example, highly sensitive technical documents might be available only to the IT support team, while user-related materials would be available to most company employees. If classification levels are used, they should be identified clearly and enforced consistently.

CASE IN POINT 12.4: Chain Link Consulting, Inc.

Chain Link Consulting is an IT consulting firm that specializes in system security issues. The company's president has asked you to help her put together a presentation to a group of potential clients at a trade show meeting next month. First, she wants you to review system security issues, considering all six security levels. Then she wants you to come up with a list of ways that Chain Link could test a client's security practices, in order to get a real-world assessment of vulnerability.

To make matters more interesting, she told you it was OK to be creative in your recommendations, but not to propose any action that would be illegal or unethical. For example, it would be OK to pose as a job applicant with false references to see if they were being checked, but it would not be appropriate to pick a lock and enter the computer room.

Your report is due tomorrow. What will you suggest?

Procedural security must be supported by upper management and fully explained to all employees. The organization must provide training to explain the procedures and issue reminders from time to time that will make security issues a priority.

Backup and Recovery

Every system must provide for data backup and recovery. **Backup** refers to copying data at prescribed intervals, or continuously. **Recovery** involves restoring the data and restarting the system after an interruption. An overall backup and recovery plan that prepares for a potential disaster is called a **disaster recovery plan**.

The tragic events of September 11, 2001, and increased concern about global terrorism have led many companies to upgrade their backup and disaster recovery plans. Heightened focus on disaster recovery has spawned a whole new industry, which includes new tools and strategies. Many IT professionals feel that terrorism concerns have raised security awareness throughout the corporate world. Although they are separate topics, backup and disaster recovery issues usually are intertwined. The following sections cover these topics in more detail.

ON THE WEB

To learn more backup and disaster recovery, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for this chapter, and locate the Backup and Disaster Recovery link.

Backup Policies

The cornerstone of business data protection is a **backup policy**, which contains detailed instructions and procedures. An effective backup policy can help a firm continue business operations and survive a catastrophe. The backup policy should specify backup media, backup types, and retention periods.

BACKUP MEDIA **Backup media** can include tape, hard drives, optical storage, and online storage. Physical backups must be carefully identified and stored in a secure location. **Offsiting** refers to the practice of storing backup media away from the main business location, in order to mitigate the risk of a catastrophic disaster such as a flood, fire, or earthquake. Even if the operating system includes a backup utility, many system administrators prefer to use specialized third-party software that offers more options and better controls for large-scale operations.

In addition to on-site data storage, many companies use Web-based data backup and retrieval services offered by vendors such as Rocky Mountain Software and IBM. For a small- or medium-sized firm, this option can be cost effective and reliable.

BACKUP TYPES Backups can be full, differential, incremental, or continuous. A **full backup** is a complete backup of every file on the system. Frequent full backups are time consuming and redundant if most files are unchanged since the last full backup. Instead of performing a full backup, another option is to perform a **differential backup**, which is faster because it backs up *only* the files that are new or changed since the last full backup. To restore the data to its original state, you restore the last full backup, and then restore the last differential backup. Many IT managers believe that a combination of full and differential backups is the best option, because it uses the least amount of storage space and is simple.

The fastest method, called an **incremental backup**, only includes recent files that never have been backed up by any method. This approach, however, requires multiple steps to restore the data — one for each incremental backup.

Most large systems use **continuous backup**, which is a real-time streaming method that records all system activity as it occurs. This method requires expensive hardware, software, and substantial network capacity. However, system restoration is rapid and effective because data is being captured in real time, as it occurs. Continuous backup often uses a **RAID** (**redundant array of independent disks**) system that mirrors the data. RAID systems are called **fault-tolerant**, because a failure of any one disk does not disable the system. Compared to one

large drive, a RAID design offers better performance, greater capacity, and improved reliability. When installed on a server, a RAID array of multiple drives appears to the computer as a single logical drive. Figure 12-38 shows a comparison of various backup methods.

Comparison of Backup Methods

BACKUP TYPE	CHARACTERISTICS	PROS AND CONS	TYPICAL FREQUENCY
Full	Backs up all files.	Slowest backup time and requires the most storage space. Rapid recovery because all files are restored in a single step.	Monthly or weekly.
Differential	Only backs up files that are new or changed since the last full backup.	Faster than a full backup and requires less storage space. All data can be restored in just two steps by using the last full backup and the last differential backup.	Weekly or daily.
Incremental	Only backs up files that are new or changed since the last backup of any kind.	Fastest backup and requires the least storage space because it only saves files that have never been backed up. However, requires many restore steps – one for each incremental backup.	Daily or more often.
Continuous	Real-time, streaming method that records all system activity.	Very expensive hardware, software, and network capacity. Recovery is very fast because system can be restored to just before an interruption.	Usually only used by large firms and network-based systems.

FIGURE 12-38 Comparison of full, differential, incremental, and continuous backup methods.

RETENTION PERIODS Backups are stored for a specific **retention period** after which they are either destroyed or the backup media is reused. Retention periods can be a specific number of months or years, depending on legal requirements and company policy. Stored media must be secured, protected, and inventoried periodically.

Business Continuity Issues

Global concern about terrorism has raised awareness levels and increased top management support for a business continuity strategy in the event of an emergency. A disaster recovery plan describes actions to be taken, specifies key individuals and rescue authorities to be notified, and spells out the role of employees in evacuation, mitigation, and recovery efforts. The disaster recovery plan should be accompanied by a **test plan**, which can simulate various levels of emergencies and record the responses, which can be analyzed and improved as necessary.

secure location. Afterward, the plan should focus on resuming business operations, including the salvaging or replacement of equipment and the recovery of backup data. The main objective of a disaster recovery plan is to restore business operations to pre-disaster levels.

Disaster recovery plans are often part of a larger **business continuity plan** (BCP), which goes beyond a recovery plan, and defines how critical business functions can continue in the event of a major disruption. Some BCPs specify the use of a hot site. A **hot site** is an alternate IT location, anywhere in the world, that can support critical systems in the event of a power outage, system crash, or physical catastrophe. A hot site requires **data replication**, which means that any transaction on the primary system must be mirrored on the hot site. If the primary system becomes unavailable, the hot site will have the latest data and can function seamlessly, with no downtime.

Although hot sites are attractive backup solutions, they are very expensive. However, a hot site provides the best insurance against major business interruptions. In addition to hot sites, business insurance can be important in a worst-case scenario. Although expensive, business insurance can offset the financial impact of system failure and business interruption.

System Obsolescence

At some point, every system becomes obsolete. For example, you might not remember punched cards, but they represented the cutting edge of data management back in the 1960s. Data was stored by punching holes at various positions, and was retrieved by machines that could sense the presence or absence of a punched hole. Most full-size cards stored only 80 characters, or bytes, so more than 12,000 cards would be needed to store a megabyte. Punched cards were even used as checks and utility bills. Today, this technology is virtually obsolete.

Constantly changing technology means that every system has a limited economic life span. Analysts and managers can anticipate system obsolescence in several ways and it never should come as a complete surprise.

A system becomes **obsolete** when it no longer supports user needs, or when the platform becomes outmoded. The most common reason for discontinuing a system is that it has reached the end of its economically useful life, as indicated by the following signs:

- The system's maintenance history indicates that adaptive and corrective maintenance are increasing steadily.
- Operational costs or execution times are increasing rapidly, and routine perfective maintenance does not reverse or slow the trend.
- A software package is available that provides the same or additional services faster, better, and less expensively than the current system.
- New technology offers a way to perform the same or additional functions more efficiently.
- Maintenance changes or additions are difficult and expensive to perform.
- Users request significant new features to support business requirements.

Systems operation and support continues until a replacement system is installed. Toward the end of a system's operational life, users are unlikely to submit new requests for adaptive maintenance because they are looking forward to the new release. Similarly, the IT staff usually does not perform much perfective or preventive maintenance because the system will not be around long enough to justify the cost. A system in its final stages requires corrective maintenance only to keep the system operational.

User satisfaction typically determines the life span of a system. The critical success factor for any system is whether or not it helps users achieve their operational and business goals. As an IT staff member, you should expect to receive input from users and managers throughout the systems development process. You should investigate and document all negative feedback, because it can be the first signal of system obsolescence.

At some point in a system's operational life, maintenance costs start to increase, users begin to ask for more features and capability, new systems requests are submitted, and the SDLC begins again.

Future Challenges and Opportunities

The only thing that is certain about the future is continuous change. Change itself is neither good nor bad — the real issue is how people and companies deal with the challenges and opportunities that are bound to occur.

No one would start a complex journey without a map and a plan. To navigate the future of information technology, companies require strategic plans, which were discussed in Chapter 2. An individual also needs a plan to reach to a specific goal or destination. This section discusses some predictions and stresses the importance of personal planning and development, including the acquisition of professional credentials.

Predictions

Although no one can foresee the future, it is safe to assume that companies will face intense competition and economic, social, and political uncertainty. Many IT experts believe that in this environment, the highest priorities will be the safety and security of corporate operations, environmental concerns, and bottom-line TCO.

Gartner Inc. is a leading consulting firm that is famous for accurate predictions of IT trends. Here is a summary of predictions that Gartner published in January, 2010:

- By 2012, 50% of traveling workers will use lighter, smaller Internet-centric devices rather than notebook computers. A new class of portable applications will enable users to re-create their work environment across multiple locations or systems.
- By 2012, 80% of commercial software will include open-source components. As open-source applications become mature, stable, and well supported, they will represent significant value opportunities for users.
- By 2012, one-third of business software spending will be for Software as a Service (SaaS).
- By 2012, 20% of businesses will use third parties to supply IT needs and will own no IT assets.
- By 2012, Facebook will become the hub for social network integration and Web socialization.
- By 2012, 60% of a new PC's total greenhouse gas emissions will have occurred before the user first turns the machine on.
- By 2013, mobile phones will overtake PCs as the most common Web access device worldwide.
- By 2014, most IT business cases will include carbon remediation costs.
- By 2014, over 3 billion adults worldwide will perform electronic transactions via mobile or Internet technology.
- By 2015, some aspects of online marketing will be regulated, which will affect more than $250 billion in Internet sales worldwide.

Gartner also predicted that large enterprises will require suppliers to certify their green credentials and sourcing policies. One issue might relate to the explosion of data storage and server farms, such as the one shown in Figure 12-39. In his 2008 book, *Planet Google*, author Randall Stross noted that the enormous amount of energy needed to drive cloud computing, including Google's servers, has raised serious environmental concerns. At the time he wrote the book, the author stated that data centers were already consuming more power in the United States than television sets.

FIGURE 12-39 The rapid growth of data centers and server farms has increased energy consumption significantly and raised environmental concerns.

Strategic Planning for IT Professionals

An IT professional should think of himself or herself as a business corporation that has certain assets, potential liabilities, and specific goals. Individuals, like companies, must have a strategic plan. The starting point is to formulate an answer to the following career planning question: What do I want to be doing three, five, or ten years from now?

Working backwards from your long-term goals, you can develop intermediate milestones and begin to manage your career just as you would manage an IT project. You can even use the project management tools described in Chapter 3 to construct a Gantt chart or a PERT/CPM chart using months (or years) as time units. Once the plan is developed, you would monitor it regularly to see whether you were still on schedule.

Planning a career is not unlike planting a tree that takes several years to reach a certain height. Once you know the desired height and the annual growth rate, you can determine when you must plant the tree. Similarly, if you want to possess a particular educational credential two years from now, and the credential takes two years to earn, then you need to start on it immediately if you want to adhere to stay on track.

IT Credentials and Certification

In recent years, technical credentials and certification have become extremely important to IT employers and employees. In a broad sense, **credentials** include formal degrees, diplomas, or certificates granted by learning institutions to show that a certain level of education has been achieved successfully. The term **certification** also has a special meaning that relates to specific hardware and software skills that can be measured and verified by examination. For example, a person might have a two- or four-year degree in Information Systems and possess an A+ certification, which attests to the person's computer hardware knowledge and skills.

Many IT industry leaders offer certification, including Microsoft, Cisco, Novell, Oracle, and Sun Microsystems.

About.com, shown in Figure 12-40 on the next page, offers hundreds of online guides and solutions for everyday questions and topics. The site includes descriptions of popular computer certifications, suggestions for choosing a certification, and tips on how to prepare for the exams.

Critical Thinking Skills

In additional to technical skills, IT professionals must have **soft skills**, such as communications, interpersonal, and perceptive abilities. IT professionals also need critical thinking skills to succeed in the workplace.

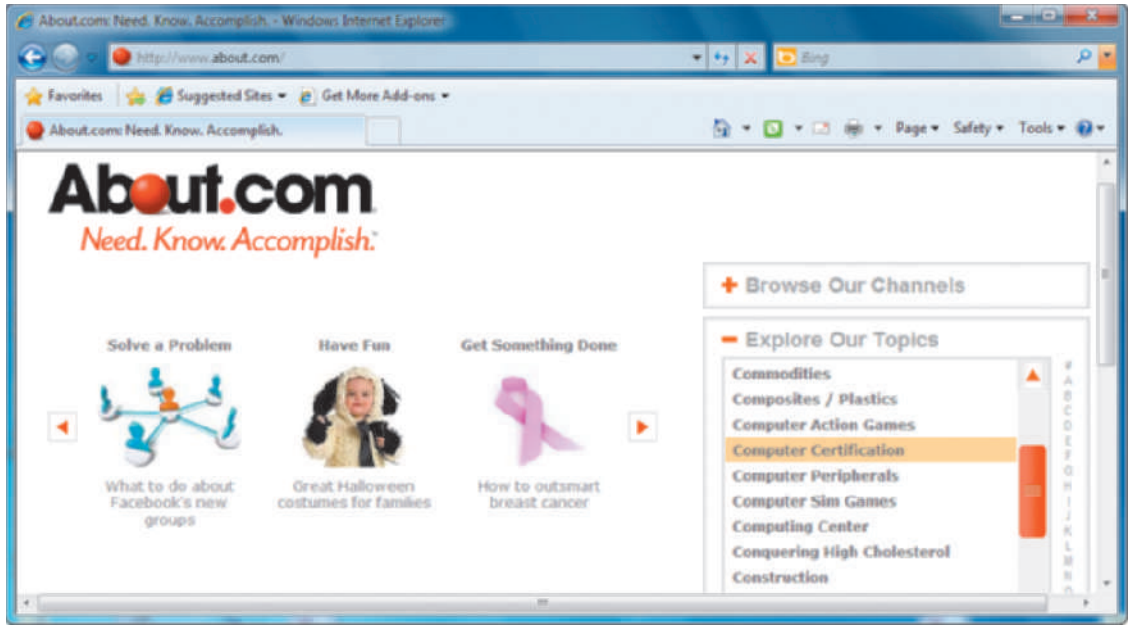


FIGURE 12-40 About.com offers online guides and solutions for everyday questions, including a section on computer certification.

Our digital society is inundated with massive amounts of data. Data mining, clever algorithms, and technical innovation are important, but the most valuable asset is an employee who can solve problems. The IT community has become interested in **critical thinking skills** that can help a person find, organize, analyze, and use the information he or she needs on the job. Many employers now seek critical thinkers who can locate data, identify important facts, and apply their knowledge in real-world decisions.

Many training courses exist for technical skills, but how do you develop your critical thinking skills? The best answer is to practice by performing tasks that resemble actual workplace tasks. As a future systems analyst, you already have an advantage — you know how to develop models, organize data, and recognize patterns. You can also complete the 12 *Ready for a Challenge* exercises at the end of each chapter. These exercises require critical thinking skills, and can help you learn, practice, and apply skills that you can take to the workplace.

Many instructors find that individual and team-based exercises can strengthen critical thinking skills. Examples include games, puzzles, brainstorming, creative problem-solving, decision tables, working with ethical questions, Boolean logic, Venn diagrams, and using cause-and-effect tools such as Pareto charts, X-Y diagrams, and fishbone diagrams, all of which can be found in this textbook.

A QUESTION OF ETHICS

Jamie just completed a routine security audit on the company's information systems, and she found several areas of vulnerability. For example, file permissions have not been updated in some time, no comprehensive password policy exists, and network traffic is not fully encrypted. She noted these areas, among others, in a report to Tamika, her supervisor. The report included specific recommendations to fix the problems.

Tamika responded by saying that budgets are tight right now, and she could not approve Jamie's requests to resolve these issues. As an IT professional, Jamie is very uncomfortable with the risk level, but she has been unable to sway Tamika. When Jamie discussed the situation with her friend, Ethan, he said, "Why worry about it? If it's good enough for Tamika, it should be good enough for you."

What do you think of Ethan's advice, and why? Is this an ethical question? If Jamie still is uncomfortable, what are her options?

Chapter Summary

Systems support and security covers the period from the implementation of an information system until the system no longer is used. A systems analyst's primary involvement with an operational system is to manage and solve user support requests.

Corrective maintenance includes changes to correct errors. Adaptive maintenance satisfies new systems requirements, and perfective maintenance makes the system more efficient. Adaptive and perfective maintenance changes often are called enhancements. Preventive maintenance is performed to avoid future problems.

The typical maintenance process resembles a miniature version of the systems development life cycle. A systems request for maintenance work is submitted and evaluated. If it is accepted, the request is prioritized and scheduled for the IT group. The maintenance team then follows a logical progression of investigation, analysis, design, development, testing, and implementation.

Corrective maintenance projects occur when a user or an IT staff member reports a problem. Standard maintenance procedures usually are followed for relatively minor errors, but work often begins immediately when users report significant errors.

In contrast to corrective maintenance, adaptive, perfective, and preventive maintenance projects always follow the organization's standard maintenance procedures. Adaptive maintenance projects occur in response to user requests for improvements to meet changes in the business or operating environments. The IT staff usually initiates perfective maintenance projects to improve performance or maintainability. Automated program restructuring and reengineering are forms of perfective maintenance. In order to avoid future problems, IT staff performs preventive maintenance, which involves analysis of areas where trouble is likely to occur.

A maintenance team consists of one or more systems analysts and programmers. Systems analysts need the same talents and abilities for maintenance work as they use when developing a new system. Many IT departments are organized into separate new development and maintenance groups where staff members are rotated from one group to the other.

Configuration management is necessary to handle maintenance requests, to manage different versions of the information system, and to distribute documentation changes. Maintenance changes can be implemented as they are completed or a release methodol-

ogy can be used in which all noncritical maintenance changes are collected and implemented simultaneously. A release methodology usually is cost effective and advantageous for users because they do not have to work with a constantly changing system. Systems analysts use functional, allocated, and product baselines as formal reference points to measure system characteristics at a specific time.

System performance measurements include response time, bandwidth, throughput, and turnaround time. Capacity management uses those measurements to forecast what is needed to provide future levels of service and support. Also, CASE tools that include system evaluation and maintenance features can be used during the systems operation, security, and support phase.

Security is a vital part of every computer system. System security is dependent upon a comprehensive security policy that defines how organizational assets are to be protected and how attacks are to be responded to.

Risk management creates a workable security policy by identifying, analyzing, anticipating, and reducing risks to an acceptable level. Because information systems face a wide array of threats and attacks, six separate but interrelated security levels should be analyzed: physical security, network security, application security, file security, user security, and procedural security. Physical security concerns the physical environment, including critical equipment located in a computer room, as well as safeguards for servers and desktops throughout the company. Network security involves encryption techniques, as well as private networks and other protective measures, especially where wireless transmissions are concerned. Application security requires an understanding of services, hardening, application permissions, input validation techniques, software patches and updates, and software logs. File security involves the use of encryption, and permissions, which can be assigned to individual users or to user groups. User security involves identity management techniques, a comprehensive password protection policy, an awareness of social engineering risks, and an effective means of overcoming user resistance. Procedural security involves managerial controls and policies that ensure secure operations.

Data backup and recovery issues include backup media, backup schedules, and retention periods, as well as backup designs such as RAID and Web-based backups.

All information systems eventually become obsolete. The end of a system's economic life usually is signaled by rapidly increasing maintenance or operating costs, the availability of new software or hardware, or new requirements that cannot be achieved easily by the existing system. When a certain point is reached, an information system must be replaced, and the entire systems development life cycle begins again.

Many IT experts predict intense competition in the future, along with economic, political, and social uncertainty. Facing these challenges, top IT priorities will be the safety and security of corporate operations, environmental concerns, and bottom-line TCO.

An IT professional should have a strategic career plan that includes long-term goals and intermediate milestones. An important element of a personal strategic plan is the acquisition of IT credentials and certifications that document specific knowledge and skills. Many IT industry leaders offer certification. In addition to technical ability, other skills, such as critical thinking skills, also are extremely valuable.

Key Terms and Phrases

acceptance *592*
adaptive maintenance *575*
administrator *601*
allocated baseline *584*
applications programmer *579*
archived *583*
asset *590*
attack *592*
automatic update service *602*
availability *590*
avoidance *592*
backup *607*
backup media *607*
backup policy *607*
bandwidth *586*
baseline *584*
benchmark testing *585*
biometric scanning systems *594*
BIOS-level password *595*
boot-level password *595*
business continuity plan (BCP) *609*
capacity planning *587*
certification *611*
change control (CC) *582*
CIA triangle *589*
confidentiality *589*
configuration management (CM) *582*
continuous backup *607*
corrective maintenance *575*
credentials *611*
critical risk *591*
critical thinking skills *612*
database programmer *579*
data replication *609*
denial of service (DOS) *599*
differential backup *607*
disaster recovery plan *607*
distributed denial of service (DDOS) *599*
dumpster diving *606*
encrypted *597*
Encrypting File System (EFS) *603*
enhancement *576*
exploit *591*
fault management *585*
fault tolerant *607*
firewall *599*
full backup *607*
functional baseline *584*
Gbps (gigabits per second) *586*
hardening *601*
help desk *572*
hot site *609*
identity management *604*
IEEE 802.11i *598*
incremental backup *607*
information center (IC) *572*
integrity *590*
Kbps (kilobits per second) *586*
keystroke logger *594*
log *602*
maintenance activities *574*
maintenance expenses *574*
maintenance release *583*
maintenance release methodology *583*
maintenance team *578*
malware *601*
Mbps (megabits per second) *586*
metrics *585*
Microsoft Management Console (MMC) *590*
mitigation *592*
network *597*
network interface *597*
network intrusion detection system (NIDS) *600*
obsolete *609*
offsiting *607*
operational costs *574*
operational security *606*
patches *576*
perfective maintenance *575*
permissions *601*
plain text *597*
port *599*
port scan *599*
power-on password *595*
pretexting *604*
preventive maintenance *575*
private key encryption *597*
private network *599*
privilege escalation attack *603*
procedural security *606*
product baseline *584*
programmer/analyst *579*
public key encryption (PKE) *597*
RAID (redundant array of independent disks) *607*
recovery *607*
remote control software *573*
response time *586*
retention period *608*
risk *591*
risk assessment *590*
risk control *590*
risk identification *590*
risk management *590*
security *589*
security hole *601*
security policy *590*
security token *605*
service *599*
service packs *583*
social engineering *604*
soft skills *611*
software reengineering *576*
superuser *601*
system administrator *578*
systems programmer *579*
tamper-evident cases *595*
test plan *608*
third-party software *602*
threat *590*
throughput *586*
transference *592*
tunnel *599*
turnaround time *587*
unencrypted *597*
uninterruptible power supply (UPS) *595*
Universal Security Slot (USS) *595*
user rights *601*
user training package *572*
version control *583*
virtual private network (VPN) *599*
vulnerability *591*
what-if analysis *587*
Wi-Fi Protected Access (WPA) *598*
Wired Equivalent Privacy (WEP) *598*
WPA2 *598*

Learn It Online

Instructions: To complete the Learn It Online exercises, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to the resources for this chapter, and click the link for the exercise you want to complete.

1 Chapter Reinforcement

TF, MC, and SA

Click one of the Chapter Reinforcement links for Multiple Choice, True/False, or Short Answer. Answer each question and submit to your instructor.

2 Flash Cards

Click the Flash Cards link and read the instructions. Type 20 (or a number specified by your instructor) in the Number of playing cards text box, type your name in the Enter your Name text box, and then click the Flip Card button. When the flash card is displayed, read the question and then click the ANSWER box arrow to select an answer. Flip through the Flash Cards. If your score is 15 (75%) correct or greater, click Print on the File menu to print your results. If your score is less than 15 (75%) correct, then redo this exercise by clicking the Replay button.

3 Practice Test

Click the Practice Test link. Answer each question, enter your first and last name at the bottom of the page, and then click the Grade Test button. When the graded practice test is displayed on your screen, click Print on the File menu to print a hard copy. Continue to take practice tests until you score 80% or better.

4 Who Wants To Be a Computer Genius?

Click the Computer Genius link. Read the instructions, enter your first and last name at the bottom of the page, and then click the Play button. When your score is displayed, click the PRINT RESULTS link to print a hard copy.

5 Wheel of Terms

Click the Wheel of Terms link. Read the instructions, and then enter your first and last name and your school name. Click the PLAY button. When your score is displayed on the screen, right-click the score and then click Print on the shortcut menu to print a hard copy.

6 Crossword Puzzle Challenge

Click the Crossword Puzzle Challenge link. Read the instructions, and then click the Continue button. Work the crossword puzzle. When you are finished, click the Submit button. When the crossword puzzle is redisplayed, submit it to your instructor.

SCR Associates Case Simulation Session 12: Managing Systems Support and Security

Overview

The SCR Associates case study is a Web-based simulation that allows you to practice your skills in a real-world environment. The case study transports you to SCR's intranet, where you complete 12 work sessions, each aligning with a chapter. As you work on the case, you will receive e-mail and voice mail messages, obtain information from SCR's online libraries, and perform various tasks.

How do I use the case?

- Review the SCR background material in Chapter 1.
- Read the Preview for this session and study the Task List.
- Visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to the **SCR Case Simulation**, and locate the intranet link.
- Enter your name and the password **sad9e**. An opening screen will display the 12 sessions.
- Select this session. Check your e-mail and voice mail carefully, and then work on the tasks.

Preview: Session 12

You assisted your supervisor, Jesse Baker, in various implementation tasks, and the TIMS system is up and running. Now she wants you to focus on system operation, support, and security tasks. Specifically, she wants you to work on a help desk, version control, configuration management, capacity planning, and system security issues. She also wants you to create a checklist that will help SCR know when the TIMS system is reaching the end of its useful life.

Task List

1. *Jesse wants a recommendation about creating an SCR help desk. She said that I can find lots of information about help desks on the Internet.*
2. *At our meeting, Jesse asked me how SCR should manage the TIMS system in the future. I need to search the Internet to learn more about version control, configuration management, and capacity planning, and send her the results of my research.*
3. *Another important issue: Security! Jesse wants my thoughts on how SCR should manage IT security. She wants me to consider all six levels, and prepare an outline for a corporate security policy.*
4. *Jesse says that no one likes surprises or problems. She wants me to draft a checklist that SCR can use to detect TIMS obsolescence as early as possible. She also said that I might be receiving some interesting news very soon. Wonder what that's about?*

FIGURE 12-41 Task list: Session 12.

Chapter Exercises

Review Questions

1. Describe the four classifications of maintenance and provide an example of each type.
2. Why are newly hired systems analysts often assigned to maintenance projects?
3. What is configuration management and why is it important?
4. What is the purpose of capacity planning? How is what-if analysis used in capacity planning?
5. What is a release methodology and what are the pros and cons of this approach? What is the purpose of version control?
6. Define the following terms: response time, bandwidth, throughput, and turnaround time. How are the terms related?
7. What are some key issues that you must address when considering data backup and recovery?
8. Explain the concept of risk management, including risk identification, assessment, and control.
9. What are the six security levels? Name at least three specific issues that apply to each level. Also provide three examples of threat categories, attacker profiles, and types of attacks.
10. List six indications that an information system is approaching obsolescence.

Discussion Topics

1. Assume that your company uses a release methodology for its sales system. The current version is 4.5. Decide whether each of the following changes would justify a version 5.0 release, or be included in a version 4.6 update: (a) Add a new report, (b) add a Web interface, (c) add data validation checks, (d) add an interface to the marketing system, and (e) change the user interface.
2. The four types of IT system maintenance also apply to other industries. Suppose you were in charge of aircraft maintenance for a small airline. What would be an example of each type of maintenance — corrective, adaptive, perfective, and preventive?
3. An IT manager assigns programmers and systems analysts to maintenance projects if they have less than two years of experience or if they received an average or lower rating in their last performance evaluation. Do you agree with this practice?
4. What are the most important security issues facing companies today? Have these changed in the last five years, and will they continue to change? How should companies prepare themselves for security threats and problems in the future?

Projects

1. Using the Internet, locate a software package designed to automate version control. List the key features and describe your findings in a brief memo.
2. Develop a process for managing change requests and design a form to handle a generic change request. The process should include a contingency plan for changes that must be resolved immediately.
3. Visit the IT department at your school or at a local company and find out whether performance measurements are used. Write a brief report describing your findings.
4. Explain how to use the Goal Seek feature in Microsoft Excel, and create a worksheet that demonstrates this feature.

Apply Your Knowledge

The Apply Your Knowledge section contains four mini-cases. Each case describes a situation, explains your role in the case, and asks you to respond to questions. You can answer the questions by applying knowledge you learned in the chapter.

1 Premium Publishers

Situation:

Premium Publishers is a small publishing firm that specializes in reprinting classic literature. A year ago the IT staff developed a Web-based order entry system. The system has performed well, but the company would like to add more features and improve performance. So far, most of the maintenance has involved correcting minor errors.

1. What types of maintenance have the IT staff performed? What types of maintenance will they perform if the existing system is retained?
2. If new features are added, what methodology should the IT staff use to add new functions and enhancements?
3. What IT security measures should the firm adopt? Prepare a security checklist, and be sure to consider all six security levels.
4. Even though the new system is only a year old, e-commerce changes constantly. At what point should Premium Publishers consider replacing the Web-based system with a new system, and why?

2 Oceanside Furniture

Situation:

Oceanside Furniture produces indoor and outdoor wicker furniture. The company grew from one store in 2007 to eight locations today. Two years ago, the company's IT department developed an inventory control system to keep track of products and reorder out-of-stock items. The new system was well received by users, and inventory problems have decreased significantly. Since the inventory system became operational, however, users steadily have requested increased functionality and changes in screen forms and reports.

1. Should Oceanside have a specific process to manage future changes and enhancements? What should it be?
2. What about version control? Should Oceanside institute a maintenance release methodology? Why or why not?
3. Suppose that you had to assign specific IT staff members to maintain the inventory control system. How would you accomplish the task? Describe your strategy in a brief memo.
4. What should Oceanside watch for to detect possible obsolescence in the future? Develop a checklist with specific examples that Oceanside management could use.

3 Robin Hood Associates

Situation:

Robin Hood Associates is an IT consulting firm that develops new systems and maintains older systems for its clients. Robin Hood recently was awarded a contract to correct problems with an existing system. The system is three years old, and the consulting firm that initially designed the system did a poor job of documentation. The data dictionary, user manuals, and other reference material never have been updated, and no process exists for version control.

1. As one of the Robin Hood team members, how should you proceed? What steps would you take, and what would be your priorities?
2. Are CASE tools available that you could use on this assignment? What are they?
3. What advice would you give to the client regarding capacity planning for the future?
4. What steps should the client take to ensure that the system is secure? Prepare a checklist with at least 15 security items that the client should evaluate and monitor. Be sure to consider all six security levels.

4 Economy Travel

Situation:

Economy Travel specializes in personalized travel packages at popular prices, and the firm operates 12 offices in major U.S. cities. A key selling point is the firm's client management database, which includes preferences such as airline seating choices and favorite hotels. Economy Travel purchased the client management software as an off-the-shelf vendor package and modified the program to meet the company's needs. The package has been operational for one year and has performed well. Economy Travel, however, is in the process of expanding its operation to include six additional locations. You have been called in as a consultant to help the company make some decisions about IT support.

1. What performance and workload measurement issues should the company consider at the present time?
2. What capacity planning issues should the company consider at the present time?
3. Should the company establish a system baseline before the integration of the six new sites? Explain your answer.
4. As an IT consultant, you must understand the client's business. From that perspective, consider the impact of the Internet on the travel agency business. Investigate this topic using the Internet and other sources of information, and decide what issues to discuss with Economy Travel.

Case Studies

Case studies allow you to practice specific skills learned in the chapter. Each chapter contains several case studies that continue throughout the textbook, and a chapter capstone case.

New Century Health Clinic

New Century Health Clinic offers preventive medicine and traditional medical care. In your role as an IT consultant, you will help New Century develop a new information system.

Background

You implemented the new system at New Century Health Clinic successfully, and the staff has used the system for nearly four months. New Century is pleased with the improvements in efficiency, office productivity, and patient satisfaction.

Some problems have surfaced, however. The office staff members call you almost daily to request assistance and suggest changes in certain reports and forms. You try to be helpful, but now you are busy with a major project for a local distributor of exercise equipment. Actually, your contract with New Century required you to provide support only during the first three months of operation. Anita Davenport, New Century's office manager, reported that the system seems to slow down at certain times during the day, making it difficult for the staff to keep up with its workload. Also, you increasingly are concerned about system security. A recent article in the local newspaper described an incident where a disgruntled former employee was about to break into the computer system and destroy or alter data.

Assignments

1. You are willing to charge a lower rate for ongoing support services because you designed the system. You want New Century to use a specific procedure for requesting assistance and changes, however, so that you can plan your activities efficiently. Prepare a complete, written procedure for New Century Health Clinic maintenance change requests. Include appropriate forms with your procedure.
2. What could be causing the periodic slowdowns at New Century? If a problem does exist, which performance and workload measures would you monitor to pinpoint the problem?
3. At the end of the systems analysis phase, you studied the economic feasibility of the system and estimated the future costs and benefits. Now that the system is operational, should those costs and benefits be monitored? Why or why not?
4. You decide to prepare a security checklist for New Century. Prepare a list of security issues that the firm should evaluate and monitor. Be sure to organize the items into categories that match the six security levels.

PERSONAL TRAINER, INC.

Personal Trainer, Inc., owns and operates fitness centers in a dozen Midwestern cities. The centers have done well, and the company is planning an international expansion by opening a new "supercenter" in the Toronto area. Personal Trainer's president, Cassia Umi, hired an IT consultant, Susan Park, to help develop an information system for the new facility. During the project, Susan will work closely with Gray Lewis, who will manage the new operation.

Background

System changeover and data conversion were successful for the new Personal Trainer system. The post-implementation evaluation indicated that users were pleased with the system. The evaluation also confirmed that the system was operating properly. Several users commented, however, that system response seemed slow. Susan Park, the project consultant,

wants to meet with you to discuss operation, maintenance, and security issues affecting the new system.

Assignments

1. What might be causing the slow response time? Prepare a brief memo explaining system performance and workload measurement, using nontechnical language that Personal Trainer users can understand easily.
2. Personal Trainer's top management asked you to provide ongoing maintenance for the new system. In order to avoid any misunderstanding, you want to provide a brief description of the various types of maintenance. Prepare a brief memo that does this, and include at least two realistic examples of each type of maintenance.
3. Although the system has been operational for a short time, users already have submitted several requests for enhancements and noncritical changes. Should Personal Trainer use a maintenance release methodology to handle the requests? Why or why not?
4. What are the main security issues that Personal Trainer should address? Prepare a memo that lists the primary concerns and offers a specific recommendation for dealing with each issue.

TARHEEL INDUSTRIES

Tarheel Industries is a medium-sized sporting goods manufacturer located in North Carolina. Tarheel's online production support system was developed in-house and was implemented two months ago. The system runs 24 hours a day in Tarheel's three manufacturing facilities.

Background

Last Monday morning, the production support system developed a problem. When a screen display for certain parts was requested, the displayed values were garbled.

When she was alerted to the situation, Marsha Stryker, Tarheel's IT manager, immediately assigned a systems analyst to investigate the problem. Marsha instructed the analyst, Eric Wu, to resolve the problem and get the system up and running as soon as possible. Eric previously worked on two small maintenance projects for the production control system, so he was somewhat familiar with the application.

Eric worked all day on the problem, and by 6:30 p.m., he developed and implemented a fix. After verifying that the production support system was capable of producing correct part displays, Eric went home. Early the following morning, Marsha called Eric and two other members of the applications maintenance group to a meeting in her office, where she briefed them on a new adaptive maintenance project for another high-priority system. She asked them to begin work on the new project immediately.

Several nights later, the production control system crashed shortly after midnight. Every time the system was reactivated, it crashed again. Finally, around 2:30 a.m., all production lines were shut down and third-shift production workers were sent home. The production support system finally was corrected and full production was restored the following day, but by that time, Tarheel Industries had incurred thousands of dollars in lost production costs. The cause of the production support system crash was identified as a side effect of the fix that Eric made to the system.

Assignments

1. Is the second production support system failure entirely unexpected?
2. Who is most to blame for the second system failure?
3. What might Marsha have done differently to avoid the situation? What might Eric have done differently?
4. Outline a new set of maintenance procedures that will help Tarheel Industries avoid such problems in the future.

MILLS IMPORTS

Mills Imports is a successful importer of gourmet coffees, cheeses, and specialty foods from around the world. Mills Imports recently developed and implemented an online sales information system.

Background

Using a client/server design, the PCs in each of the firm's 12 retail stores were networked with a server located in the sales support center at the main office. Salespeople in the retail stores use the customer sales information system to record sales transactions; to open, close, or query customer accounts; and to print sales receipts, daily sales reports by salesperson, and daily sales reports by merchandise code. The sales support staff uses the system to query customer accounts and print various daily, weekly, and monthly reports.

When the customer sales system was implemented, the IT department conducted extensive training for the salespeople and the sales support center staff. One member of the systems development team also prepared a user manual, but users are familiar with the system so the manual rarely is used.

Two weeks ago, Mills opened two additional stores and hired six new sales representatives. A manager gave the user manual to the new sales representatives and asked them to read it and experiment with the system. Now, salespeople in both new stores are having major problems using the sales system. When a representative from the main office visited the stores to investigate the problem, she discovered that the new people could not understand the user manual. When she asked for examples of confusing instructions, several salespeople pointed to the following examples:

- *Obtaining the authorization of the store manager on Form RBK-23 is required before the system can activate a customer charge account.*
- *Care should be exercised to ensure that the BACKSPACE key is not pressed when the key on the numeric keypad with a left-facing arrow is the appropriate choice to accomplish nondestructive backspacing.*
- *To prevent report generation interruption, the existence of sufficient paper stock should be verified before any option that requires printing is selected. If not, the option must be reselected.*
- *The F2 key should be pressed in the event that a display of valid merchandise codes is required. That same key terminates the display.*

Assignments

1. What could Mills Imports have done to avoid the situation?
2. Should the sales support staff ask the IT department to rewrite the user manual as a maintenance project, or should they request a training session for the new salespeople? Can you offer any other suggestions?
3. Rewrite the user manual instructions so they are clear and understandable for new users. What steps might you take to ensure the accuracy of the new user manual instructions?
4. In the process of rewriting the user manual instructions, you discover that some of the instructions were not changed to reflect system maintenance and upgrade activities. A request form on the firm's intranet, for example, has replaced Form RBK-23. Mills also has phased out printed reports in favor of online reports, which users can view by entering a username and password. Rewrite the user manual instructions to reflect the changes.

CHAPTER CAPSTONE CASE: SoftWear, Limited

SoftWear, Limited (SWL), is a continuing case study that illustrates the knowledge and skills described in each chapter. In this case study, the student acts as a member of the SWL systems development team and performs various tasks.

Background

In mid-December 2012, five months after the post-implementation evaluation, the payroll package and the ESIP system were operating successfully and users seemed satisfied with both systems.

During that time, users requested minor changes in reports and screen displays, which the IT staff handled easily. Jane Rossman, manager of applications, continued to assign a mixture of new systems and maintenance tasks to the IT team, and the members indicated that they enjoyed the variety and challenge of both types of work.

Debra Williams, the payroll clerk who prints the ESIP checks, reported the only operational problem. She could not load and align the special check stock in the printer correctly. Becky Evans visited Debra to study the situation and then wrote a specific procedure to solve the problem.

No overtime had been paid in the payroll department since the new system was implemented, and errors in payroll deductions had stopped. Michael Jeremy, SWL's vice president of finance, who initiated the payroll and ESIP projects, is very pleased with the system's operation and output. He recently visited an IT department staff meeting to congratulate the entire group personally.

Some requests for enhancements also occurred. Mike Feiner recently submitted a systems request for the ESIP system to produce an annual employee benefits statement with the current value of all savings plan deductions, plus information on insurance coverage and other benefits data. Mike also indicated that the company would offer several new ESIP choices, including various mutual funds.

In mid-December, Pacific Software announced the latest release of its payroll package. The new version supported full integration of all payroll and human resources functions and data. Ann Hon, director of information systems, was interested in the announcement because she knew that Rob King, SWL's vice president of human resources, wanted a human resources information system (HRIS) to support SWL's long-term needs. At Ann's request, Jane Rossman assigned Becky Evans to analyze the new payroll package to determine if SWL could implement the latest version as a company-wide client/server application.

Becky began the preliminary investigation by reviewing the current system and meeting with Mike Feiner to learn more about the new ESIP options. Next, she met with Marty Hoctor, a representative from Pacific Software, to review the features of the new release. After describing the new software, Marty mentioned that a large Midwestern retail chain recently implemented the package, and he invited Becky to contact Sean Valine, director of IT at that company, to discuss the new release. Becky spoke with Sean, and he agreed to e-mail her a summary of comments that users had made about the new software.

Becky completed her preliminary investigation, including a cost-benefit analysis, and worked with Jane Rossman and Ann Hon to prepare a report and presentation to SWL's newly formed systems review committee, which was created at Ann's suggestion. In their presentation, the IT team recommended that SWL upgrade to the new release of the payroll package and build a client/server application for all of SWL's payroll and personnel functions, including the ESIP system. They also suggested that a team of IT and human resources people get together to study preliminary economic, technical, and operational factors involved in a human resources information system and report back to the systems review committee. They pointed out that if the project was approved, the same team could handle the systems development using JAD or RAD techniques. After the presentation, the committee approved the

CHAPTER CAPSTONE CASE: SoftWear, Limited (continued)

request and Ann called an IT department staff meeting for the next morning to start planning the systems analysis phase.

During the meeting, Ann and Jane thanked the entire department for its efforts on the payroll and ESIP projects. Ann pointed out that although the payroll package and the ESIP system support SWL's current needs, the business environment changes rapidly and a successful, growing company must investigate new information management technology constantly. At this point, the systems development life cycle for SWL begins again.

SWL Team Tasks

1. Now that the new ESIP system is operational, Jane Rossman wants you to track system performance using various measurements. At a minimum, she expects you to monitor operational costs, maintenance frequency, technical issues, and user satisfaction. You can add other items if you choose. Write a proposal for Jane that lists each factor you will measure, and make sure that you explain why the item is important and how you plan to obtain the information.
2. Jane assigned you to the SWL team that will study the feasibility of a human resources information system (HRIS). Using the Internet, identify several commercial packages and the names of firms or consultants who specialize in HRIS implementation. Write a brief memo to Jane with your findings.
3. Jane wants you to prepare a security audit procedure for SWL. Specifically, she wants you to prepare a checklist of security issues that need to be evaluated and rated. She said to consider all six security levels, and to include as many specific items as possible that should be assessed.
4. As Ann Hon pointed out in the last meeting, the business environment changes rapidly and a successful, growing company like SWL must investigate new information management technology constantly. Ann has asked you to describe trends in software and hardware that might affect SWL's future IT plans. Perform research on the Internet to identify several technology issues that might represent potential problems or opportunities for SWL, and present the results in a memo to Ann.

Manage the SWL Project

You have been asked to manage SWL's new information system project. One of your most important activities will be to identify project tasks and determine when they will be performed. Before you begin, you should review the SWL case in this chapter. Then list and analyze the tasks, as follows:

LIST THE TASKS Start by listing and numbering at least 10 tasks that the SWL team needs to perform to fulfill the objectives of this chapter. Your list can include SWL Team Tasks and any other tasks that are described in this chapter. For example, Task 3 might be to Perform necessary corrective maintenance and Task 6 might be to Identify perfective maintenance tasks.

ANALYZE THE TASKS Now study the tasks to determine the order in which they should be performed. First identify all concurrent tasks, which are not dependent on other tasks. In the example shown in Figure 12-42, Tasks 1, 2, 3, 4, and 5 are concurrent tasks, and could begin at the same time if resources were available.

CHAPTER CAPSTONE CASE: SoftWear, Limited (continued)

Other tasks are called dependent tasks, because they cannot be performed until one or more earlier tasks have been completed. For each dependent task, you must identify specific tasks that need to be completed before this task can begin. For example, you would to perform any necessary corrective maintenance before you could identify perfective maintenance tasks, so Task 6 cannot begin until Task 3 is completed, as Figure 12-42 shows.

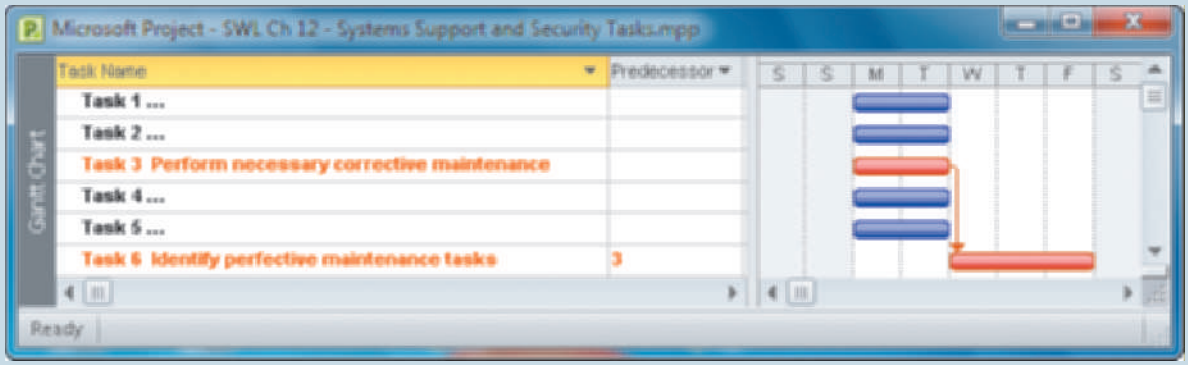


FIGURE 12-42 SWL Tasks 1, 2, 3, 4, and 5 are concurrent tasks that could be performed at the same time. Task 6 is a dependent task that cannot be performed until Task 3 has been completed.

Chapter 3 describes project management tools, techniques, and software. To learn more, you can use the Features section on your Student Study Tool CD-ROM, or visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com** and locate the project management resources library for this book. On the Web, Microsoft offers demo versions, training, and tips for using Project 2010. You also can visit the OpenWorkbench.org site to learn more about this free, open-source software.

Ready for a Challenge?

In additional to technical skills, IT professionals need critical thinking skills such as perception, organization, analysis, problem-solving, and decision-making. The Ready for a Challenge feature can help you learn, practice, and apply critical thinking skills that you can take to the workplace.

Your team leader wants to develop a standard method for rating and ranking maintenance requests for the new C^3 system. The idea is to develop some type of grid that could suggest priorities based on the type of maintenance requested and the potential impact on operations. When you review your notes from your systems analysis textbook, you realize that you used a similar approach when you created a risk matrix in Chapter 3, developed an evaluation model in Chapter 7, and selected a changeover method in Chapter 11.

The team leader also wants to test IT security levels with a simulated attack, something like a fire drill. The planned exercise would include realistic threats that will allow the team to evaluate responses and security procedures.

Practice Tasks

Before you begin, review different techniques for showing multifactor grids. Also review the material on user support and types of maintenance. Then complete these tasks:

A. Develop the maintenance request grid, using the factors listed and any others you want to include. The design should enable requests to be rated or ranked, and the style is not important, as it will be refined later.
B. Draft a plan for the simulated attacks on IT security. Include at least five types of attacks. For each attack, provide an example and suggest a response or action that should be taken to counter the attack.

After you complete the Practice Tasks, to check your work and view sample answers, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to the resources for this chapter, and locate Ready for a Challenge?.

The Challenge

Your initial design was good, but the team leader wants you to try another approach. She put these questions to you: "Should corrective maintenance get a higher priority than other types of maintenance? Why or why not? Should cost-benefit issues be considered? If so, how would this be done?"

Also, your security plan was good, but did not go far enough. The team leader wants you to include at least five more types of attacks, with examples and suggested responses.

Challenge Tasks

A. Consider the team leader's questions carefully. When you reply, include a revised grid design as needed.
B. Revise the simulated attack plan by including five more types of attacks, with examples and suggested responses.

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THE SYSTEMS ANALYST'S TOOLKIT

The Systems Analyst's Toolkit presents a valuable set of cross-phase skills and knowledge that you can use throughout the systems development process. Part A discusses communication tools that can help you write clearly, speak effectively, and deliver powerful presentations. Part B describes CASE tools that you can use to design, construct, and document an information system. Part C demonstrates financial analysis tools you can use to measure project feasibility, develop accurate cost-benefit estimates, and make sound decisions. Part D describes Internet resource tools that you can use to locate information, obtain reference material, and monitor IT trends and developments.

PART A

Communication Tools

In **Part A** of the Systems Analyst's Toolkit, you will learn about written and oral communication skills that you will need to use as a systems analyst.

INTRODUCTION

OBJECTIVES

When you finish this part of the Toolkit, you will be able to:

- List overall guidelines for successful communications
- Write effective letters, memos, and e-mail messages
- Measure the readability of written material
- Organize and prepare written reports that are required during systems development
- Follow guidelines for effective oral communication
- Plan, develop, and deliver a successful presentation
- Use effective speaking techniques to achieve your objectives
- Manage and strengthen your communication skills

A successful systems analyst must have good written and oral communication skills to perform his or her job effectively. Never underestimate the importance of effective communication, whether you are using a memo, e-mail, an oral presentation, or a social networking site to convey your ideas. The following guidelines will help you prepare and deliver effective presentations. Remember, however, that nothing increases your ability to communicate better than practicing these skills.

TOOLKIT INTRODUCTION CASE: Mountain View College Bookstore

Background: Wendy Lee, manager of college services at Mountain View College, wants a new information system that will improve efficiency and customer service at the three college bookstores.

In this part of the case, Tina Allen (systems analyst) and David Conroe (student intern) are talking about communication tools and techniques.

Participants: Tina and David
Location: Mountain View College Cafeteria, at the beginning of the bookstore information system project
Discussion topics: Guidelines for successful oral and written communications

Tina: David, before we start the project for Wendy, let's talk about written and oral communication tools and techniques. We'll be using these throughout the systems development process.

David: *Fine with me. I've always enjoyed my English and writing courses.*

Tina: Well, everything you learned in school certainly applies in the workplace. The basic principles of good communications apply everywhere. But in a business environment there are some additional issues to keep in mind.

David: *Such as?*

Tina: For example, you will be preparing documents, presentations, and training material for users. In each situation, you have to consider the audience very carefully, including their technical knowledge, organizational level, and experience. You'll need to adjust your approach based on those factors, and be aware of the readability of your written work. Also, you'll be using e-mail as a primary communications tool.

David: *I understand. Are there any special ground rules for using e-mail?*

Tina: Well, e-mail can be more casual than typical business writing — but not *too* casual. We'll talk about that, along with ways to maximize your online effectiveness using software such as Microsoft Outlook. Also, we'll go over some guidelines for preparing presentations.

David: *Sounds good to me. When do we start?*

Tina: Right now. Here's a task list to get us under way:

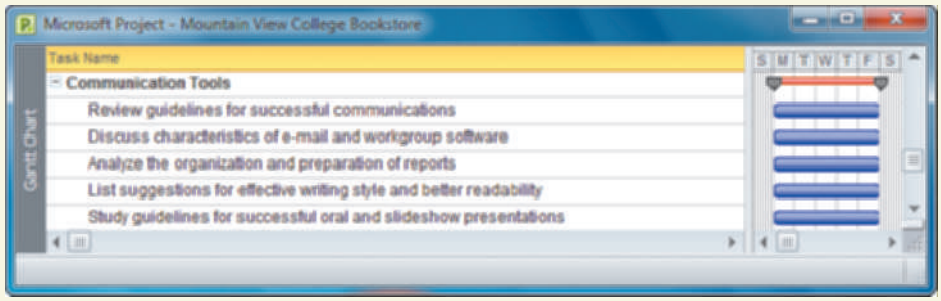

FIGURE TK A-1 Typical communication tasks.

Successful Communication Strategies

Successful communication does not just happen. Usually, it is the result of a specific strategy that includes careful planning, hard work, and practice. To be a successful communicator, you must consider five related questions about yourself, your audience, and your objectives: why, who, what, when, and how. You also must consider the cultural context of your communication. Above all, you must know your subject and have confidence in yourself.

Why, Who, What, When, and How

The **why, who, what, when, and how of communications** are important questions that you must answer before you communicate. These five questions are described in the following section.

WHY Know *why* you are communicating, and what you want to accomplish. Ask yourself the question, "Is this communication necessary, and what specific results am I seeking?" Your entire communication strategy depends on the results that you need.

WHO Know *who* your targets are. Chapter 1 describes how information needs of users depend on their organizational and knowledge levels. When communicating with management, for example, sometimes a fine line exists between saying enough and saying too much. Each situation is different, so you must use good judgment and be alert for input from your audience.

WHAT Know *what* is expected of you and when to go into detail. This is directly related to knowing who your targets are and the organizational and knowledge levels of your audience. For example, a vice president might expect less detail and more focus on how a project supports the company's strategic business goals. You must design your communications just as carefully as your systems project. For example, will the recipients expect you to address a specific issue or topic? Will they expect cost estimates or charts? Design your communications based on the answers to those questions.

WHEN Know *when* to speak and *when* to remain silent and let others continue the discussion. To be an effective speaker, you must be a good listener — and use audience feedback to adjust your presentation. Good timing is an essential part of every presentation. Your delivery must be paced properly — too fast and you will lose your audience; too slow and they might become bored.

HOW Know *how* to communicate effectively. You can strengthen your communication skills by using Toolkit suggestions, reflecting upon your own experiences, and observing successful and unsuccessful techniques used by others.

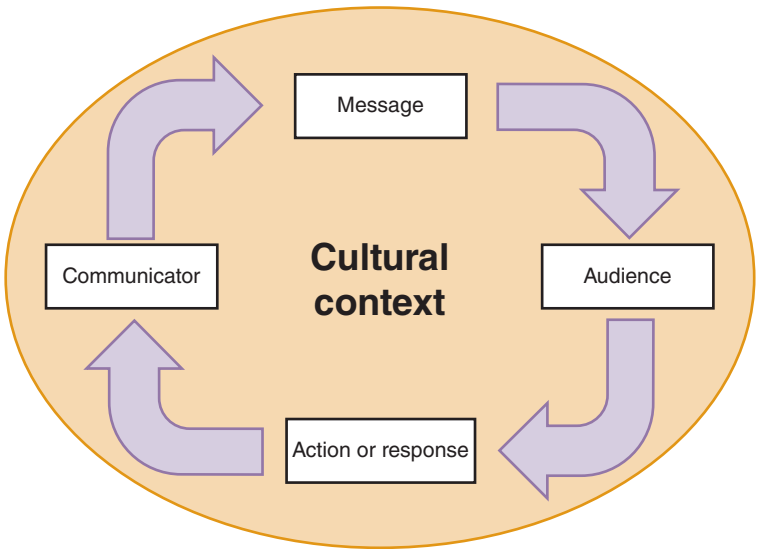

FIGURE TK A-2 Every communication takes place within an overall cultural context.

Cultural Context

Communication strategy is affected by the cultural context in which the communication takes place, as shown in Figure TK A-2. Cultural factors can include geography, background, educational level, and societal differences, among others. These differences

must be considered when asking and answering the *why*, *who*, *what*, *when*, and *how* questions.

In addition to these factors, you learned in Chapter 1 that corporate culture is very important. A **corporate culture** includes the beliefs, rules, traditions, values, and attitudes that define a company and influence its way of doing business. To be successful, a systems analyst must understand, and work within this culture. For example, if you speak to a group in a company that encourages a highly participative style, you might want to solicit feedback, invite audience comments, or conduct a poll during your presentation. Similarly, if the organization or group is very formal, or very informal, you might want to adjust your style accordingly.

Know Your Subject

No matter how well you plan your communication, you must know your subject inside and out. Your credibility and effectiveness will depend on whether others believe you and support your views. No one can know everything, so it is important to adopt a specific preparation strategy. For example, before a presentation, consider what others expect you to know and what questions they will ask. No matter how well you prepare, however, you will not have an answer for every question. Remember that it is better to say, "I don't know, but I'll find out and get back to you," rather than to guess.

Written Communications

Good writing is important because others often judge you by your writing. If you make a mistake while speaking, your audience probably will forget it. Your written errors, however, might stay around for a long time. Grammatical, typographical, and spelling errors distract readers from your message. Your written communications will include e-mail messages, memos, letters, workgroup communications, and formal reports.

ON THE WEB

To learn more about effective written communications, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part A, and locate the Effective Written Communications link.

Writing Style and Readability

If you have not taken a writing course, you should consider doing so. If you have a choice of courses, select one that focuses on business writing or technical writing. Any writing class, however, is worth the effort. Most bookstores and libraries have excellent books on effective communications, and many Internet sites offer writing guidelines, tips, and grammar rules. As you prepare written documents, keep in mind the following suggestions:

1. Know your audience. If you are writing for nontechnical readers, use terms that readers will understand.
2. Use the **active voice** whenever possible. For example, the active voice sentence "Tom designed the system," is better than, "The system was designed by Tom," which is an example of the **passive voice**.
3. Keep your writing clear, concise, and well-organized. Each paragraph should present a single topic or idea.
4. Use an appropriate style. For example, use a conversational tone in informal documents and a business tone in formal documents.
5. Use lists. If a topic has many subtopics, a list can organize the material and make it easier to understand.
6. Use short, easy-to-understand words. Your objective is not to impress your audience with the size of your vocabulary.
7. Avoid repeating the same word too often. Use a thesaurus to locate synonyms for frequently repeated words. Many word processing programs include a thesaurus and other tools to help you write better.

ON THE WEB

To learn more about grammar checkers, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part A, and locate the Grammar Checkers link.

8. Check your spelling. You can use the spell checker in your word processing program to check your spelling, but remember that a **spell checker** is a tool that identifies only words that do not appear in the program's dictionary. For example, a spell checker will not identify instances when you use the word *their*, instead of the word *there*.
9. Check your grammar. Most word processing programs include a **grammar checker**, which is a tool that can detect usage problems and offer suggestions. When you use a grammar checker, you can set various options to match the level and style of the writing and to highlight or ignore certain types of usage. For example, you can set the grammar checker in Microsoft Word to check grammar rules only, or you can configure it to check writing style, as shown in Figure TK A-3, including gender-specific words, sentence fragments, and passive sentences.
10. Review your work carefully. Then double-check it for spelling, grammatical, and typographical mistakes. If possible, ask a colleague to proofread your work and suggest improvements.

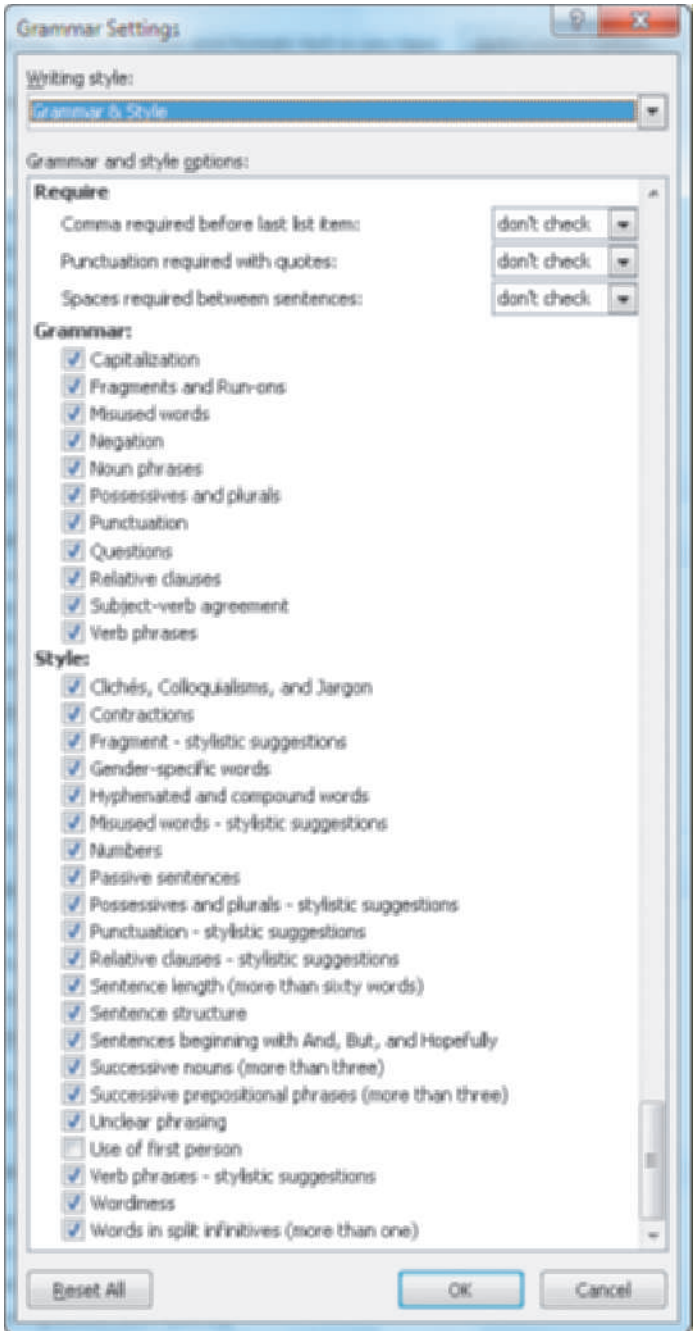

FIGURE TK A-3 You can set the grammar checker in Microsoft Word to check grammar rules only, or you can configure it to check your writing style.

All writers must consider **readability**, which analyzes ease of comprehension by measuring specific characteristics of syllables, words, and sentences. Two popular readability tools are the Flesch Reading Ease Score and the Flesch-Kincaid Grade Level Score.

The **Flesch Reading Ease score** measures the average sentence length and the average number of syllables per word and rates the text on a 100-point scale using the formula shown in Figure TK A-4. With this tool, the higher the score, the easier it is to understand. Microsoft suggests that for most standard documents, you should aim for a score of 60-70.

The **Flesch-Kincaid Grade Level score** uses the same variables, but in a different formula that produces a rating keyed to a U.S. grade-school level. For example, a score of 8.0 would indicate material easily understood by a person at an eighth-grade reading level. With this tool, Microsoft suggests that for most standard documents, you should aim for a score of 7.0 to 8.0.

E-Mail, Memos, and Letters

Because e-mail will be your primary tool for written communication, it is important to use it properly and effectively. E-mail usually is less formal than other written correspondence, but you still must follow the rules of good grammar, correct spelling, and clear writing.

Although many authors use a more conversational style for e-mail, you should remember that e-mail messages often are forwarded to other recipients or groups, and so you must consider the users to whom it might be distributed. If you regularly exchange messages with a specific group of users, most e-mail programs allow you to create a distribution list that includes the members and their e-mail addresses. For example, Figure TK A-5 shows how to use Microsoft Outlook to send an e-mail to a six-person systems development team. Now that e-mail has become the standard method of business communication, it is important that all users know how to use e-mail properly, professionally, and courteously. This topic is discussed in the following section.

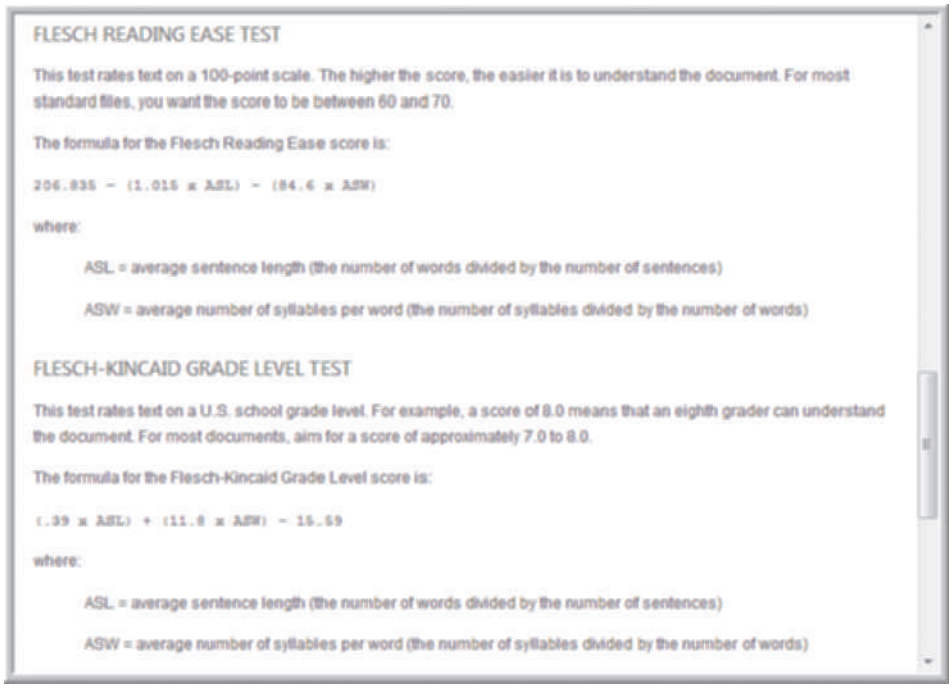

FIGURE TK A-4 Two popular readability measurement tools are the Flesch Reading Ease Score and the Flesch-Kincaid Grade Level Score.

Although e-mail is the main form of internal communication, internal memos and announcements still are important, and external communications often require letters printed on company letterhead. Most companies use a standard format, or template, for internal memos and external letters. If your company stores those on a network, you can download and use the templates. If you want to create your own designs, you can use a word processor to create templates with specific layouts, fonts, and margin settings. A **template** gives your work a consistent look and makes your job easier. Most word processing programs also provide a feature that allows you to design your memos as forms and fill in the blanks as you work.

ON THE WEB

To learn more about readability, locate the **On the Web links** for Toolkit A at **www.cengagebrain.com** and click the Readability link.

Netiquette

Netiquette is a term that combines the words *Internet* and *etiquette*. With the explosive growth of social networking, netiquette is more important than ever. On the Web, you can find many sources of information about netiquette. One example is the site shown in Figure TK A-6 on the next page, which offers an excellent source of netiquette guidelines, tips, and links.

All e-mail users should be aware of some simple rules, most of which are nothing more than good manners and common sense. For example, an excellent starting point is to avoid sending material that is personal or confidential, because your messages might be forwarded by others and distributed more

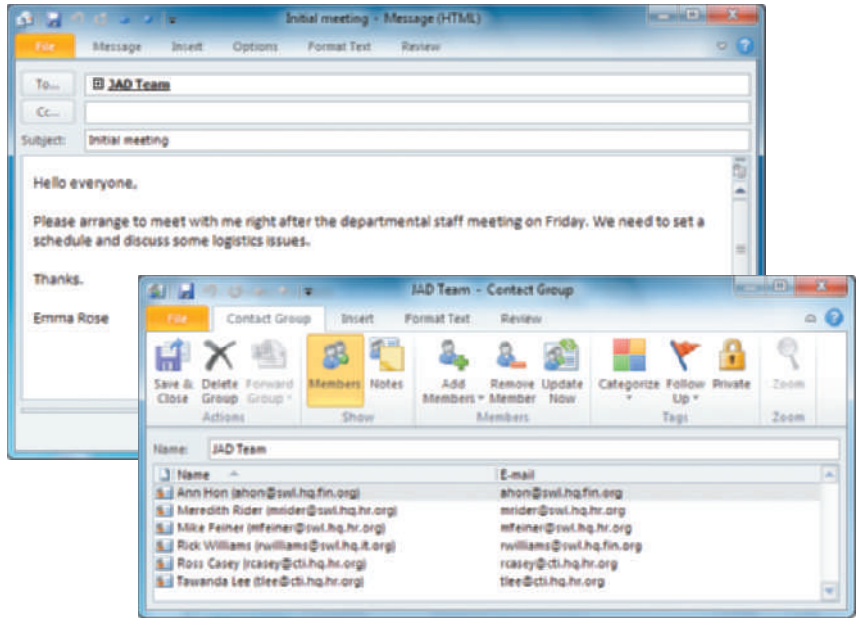

FIGURE TK A-5 Microsoft Outlook allows users to create distribution lists for sending e-mail messages.

FIGURE TK A-6 This site offers netiquette guidelines, tips, and links.

widely than you intended. Another important rule is never to send or reply to an e-mail when you are tired or upset. Instead, you can write a draft if you want to, but save the unsent message so you can review it later.

Here are some common rules and tips:

- Always fill in the subject field with a brief description of the contents.
- Be brief — in most cases, less is more.
- Be professional. Remember, if it has your name on it, it reflects on you personally and that often is how people will view your messages.
- Be sure to check your spelling.
- Don't forward jokes or chain letters without the permission of the recipient.
- Don't overuse humor or sarcasm that might work in a face-to-face situation, but not in an e-mail context.
- Don't type in all caps — it is like YELLING! It is also hard to read.
- Don't use colored fonts, background, or images in business e-mail messages.
- Don't use the return receipt request feature unless there is a valid business reason to do so.
- If you have large attachment files, try to zip or compress them before sending.
- If you send a message to a group of people, especially if they don't know each other, use a blind copy (Bcc) for all of the recipients in order to shield the addresses from the entire group.
- Never give out personal contact information of others without their specific permission to do so.
- Never include personal information unless you are 100% sure of your recipient and no other means of communication would provide better privacy and security.
- Remember that there are copyright laws. You do not have an unrestricted right to do whatever you please with someone else's e-mail message to you. Laws against discrimination and defamation can also apply to e-mail messages.
- When replying, don't include all the earlier messages unless there is a reason to do so.
- Social networking, instant messaging (IM), and cell-phone texting are popular because they allow informal, interactive, and immediate communication. While IM and texting can be valuable collaboration tools, users should exercise good judgment and common sense, just as they would in any form of business conversation.

In addition to these guidelines, it is important to follow company policy regarding communications at work. Many firms restrict personal communications that involve company time or equipment, and courts have upheld an employer's right to limit or monitor such communications.

Workgroup Software

Many companies use **workgroup software**, often called **groupware**, because it enhances employee productivity and teamwork. In addition to basic e-mail, workgroup software enables users to manage and share their calendars, task lists, schedules, contact lists, and documents. Popular examples of workgroup software include Microsoft Outlook and Novell's GroupWise, which is shown in Figure TK A-7.

Google Docs, which is shown in Figure TK A-8, offers free, Web-based collaboration. Using this application, a team can work on centrally stored documents instead of e-mailing drafts back and forth. Teams also can use powerful multiauthoring software, such as Adobe Acrobat, to add revisions, notes, and comments to PDF documents.

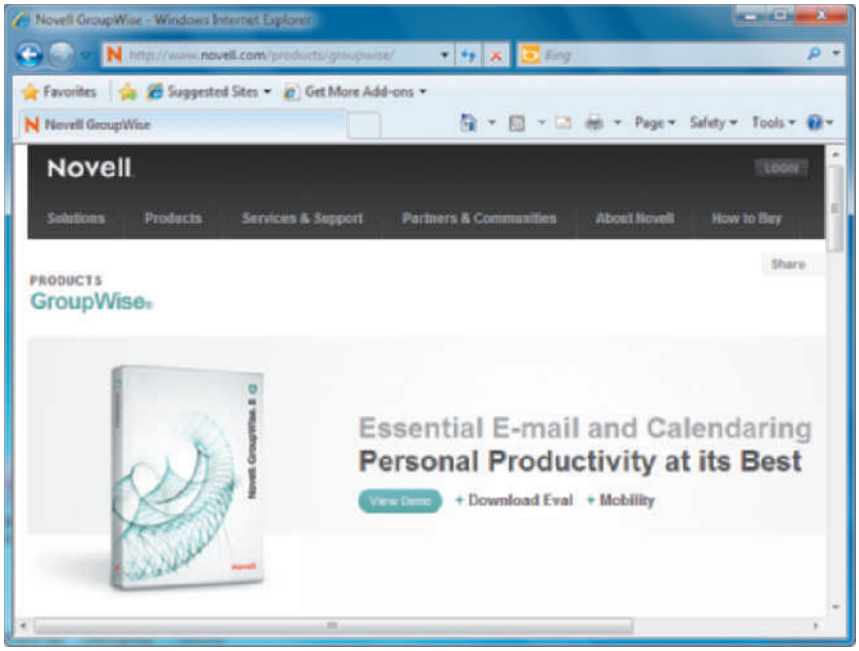

FIGURE TK A-7 Workgroup software, such as Novell's GroupWise, allows a user to collaborate with others by sharing documents and folders.

Reports

You must prepare many reports during systems development, including the preliminary investigation report, the system requirements document at the end of the systems analysis phase, the system design specification at the end of the system design phase, and the final report to management when the system goes into operation. You also might submit other reports, such as status reports, activity reports, proposals, and departmental business plans. You will create your reports as electronic documents, so you can attach them to e-mails. Although most reports are delivered electronically, in some cases you must prepare printed versions. For example, Figure TK A-9 on the next page shows a binder for a system requirements document, which includes an introduction, an executive summary, findings, recommendations, time and cost estimates, expected benefits, and an appendix containing relevant data.

You can use a cover memo, or an e-mail message similar to the one shown in Figure TK A-9, when you send a report, and you can set a date, time, and place for an oral presentation. You also can request that the recipients read the report in advance of the presentation.

The introduction usually includes a title page, table of contents, and brief description of the proposal. The title page should be clean and neat and contain the name of the proposal, the subject, the date, and the

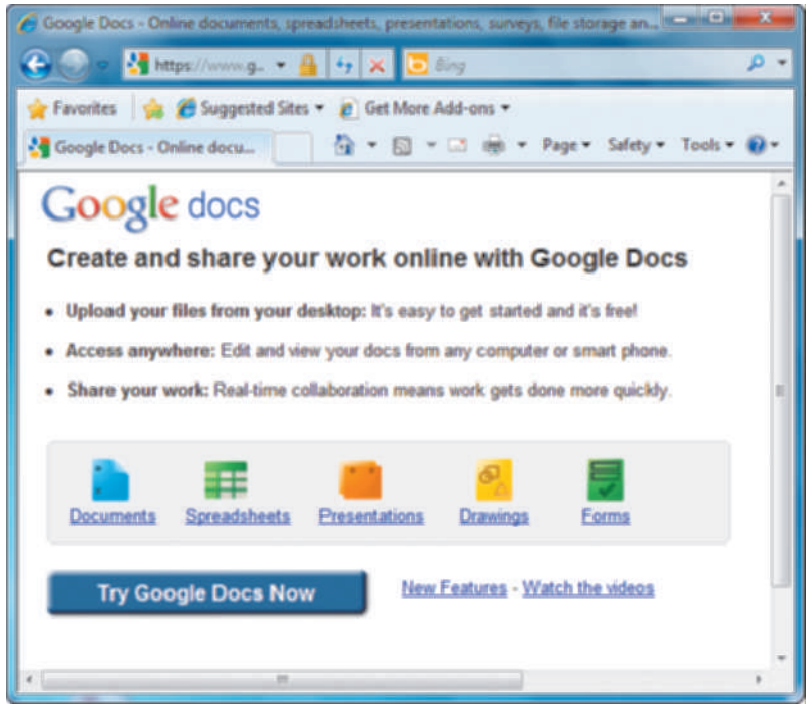

FIGURE TK A-8 An employee team can use Google Docs to work on centrally stored documents.

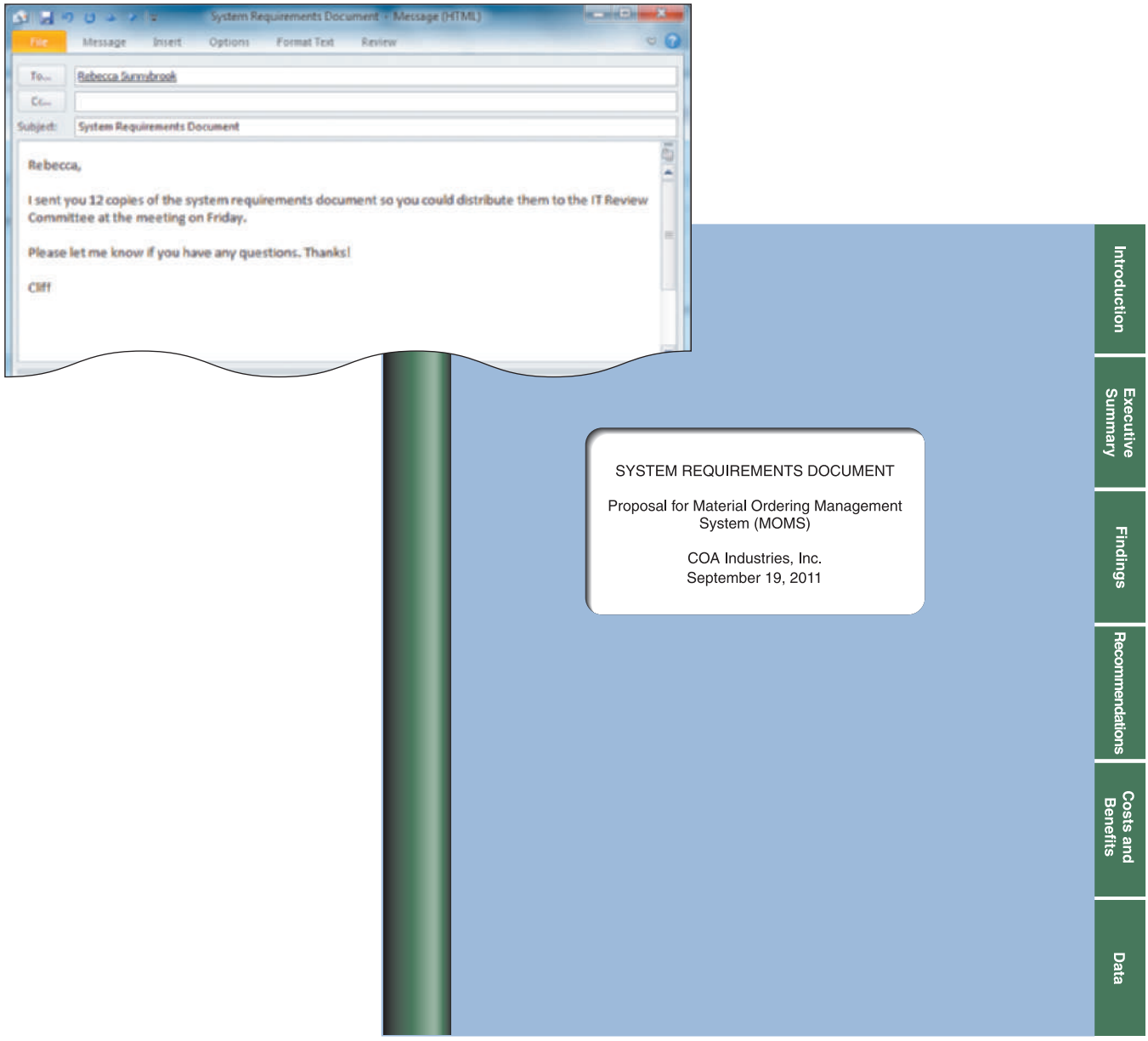

FIGURE TK A-9 Typical binder for a system requirements document, with an explanatory e-mail message.

names of the development team members. If the project already has a recognized name or acronym, use it. Include a table of contents when the report is long or includes many exhibits. Many word processing programs include a tool that can generate a table of contents automatically.

The executive summary is used to summarize the entire project, including your recommendations, in several paragraphs. Generally, the executive summary should not exceed 200 words or one page.

Use the findings section to describe the major conclusions that you or the team reached during the systems analysis phase. You can make the findings section detailed or summarized, depending on the project. You must explain the logical design of the new system in a way that nontechnical managers can understand clearly. With a management audience, the most important task is to explain how the proposed system supports the company's business needs.

The recommendations section presents the best system alternative, with a brief explanation that should mention economic, technical, operational, and schedule feasibility.

In the costs and benefits section, you should list the advantages, disadvantages, costs, and benefits of each major system alternative. You should include a clear description of the financial analysis techniques you used. You might want to apply one or more of the financial analysis tools described in Part C of the Systems Analyst's Toolkit. You can use tables or graphs to support and clarify your alternatives when necessary.

When you have a large number of supporting documents such as questionnaires or sampling results, you should put those items in a data section located at the end of the document. Make sure you include only relevant information, and provide references for interested readers.

Oral Communications

An **oral presentation** is required at the end of the preliminary investigation and again at the conclusion of the systems analysis phase. You might need to give more than one presentation in some situations to present technical material to members of the IT department or to present an overview for top managers. When preparing an oral presentation, you should perform six important tasks: Define the audience, define the objectives for your presentation, organize the presentation, define any technical terms you will use, prepare your presentation aids, and practice your delivery.

ON THE WEB

To learn more about effective presentations, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part A, and locate the Effective Presentations link.

Define the Audience

Before you develop a detailed plan for a management presentation, you must define the audience. Senior managers often prefer an executive summary rather than a detailed presentation, but that is not always the case, especially in smaller companies where top management is more involved in day-to-day activities. If you consider the expectations of your audience and design your presentation accordingly, you will improve your chances of success.

Define the Objectives

When you communicate, you should focus on your objectives. In the management presentation for the systems analysis phase, your goals are the following:

- Inform management of the status of the current system
- Describe your findings concerning the current system problems
- Explain the alternative solutions that you developed
- Provide detailed cost and time estimates for the alternative solutions
- Recommend the best alternative and explain the reasons for your selection

Organize the Presentation

Plan your presentation in three stages: the introduction, the information, and the summary. First, you should introduce yourself and describe your objectives. During the presentation, make sure that you discuss topics in a logical order. You should be as specific as possible when presenting facts — your listeners want to hear your views about what is wrong, how it can be fixed, how much it will cost, and when the objectives can be accomplished. In your summary, briefly review the main points, and then ask for questions.

ON THE WEB

To learn more about presentation software, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part A, and locate the Presentation Software link.

Define Any Technical Terms

You should avoid specialized or technical terminology whenever possible. If your audience might be unfamiliar with a term that you plan to use, either define the term or find another way to say it so they will understand your material.

Prepare Presentation Aids

Much of what people learn is acquired visually, so you should use helpful, appropriate visual aids to help the audience follow the logic of your presentation and hold their attention. Visual aids also can direct audience attention away from you, which is helpful if you are nervous when you give the presentation. You can use a visual aid with an outline of topics that will help you stay on track. You can enhance the effect of your presentation with visual aids that use various media and software, as explained in the following sections.

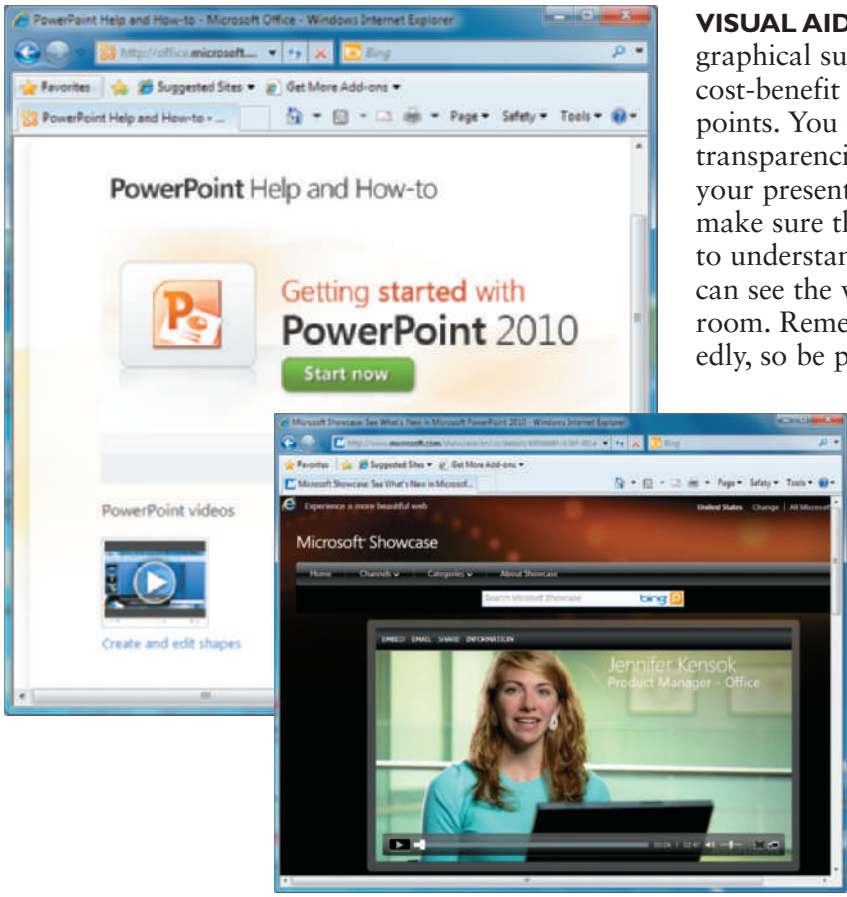

FIGURE TK A-10 Microsoft PowerPoint offers many free online tutorials that demonstrate the full potential of the software.

VISUAL AIDS **Visual aids** can help you display a graphical summary of performance trends, a series of cost-benefit examples, or a bulleted list of important points. You can use whiteboards, flip charts, overhead transparencies, slides, films, and videotapes to enhance your presentation. When preparing your visual aids, make sure that the content is clear, readable, and easy to understand. Verify ahead of time that the audience can see the visual material from anywhere in the room. Remember that equipment can fail unexpectedly, so be prepared with an alternate plan.

PRESENTATION SOFTWARE With a computer and a projection system, you can use **presentation software**, such as Microsoft PowerPoint, to create a multimedia slide show. As shown in Figure TK A-10, Microsoft offers free tutorials with advanced tips and techniques that can improve your presentations. The lower screen shows a Microsoft PowerPoint 2010 training video.

Preparing an effective slide presentation requires time and effort, and personal experience is the best teacher. There is no universal agreement about

how to prepare a slide show, and many sources of information exist. Some overall guidelines include the following:

- Your first step (and perhaps the most important) is to prepare an overall outline that will be the foundation of your presentation. You should focus on the content and structure of your presentation before you consider visual issues.
- Remember that a fine line exists between providing too little information and too much.
- Display one topic per slide, and try to follow the rule often called the **7 by 7 rule**: no more than seven items per slide, and no more than seven words per item. Some presenters believe that a **6 by 6 rule** is even more effective.
- When displaying a list of items, consider using a series of slides to add each point sequentially, especially if you want to focus attention on the item being discussed.
- Use bullets rather than numbers, unless you are showing a specific sequence or order.
- Choose easily readable fonts. Use sans serif styles, such as Arial, for all body text. If you do use a serif style (such as Times Roman), apply it only in titles.
- Use appropriate point sizes for titles and body text. Your goal is to prepare slides that are readable and visually attractive. Although point size selection depends on individual judgment and experience, here are some suggestions to get you started: For titles, try either 40- or 36-point fonts; for body text, 32- or 24-point fonts usually work well.
- Select special effects carefully — too many graphics, colors, sounds, or other special effects will distract your audience.
- You can include tables or graphics, but keep them simple and easy to understand. Also, you can use a special effect, such as boldface, italic, underlining, or a different color, to highlight an important word or phrase.
- Strive for a consistent look and feel among your slides, and position visual elements in the same place on each slide. You should use a master template to ensure uniformity and conform to company-wide standards that might apply, such as a copyright notice, a confidentiality statement, or placement of the company name and logo. Choose colors carefully, and keep them consistent. Usually, light letters on a dark background are easiest to read. Presentation software normally has predefined color palettes that provide background and text colors that ensure readability. Use these palettes as a guideline for selecting colors when possible.
- Be sure to check spelling and grammar!
- During the presentation, do *not* read your slides to the audience! They can read the slides on their own. Your slide presentation is an outline that provides structure and emphasis — it is not the presentation itself.
- It is important to deliver a presentation that can be viewed easily from anywhere in the room. When setting up, consider the size of the room, the number of people attending, the size and location of your visual aids, and the characteristics of any projection equipment you will be using.

Practice

The most important part of your preparation is practice. You should rehearse several times to ensure that the presentation flows smoothly and the timing is correct. Practicing will make you more comfortable and build your confidence.

Do not be tempted to write a script. If you read your presentation, you will be unable to interact with your audience and adjust your content based on their reactions. Instead, prepare an outline of your presentation and practice from the outline. Then, when you deliver the actual presentation, you will not have to struggle to remember the exact words you planned to say, and you will be able to establish a good rapport with your audience.

The Presentation

When you deliver your presentation, the following pointers will help you succeed:

SELL YOURSELF AND YOUR CREDIBILITY As a presenter, you must sell yourself and your credibility. A brilliant presentation will not convince top managers to approve the system if they are not sold on the person who gave the presentation. On the other hand, projects often are approved on the basis of the presenter's knowledge, commitment, and enthusiasm.

Your presentation must show confidence about the subject and your recommendations. You should avoid any conflicts with the people attending the presentation. If you encounter criticism or hostility, remain calm and stay focused on the issues — not the person making the comments. You will have a successful presentation only if you know the material thoroughly, prepare properly, and sell yourself and your credibility.

CONTROL THE PRESENTATION During the presentation, you must control the discussion, maintain the pace of the presentation, and stay focused on the agenda — especially when answering questions. Although you might be more familiar with the subject material, you should not display a superior attitude toward your listeners. Maintain eye contact with the audience and use some humor, but do not make a joke at someone else's expense.

ANSWER QUESTIONS APPROPRIATELY Let your audience know whether you would prefer to take questions as you go along or have a question-and-answer session at the end. Sometimes the questions can be quite difficult. You must listen carefully and respond with a straightforward answer. Try to anticipate the questions your audience will ask so you can prepare your responses ahead of time.

When answering a difficult or confusing question, repeat the question in your own words to make sure that you understand it. For example, you can say, "If I understand your question, you are asking …" This will help avoid confusion and give you a moment to think on your feet. To make sure that you gave a clear answer, you can say, "Have I answered your question?" Allow follow-up questions when necessary.

USE EFFECTIVE SPEAKING TECHNIQUES The delivery of your presentation is just as important as its content. You can strengthen your delivery by speaking clearly and confidently and projecting a relaxed approach. You also must control the pace of your delivery. If you speak too fast, you will lose the audience, and if the pace is too slow, people will lose their concentration and the presentation will not be effective.

Many speakers are nervous when facing an audience. If this is a problem for you, keep the following suggestions in mind:

- Control your environment. If you are most nervous when the audience is looking at you, use visual aids to direct their attention away from you. If your hands are shaking, do not hold your notes. If you are delivering a computer-based presentation, it is a good idea to use a handheld wireless device to control the slides. Concentrate on using a strong, clear voice. If your nervousness distracts you, take a deep breath and remind yourself that you really do know your subject.
- Turn your nervousness to your advantage. Many people do their best work when they are under a little stress. Think of your nervousness as normal pressure.

- Avoid meaningless filler words and phrases. Using words and phrases such as *okay, all right, you know, like, um*, and *ah* are distracting and serve no purpose.
- Practice! Practice! Practice! Some people are naturally gifted speakers, but most people need lots of practice. You must work hard at practicing your presentation and building your confidence. Many schools offer speech or public speaking courses that are an excellent way of practicing your skills. It also can be advantageous to preview your presentation with one or more people and ask for input.

Online Presentations

In addition to face-to-face meetings, you might have to deliver an **online presentation**, possibly with two-way communication between you and the audience. You have several options. You might use PowerPoint 2010 to broadcast a live presentation, as shown in Figure TK A-11, and your online audience would see the slides in a Web browser. Your presentation also could include an audio narrative. If you want real-time participation, you might consider Cisco's WebEx, which is shown in Figure TK A-12, or a similar product. WebEx can handle live audio and video, and allows you to deliver a fully interactive Webinar. Microsoft also offers a robust Web-conferencing platform called Live Meeting, shown in Figure TK A-13, which supports presentations, group meetings, and collaboration.

FIGURE TK A-11 With PowerPoint 2010, you can broadcast a live presentation to a remote audience, who can view it in a Web browser.

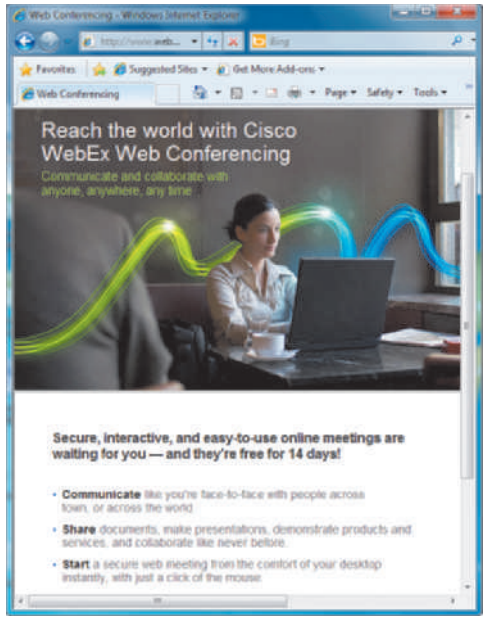

FIGURE TK A-12 Cisco's WebEx can handle live audio and video, and allows you deliver an interactive Webinar.

FIGURE TK A-13 Microsoft Live Meeting supports presentations, group meetings, conferences, and collaboration.

Managing Your Communication Skills

More than ever, employees must rely on their personal skills and experience. In an uncertain world and a turbulent economy, individuals should think of themselves as profit-making companies, complete with assets, liabilities, strengths, and areas for development. In Chapter 2, you learned that a company must have a strategic plan, and the same is true for an individual. Armed with a plan to improve your communication skills, you are much more likely to reach your full potential.

Communicating is like any other activity — the more you practice, the better you become. Many resources are available for students and IT professionals who want to improve their written and oral communication skills. For example, the Vocational Information Center site shown in Figure TK A-14 offers a wide range of free resources and links that can help you become a better writer, presenter, and public speaker. The Association for Computing Machinery (ACM) also offers many online courses and tutorials for members, including students and IT professionals.

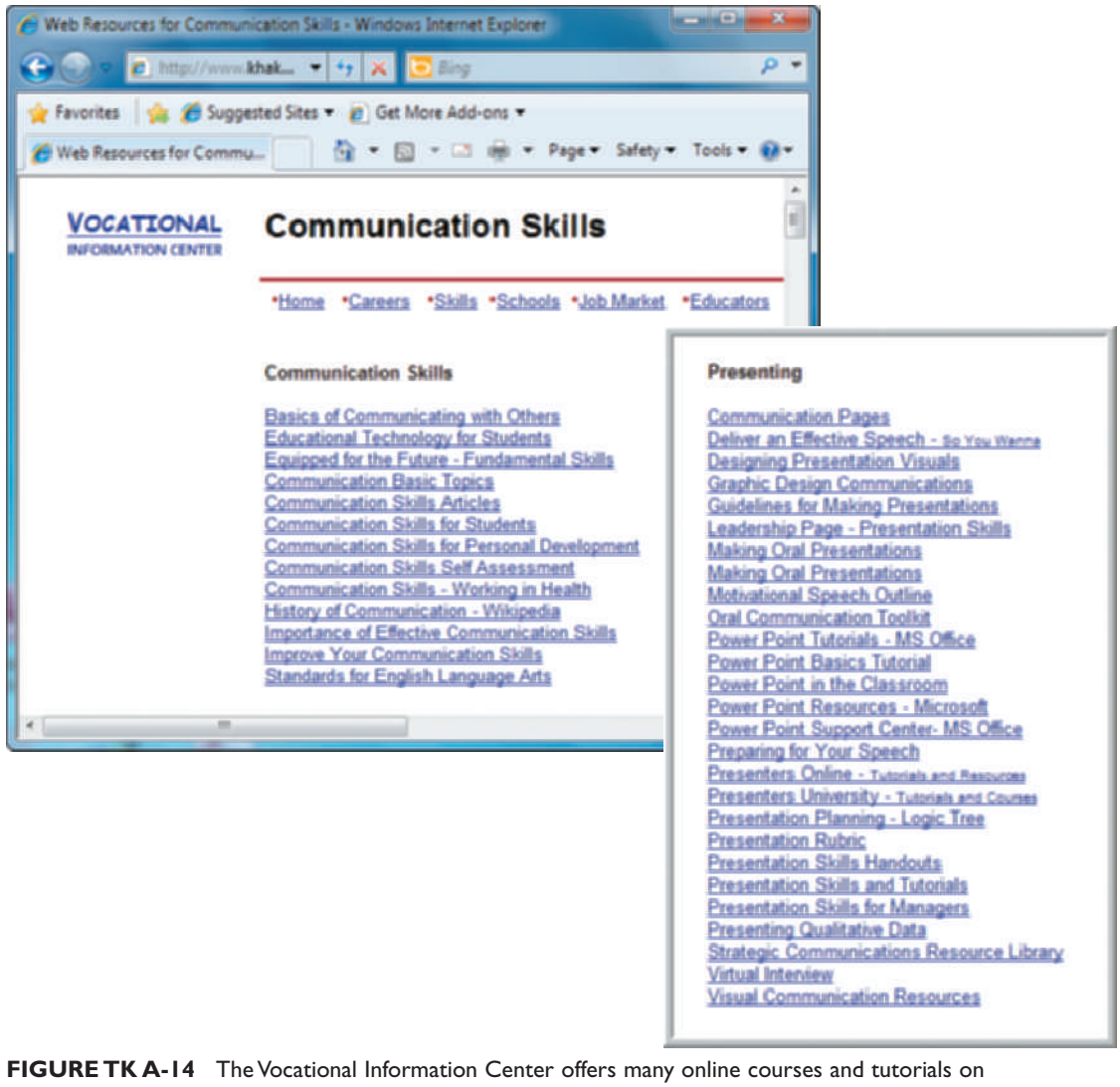

FIGURE TK A-14 The Vocational Information Center offers many online courses and tutorials on communications skills.

Some people find it difficult to stand in front of a group and deliver a presentation or report. For many years, membership in Toastmasters, International has been a popular way to gain confidence, overcome stage fright, and develop public speaking skills. As shown in Figure TK A-15, Toastmasters offers a friendly environment where members critique each speech in a positive manner, note the strengths, and offer suggestions about what might be improved. With more than 200,000 members in 92 countries, this organization offers an excellent way to develop better public speaking skills.

FIGURE TK A-15 Toastmasters International is famous for helping people become better public speakers.

Toolkit Summary

Your success as a systems analyst depends on your ability to communicate effectively. You must know why you are communicating, what you want to accomplish, who your targets are, what is expected of you, and when to go into detail. You must know your subject and how to use good written and oral communications techniques.

You will be judged by your written work, so it must be free of grammatical, spelling, and punctuation errors. You should write e-mail, letters, and memos clearly, and the writing style should match the situation. Many firms have standard formats for letters and memos, and you can use templates to achieve consistency.

Your writing must be clear and understandable. You can use readability measurement tools such as the Flesch Reading Ease score and the Flesch-Kincaid Grade Level score.

You will prepare various reports during systems development, and the format will vary depending on the nature of the report. Your reports should have a cover memo and might include an introduction, an executive summary, findings, recommendations, time and cost estimates, expected benefits, and a data section.

In addition to written communications, you must communicate effectively in person. You might have to deliver several presentations to different audiences at different times during the SDLC. Presentations are an important form of oral communication, and you should follow specific guidelines in preparing your presentation. You prepare by defining your audience, identifying your objectives, and organizing the presentation itself. You also need to define technical terms and prepare visual aids to help your audience understand the material. Most important, you must practice your delivery to gain confidence and strengthen your presentation skills. You may also want to deliver your presentation through an online venue.

When you develop slide presentations, you should follow the 6 by 6 rule or 7 by 7 rule and other guidelines that will make your slides easy to read and understand. You should select fonts and point sizes carefully, and strive for a consistent look and feel throughout the presentation. Special effects can be interesting, but do not overuse them.

When you give the presentation, you are selling your ideas and your credibility. You must control the discussion, build a good rapport with the audience, answer all questions clearly and directly, and try to use good speaking techniques. Again, the best way to become a better speaker is to practice.

Every IT professional should have a strategic plan to manage and improve written and oral communication skills. Many online resources offer courses, tutorials, and support to help you develop the skills you will need in the workplace.

Key Terms and Phrases

6 by 6 rule *641*
7 by 7 rule *641*
active voice *633*
corporate culture *633*
Flesch-Kincaid Grade Level score *634*
Flesch Reading Ease score *634*
grammar checker *634*
groupware *636*
netiquette *635*
online presentation *643*
oral presentation *639*
passive voice *633*
presentation software *640*
readability *634*
spell checker *634*
template *635*
visual aids *640*
why, who, what, when, and how of communications *632*
workgroup software *636*

Toolkit Exercises

Review Questions

1. Describe the why, who, what, when, and how of communications. Explain each term and give an example. Also, what is a corporate culture and why is it important?
2. Mention five specific techniques you can use to improve your written documents.
3. What techniques can help to improve your e-mail communications?
4. Describe the main sections of a written report to management.
5. When preparing an oral presentation, what six tasks should you perform?
6. When you organize the presentation, what three stages do you plan?
7. Why are visual aids important? Give at least three examples of different types of visual aids, and explain how you would use each type in a presentation.
8. What can you do during your presentation to improve its success?
9. Name three specific strategies you can use if you get nervous during a presentation.
10. Why is practice so important when preparing a presentation?

Discussion Topics

1. Most people agree that business e-mail can be more conversational than formal written documents, but even e-mail has its limits. As a manager, what guidance would you give people regarding e-mail style and usage?
2. Is it possible to overcommunicate? For example, in Chapter 4 you learned to avoid leading questions, which might suggest an answer. Can you think of other examples, like newspaper headlines, where "less is more"?
3. Many articles stress the importance of body language. Think of examples where you noticed a person's body language. Did it relate to something they were trying to communicate — or something they were trying *not* to communicate?
4. Should e-mail monitoring by an employer always be permissible, never permissible, or does the answer depend on specific factors? If so, what are they?

Projects

1. *The Elements of Style* by William Strunk, Jr. and E. B. White is a popular reference manual for proper English usage. The book identifies many words and phrases that are commonly misused, including *between* and *among*, *affect* and *effect*, *different from* and *different than*, *like* and *as*, and *infer* and *imply*. Review *The Elements of Style* or another source, and explain how these words should be used.
2. Using Microsoft PowerPoint or another program, prepare a presentation on "How to Prepare an Effective Slide Presentation." Assume that your audience is familiar with presentation software, but has no formal training.
3. As a training manual writer, choose a simple hardware or software task and write a two- or three-paragraph description of how to perform the task. Then use your word processing software to check the readability statistics. Try to keep the Flesch Reading Ease score above 60 and the Flesch-Kincaid Grade Level score to 8.0 or less.
4. View at least three examples of public speaking. You can investigate TV network news broadcasts, C-SPAN, or any other source. Describe each speaker's gestures, expressions, voice levels, inflections, timing, eye contact, and effectiveness.

PART B

CASE Tools

In **Part B** of the Systems Analyst's Toolkit, you will learn how CASE tools can help you perform systems development and maintenance tasks.

INTRODUCTION

OBJECTIVES

When you finish this part of the Toolkit, you will be able to:

- Explain CASE tools and the concept of a CASE environment
- Trace the history of CASE tools and their role in a fourth-generation environment
- Define CASE terms and concepts, including a repository, modeling tools, documentation tools, engineering tools, and construction tools
- Explain an integrated development environment
- Provide examples of CASE tool features
- Describe CASE tool trends, and how they relate to object-oriented analysis and agile methods

Computer-aided systems engineering (**CASE**), also called **computer-aided software engineering**, is a technique that uses powerful software, called **CASE tools**, to help system developers design and construct information systems. In this part of the Systems Analyst's Toolkit, you will learn about the history, characteristics, and features of CASE tools. You will see specific examples of CASE tools and how they are used in various development tasks. In addition, you will learn about integrated software development environments.

TOOLKIT INTRODUCTION CASE: Mountain View College Bookstore

Background: Wendy Lee, manager of college services at Mountain View College, wants a new information system that will improve efficiency and customer service at the three college bookstores.

In this part of the case, Tina Allen (systems analyst) and David Conroe (student intern) are talking about CASE tools and concepts.

Participants: Tina and David
Location: Tina's office, early in the systems planning phase
Discussion topics: CASE tools, integrated development environments, CASE terms and concepts

Tina: David, before we get too far into the project, let's talk about CASE tools and concepts and how we can use them in the development process.

David: *Sure. I saw examples of CASE tools in my systems analysis course. CASE stands for computer-aided systems engineering, right?*

Tina: Yes. Some people say CASE stands for computer-aided *software* engineering instead of computer-aided *systems* engineering. There's really no difference. Either way, CASE tools are an integral part of the systems development process, and can be used with structured, object-oriented, or agile development methods.

David: *Will we use CASE tools on the bookstore project?*

Tina: Yes. We'll start by identifying and modeling business functions and processes. That information will become part of a central repository, which is a database that stores all the characteristics of the information system.

David: *Then what?*

Tina: We'll use CASE tools to draw various diagrams, including DFDs, UML diagrams, functional decomposition diagrams, and business process diagrams. You'll learn about these as we go along. We might also use CASE tools to generate program code, screens, and reports. Also, depending on the software environment we select, we might use an integrated development environment.

David: *What's that?*

Tina: An integrated development environment is like a built-in CASE tool that a vendor integrates into a software product.

David: *Anything else?*

Tina: Well, before we decide on a CASE tool, we'll take a look at several examples. Here's a task list to get us started:

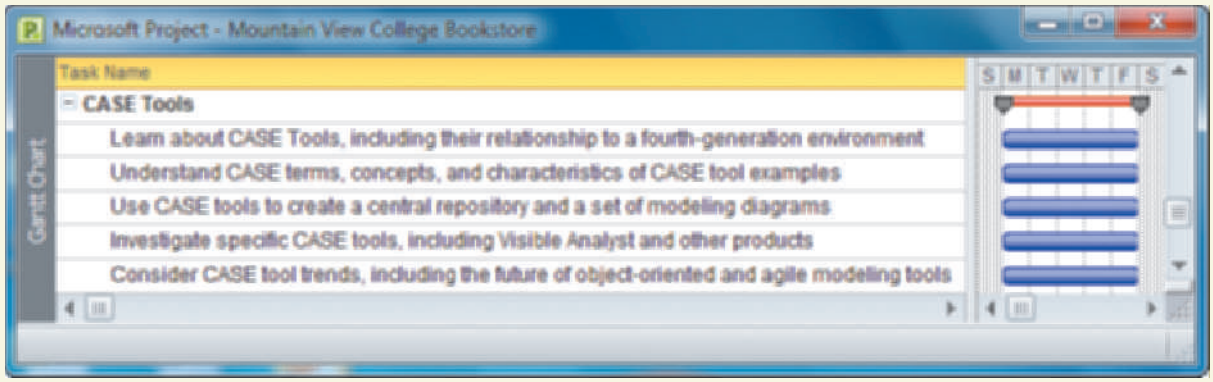

FIGURE TK B-1 Typical CASE tool tasks.

Overview of CASE Tools

If you ask a carpenter for an example of a tool, the response might be a hammer, drill, or screwdriver. Put the same question to a chef, and the answer might be a measuring cup, knife, or spatula. Every type of work requires specific tools to do the job properly, and system development is no different. CASE tools can reduce costs, speed up development, and provide comprehensive documentation for future maintenance or enhancements.

The Carnegie Mellon Software Engineering Institute (SEI) is a leader in software engineering and development. SEI helps organizations improve their software capabilities and develop or acquire high quality software. As shown in Figure TK B-2, SEI focuses on overall architecture, system design, software development, tools, and methods.

FIGURE TK B-2 As a leader in software standards and quality management, SEI focuses on overall architecture, system design, software development, tools, and methods.

CASE Tools History

As early as the 1960s, programmers used tools such as editors and code debuggers to write mainframe computer applications. Today, in our software-driven world, CASE tools have evolved into powerful resources that systems analysts need to build and maintain complex information systems.

Traditional code was written in **procedural programming languages** such as COBOL, which required a programmer to create a command for each processing step. In contrast, modern languages such as Visual Basic or Java are called **non-procedural**, or **event-driven**, programming languages because instead of writing a series of instructions, a programmer defines the actions that the program must perform when certain events occur. Because non-procedural languages are **object-oriented programming languages** (**OOPL**), they make it easier to implement an object-oriented system design, which you learned about in Chapter 6.

Another trend involves powerful programming languages called **fourth-generation languages** (**4GLs**) that are part of the **fourth-generation environment**, which was described in Chapter 7, Development Strategies. In a fourth-generation environment that includes modern CASE tools, system developers can develop accurate prototypes, cut development time, and reduce expense.

ON THE WEB

To learn more about fourth-generation languages, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part B, and locate the Fourth-Generation Languages link.

The Marketplace for CASE Tools

The CASE tool marketplace includes a wide variety of vendors and products, and no one tool dominates the market. You can use a site such as the one shown in Figure TK B-3 to locate CASE tool products and vendors. Depending on their features, some CASE tools can cost thousands of dollars, while others are available as shareware, or even as freeware, as shown in Figure TK B-4 on the next page.

You also can visit Microsoft's download center to sample various Express Editions, which are free, but limited, versions of various software development tools, as shown in Figure TK B-5 on the next page.

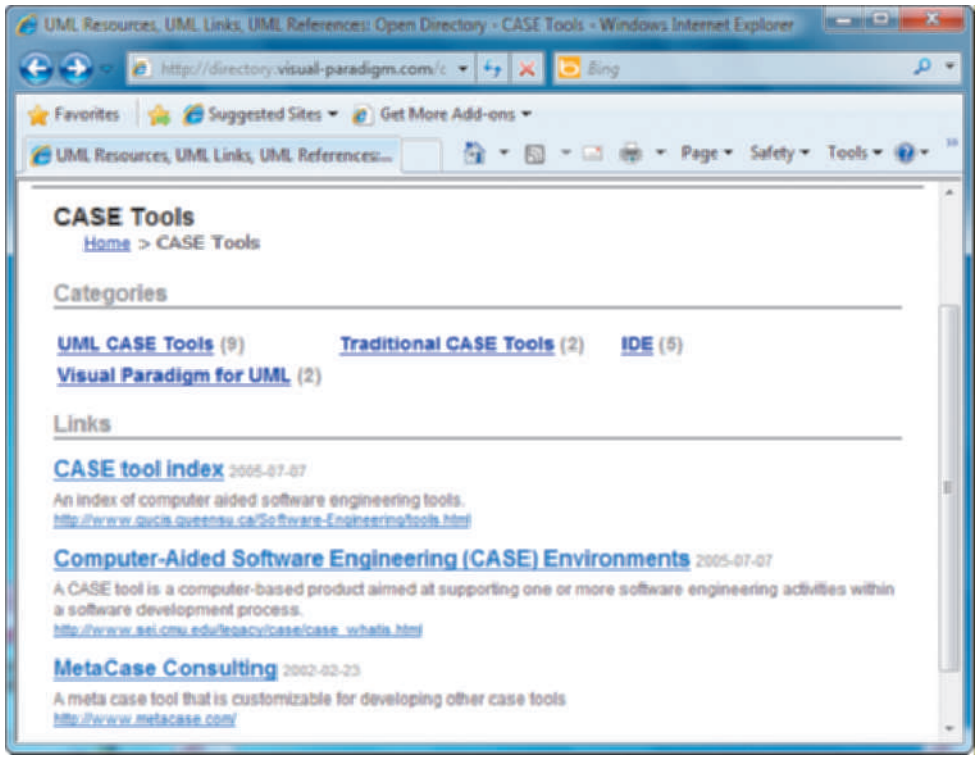

FIGURE TK B-3 Visual Paradigm's Web site offers information about many types of CASE tools.

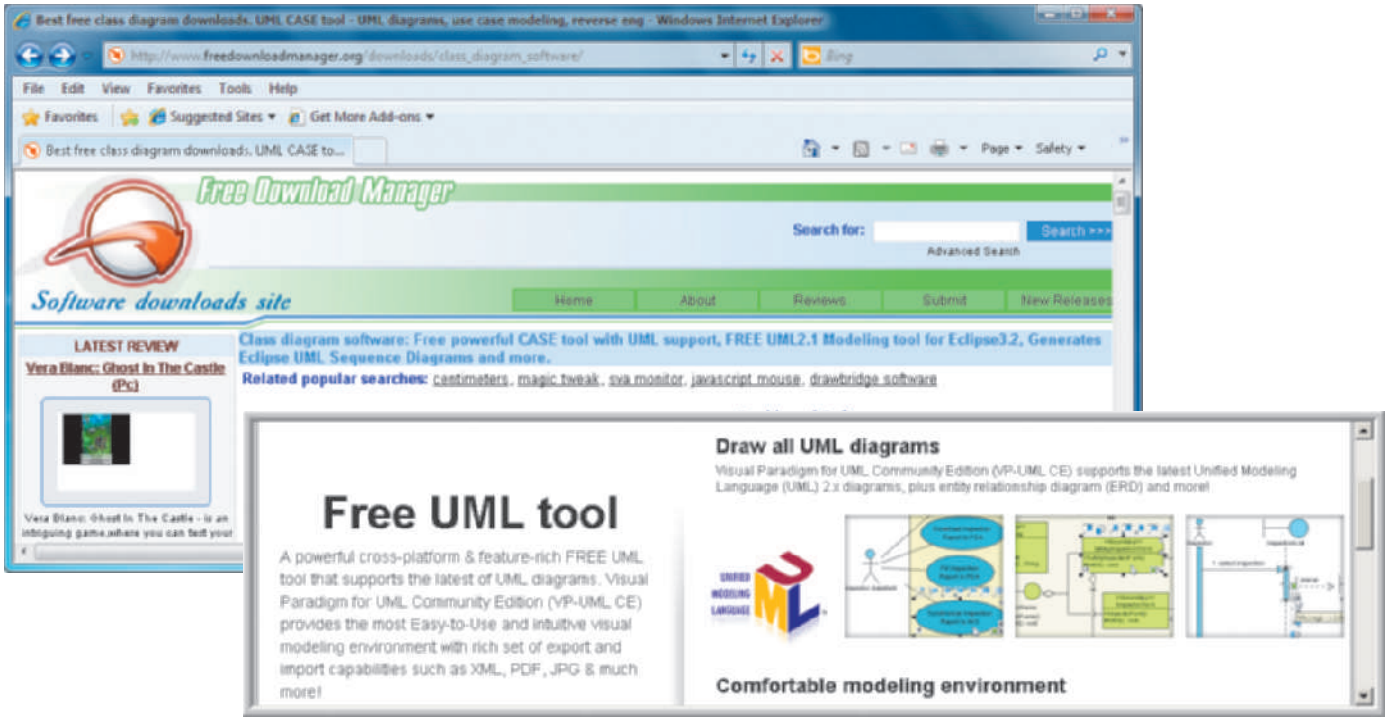

FIGURE TK B-4 This site offers many free downloads, such as the UML modeling tool shown here.

ON THE WEB

To learn more about the CASE tool marketplace, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part B, and locate The CASE Tool Marketplace link.

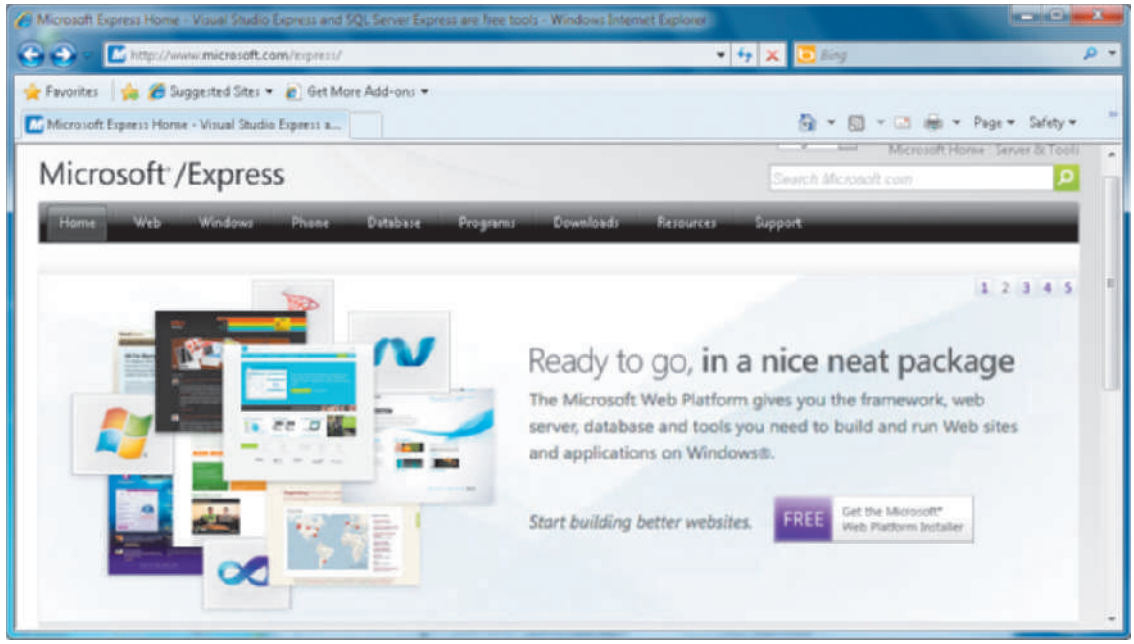

FIGURE TK B-5 Microsoft offers free Express Editions, which are trial versions of software development tools.

How do you select a CASE tool? The answer depends on the type of project, its size and scope, possible budgetary and time constraints, and the preferences and experience of the system development team. After you study the terms, concepts, and examples in this part of the Toolkit, you will be able to evaluate various products and make an informed decision. The first step in learning about CASE tools is to understand basic CASE terms and concepts.

CASE Terms and Concepts

A typical CASE tool is actually a set of individual tools that share a repository of information. The important terms and concepts are explained in the following sections.

Repository

A **repository** is a database that serves as a central storage location for all information about the system being developed. Once a data element has been defined in the repository, it can be accessed and used by processes and other information systems. For example, your sales processing, accounts receivable, and shipping systems all might require data about customers. After the CUSTOMER data element is entered in the repository, all three systems can share a consistent, up-to-date definition.

When you define a data element in the repository, you can assign a data type and format, a range of acceptable values, and one or more aliases. An **alias** is an alternative name for a data element. The repository can be searched, and all instances of the data element will be listed. For example, Figure TK B-6 shows a Visible Analyst search for the data element named CUSTOMER NUMBER. As the screens show, you can search the entire repository, or among specific types of diagrams, and the results will show all instances of the data element.

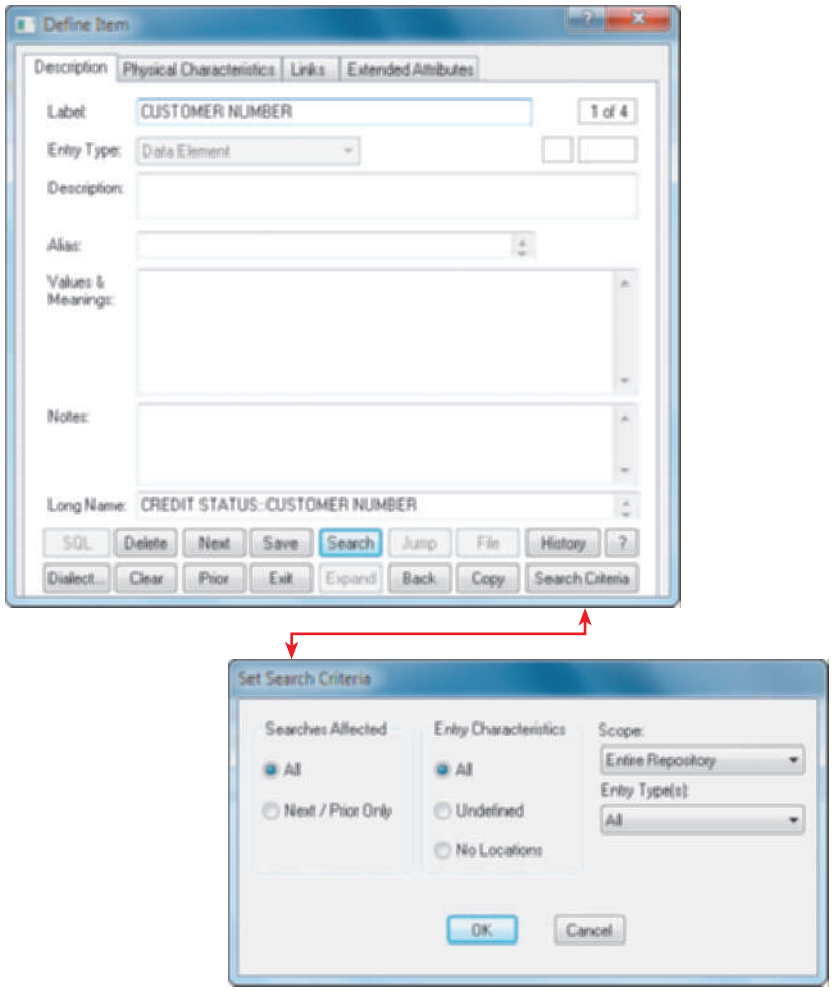

FIGURE TK B-6 A Visible Analyst repository search for the data element named CUSTOMER NUMBER. The results will show all instances of the data element.

Individual Tools

An integrated set of CASE tools can be used to model, document, engineer, and construct the information system, as explained in the following sections.

MODELING TOOLS Throughout the SDLC, system developers use modeling tools and diagrams to represent the system graphically. The textbook describes many examples, including Unified Modeling Language diagrams and functional decomposition diagrams (Chapter 4), data flow diagrams (Chapter 5), various object diagrams (Chapter 6), entity-relationship diagrams (Chapter 9), and structure charts (Chapter 10). Most popular CASE products offer these modeling tools, among others. One of the most important benefits of a **CASE environment** is that it provides an overall framework that allows a developer to create a series of graphical models based on data that has already been entered into a central repository.

DOCUMENTATION TOOLS The main source of system documentation is the repository, which was explained in the previous section. In most CASE software, the repository automatically identifies the new entries and adds them to the database. In addition to the repository itself, many CASE products provide tools that check automatically for

inconsistent or incomplete information in forms, reports, and diagrams. This is especially important in large, complex systems.

ENGINEERING TOOLS Engineering tools include forward engineering and reverse engineering tools. **Forward engineering** means translating business processes and functions into applications. Some CASE tools allow you to build the system either by editing objects and code directly, or by modifying graphical representations such as DFDs and UML diagrams. As you learned in Chapter 1, CASE tools such as System Architect and Visible Analyst allow you to develop a business model that can be translated into information system components. **Reverse engineering** allows you to examine an existing application and break it down into a series of diagrams, structure charts, and source code. Using a reverse engineering CASE tool, an analyst can transform existing application source code into a working model of the system. This can be especially important when integrating new systems with legacy systems or systems that were developed in different environments. Figure TK B-7 shows an example of a Visual Paradigm reverse engineering tool.

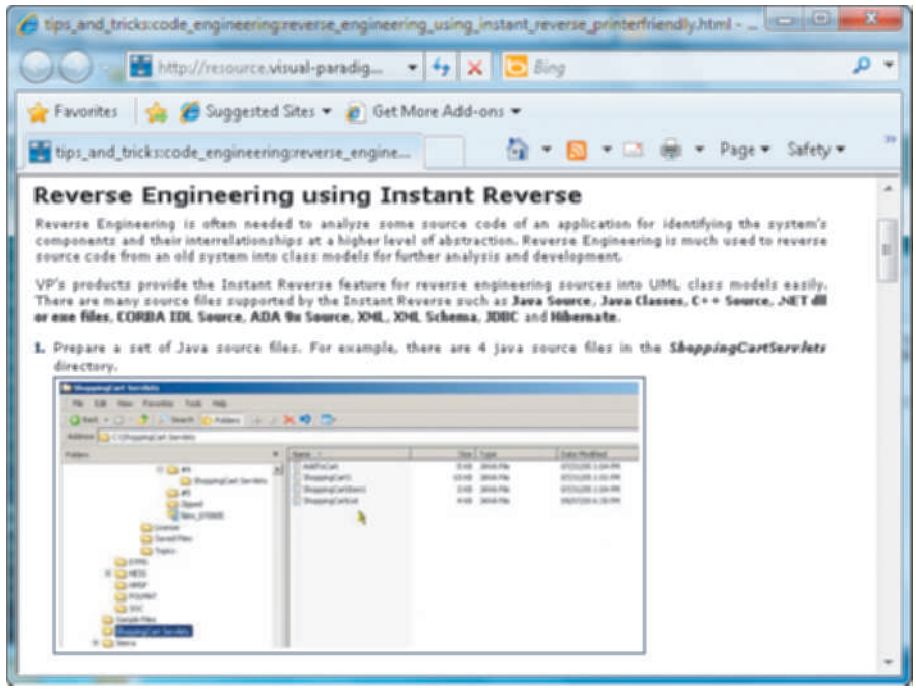

FIGURE TK B-7 An example of a CASE tool that allows reverse engineering.

CONSTRUCTION TOOLS A full-featured CASE tool can handle many program development tasks, such as generating application code, screens, and reports.

- An **application generator**, also called a **code generator**, allows you to develop computer programs rapidly by translating a logical model directly into code. As shown in Figure TK B-8, the Tangible Architect states that it easily can create .NET database applications. In this crowded marketplace, other vendors offer products that can generate applications in languages such as C, C++, Java, and AgileC.
- A **screen generator**, or **form painter**, is an interactive tool that helps you design a custom interface, create screen forms, and handle data entry format and procedures. The screen generator allows you to control how the screen will display captions, data fields, data, and other visual attributes. Modern CASE tools usually include a screen generator that interacts with the data dictionary. As shown in Figure TK B-9, Gillani Software's FourGen® CASE tool set includes a form painter and a screen code generator, along with many other powerful features.

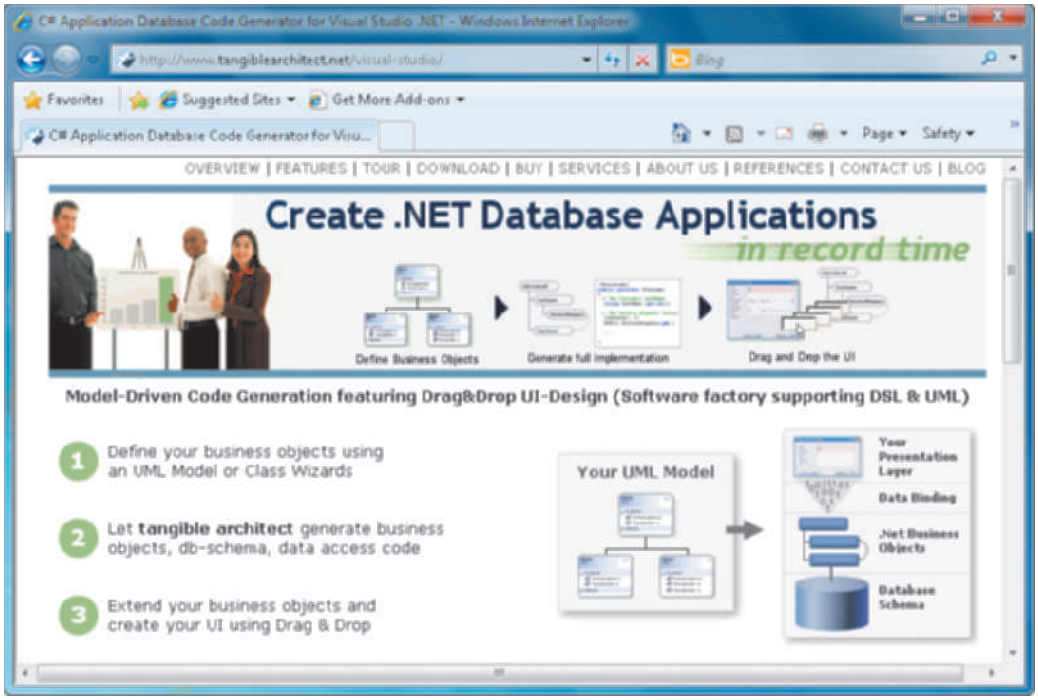

FIGURE TK B-8 Tangible Architect includes a code generator that can create .NET database applications.

FIGURE TK B-9 Gillani's FourGen® CASE tools include a form painter and a screen code generator.

- A **report generator**, also called a **report writer**, is a tool for designing formatted reports rapidly. Using a report generator, you can modify a report easily at any stage of the design process. When you are satisfied with the report layout, the report writer creates a report definition and program code that actually produces the report. You also can input sample field values to create a **mock-up report** for users to review and approve.

Integrated Development Environments

ON THE WEB

To learn more about integrated development environments, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part B, and locate the Integrated Development Environments link.

An **integrated development environment** (**IDE**) uses a built-in CASE tool that a software vendor includes to make it easier to plan, construct, and maintain a specific software product. For example, firms such as Microsoft, Oracle, and IBM offer IDEs that support their family of products. The following sections explain how these tools are used.

Examples of Integrated Development Environments

Although generic CASE tools can be used to plan and design any type of information system, it usually is easier to use an integrated tool that the vendor provides. For example, as shown in Figure TK B-10, Oracle provides Oracle Designer, which is packaged with Oracle's application software. According to the company, Oracle Designer models business processes, data entities, and relationships — and can transform the models into applications. Other leading firms, such as SAP and Sybase, also offer powerful development tools.

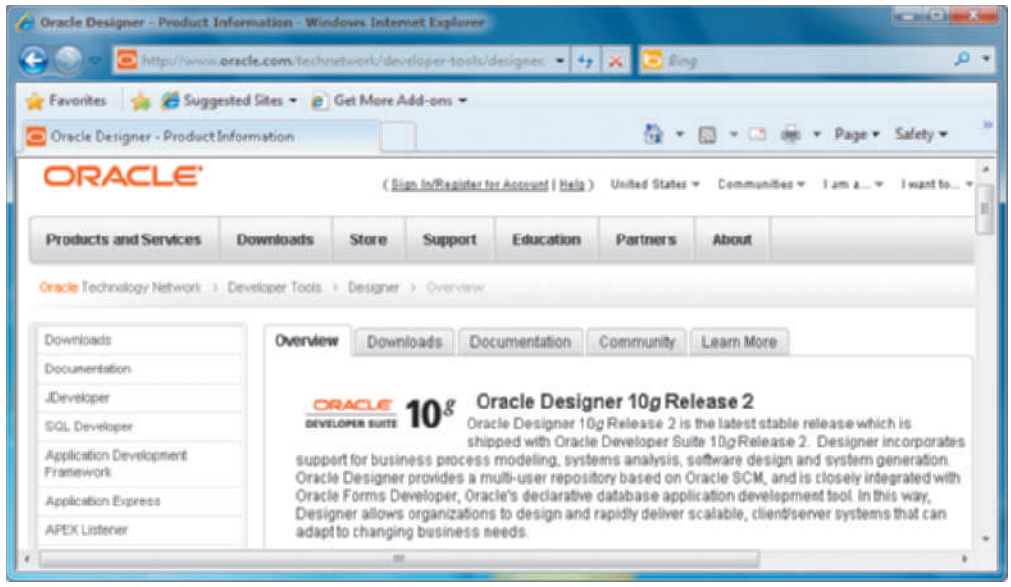

FIGURE TK B-10 Oracle Designer is a modeling and application development tool packaged with Oracle's application software.

Figure TK B-11 shows Microsoft's Visual Studio 2010, which is another example of an integrated development environment. Visual Studio 2010 includes various application development tools that are specifically designed to support Microsoft's .NET Web-based application development strategy. In addition to these commercial packages, programmers can use open-source software such as Java-based NetBeans IDE and Eclipse.

IBM's approach to integrated development stresses integration and teamwork. In the Redpaper® shown in Figure TK B-12, authors Bruce Powel Douglass and Mats Gothe

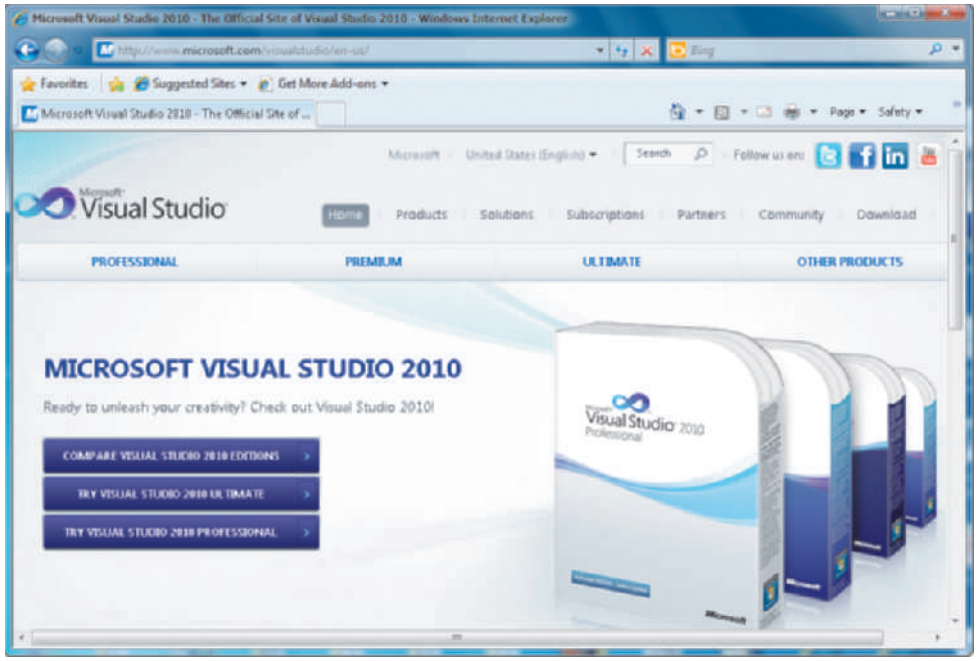

FIGURE TK B-11 Visual Studio 2010 is an integrated development environment that supports Microsoft's family of .NET applications.

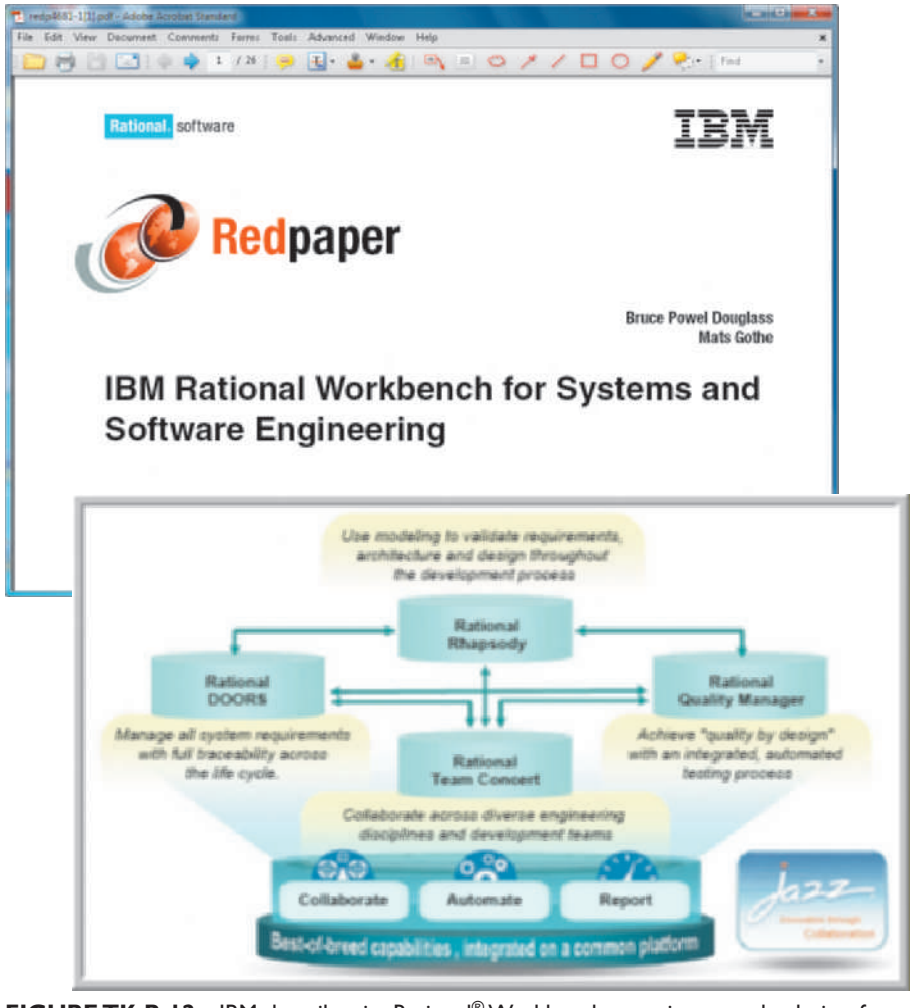

FIGURE TK B-12 IBM describes its Rational® Workbench as an integrated solution for systems life cycle management.

describe IBM's Rational® Workbench as an integrated solution for systems life cycle management. Without integration, they claim, systems and software teams operate in what they call *silos*, and effectiveness suffers. The Rational Workbench spans multiple categories, such as systems engineering, project management, software development, and quality management.

Figure TK B-12 on the previous page shows how the Rational Workbench uses IBM's Jazz™ platform to integrate people, processes, and projects. The authors suggest that the Jazz platform is a powerful, flexible new approach that replaces what they call *one-size fits no one* development solutions. The full text of the Redpaper is available at *www.ibm.com/redbooks*.

Pros and Cons of Integrated Development Tools

In a specific software environment, an integrated development tool is highly effective because it is built into the vendor's software package. The only possible disadvantage is that each IDE is different, and requires a learning curve and skills that might or might not be readily transferable. In contrast, non-specific CASE tools such as Visible Analyst or Rational System Architect can be used in any development environment. Given the dynamic changes in IT, a systems analyst should seek to learn as many development and CASE tools as possible.

CASE Tool Examples

ON THE WEB

To learn more about the Visible Analyst CASE tool, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part B, and locate the Visible Analyst CASE Tool link.

You can choose from dozens of vendors and CASE tools that offer a wide range of functions, characteristics, and appearance. The following sections include examples of several popular CASE tools.

Visible Analyst

Visible Systems Corporation is an important player in the software development market. Visible offers tools for data and application modeling, code generation, and software configuration management.

The Visible Analyst® CASE tool can generate many types of models and diagrams. Figure TK B-13 shows sample diagrams for a library system: an entity-relationship diagram, a data flow diagram, and a structure chart. All three examples are integrated with a central data repository.

Visible Analyst also provides a full range of Help features, including the error message analysis screen shown in Figure TK B-14 on page 660. When a user clicks an alphabetic letter, he or she can learn more about a specific error message that the program has displayed.

ON THE WEB

To learn more about the Rational System Architect, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part B, and locate the Rational System Architect link.

Rational Software

IBM offers many systems development and modeling products, including a powerful tool called Rational System Architect, shown in Figure TK B-15 on page 660. IBM claims that the product stresses modeling and collaboration, and is a suite of tools that can align processes, information, and technologies. A trial version of the software can be downloaded from IBM's site.

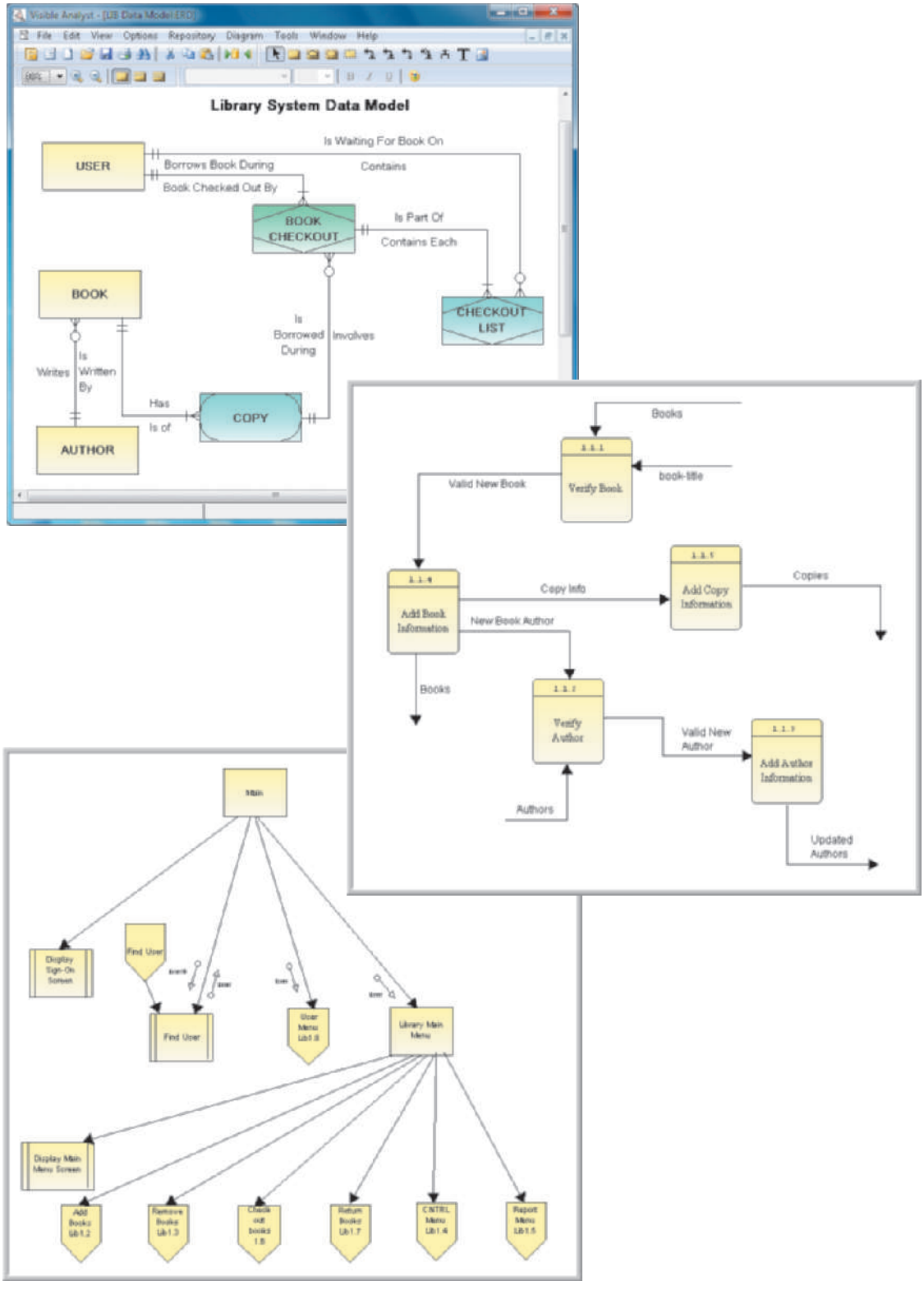

FIGURE TK B-13 Three sample Visible Analyst diagrams are integrated with the central data repository for a library system.

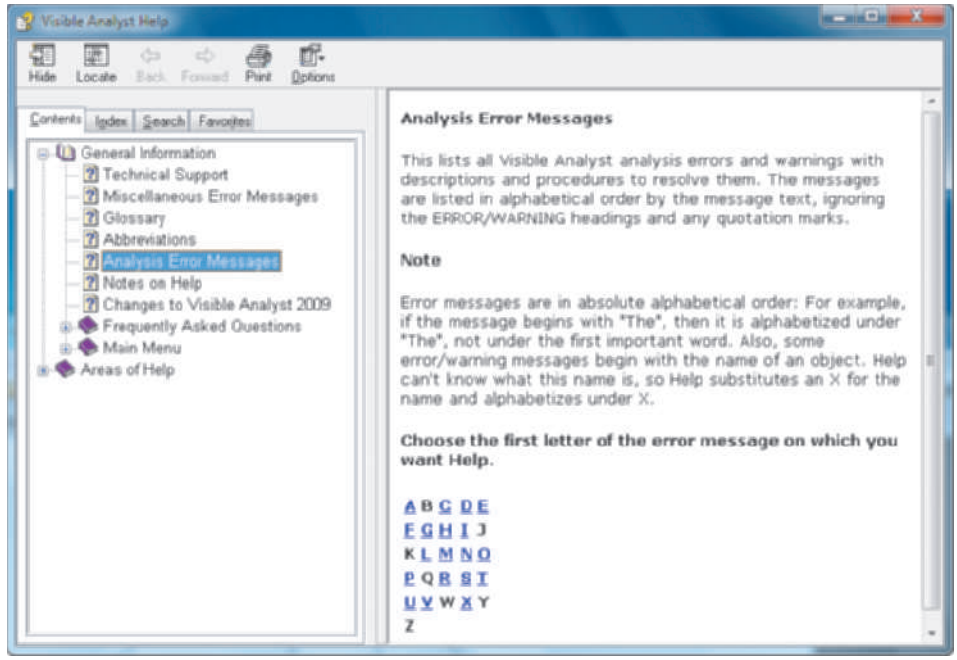

FIGURE TK B-14 Visible Analyst provides error message analysis. When a user clicks an alphabetic letter, he or she can learn more about a specific error message.

FIGURE TK B-15 IBM's Rational System Architect stresses modeling and collaboration.

CASE Tool Trends

Traditional CASE software evolved from simple utilities, such as code editors, to powerful multipurpose tools that can help you envision, plan, and build an entire information system. The evolution of CASE software will continue, as developers seek even more powerful tools that can model complex business processes and integrate with customer and supplier systems.

Just as modern spacecraft could not have been built without specialized, high-technology tools, future software will be planned, constructed, and maintained with a new generation of CASE tools. The following sections discuss CASE tool trends and method-specific tools.

New Products and Features

CASE tool vendors constantly offer more features and greater flexibility. One example is a framework to help transform business processes into an information system. A **framework** organizes and documents system development tasks. For example, the **Zachman Framework** shown in Chapter 4 on page 158 arranges traditional fact-finding questions into a useful matrix.

As software becomes more powerful and complex, the lines between traditional CASE tools and other modeling tools continue to blur. For example, Microsoft Visio can model networks, business processes, and many types of special diagrams. Visio offers a variety of online tutorials and training sessions (Figure TK B-16). Step-by-step examples are provided for many tasks, such as creating cross-functional flowcharts, and EPC (Event-driven Process Chain) diagrams, as shown in Figure TK B-17 on the next page.

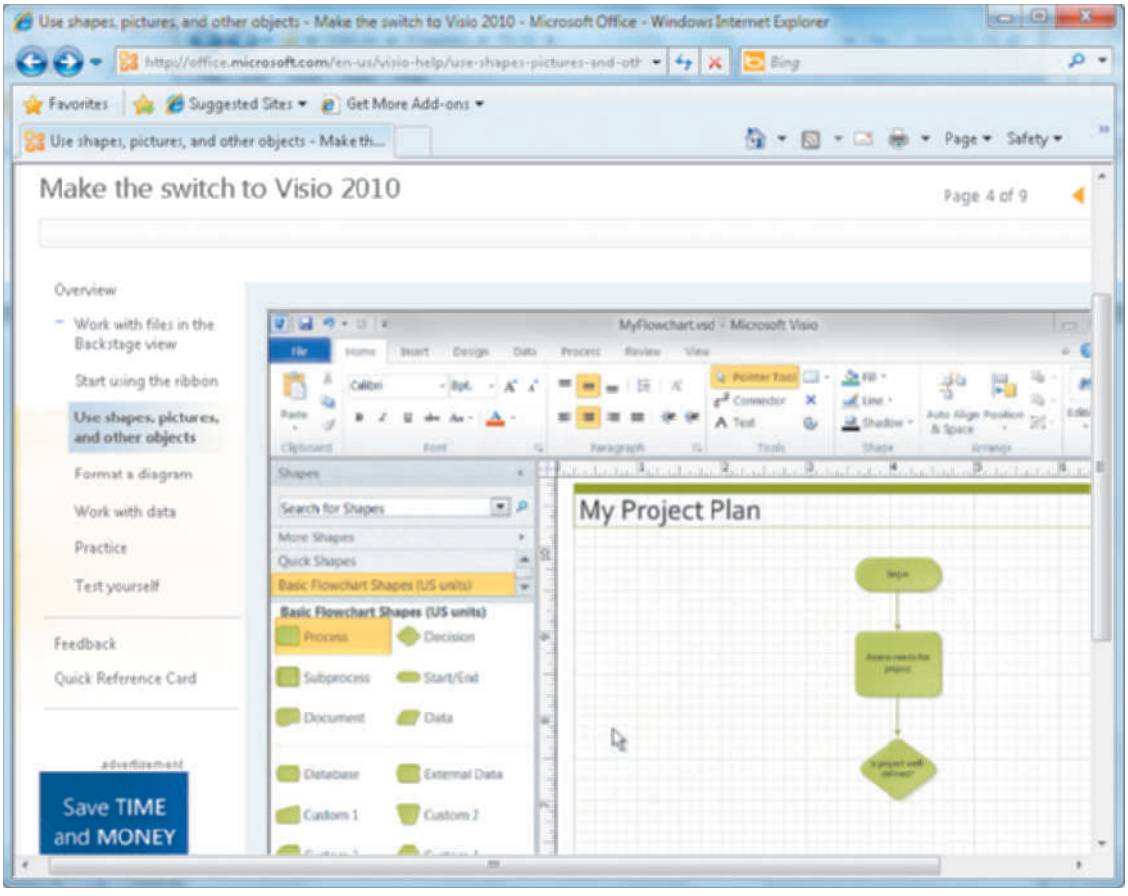

FIGURE TK B-16 Microsoft Visio offers self-paced online tutorials, complete with a self-assessment feature.

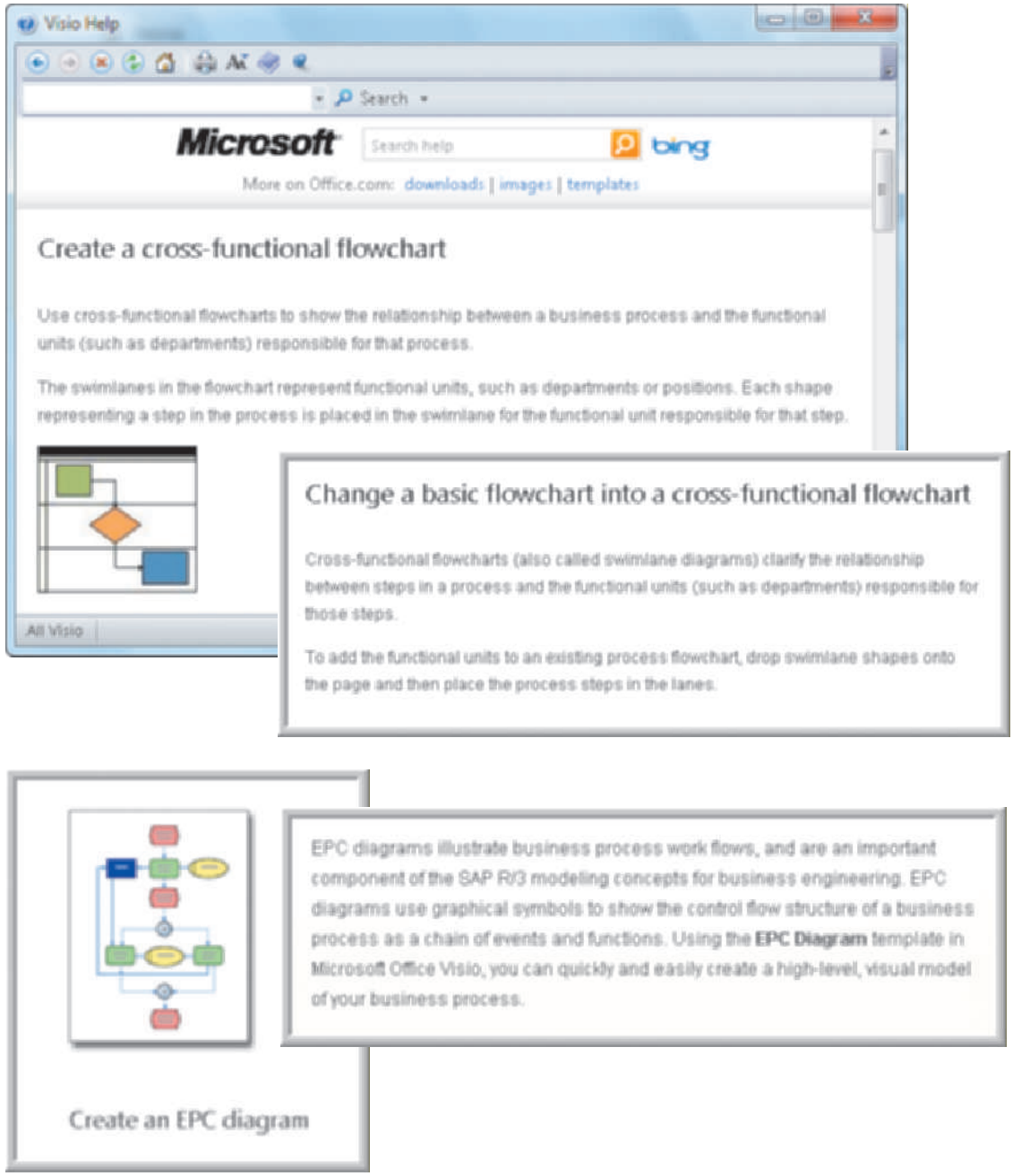

FIGURE TK B-17 Microsoft Visio offers a wide selection of diagrams, including cross-functional flowcharts and EPC diagrams.

Another trend is the increasing use of integrated development environments. Chapter 11 explains how an IDE can simplify the integration of system components and reduce code development time. An IDE typically includes built-in tools such as real-time error detection, syntax hints, highlighted code, class browsers, and version control. In addition to IBM's WebSphere and Microsoft's .NET, programmers can use open-source IDEs such as Java-based NetBeans IDE and Eclipse.

Method-Specific CASE Tools

As Chapter 11 explains, each systems development approach has a set of tools that has worked especially well for that method. For example, structured development relies heavily on DFDs and structure charts. Object-oriented methods use a variety of diagrams, such as

use case, class, sequence, and transition state diagrams. Agile methods tend to use spiral or other iterative models. In Chapter 1, Figure 1-25 on page 21 lists several method-specific modeling tools. System developers also use multipurpose tools to help them translate the system logic into properly functioning program modules. These generic tools include entity-relationship diagrams, flowcharts, pseudocode, decision tables, and decision trees.

Structured analysis is a traditional approach that is time-tested and easy to understand. Structured modeling tools are described in detail in Chapter 5, Data and Process Modeling. However, as Chapter 1 points out, **object-oriented analysis and design (OOAD)** is very popular. Widespread use of object-oriented languages has spurred interest in O-O CASE and UML-based modeling tools, which provide seamless development from planning to actual coding. Other O-O features include modular design and reusable code, which can reduce costs and speed up development. Object-oriented analysis and design tools and techniques are described in Chapter 6, Object Modeling.

The most recent trend is the popularity of agile methods. Chapter 11 includes a detailed description of an agile project, including the iterative cycles and the intense contact between developers and users. According to Scott W. Ambler, a well-known IT consultant, agile developers use a wide range of modeling tools, including CASE tools. However, many agile teams find that simple whiteboard sketching works best for them, as shown in Figure TK B-18.

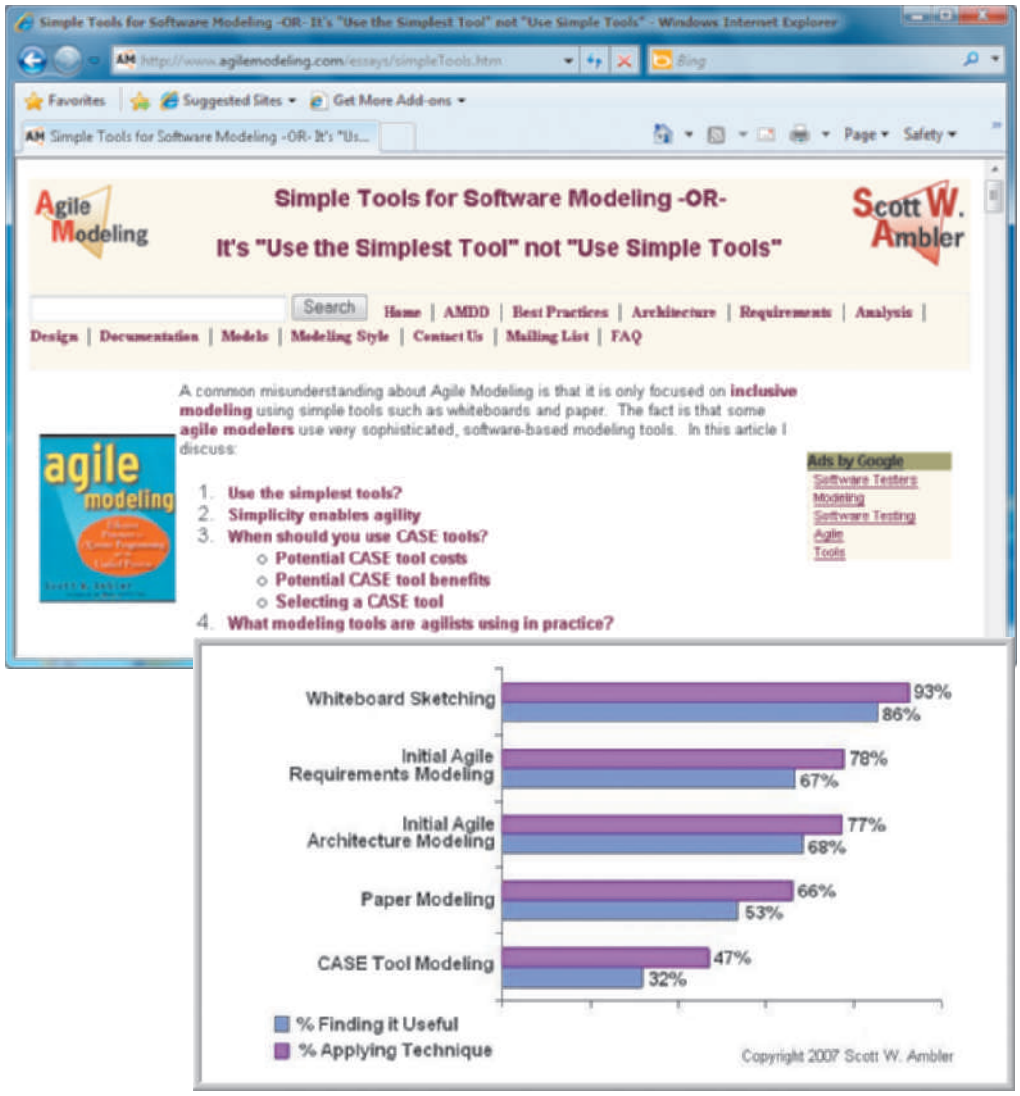

FIGURE TK B-18 Agile teams use a wide range of modeling techniques, from simple whiteboards to CASE tools.

Although it is difficult to predict the future, it seems clear that CASE tools will continue to evolve and become more powerful. At the same time, system developers will sometimes choose simpler, low-tech methods and techniques as modeling tools.

Toolkit Summary

CASE stands for computer-aided systems engineering. CASE tools are software programs that system developers use to help them design and construct information systems. CASE tools can reduce costs, speed up development, and provide comprehensive documentation that can be used for future maintenance or enhancements.

Older systems used program code that was written in procedural languages such as COBOL, which required a programmer to create code statements for each processing step. Modern languages such as C++ and Java are non-procedural, or event-driven, languages because a programmer defines the actions that the program must perform when certain events occur.

Non-procedural languages, called 4GLs, are object-oriented programming languages (OOPL). 4GLs are important components of a fourth-generation environment that allows system developers to develop accurate prototypes, cut development time, and reduce expense.

A repository is a database that serves as a central storage location for all information about the system being developed. Once a data element has been defined in the repository, it can be accessed and used by processes and other information systems. An alias is an alternative name for a data element. The repository can be searched, and all instances of the data element will be listed.

An integrated set of CASE tools can be used to model, document, engineer, and construct the information system. Modeling tools represent the system graphically by using various types of diagrams, including data flow diagrams (DFDs), Unified Modeling Language (UML) diagrams, functional decomposition diagrams, structure charts, and network diagrams.

The main source of system documentation is the repository, which identifies new elements and adds them to the database. Additional documentation is provided by tools that check automatically for inconsistent or incomplete information in forms, reports, and diagrams.

Forward engineering means translating business processes and functions into applications. Reverse engineering allows you to examine an existing application and break it down into a series of diagrams, structure charts, and, in some cases, source code.

A CASE tool can handle many program development tasks, such as generating application code, screens, and reports.

An integrated development environment (IDE) uses a built-in CASE tool that a software vendor includes to make it easier to plan, construct, and maintain a specific software product. Examples of IDEs include Oracle Designer and Microsoft's Visual Studio 2010.

Two trends seem clear: CASE tool vendors will continue to include powerful new features, and the popularity of object-oriented tools will continue to grow.

Key Terms and Phrases

alias *653*
application generator *654*
CASE environment *653*
CASE tools *648*
code generator *654*
computer-aided software engineering (CASE) *648*
computer-aided systems engineering (CASE) *648*
event-driven programming language *651*
form painter *654*
forward engineering *654*
fourth-generation environment *651*
fourth-generation languages (4GLs) *651*
framework *661*
integrated development environment (IDE) *656*
mock-up report *656*
non-procedural programming language *651*
object-oriented analysis and design (OOAD) *663*
object-oriented programming languages (OOPL) *651*
procedural programming language *651*
report generator *656*
report writer *656*
repository *653*
reverse engineering *654*
screen generator *654*
structured analysis *663*
Zachman Framework *661*

Toolkit Exercises

Review Questions

1. Define CASE, CASE tools, and a CASE environment.
2. Explain the difference between procedural and non-procedural languages.
3. Describe 4GLs and their characteristics.
4. Define a repository, and explain its role in the systems development process.
5. What are forward and reverse engineering tools, and how are they used?
6. Provide an example of an application generator and a screen generator.
7. How is a report generator used, and what is a mock-up report?
8. Explain the concept of an integrated development environment and provide two examples of IDEs.
9. What are some features of the Visible Analyst CASE tool?
10. What is the emerging role of object-oriented analysis and design methods? Agile methods?

Discussion Topics

1. Would a systems analyst be better off in a position where he or she works with an IDE, or where generic CASE tools are used? Explain your answer.
2. Visit the Web sites for Rational System Architect and Visible Analyst. If you could choose only one of these products, which one would you select, and why?
3. If you were a programmer, would you prefer to work with procedural or non-procedural languages? Explain your reasons.
4. Review the Dilbert© cartoon on page 141. Although the example might be far-fetched, perhaps future software will be able to identify business opportunities and requirements. Meanwhile, if the trend toward more powerful CASE tools continues, many of the tedious program development tasks might be performed automatically. Is there a limit to the capabilities of future CASE software? Could a complete information system be designed by describing a business operation and specifying certain inputs and outputs? Explain your answer.

Projects

1. Go to the site shown in Figure TK B-3 on page 651 and choose a CASE tool. Visit the vendor's site and learn all you can about the product. Write a brief report that describes your experience.
2. Visit the *freedownloadmanager.org* Web site shown in Figure TK B-4 on page 652, and download the free UML modeling tool. Experiment with the program and write a brief report that describes your experience.
3. Search the Internet and locate an example of a screen generator. Visit the vendor's site and learn all you can about the product. Write a brief report that describes your experience.
4. Go to the site shown in Figure TK B-9 on page 655 and learn more about Gillani's FourGen CASE Tools. Write a brief report summarizing your findings.

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PART C

Financial Analysis Tools

In **Part C** of the Systems Analyst's Toolkit, you will learn how to use financial analysis tools during the planning, analysis, design, implementation, support, and securing of an information system.

INTRODUCTION

OBJECTIVES

When you finish this part of the Toolkit, you will be able to:

- Define economic feasibility
- Classify costs and benefits into various categories, including tangible or intangible, direct or indirect, fixed or variable, and developmental or operational
- Understand chargeback methods and how they are used
- Use payback analysis to calculate the length of time that it takes for a project to pay for itself
- Use return on investment analysis to measure a project's profitability
- Use present value analysis to determine the value of a future project measured in current dollars

Part C of the Systems Analyst's Toolkit shows you how to use various tools to calculate a project's costs and benefits. As a systems analyst, you need to know how to calculate costs and benefits when you conduct preliminary investigations, evaluate IT projects, and make recommendations to management.

Financial analysis tools are important throughout the systems development life cycle. For example, in Chapter 2 you learn that economic feasibility depends on a comparison of costs and benefits. A project is economically feasible if the future benefits outweigh the estimated costs of developing or acquiring the new system. In Chapter 7, when you analyze development strategies, you apply financial analysis tools and techniques as you examine various options. Then, as Chapter 12 explains, you use these tools again to recognize the end of a system's useful life.

TOOLKIT INTRODUCTION CASE: Mountain View College Bookstore

Background: Wendy Lee, manager of college services at Mountain View College, wants a new information system that will improve efficiency and customer service at the three college bookstores.

In this part of the case, Tina Allen (systems analyst) and David Conroe (student intern) are talking about financial analysis tools and techniques.

Participants: Tina and David
Location: Mountain View College Cafeteria, during the systems planning phase
Discussion topics: Economic feasibility, chargeback methods, cost-benefit classification, payback analysis, return on investment analysis, and net present value analysis

Tina: Hi, David. Before we go any further with the preliminary investigation, I wanted to meet with you to discuss financial analysis tools and techniques, and how we will apply them.

David: *Fine with me. Where do we start?*

Tina: Well, because economic feasibility depends on a project's costs and benefits, the first step is to classify those costs and benefits into specific categories. For example, costs can be tangible or intangible, direct or indirect, fixed or variable, and developmental or operational.

David: *Okay, I understand. What do we do after we classify everything?*

Tina: Then we use one or more financial analysis tools: payback analysis, return on investment analysis, and net present value analysis. We'll learn how to use them to evaluate the system and compare alternatives. We'll also talk about chargeback methods.

David: *What are they?*

Tina: A chargeback method is just a way to allocate costs for an IT system. We'll have to talk to Wendy about that. Meanwhile, here's a task list we can work on:

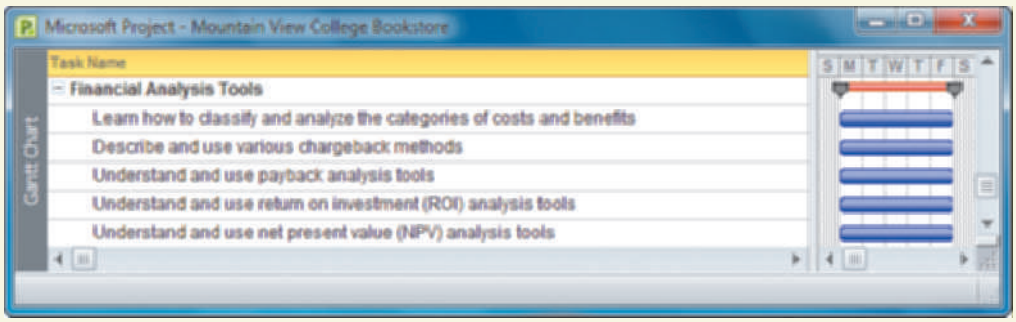


FIGURE TK C-1 Typical financial analysis tasks.

Describing Costs and Benefits

As a systems analyst, you must review a project's costs and benefits at the end of each SDLC phase so management can decide whether or not to continue the project. Before you can use the economic analysis tools described in this section of the Toolkit, you must learn how to identify and classify all costs and benefits.

As you learned in Chapter 2, **economic feasibility** means that the projected benefits of the proposed system outweigh the projected costs. When you determine economic feasibility, you must consider the project's benefits compared to the project's **total cost of ownership** (**TCO**), which includes ongoing support and maintenance costs, as well as acquisition costs.

Figure TK C-2 shows an online TCO analysis tool provided by HP Services. HP stresses the importance of TCO analysis, and points to studies showing that the majority of total IT costs occur *after* the purchase, and that nearly half the costs lie outside the IT

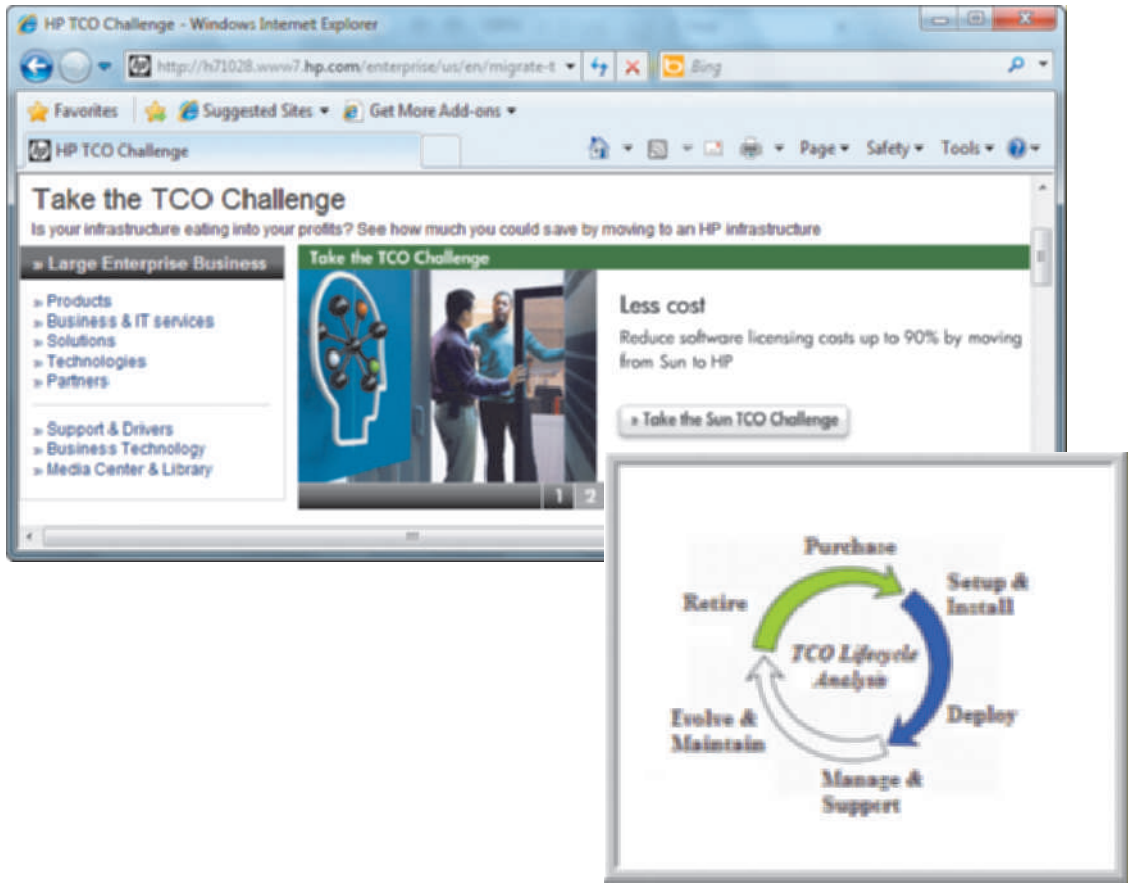


FIGURE TK C-2 HP Services offers an online TCO analysis tool.

department's budget. HP also cites a study that shows a staggering TCO of $21,000 for a $2,000 PC when all costs are considered over a five-year period. HP noted that the most significant cost factor is user support, including peer-to-peer assistance that rarely is documented or measured.

Cost-benefit analysis tools also are available from various vendors and organizations, including the Info~Tech Research Group site shown in Figure TK C-3. Info~Tech's free TCO tool provides a three-year planning horizon and graphical output.

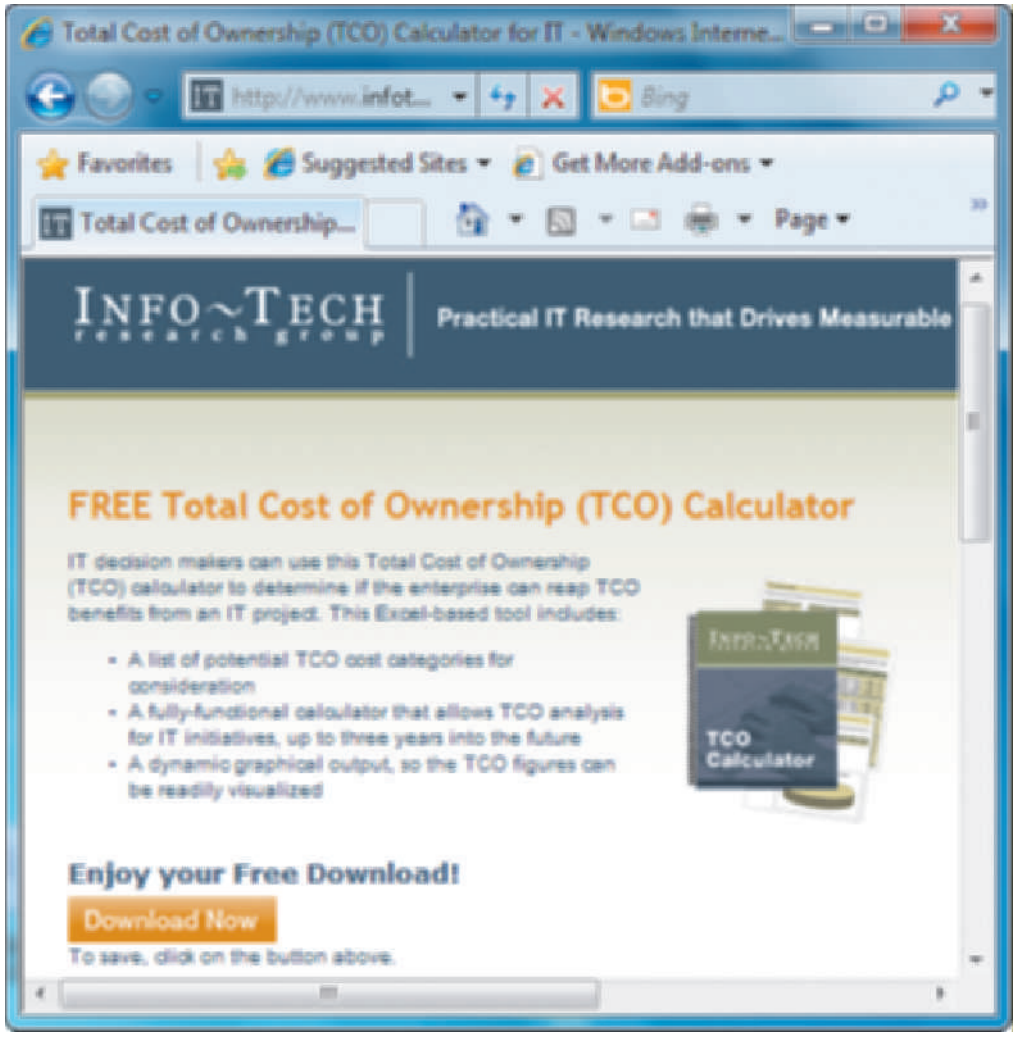


FIGURE TK C-3 Example of cost-benefit analysis software available on the Web.

Figure TK C-4 on the next page shows a cost-benefit tool that focuses on technology evaluation. The vendor, New Venture Tools, offers a demo version and a step-by-step tutorial.

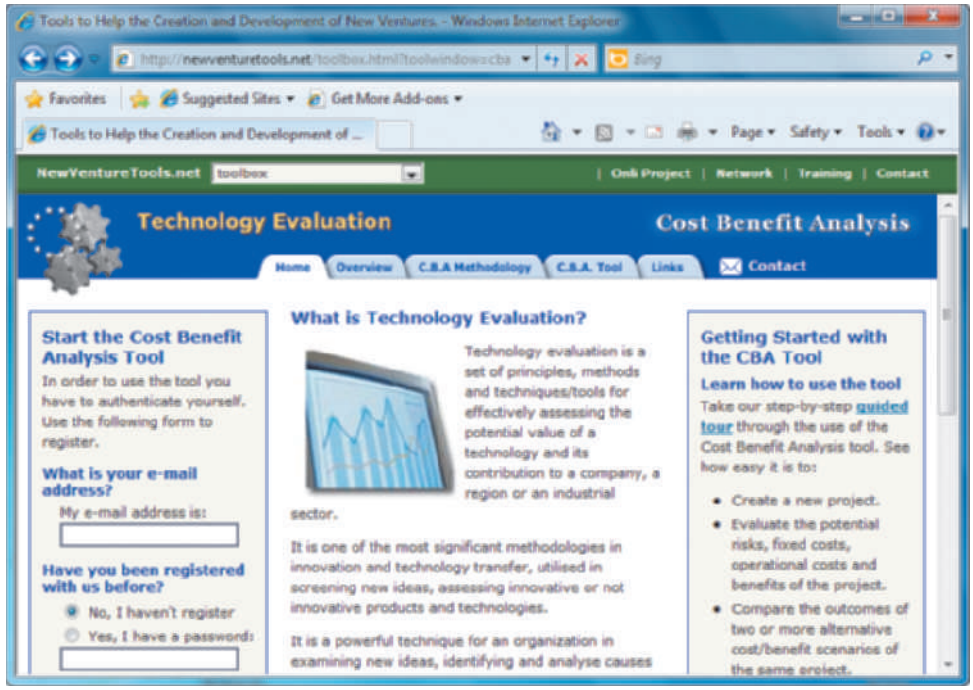


FIGURE TK C-4 New Venture Tools claims that technology evaluation requires a set of principles, methods, techniques, and tools.

Cost Classifications

Costs can be classified as tangible or intangible, direct or indirect, fixed or variable, and developmental or operational. **Tangible costs** are costs for which you can assign a specific dollar value. Examples of tangible costs include employee salaries, hardware and software purchases, and office supplies. Tangible costs also include the interest charges that firms must pay when they need to borrow money for working capital or to finance new projects. In times of high interest rates, these costs can be significant and must be considered.

In contrast, **intangible costs** are costs whose dollar value cannot be calculated easily. The cost of customer dissatisfaction, lower employee morale, and reduced information availability are examples of intangible costs.

If the analyst examines an intangible item carefully, however, it sometimes is possible to estimate a dollar value. For example, users might dislike a system because it is difficult to learn. Their dissatisfaction is an intangible cost, but if it translates into an increase in errors that must be corrected, you probably could assign a tangible dollar cost. You should try to work with tangible costs whenever possible.

Direct costs are costs that can be associated with the development of a specific system. Examples of direct costs include the salaries of project team members and the purchase of hardware that is used only for the new system. In contrast, **indirect costs**, or **overhead expenses**, cannot be attributed to the development of a particular information system. The salaries of network administrators, copy machine rentals, and insurance expenses are examples of indirect costs.

Fixed costs are costs that are relatively constant and do not depend on a level of activity or effort. Many fixed costs recur regularly, such as salaries and hardware rental charges. **Variable costs** are costs that vary depending on the level of activity. The costs of printer paper, supplies, and telephone line charges are examples of variable costs.

Developmental costs are incurred only once, at the time the system is developed or acquired. Those costs might include salaries of people involved in systems development, software purchases, initial user training, and the purchase of necessary hardware or

furniture. **Operational costs** are incurred after the system is implemented and continue while the system is in use. Examples of operational costs include system maintenance, ongoing training, annual software license fees, and communications expense.

Some costs apply to more than one category of expenses. For example, overtime pay for clerical staff during the systems analysis phase would be classified as developmental, variable, and direct. A monthly fee for maintaining the company's Web site would be regarded as operational, fixed, and indirect.

Managing Information Systems Costs and Charges

Management wants to know how much an information system costs, so it is important for the systems analyst to understand direct costs, indirect costs, and methods of allocating IT charges within the company.

Direct costs usually are easier to identify and predict than indirect costs. For example, the salaries of project team members and the purchase of hardware, software, and supplies for the new system are direct costs. After a new information system goes into operation, other direct costs might include the lease of system-specific hardware or software.

Many IT department costs cannot be attributed directly to a specific information system or user group. Those indirect costs can include general hardware and software acquisition expenses; facility maintenance, air conditioning, security, rent, insurance, and general supplies; and the salaries of operations, technical support, and information center personnel.

A **chargeback method** is a technique that uses accounting entries to allocate the indirect costs of running the IT department. Most organizations adopt one of four chargeback methods: no charge, a fixed charge, a variable charge based on resource usage, or a variable charge based on volume.

1. **No charge method**. Some organizations treat information systems department indirect expenses as a necessary cost of doing business, and IT services are seen as benefiting the entire company. Thus, indirect IT department costs are treated as general organizational costs and are not charged to other departments. In this case, the information systems department is called a **cost center**, because it generates accounting charges with no offsetting credits for IT services.
2. **Fixed charge method**. With this method, the indirect IT costs are divided among all the other departments in the form of a fixed monthly charge. The monthly charge might be the same for all departments or based on a relatively constant factor such as department size or number of workstations. By using a fixed charge approach, all indirect costs are charged to other departments, and the IT group is regarded as a profit center. A **profit center** is a department that is expected to break even or show a profit. Under the profit center concept, company departments purchase services from the IT department and receive accounting charges that represent the cost of providing the services.
3. **Variable charge method based on resource usage. Resource allocation** is the charging of indirect costs based on the resources used by an information system. The allocation might be based on connect time, server processing time, network resources required, printer use, or a combination of similar factors. **Connect time** is the total time that a user is connected actively to a remote server — some Internet service providers use this as a basis for charges. In a client/server system, **server processing time** is the time that the server actually responds to client requests for processing. The amount a particular department is charged will vary from month to month, depending not only on that department's resource usage, but also on the total resource usage. The IT department is considered a profit center when an organization uses the resource allocation method.

4. **Variable charge method based on volume.** The indirect IT department costs are allocated to other departments based on user-oriented activity, such as the number of transactions or printing volume. As with the resource allocation method, a department's share of the costs varies from month to month, depending on the level of activity. In this case, the IT department is considered a profit center.

Benefit Classifications

In addition to classifying costs, you must classify the benefits that the company expects from a project. Like costs, benefits can be classified as tangible or intangible, fixed or variable, and direct or indirect. Another useful benefit classification relates to the nature of the benefit: positive benefits versus cost-avoidance benefits. **Positive benefits** increase revenues, improve services, or otherwise contribute to the organization as a direct result of the new information system. Examples of positive benefits include improved information availability, greater flexibility, faster service to customers, higher employee morale, and better inventory management.

In contrast, **cost-avoidance benefits** refer to expenses that would be necessary if the new system were not installed. Examples of cost-avoidance benefits include handling the work with current staff instead of hiring additional people, not having to replace existing hardware or software, and avoiding problems that otherwise would be faced with the current system. Cost-avoidance benefits are just as important as positive benefits, and you must consider both types when performing cost-benefit analysis.

Cost-Benefit Analysis

Cost-benefit analysis is the process of comparing the anticipated costs of an information system to the anticipated benefits. Cost-benefit analysis is performed throughout the SDLC to determine the economic feasibility of an information system project and to compare alternative solutions. Many cost-benefit analysis techniques exist. This section covers discussion of only the three most common methods: payback analysis, return on investment analysis, and present value analysis. Each of the approaches analyzes cost-benefit figures differently, but the objective is the same: to provide reliable information for making decisions.

VIDEO LEARNING SESSION: Payback Analysis

Video Learning Sessions can help you understand key concepts, practice your skills, and check your work. To access the sessions, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com** and navigate to the **Video Learning Sessions** for this book. This session is about payback analysis. You'll learn how to calculate the payback period for a project and how to use a spreadsheet to determine a project's payback period.

Payback Analysis

Payback analysis is the process of determining how long it takes an information system to pay for itself. The time it takes to recover the system's cost is called the **payback period**. To perform a payback analysis, you carry out the following steps:

1. Determine the initial development cost of the system.
2. Estimate annual benefits.
3. Determine annual operating costs.
4. Find the payback period by comparing total development and operating costs to the accumulated value of the benefits produced by the system.

When you plot the system costs over the potential life of the system, you typically see a curve such as the one shown in Figure TK C-5. After the system is operational, costs decrease rapidly and remain relatively low for a period of time. Eventually, as the system requires more maintenance, costs begin to increase. The period between the beginning of systems operation and the point when operational costs are rapidly increasing is called the **economically useful life** of the system.

ON THE WEB

To learn more about payback analysis, visit **scsite.com/** the Management Information Systems CourseMate Web site at **www.cengagebrain.com,** navigate to **On the Web Links** for Toolkit Part C, and locate the Payback Analysis link.

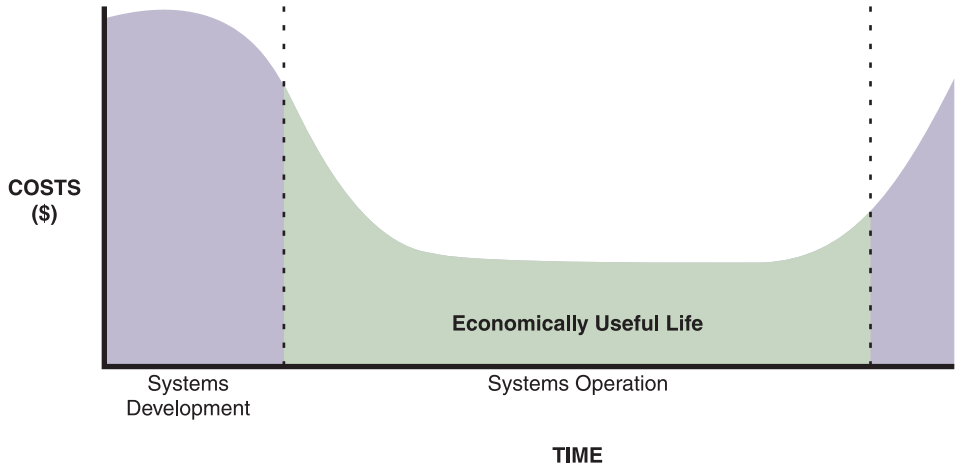


FIGURE TK C-5 The costs of a typical system vary over time. At the beginning, system costs are high due to initial development expense. Costs then drop during systems operation. Maintenance costs begin to increase until the system reaches the end of its economically useful life. The area between the two dashed lines shows the economically useful life of this system.

When you plot the benefits provided by an information system against time, the resulting curve usually resembles the one shown in the upper graph in Figure TK C-6. Benefits start to appear when the system becomes operational, might increase for a time, and then level off or start to decline.

When conducting a payback analysis, you calculate the time it takes for the accumulated benefits of an information system to equal the accumulated costs of developing and operating the system.

In the lower graph in Figure TK C-6, the cost and benefit curves are plotted together. The dashed line indicates the payback period. Notice that the payback period is not the point when current benefits equal current costs, where the two lines cross. Instead, the payback period compares accumulated costs and benefits. If you graph current costs and benefits, the payback period corresponds to the time at which the areas under the two curves are equal.

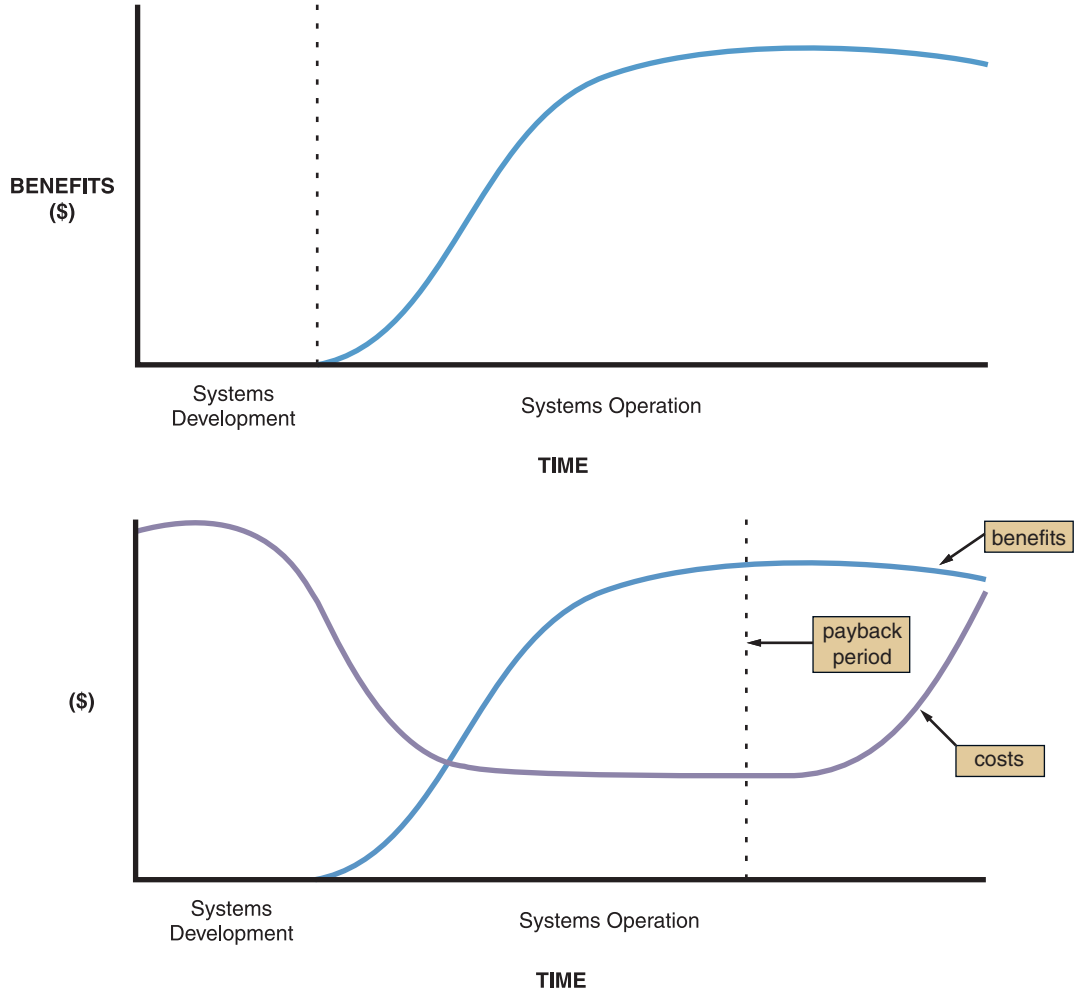


FIGURE TK C-6 Benefits of an information system change over time, as shown in the upper graph. The lower graph shows costs and benefits plotted on the same graph. The dashed line indicates the payback period, when accumulated benefits equal accumulated costs.

Figure TK C-7 contains two cost-benefit tables. The tables show the anticipated annual costs, cumulative costs, annual benefits, and cumulative benefits for two information systems projects. Year 0 (zero) corresponds to the year in which systems development begins. The development of Project A takes less than one year, so some benefits are realized in Year 0. Systems development for Project B requires more than one year, so the benefits do not begin until some time in Year 1.

In Project A, by the end of Year 4, the cumulative costs are $135,700, which slightly exceeds the $132,000 cumulative benefits. By the end of Year 5, however, the cumulative benefits of $171,000 far exceed the cumulative costs, which are $157,700. Therefore, at some point in time during Year 5, the accumulated costs and benefits are equal, and the payback period is established. In Project B, a similar situation exists. By the end of Year 4, Project B's cumulative costs are $191,000, which is greater than the cumulative benefits of $156,000. At some point during Year 5, cumulative benefits will exceed cumulative costs, and the system will have paid for itself.

If more specific information is available regarding the timing of costs and benefits during a year, you can calculate the payback period more precisely. Another approach is to create a chart that shows the exact point when cumulative benefits exceed cumulative costs, which is explained in the following section.

Some managers are critical of payback analysis because it places all the emphasis on early costs and benefits and ignores the benefits received after the payback period. Even if the benefits for Project B in Year 6 soared as high as $500,000, the payback period for

PAYBACK ANALYSIS EXAMPLES

PROJECT A:

YEAR	COSTS	CUMULATIVE COSTS	BENEFITS	CUMULATIVE BENEFITS
0	60,000	60,000	3,000	3,000
1	17,000	77,000	28,000	31,000
2	18,500	95,500	31,000	62,000
3	19,200	114,700	34,000	96,000
4	21,000	135,700	36,000	132,000
5	22,000	157,700	39,000	171,000
6	23,300	181,000	42,000	213,000

PROJECT B:

YEAR	COSTS	CUMULATIVE COSTS	BENEFITS	CUMULATIVE BENEFITS
0	80,000	80,000	——	——
1	40,000	120,000	6,000	6,000
2	25,000	145,000	26,000	32,000
3	22,000	167,000	54,000	86,000
4	24,000	191,000	70,000	156,000
5	26,500	217,500	82,000	238,000
6	30,000	247,500	92,000	330,000

FIGURE TK C-7 Payback analysis data for two information systems proposals: Project A and Project B.

that project still occurs during the fifth year of operation. In defense of payback analysis, the earlier cost and benefit predictions usually are more certain. In general, the further out in time that you extend your projections, the more unsure your forecast will be. Thus, payback analysis uses the most reliable of your cost and benefit estimates.

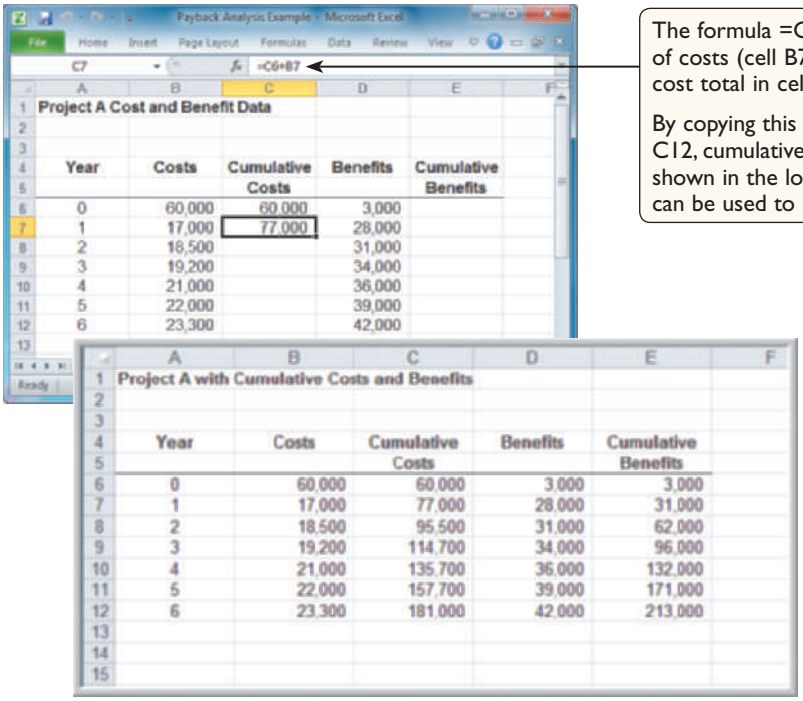
Payback analysis rarely is used to compare or rank projects because later benefits are ignored. You would never decide that Project A is better than Project B simply because the payback period for A is less than that for B; considering all the costs and all the benefits when comparing projects makes more sense.

Even with its drawbacks, payback analysis is popular. Many business organizations establish a minimum payback period for approved projects. If company policy requires a project to begin paying for itself within three years, then neither project in Figure TK C-7 would be approved, though both are economically feasible because total benefits exceed total costs.

Using a Spreadsheet to Compute Payback Analysis

You can use a spreadsheet to record and calculate accumulated costs and benefits, as shown in Figure TK C-8 on the next page. The first step is to design the worksheet and label the rows and columns. After entering the cost and benefit data for each year, you enter the formulas. For payback analysis, you will need a formula to display cumulative totals, year by year. For example, the first year in the cumulative costs column is the same as Year 0 costs, so the formula in cell C6 is =B6. The cumulative cost total for the second year is Year 0 cumulative total + Year 1 costs, so the formula for cell C7 is =C6+B7, and so on. The first worksheet shows the initial layout and the second worksheet shows the finished spreadsheet.

After you verify that the spreadsheet operates properly, you can create a line chart that displays the cumulative costs, benefits, and payback period, which is identified by the intersection of the cost and benefit lines, as shown in Figure TK C-9 on the next page.



The formula =C6+B7 adds an additional year of costs (cell B7) to the running, or cumulative, cost total in cell C6.

By copying this formula into cells C8 through C12, cumulative costs totals can be obtained, as shown in the lower screen. The same method can be used to calculate cumulative benefits.

FIGURE TK C-8 A Microsoft Excel worksheet displays payback analysis data for Project A in the upper screen. When cumulative cost and benefit formulas are entered, the finished worksheet in the lower screen appears.

VIDEO LEARNING SESSION: RETURN ON INVESTMENT

Video Learning Sessions can help you understand key concepts, practice your skills, and check your work. To access the sessions, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com** and navigate to the **Video Learning Sessions** for this book. This session is about return on investment (ROI) analysis. You'll learn how to calculate ROI for a project and how to use a spreadsheet to determine a project's return on investment.

ON THE WEB

To learn more about return on investment analysis, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part C, and locate the Return on Investment Analysis link.

Return on Investment Analysis

Return on investment (**ROI**) is a percentage rate that measures profitability by comparing the total net benefits (the return) received from a project to the total costs (the investment) of the project. ROI is calculated as follows:

ROI = (total benefits – total costs) / total costs

Return on investment analysis considers costs and benefits over a longer time span than payback analysis. ROI calculations usually are based on total costs and benefits for a period of five to seven years. For example, Figure TK C-10 shows the ROI calculations for Project A and Project B. The ROI for Project A is 17.7%, and the ROI for Project B is 33.3%.

In many organizations, projects must meet or exceed a minimum ROI. This minimum ROI can be an estimate of the return the organization would receive from investing its money in other investment opportunities such as treasury bonds, or it can be a higher rate that the company requires for all new projects. If a company requires a minimum ROI of 15%, for example, then both Projects A and B would meet the criterion.

You also can use ROI for ranking projects. If Projects A and B represent two different proposed solutions for a single information systems project, then the solution represented

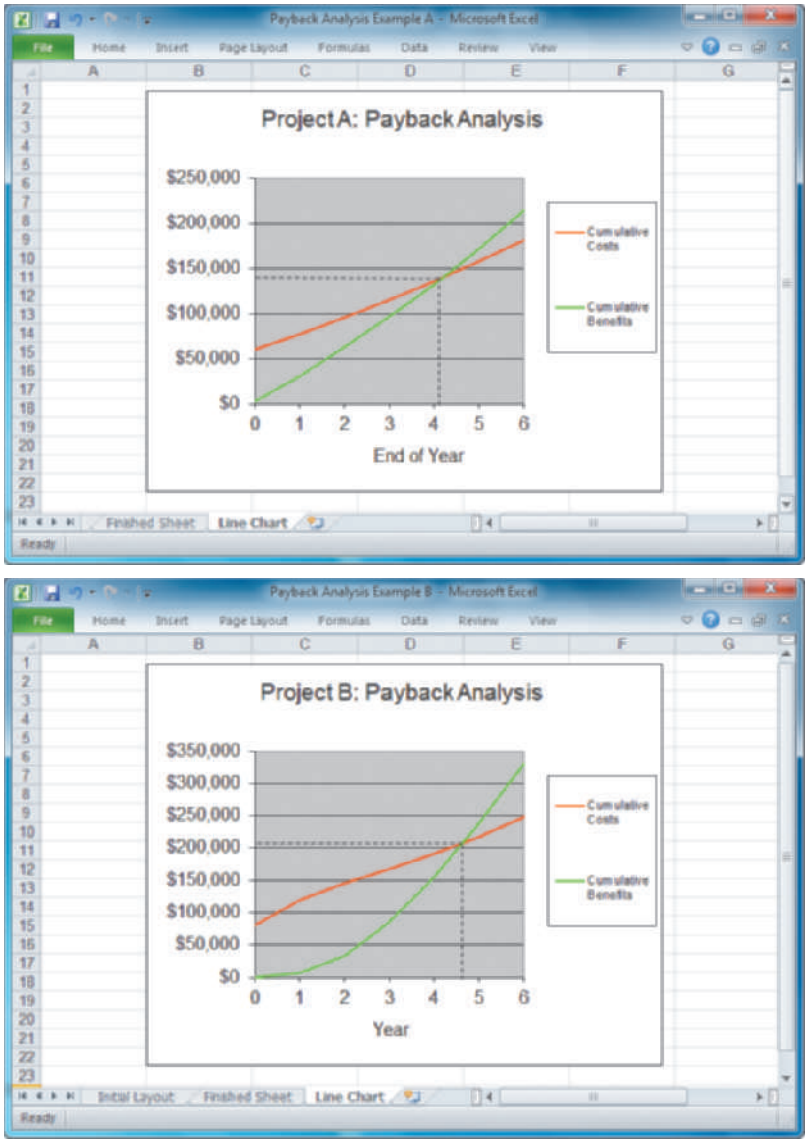


FIGURE TK C-9 Microsoft Excel can be used to show the payback period by creating a chart of cumulative costs and benefits. Note that Project A has a shorter payback period than Project B.

by Project B is better than the Project A solution. If Projects A and B represent two different information systems projects, and if the organization has sufficient resources to pursue only one of the two projects, then Project B is the better choice.

Critics of return on investment analysis raise two points. First, ROI measures the overall rate of return for the total period, and annual return rates can vary considerably. Two projects with the same ROI might not be equally desirable if the benefits of one project occur significantly earlier than the benefits of the other project. The second criticism is that the ROI technique ignores the timing of the costs and benefits. This concept is called the time value of money, and is explained in the section on the present value analysis method.

ROI ANALYSIS EXAMPLES

PROJECT A:

$$\text{ROI} = \frac{\text{Total Benefits} - \text{Total Costs}}{\text{Total Costs}} = \frac{213{,}000 - 181{,}000}{181{,}000} = 17.7\%$$

ROI for Project A

PROJECT B:

$$\text{ROI} = \frac{\text{Total Benefits} - \text{Total Costs}}{\text{Total Costs}} = \frac{330{,}000 - 247{,}500}{247{,}500} = 33.3\%$$

ROI for Project B

FIGURE TK C-10 Return on investment analysis for Project A and Project B shown in Figure TK C-7 on page 677.

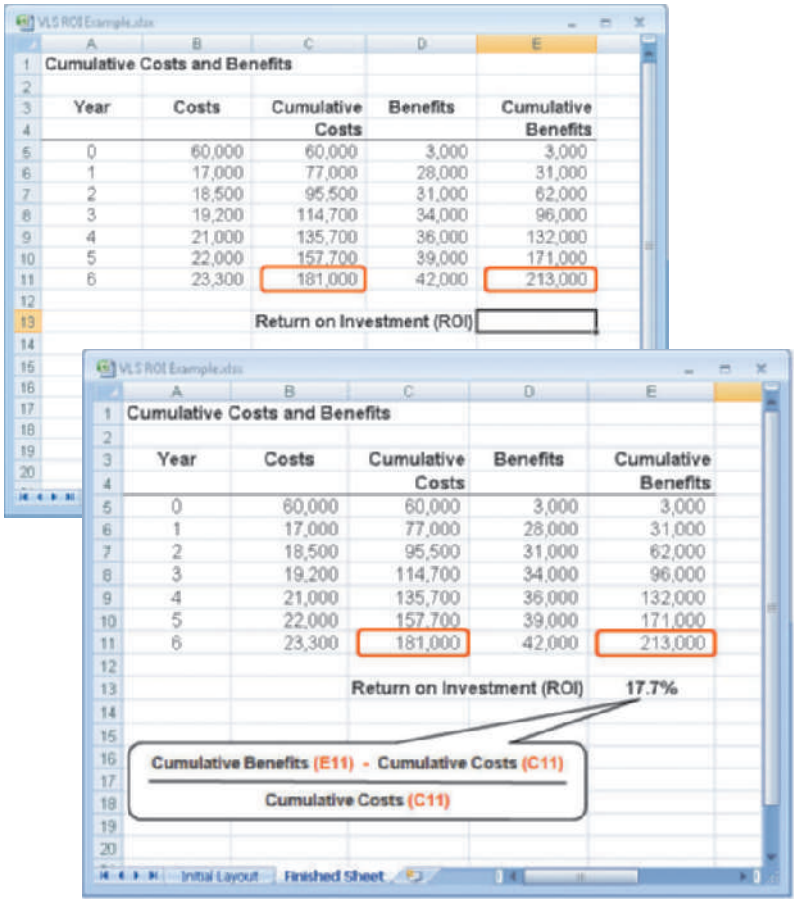


FIGURE TK C-11 Sample worksheets showing ROI formula and analysis.

Using a Spreadsheet to Compute ROI

You also can use spreadsheet programs to calculate the ROI. To do so for Project A, first set up the worksheet and enter the cost and benefit data. You can use cumulative columns (as you did in payback analysis) but you also will need two overall totals (one for costs and one for benefits), as shown in Figure TK C-11.

The last step is to add a formula to calculate the ROI percentage rate, which is displayed in cell E13 in Figure TK C-11. As stated previously, the ROI calculation is total benefits minus total costs, divided by total costs. Therefore, the formula that displays the ROI percentage in cell E13 is = (E11–C11)/C11.

A major advantage of using a spreadsheet is if your data changes, you can modify your worksheet and calculate a new result instantly.

A spreadsheet can be a powerful tool when combined with an ROI template. Hall Consulting and Research offers several free ROI templates, as shown in Figure TK C-12.

VIDEO LEARNING SESSION: PRESENT VALUE ANALYSIS

Video Learning Sessions can help you understand key concepts, practice your skills, and check your work. To access the sessions, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com** and navigate to the **Video Learning Sessions** for this book. This session is about present value analysis. You'll learn how to calculate net present value (NPV) for a project and how to use a spreadsheet to determine a project's net present value.

ON THE WEB

To learn more about present value analysis, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part C, and locate the Present Value Analysis link.

Present Value Analysis

A dollar you have today is worth more than a dollar you do not receive until one year from today. If you have the dollar now, you can invest it and it will grow in value. For example, would you rather have $100 right now or a year from now? The answer should be obvious. If you receive the $100 now, you can invest it in a mutual fund that has an annual return of 8%. One year from now, you will have $108 instead of $100.

You might decide to approach ROI from a different direction. For example, instead of asking, "How much will my $100 be worth a year from now?" you can ask, "How much do I need to invest today, at 8%, in order to have $100 a year from now?" This concept is known as the **time value of money**, as shown in Figure TK C-13, and it is the basis of the technique called **present value analysis**.

The **present value** of a future dollar is the amount of money that, when invested today at a specified interest rate, grows to exactly one dollar at a certain point in the future. The specified interest rate is called the discount rate. In present value analysis, a company uses a discount rate that represents the rate of return if the money is put into relatively risk-free investments, such as bonds, instead of being invested in the project.

Most companies require a rate of return that is higher than the discount rate because of the degree of risk in any project compared with investing in a bond. Companies often reject projects that seem attractive because the risk is not worth the potential reward.

FIGURE TK C-12 Hall Consulting and Research offers ROI information and templates.

To help you perform present value analysis, adjustment factors for various interest rates and numbers of years are calculated and printed in tables called **present value tables**. Figure TK C-13 shows a portion of a present value table, including values for 10 years at various discount rates.

PERIODS	6%	8%	10%	12%	14%
1	0.943	0.926	0.909	0.893	0.877
2	0.890	0.857	0.826	0.797	0.769
3	0.840	0.794	0.751	0.712	0.675
4	0.792	0.735	0.683	0.636	0.592
5	0.747	0.681	0.621	0.567	0.519
6	0.705	0.630	0.564	0.507	0.456
7	0.665	0.583	0.513	0.452	0.400
8	0.627	0.540	0.467	0.404	0.351
9	0.592	0.500	0.424	0.361	0.308
10	0.558	0.463	0.386	0.322	0.270

FIGURE TK C-13 Portion of a present value table showing adjustment factors for various time periods and discount rates. Values in the table are calculated using the formula shown in the text. Notice how the factors decrease as time and percentages increase.

To use a present value table, you locate the value in the column with the appropriate discount rate and the row for the appropriate number of years. For example, to calculate the present value of $1 at 12% for five years, you look down the 12% column in Figure TK C-13 until you reach the row representing five years. The table value is 0.567. To determine what the present value of $3,000 will be in five years with a discount rate of 12%, multiply the present value factor from the table by the dollar amount; that is, PV = $3,000 × 0.567 = $1,701.

Many finance and accounting books contain comprehensive present value tables, or you can obtain this information on the Internet, as shown in Figure TK C-14.

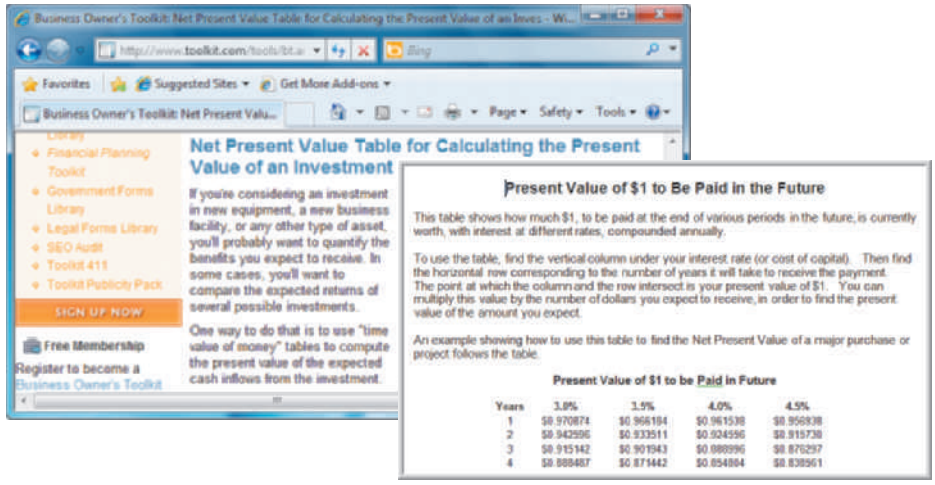


FIGURE TK C-14 The Business Owner's Toolkit site provides valuable information, such as these present value tables.

To perform present value analysis, you must time-adjust the cost and benefit figures. First, you multiply each of the projected

ON THE WEB

To learn more about the time value of money, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part C, and locate The Time Value of Money link.

benefits and costs by the proper present value factor, which depends on when the cost will be incurred or the benefit will be received. The second step is to sum all the time-adjusted benefits and time-adjusted costs. Then, you calculate the **net present value** (**NPV**) of the project, which is the total present value of the benefits minus the total present value of the costs. Figure TK C-15 shows the calculation of net present value for two sample projects.

In theory, any project with a positive NPV is economically feasible because the project will produce a larger return than would be achieved by investing the same amount of money in a discount rate investment. Remember that risks are associated with any project, however, and management typically insists on a substantially higher return for high-risk projects. For example, both projects in Figure TK 3-16 have positive net present values and appear economically worthwhile.

Suppose, however, that you knew one of the projects had a 90% probability of achieving its goals, while the other project had only a 70% chance. To be attractive, the project with the higher risk would have to offer a corresponding higher reward. Chapter 3 explains how project managers evaluate risks. Figure 3-33 on page 122 shows a matrix that includes various combinations of risk probability and impact.

Net present value also can be used to compare and rank projects. All things being equal, the project with the highest net present value is the best investment. Figure TK C-15 shows that Project B is a better investment than Project A because it has a higher net present value.

NET PRESENT VALUE EXAMPLES

PROJECT A:

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
Benefits:	3,000	28,000	31,000	34,000	36,000	39,000	42,000	
Present Value Factor (12%):	1.000	0.893	0.797	0.712	0.636	0.567	0.507	
Present Value:	3,000	25,004	24,707	24,208	22,896	22,113	21,294	143,222
Costs:	60,000	17,000	18,500	19,200	21,000	22,000	23,300	
Present Value Factor (12%):	1.000	0.893	0.797	0.712	0.636	0.567	0.507	
Present Value:	60,000	15,181	14,745	13,670	13,356	12,474	11,813	141,239
Net Present Value:					net present value of Project A →			**1,983**

PROJECT B:

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
Benefits:	—	6,000	26,000	54,000	70,000	82,000	92,000	
Present Value Factor (12%):	—	0.893	0.797	0.712	0.636	0.567	0.507	
Present Value:	—	5,358	20,722	38,448	44,520	46,494	46,644	202,186
Costs:	80,000	40,000	25,000	22,000	24,000	26,500	30,000	
Present Value Factor (12%):	1.000	0.893	0.797	0.712	0.636	0.567	0.507	
Present Value:	80,000	35,720	19,925	15,664	15,264	15,026	15,210	196,809
Net Present Value:					net present value of Project B →			**5,377**

FIGURE TK C-15 Net present value analysis for Project A and Project B.

Present value analysis provides solutions to the shortcomings of payback analysis and return on investment analysis. Unlike payback analysis, present value analysis considers all the costs and benefits, and not just the earlier values. In addition, present value analysis takes into account the timing of costs and benefits, so their values can be adjusted by the discount rate that provides a common yardstick and recognizes the time value of money. Even so, companies often use all three methods to get more input for making decisions. Sometimes a project will score higher on one method of analysis and lower on another.

Using a Spreadsheet to Calculate Present Value

There are two ways to calculate present value using a spreadsheet program such as Microsoft Excel. You can enter the discount adjustment factors from an external table, and use a simple formula to apply the factors. However, many analysts find it easier to use a built-in NPV formula that handles the calculations. The two methods are described in the following sections. The example shows costs and benefits for a proposed information system with a one-year development period, a three-year useful life, and a 6% discount rate.

USING EXTERNAL FACTORS The first method is to create a spreadsheet similar to the one in Figure TK C-16. Starting with the estimated benefits, you would enter adjustment factors in cells C6, D6, and E6. Then you would create formulas in cells C7, D7, and E7 that multiply the three factors times the dollar amounts for each year, with a total shown in column F. You would do the same thing for the estimated costs. Finally, when you subtract total costs from total benefits, the net present value for the proposed system displays in cell F13.

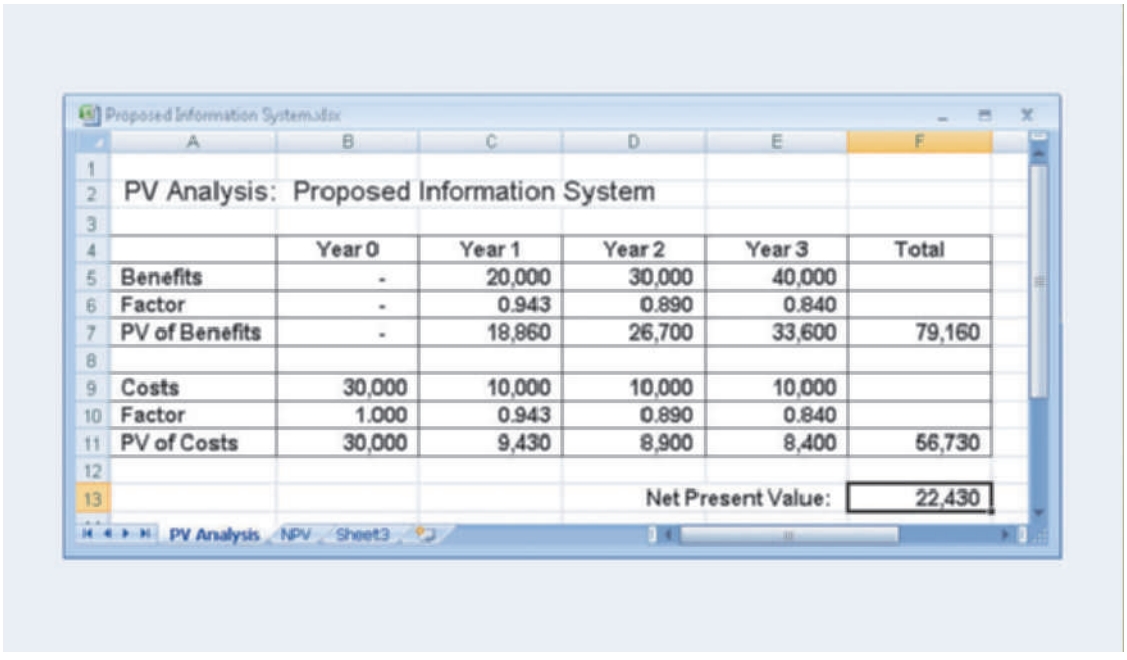


FIGURE TK C-16 This sample spreadsheet shows how you can use external discount factors and formulas to calculate present value.

USING A BUILT-IN FORMULA The second method uses a built-in spreadsheet function to calculate present value. You enter the amounts, the discount rate, and number of time periods, and the program does the rest. Using this approach, you perform four steps, starting with the benefits.

1. First, create a spreadsheet with cost and benefit data arranged similar to Figure TK C-17. You will enter the NPV functions in column I.
2. Next, select cell I5, and click the Function button on the formula bar. Select the NPV function, and you will be prompted to enter a rate. You are using a 6% discount rate, so enter .06.
3. Now enter the three benefit amounts: 20,000 for Value 1, 30,000 for Value 2, and 40,000 for Value 3.
4. When you click OK, a net present value appears in cell I5. Now follow the same method to enter the cost amounts, subtract costs from benefits, and the net present value displays in cell I8. Notice there is a slight difference in the two methods because Excel uses more decimal places. The difference is not significant.

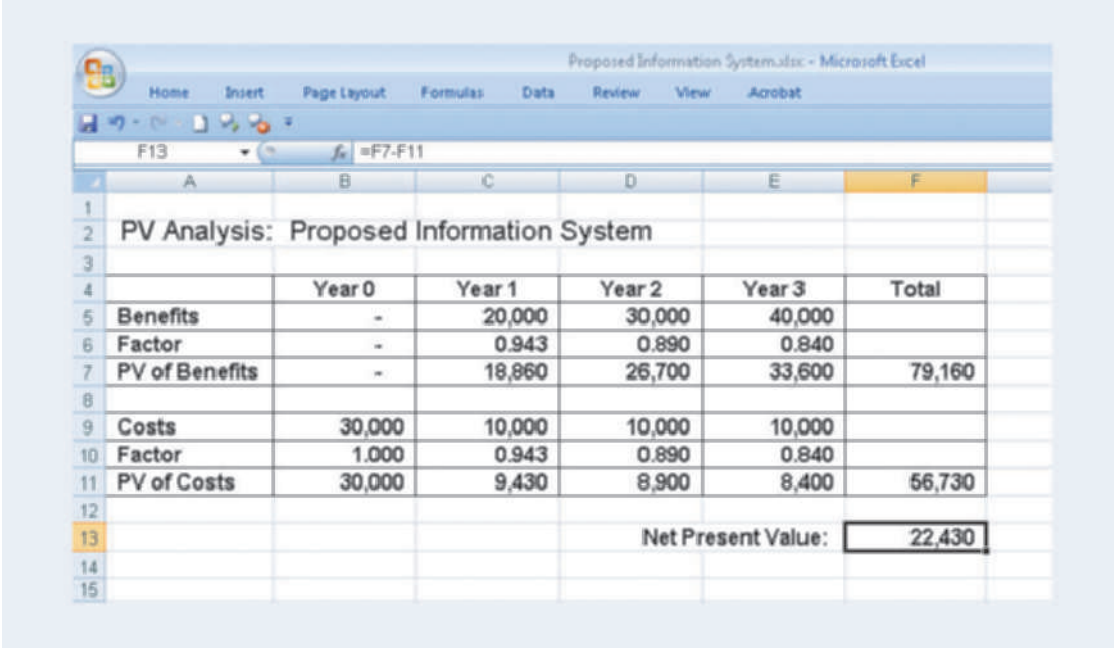


FIGURE TK C-17 This sample spreadsheet shows how you can use a built-in NPV function to calculate present value.

Toolkit Summary

As a systems analyst, you must be concerned with economic feasibility throughout the SDLC, and especially during the systems planning and systems analysis phases. A project is economically feasible if the anticipated benefits exceed the expected costs. When you review a project, you work with various feasibility and cost analysis tools.

You must classify project costs as tangible or intangible, direct or indirect, fixed or variable, and developmental or operational. Tangible costs are those that have a specific dollar value, whereas intangible costs involve items that are difficult to measure in dollar terms, such as employee dissatisfaction. Direct costs can be associated with a particular information system, while indirect costs refer to overhead expenses that cannot be allocated to a specific project. Fixed costs remain the same regardless of activity levels, while variable costs are affected by the degree of system activity. Developmental costs are one-time systems development expenses, while operational costs continue during the systems operation and use phase.

Every company must decide how to charge or allocate information systems costs and the chargeback method. Common chargeback approaches are no charge, a fixed charge, a variable charge based on resource usage, or a variable charge based on volume.

Some companies use a no charge approach because IT services benefit the overall organization. This method treats the IT group for accounting purposes as a cost center that offers services without charge. In contrast, if management imposes charges on other departments, the IT department is regarded as a profit center that sells services that otherwise would have to be purchased from outside the company.

You also must classify system benefits. Many benefit categories are similar to costs: tangible or intangible, fixed or variable, and direct or indirect. Benefits also can be classified as positive benefits that result in direct dollar savings or cost-avoidance benefits that allow the firm to avoid costs that they would otherwise have incurred.

Cost-benefit analysis involves three common approaches: payback analysis, return on investment (ROI) analysis, and present value analysis. You can use spreadsheet programs to help you work with those tools.

Payback analysis determines the time it takes for a system to pay for itself, which is called the payback period. In payback analysis, you compare total development and operating costs to total benefits. The payback period is the point at which accumulated benefits equal accumulated costs. A disadvantage of this method is that payback analysis analyzes only costs and benefits incurred at the beginning of a system's useful life.

Return on investment (ROI) analysis measures a system by comparing total net benefits (the return) to total costs (the investment). The result is a percentage figure that represents a rate of return that the system offers as a potential investment. Many organizations set a minimum ROI that all projects must match or exceed and use ROI to rank several projects. Although ROI provides additional information compared with payback analysis, ROI expresses only an overall average rate of return that might not be accurate for a given time period. Also, ROI does not recognize the time value of money.

Present value analysis adjusts the value of future costs and benefits to account for the time value of money. By measuring all future costs and benefits in current dollars, you can compare systems more accurately and consistently. Present value analysis uses mathematical factors that you can derive or look up in published tables. You also can use a spreadsheet function to calculate present value. Many companies use present value analysis to evaluate and rank projects.

Key Terms and Phrases

chargeback method *673*
connect time *675*
cost center *673*
cost-avoidance benefits *674*
cost-benefit analysis *674*
developmental costs *672*
direct costs *672*
economic feasibility *670*
economically useful life *675*
fixed charge method *673*
fixed costs *672*
indirect costs *672*
intangible costs *672*
net present value (NPV) *682*
no charge method *673*
operational costs *673*
overhead expenses *672*
payback analysis *675*
payback period *675*
positive benefits *674*
present value *681*
present value analysis *680*
present value tables *681*
profit center *673*
resource allocation *673*
return on investment (ROI) *678*
server processing time *673*
tangible costs *672*
time value of money *680*
total cost of ownership (TCO) *670*
variable charge method based on resource usage *673*
variable charge method based on volume *674*
variable costs *672*

Toolkit Exercises

Review Questions

1. What is economic feasibility? How do you know if a project is economically feasible?
2. How can you classify costs? Describe each cost classification, and provide a typical example for each category.
3. What is a chargeback method? What are four common chargeback approaches?
4. How can you classify benefits? Describe each benefit classification, and provide a typical example for each category.
5. What is payback analysis, and what does it measure? What is a payback period, and what is the formula to calculate the payback period?
6. What is return on investment (ROI) analysis, and what does it measure? What is the formula to calculate ROI?
7. What is present value analysis, and what does it measure?
8. What is the meaning of the phrase, *time value of money*?
9. Why is it difficult to assign a dollar figure to an intangible cost? When and how can it be done? Provide an example with your explanation.
10. What is a system's economically useful life, and how is it measured?

Discussion Topics

1. Suppose your supervisor asks you to inflate the benefit figures for an IT proposal, in order to raise the priority of his or her favorite project. Would this be ethical or not? Does internal cost-benefit analysis affect company shareholders? Why or why not?
2. In this Toolkit Part, you learned how to use payback analysis, ROI, and NPV to assess IT projects. Could these tools also be used in your personal life? Give an example of how you might use each one to help you make a financial decision.
3. Is there a role for intuition in the decision-making process, or should all judgments be made strictly on the numbers? Explain your answer.
4. The time value of money is an important factor when analyzing a project's NPV. Is the time value of money more important, less important, or of the same importance in periods of low inflation compared with periods of high inflation? Explain your answer.

Projects

1. Suppose you are studying two hardware lease proposals. Option 1 costs $4,000, but requires that the entire amount be paid in advance. Option 2 costs $5,000, but the payments can be made $1,000 now and $1,000 per year for the next four years. If you do an NPV analysis assuming a 14% discount rate, which proposal is less expensive? What happens if you use an 8% rate?
2. Assume the following facts:

   A project will cost $45,000 to develop. When the system becomes operational, after a one-year development period, operational costs will be $9,000 during each year of the system's five-year useful life. The system will produce benefits of $30,000 in the first year of operation, and this figure will increase by a compound 10% each year. What is the payback period for this project?
3. Using the same facts as in Project 2, what is the ROI for this project?
4. Using the same facts as in Project 2, what is the NPV for this project?

PART D

Internet Resource Tools

In **Part D** of the Systems Analyst's Toolkit, you will learn about Internet resource tools that can help you perform your duties and achieve your personal and professional goals.

INTRODUCTION

OBJECTIVES

When you finish this part of the Toolkit, you will be able to:

- Describe the characteristics of the Internet and the World Wide Web
- Plan an Internet search strategy, review your information requirements, use the proper search tools and techniques, evaluate the results, and consider copyright and data integrity issues
- Use search engines, subject directories, and the invisible Web to locate the information you require
- Demonstrate advanced search techniques, including Boolean logic and Venn diagrams
- Describe Internet communication channels including social networking, newsgroups, newsletters, blogs, podcasts, RSS feeds, Webinars, mailing lists, Web-based discussion groups, chat rooms, instant messaging, and text messaging
- Provide examples of IT community resources of value to a systems analyst
- Explain the benefits and disadvantages of online learning opportunities

The Internet offers a wealth of information about every conceivable subject. Without a good road map, however, it is easy to become overwhelmed by the sheer volume of material. Part D of the Systems Analyst's Toolkit will describe various Internet resources, assist you in formulating an effective information gathering strategy, and explain Internet resource tools and techniques that you can use to access the information you need.

TOOLKIT INTRODUCTION CASE: Mountain View College Bookstore

Background: Wendy Lee, manager of college services at Mountain View College, wants a new information system that will improve efficiency and customer service at the three college bookstores.

In this part of the case, Tina Allen (systems analyst) and David Conroe (student intern) are talking about Internet resource tools.

Participants: Tina and David
Location: Mountain View College Cafeteria, near the end of the systems analysis phase
Discussion topics: Internet resource tools

Tina: Hi, David. Did you get a chance to try that new search engine?

David: *I sure did. First, I formulated an Internet search strategy, as you suggested, and then I did a search using the logical operators that we talked about. I liked the way the search engine organized the results for me. I also followed your suggestions about checking out the quality of the results.*

Tina: Sounds good. But remember — sometimes it might be better not to start your search with a search engine.

David: *Why not?*

Tina: Well, the Internet is a huge place. In some situations, you might want to get a broad overview of a topic before plunging into a specific search. If so, you might want to use a subject directory like Yahoo! or the Librarians' Index to the Internet. Another important resource is called the invisible Web, which is a collection of searchable databases that usually are not accessed by search engines.

David: *Okay. What about using other communication channels like social networking sites, newsgroups, newsletters, blogs, podcasts, RSS feeds, Webinars, mailing lists, Web-based discussion groups, chat rooms, instant messaging, and text messaging?*

Tina: They all are important ways to get online information. Also remember that the IT community has many resources that can help you locate information, keep up with IT developments, and advance your career with knowledge and training.

David: *It seems like the more I know about the Internet, the more I have to learn.*

Tina: I feel the same way. Let's see what else we can learn about Internet resource tools. Here's a task list to get us started:

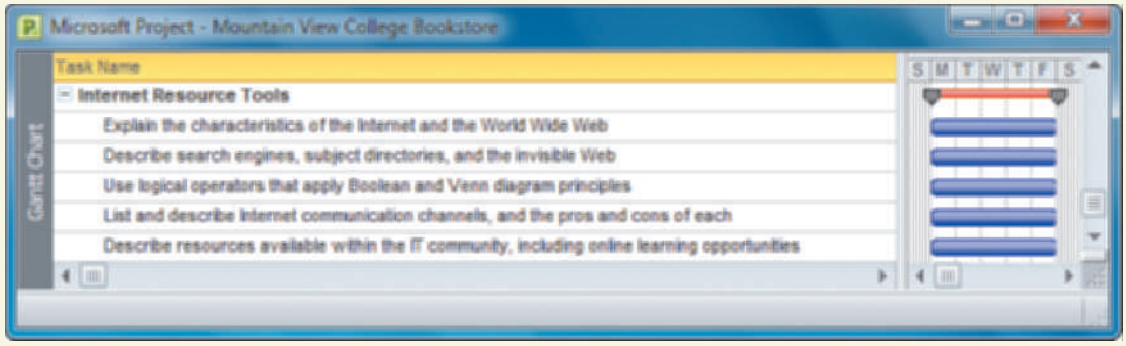


FIGURE TK D-1 Typical Internet resource tasks.

Overview

As a systems analyst, you rely on your knowledge, skills, and experience. Fortunately, you have access to the Internet, where an enormous storehouse of information is available to you at little or no cost. The **Internet** is a worldwide network that integrates many thousands of other networks, which in turn link millions of government, business, educational, and personal users around the globe. The Internet can assist you with technical problems and can help you advance your career by offering access to training, education, and communication with other IT professionals.

The Internet allows you to visit the **World Wide Web**, usually referred to as the **Web**, which contains billions of text and multimedia documents called **Web pages**. A collection of related Web pages is called a **Web site** and is stored on a computer called a **Web server**. A **Web browser**, or **browser**, is a software program that allows you to access and display Web pages that are delivered to you by a Web server. Microsoft Internet Explorer, Mozilla Firefox, and Apple Safari are popular browsers that offer powerful graphic interfaces to help you navigate the Web.

This Toolkit Part begins with a step-by-step plan for Internet research, followed by a summary of search basics and a detailed discussion of search engines, subject directories, and the invisible Web. Internet communications tools are covered next, including social networking, newsgroups, newsletters, blogs, podcasts, RSS feeds, Webinars, mailing lists, Web-based discussion groups, chat rooms, and instant messaging. The last section presents valuable online resources available within the IT community.

ON THE WEB

To learn more about the World Wide Web, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part D, and locate the World Wide Web link.

Planning an Internet Research Strategy

An Internet research strategy is necessary to avoid frustration and wasted time. A pilot or ship captain would not begin a journey without knowing the destination. Similarly, you can use a four-step plan to navigate efficiently and confidently toward your objectives:

Step 1. Review your information requirements.

Step 2. Use the proper search tools and techniques.

Step 3. Evaluate the results.

Step 4. Consider copyright and data integrity issues.

Over time, you will gain experience and develop your own preferences for using the Internet. You should remember that each research situation is unique, and several tools and techniques might be necessary to achieve the results you seek.

Step 1. Review Your Information Requirements

The first step to finding information online is to make sure you really understand what you are seeking. You need to think about the topic to ensure that you are casting an appropriate net. For example, a supervisor might ask you to help decide between two specific CASE products. Your initial inclination might be to find a review of various CASE applications. Upon reflection, however, you realize it would be more useful to understand CASE tools in a general sense before comparing specific products. Therefore, you decide to start with a more generalized search instead of going directly to vendor sites.

Step 2. Use the Proper Search Tools and Techniques

Once you feel that you understand the information required, it is time to pick an initial tool. At this point, you face some choices. Should you use search engines or subject directories? Should you seek commercial sites, IT publications, professional associations, newsgroups, or other areas to explore? What about social networking?

As you gain experience, you will be able to handle a wide range of Internet tools and resources. As with most skills, the more you use them, the more expertise you acquire. In time, you probably will develop your own list of favorite tools and resources.

Step 3. Evaluate the Results

By definition, the Internet is essentially open and unregulated. On the plus side, a huge diversity of information is available. The quality of content, however, varies greatly. Unlike published journals or textbooks, almost anyone can post **content**, or material, on the Web. This means that the searcher must review the information very carefully. Questions to ask when accessing content include the following:

SOURCE Is the author identifiable? Does the author have expertise on the subject? You might need to trace back through Web site addresses or URLs to find biographical information, or do a separate search on the author's name.

ACCURACY Does the information come from a commercial source that is offering its own solution? Is it from an association with an inherent bias? Often, it is very difficult to find completely objective information. Identifying biases and finding information from a variety of sources is a way to address this problem.

SCOPE Is the information specific enough? If not, you should narrow and refine your search and seek additional resources until you locate the information you need. When you use a search engine, one way to do this is to perform a **subsearch** using the results of the initial search as a starting point.

CURRENCY How old is the information? Is the topic static or dynamic? In the IT world, technology changes very quickly. If you locate information that appears to be out of date, you might seek more recent data to ensure that your results are valid.

LOOK AND FEEL Is the information easy to access and navigate? If the site is designed in a logical manner and offers value-added links to worthwhile pages and resources, do not be overly concerned with style — some excellent material is created by authors and producers who focus on content, not design.

If you find the content useful, be sure to credit the source properly when you use it. You must observe legal and ethical standards when you deal with Internet material. To learn more about proper citation and to view specific examples of how to cite electronic material, you can visit the excellent collection of resources at *www.aresearchguide.com*.

Step 4. Consider Copyright and Data Integrity Issues

Before you copy or download your search results, you must ensure that you legally can use the material, and that the content is safe and free of threats.

The first issue involves copyright law. Many people regard the Web as a public domain, but in reality, it is more like a book or a CD. In other words, you might own a CD, but you do not own the material on that CD — you only possess a license to use the content in certain ways. On the Web, you should look for copyright notices and restrictions. If in doubt, you might have to contact the copyright holder to seek permission.

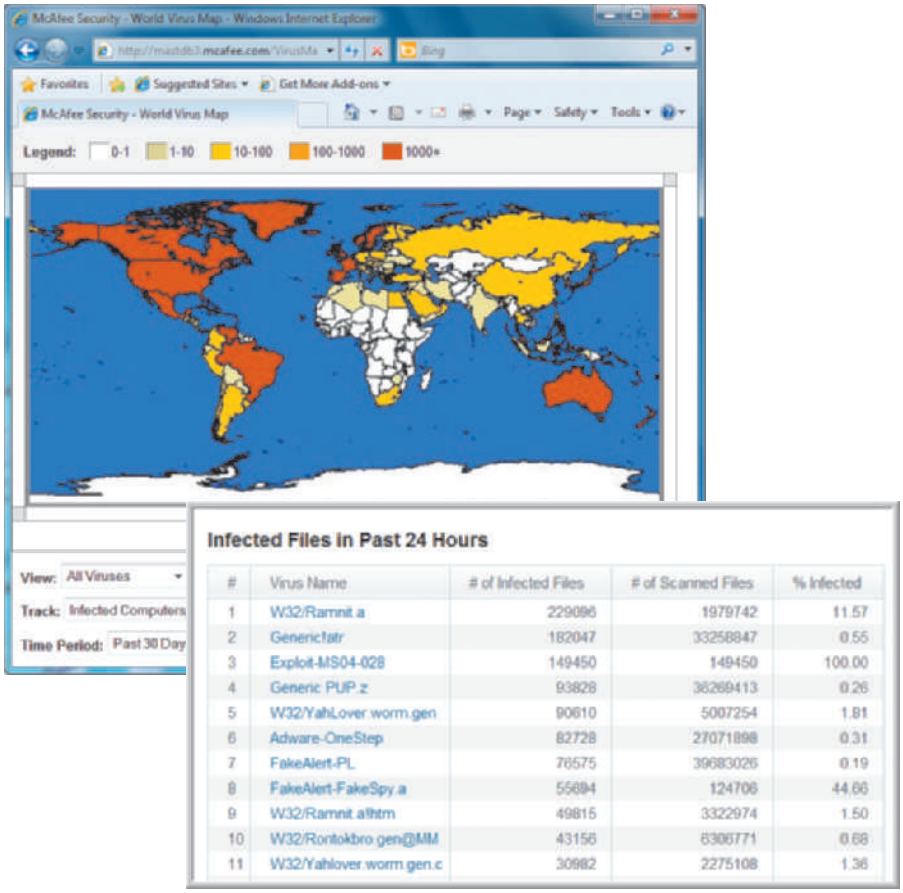


FIGURE TK D-2 McAfee's site shows how many computers and files are infected at any given time.

The second issue involves data integrity. It is important to protect your network and computer system from any unwanted viruses or **malware**, which is malicious software that might jeopardize your security or privacy. Unlike intellectual content, which is easy to evaluate, it is impossible for you to determine the integrity and validity of the internal file structure and format without a virus detection tool. As Figure TK D-2 shows, many thousands of viruses are identified each day. Viruses and other intrusions cost businesses many millions of dollars in lost data and additional effort. Without proper protection, you run the risk of not only corrupting your own files or hard drive, but bringing your entire company network down.

If the information is legally usable and safe, you can save it to your hard drive or network, depending on the content and purpose. The information you find may be in one of many formats, including word-processing documents, spreadsheets, and databases; Adobe PDF files; and multimedia material with file extensions such as .jpg, .mp3, .flv, and .mov.

You can download files directly to your hard drive from many Web sites. If this option is not offered explicitly, you can try right-clicking a link or embedded object to display a list of choices that includes downloading the selected information.

The following sections discuss search engines, subject directories, the invisible Web, and other Internet tools in more detail.

Search Basics

As you journey on the Internet, you will use various navigation tools and techniques. To reach your destination, you must know how to use search engines, subject directories, and a collection of searchable databases called the invisible Web.

A **search engine** is an application that uses keywords and phrases to locate information on the Internet. **Meta-search engines** are tools that can apply multiple search engines simultaneously. For most people, search engines are the workhorses of information gathering. Search engines employ a variety of approaches to gathering information, and although they are extremely valuable, users should be aware of potential problems. For example, search results can be affected if the search engine permits commercial users to achieve higher priority based on payment of fees. Also, search engines access only a portion of the Internet.

A **subject directory** or **topic directory** is a Web site that allows you to find information by using a hierarchy, starting with a general heading and proceeding to more specific topics. A subject directory is an excellent starting point when you want an overview of a topic before proceeding to specific Web sites. Typically, a subject directory is created by an editorial staff that visits, evaluates, and organizes the sites into various categories and subcategories.

The **invisible Web**, also called the **deep Web** or **hidden Web**, refers to a vast collection of documents, databases, and Web pages that are usually not detected by search engines, but can be accessed using other tools and techniques. The invisible Web is a huge information storehouse, many times larger than the searchable Web, and includes thousands of university, scientific, and government libraries.

The following sections cover search engines, subject directories, and the invisible Web in more detail.

Search Engines

A search engine often is the best starting point for gathering information. A well-planned search will narrow the range of content to a manageable level and will allow you to explore the choices or execute a subsearch within the focused results. As with any tool, it is important to understand the intended use and limitations of a search engine before applying it to a task.

Search Engine Concepts

Search engines use a specialized computer program called a **spider** or **crawler** that travels from site to site **indexing**, or cataloging, the contents of the pages based on **keywords**. The results are compiled into a database, so what you are searching is not the Web itself, but the contents of the search engine's database.

No single search engine can catalog the shifting contents of the Web, and even the most powerful engines cover a fraction of known Web content. If a particular site is not widely linked, or its author does not submit it to major search engines, then the material is invisible to them. Also, any site that requires a visitor to type in data, such as a name, cannot be accessed by search engines.

Although search engine indexes are incomplete and often dated, they are capable of delivering an overwhelming number of results, or **hits**. The real issue is quality versus quantity. When comparing search engines, it is important to know the company's policy toward allowing commercial sites to boost their ranking in a **pay for performance** arrangement. Links that are subsidized by companies are called **sponsored links**.

Not all search engines work the same way. By understanding the underlying algorithms, or specific rules, that drive these information engines, it is possible to better target your search. For example, some sites, like Google, rank their pages by analyzing the number of other sites that link to that page. Other search engines organize results differently. For example, Ask.com uses an interesting approach called ExpertRank™ technology, which ranks a site based on the number of authoritative sites that reference it, not just based on general popularity.

You usually can determine an engine's approach by clicking the *About* tab or link on the search site. The following section describes several examples of search engines, which are shown in Figure TK D-3 on the next page.

ON THE WEB

To learn more about search engines, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part D, and locate the Search Engines link.

FIGURE TK D-3 Bing and Google are examples of indexed search engines, ixquick is an example of a meta-search tool, and Ask is a combination engine that includes ranked pages, suggestions to refine or narrow the search, and an expert-compiled resources section.

INDEXED SEARCH ENGINES Google and Bing are **indexed search engines** that organize and rank the results of a search. Although they have much in common, each tool has its own search algorithms, features, and user interface. Other examples of indexed search engines include Yahoo! and AltaVista, among others.

META-SEARCH ENGINES Meta-search engines can apply multiple search engines simultaneously. A meta-search engine examines the indexed results of several search engines to provide broader coverage. In addition to ixquick, other examples of meta-search engines include Metacrawler and Dogpile, which claims to use meta-search technology to remove duplicates and bring the most relevant sites to the top of the list.

Search Techniques

Consider the following suggestions when you begin a search:

- Refine your topic. Unless you limit the scope of your search, you might be overwhelmed by the number of results. If you are looking for general information on a broad topic, consider a subject directory site.
- Translate your question into an effective search query. Searches are executed on keywords. You will improve your success if you pick the proper keywords. Try to find unique words or phrases and avoid those with multiple uses. For example, a search for the term *hard drive* might produce information about a computer hardware device or a difficult auto trip. Also consider using advanced search techniques, which are described in the following section.
- Review the search results and evaluate the quality of the results. If the search needs refinement or additional material, you can either use the site's advanced search techniques or select a different Internet resource altogether.
- It is important to organize the results of your search, so you can recognize and revisit important sites. Some search engines offer a personalized search history, which you can review and edit for this purpose. Many people find that the easiest solution is to create favorites or bookmarks in their browser for sites visited in important searches, using a set of folders and subfolders. If you do this, you can wait until you start the search, or you can create your filing system ahead of time.

To be effective, you should understand the mechanics of the search engine, use proper spelling, find unique phrases, and experiment with a variety of approaches. If you are consistently returning too many results, try using topic-specific terms and advanced search techniques. Conversely, if too few results are returned, eliminate the least important terms or concepts, broaden your subject, or use more general vocabulary when you select terms. An excellent tutorial, which includes a glossary and a comparison of several search engines, can be found at the University of California at Berkeley Library site, as shown in Figure TK D-4.

Advanced Search Techniques

Many search engines offer powerful features that allow you to refine and control the type of information returned from searches. These features can include the option to search within returned results and the ability to search within specific areas, such as newsgroups. Perhaps the most powerful advanced feature is the option to use Boolean logic.

Boolean logic is a system named after British mathematician George Boole and refers to the relationships among search terms. You can use various combinations of the **logical operators** OR, AND, and NOT to improve your search success greatly. Figure TK D-5 on the next page graphically illustrates the use of the operators with search terms. The circles shown in the figure are called Venn diagrams. A **Venn diagram** uses circular symbols to illustrate Boolean logic. Venn diagrams are named after John Venn, a nineteenth-century scholar who devised a scheme for visualizing logical relationships. In the sample diagrams, the shaded area indicates the results of the search.

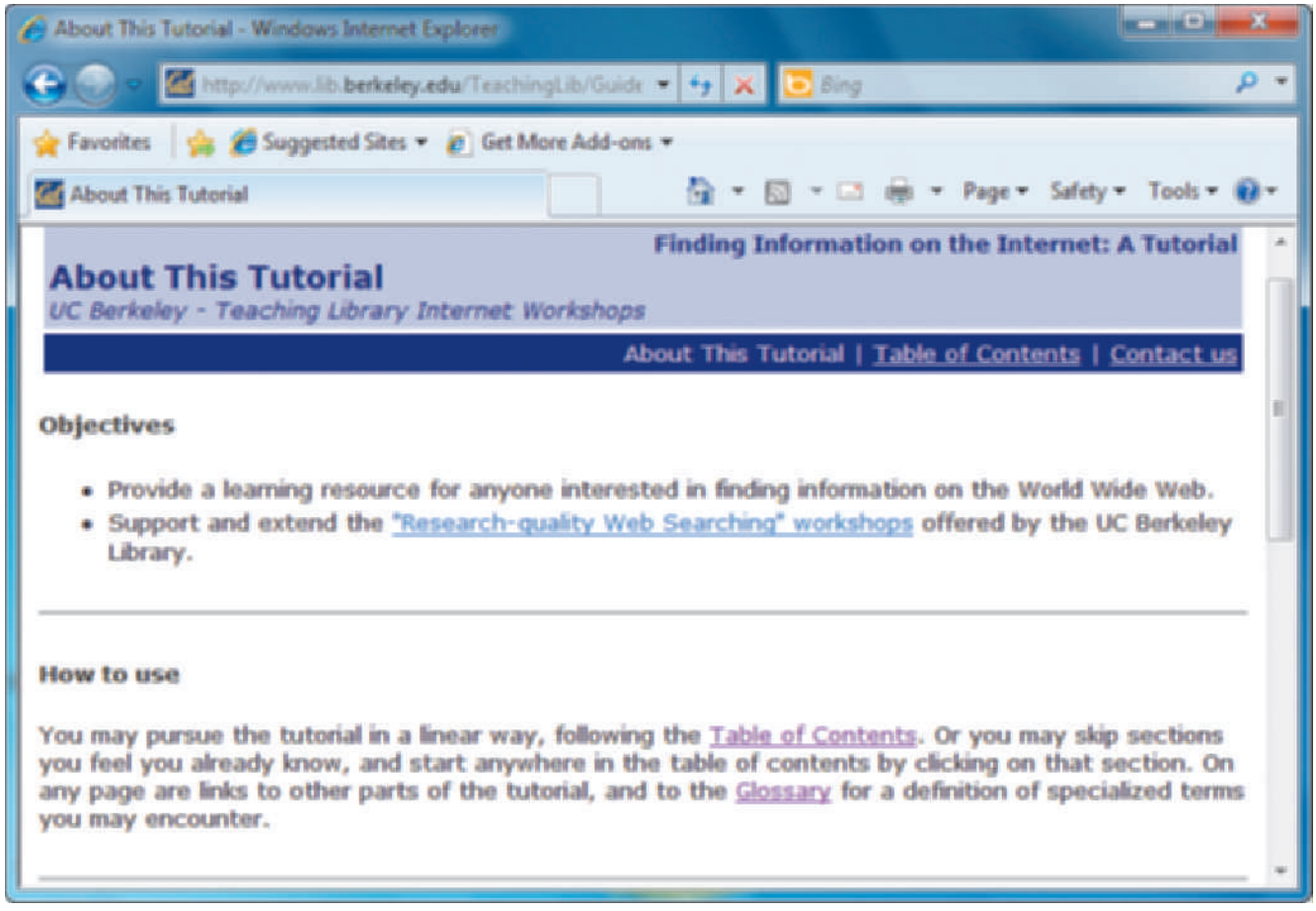


FIGURE TK D-4 The University of California at Berkeley offers search-related tutorials, tips, and resources.

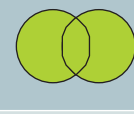
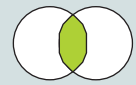
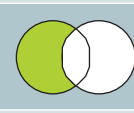
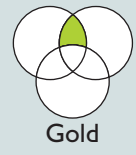
LOGICAL OPERATORS	EXAMPLE	VENN DIAGRAM (SHADED AREA INDICATES RETURNED RESULTS)
A **or** B	Baseball **or** Football	
A **and** B	Baseball **and** Football	
A **not** B	Internet **not** Web	
A **or** B **or** C	Colorado **or** Mining **or** Gold	
A **and** B **and** C	Colorado **and** Mining **and** Gold	
A **and** B **not** C	Colorado **and** Mining **not** Gold	

FIGURE TK D-5 Examples of logical operators OR, AND, and NOT. The shaded area represents the returned results. OR is the most inclusive term, returning results if any of the terms appear; AND requires all keywords to appear; and NOT excludes results even if they are found in the same document.

To learn more about how logical operators work, consider the following diagrams:

OR The first diagram at the top of Figure TK D-5 shows that the **OR** term will retrieve all results containing either term. Notice that the shaded area includes both circles. The OR operator can be used when you need a wide search net.

AND The second diagram in Figure TK D-5 shows that the **AND** term will retrieve only those results in which all terms linked by the AND operator are present. Notice that the shaded area includes only the overlapping portion of the two circles. The more terms or concepts combined in an AND search, the fewer pages will be returned. The AND operator often is used to narrow a set of search results.

NOT The third diagram in Figure TK D-5 shows how the NOT operator can be used to exclude certain records. In this diagram, consider the closely related terms, Internet and Web. It is likely that these terms both appear in many Web pages. The **NOT** operator will strip out the results containing the unwanted term. For example the search string, Internet NOT Web, will return only those pages with the term, Internet. You should use the NOT operator carefully, because the term you want to exclude may be intertwined with the term you seek in many documents that would be useful to you.

The last three diagrams in Figure TK D-5 illustrate other combinations of logical operators where three search terms are involved.

Figure TK D-6 shows an excellent online tutorial that explains Boolean logic and provides many examples of OR, AND, and NOT operators.

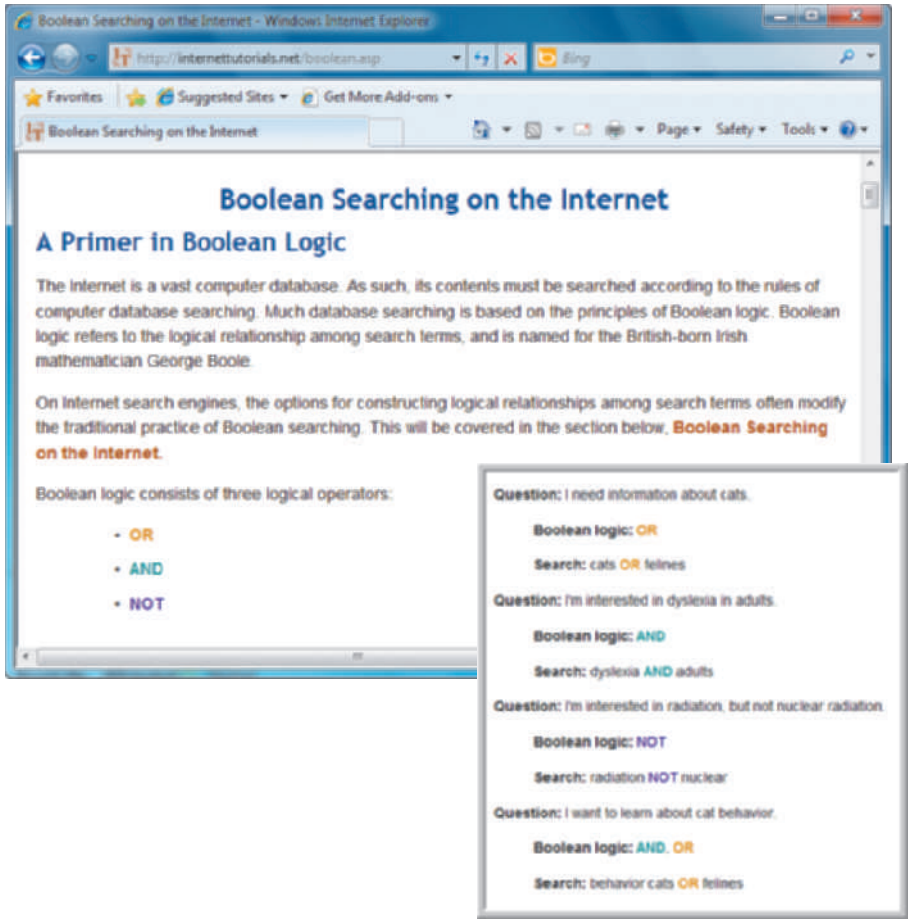


FIGURE TK D-6 This is an example of an online tutorial about Boolean logic, complete with various of examples of OR, AND, and NOT operators.

USING PHRASES Suppose you want to find sites that sell board games that require players to use strategy, such as Monopoly®. In your search, you could specify both terms, *strategy* AND *game*, but your results probably would include many documents that describe game strategies used in various sports, which is not what you are seeking. A better approach might be to search using the phrase "strategy game" enclosed in quotes. A **phrase** is more specific than an AND operator, because it specifies an exact placement of terms. In this example, the phrase "strategy game" will not retrieve any documents unless they contain that exact phrase.

The implementation of Boolean logic varies by search engine. Some engines require the use of full Boolean searching using the complete operators (OR, AND, NOT) in the search window. Others use implied Boolean logic with keyword searching. In **implied Boolean logic**, symbols are used to represent Boolean operators, such as a plus sign (+) for AND, and a minus sign (-) for NOT. If two search terms are entered in the search window with a space between them, some search engines may assume an OR; others assume an AND. You need to consult the site's Help files to understand the underlying rules.

USING FILL-IN FORMS Most search engines provide an **advanced search** feature that offers a fill-in form similar to the Google example shown in Figure TK D-7 on the next page. Notice that the Google site also offers advanced search tips.

Search Checklist

Many people find it helpful to prepare for an Internet search by using a checklist similar to the following.

- Does the topic have any unique words, phrases, or acronyms? If so, use these terms in the search.
- Do any of the search terms have other spellings or names? If so, include these with an OR operator in the search.

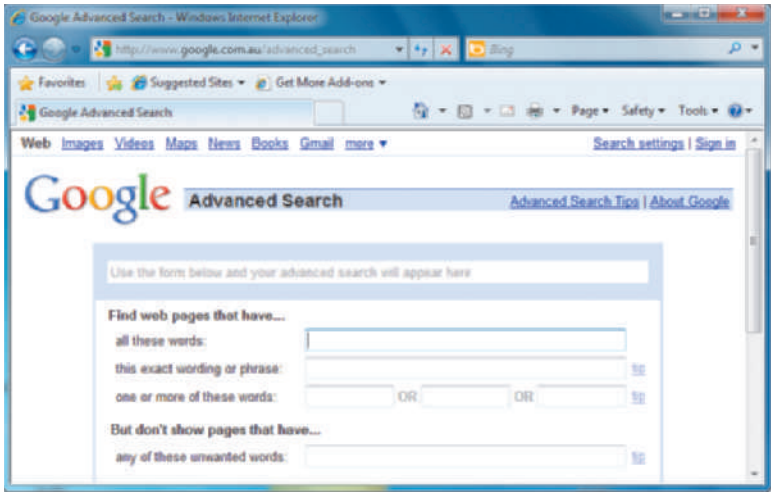


FIGURE TK D-7 For users unfamiliar with Boolean terms, many search engines offer an advanced search feature with fill-in forms. This example shows that *all these words* is like the AND operator, *this exact wording or phrase* is like putting quotes around the search terms, *one or more of these words* is like the OR operator, and *any of these unwanted words* is like the NOT operator.

- Are certain additional words or phrases likely to appear in any Web document? If so, consider adding an AND operator to narrow the search.
- Is there any unrelated material that my search terms might pick up? If so, consider using the NOT operator to exclude these documents.
- Are any organizations, publications, or institutions likely to have an interest in my topic? If so, try to locate their Web sites and then conduct a further search using the site indexes and databases available on the site.
- Is the search returning results too numerous to examine? If so, keep adding additional terms to narrow the search and reduce the number of hits until a reasonable number is achieved.

ON THE WEB

To learn more about subject directories, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part D, and locate the Subject Directories link.

Subject Directories

A subject directory collects and organizes Web sites in a top-down format, based on subjects and topics. An analogy might be a corporate organization chart, where you could go to the top person for an overview, then visit with lower-level employees to obtain specific information about their areas.

A subject directory is an excellent tool when you want general information about a topic before plunging into an array of specific Web sites. Yahoo! offers a popular subject directory that serves as a **portal**, or entrance to other Internet resources. Other academic and professional directories target the specific needs of researchers and users who concentrate on particular subjects. Many subject directories are reviewed by human experts, rather than computer robots, to ensure relevance and quality of links.

A Subject Directory Example

Subject directories organize information into various categories and provide an overall framework for finding information. For example, suppose you wanted to use the Yahoo! Directory to learn more about IT security magazines. You could visit the Yahoo! site, and start with a list of main topics, one of which is called *Computers & Internet*. When you click this item, you would see a display similar to the second screen in Figure TK D-8, which shows various subtopics, including *Security and Encryption*. As you continue, you would click the *Magazines* link shown in the third screen, and you would see a list of publications that you could explore, some of which appear in the bottom screen.

In addition to Yahoo!, other popular subject directories include About.com and an organization called ipl2, which was the result of a merger between the Internet Public Library (IPL) and the Librarians' Internet Index (LII). The new entity, which has a Web site at ipl2.org, offers a free question-and-answer service staffed by volunteers who are professional librarians and library science graduate students.

Advantages and Disadvantages of Subject Directories

The main advantage of a subject directory is that it provides an overview when you are not sure of the size and scope of your topic. Later, when you have a better understanding of your subject, you can use a search engine to seek additional information and examples.

Subject directories also have shortcomings. Many subject directories use human expertise to formulate the subject organization and determine the placement of links. This process involves subjective decisions that might affect the quality of search results. Some subject directories are updated continually; others might not be current. Also, unlike a search engine, a subject directory forces you to work your way through a series of levels, rather than using specific words and phrases to locate directly the material you seek.

The Invisible Web

Everyone is familiar with what is called the **visible Web**, which refers to Web sites that are indexed by the major search engines and are publicly accessible. As discussed earlier, much more information is available on the Internet that is not indexed. This valuable information source includes numerous text, graphics, and data files stored in collections that are unreachable by search engines.

The invisible Web includes searchable databases that contain an enormous amount of information in university and government libraries, as well as thousands of specialized databases that are maintained by institutions and organizations around the world.

Much of the invisible Web is open to the public, but some databases are password protected. Many sites allow guest access, but some areas can be accessed only by members of a specific group.

In an article in the *Journal of Electronic Publishing*, author Michael K. Bergman compared Internet searching to dragging a net across the surface of the ocean. He stated that "While a great deal may be caught in the net, there is still a wealth of information that is deep, and therefore, missed. The reason is simple: Most of the Web's information is buried far down on dynamically generated sites, and standard search engines never find it." Mr. Bergman pointed out that traditional search engines create their indices by spidering, or crawling, through many millions of Web pages. He pointed out that "To be discovered, the page must be static and linked to other pages.… Because traditional search engine crawlers cannot probe beneath the surface, the deep Web has heretofore been hidden."

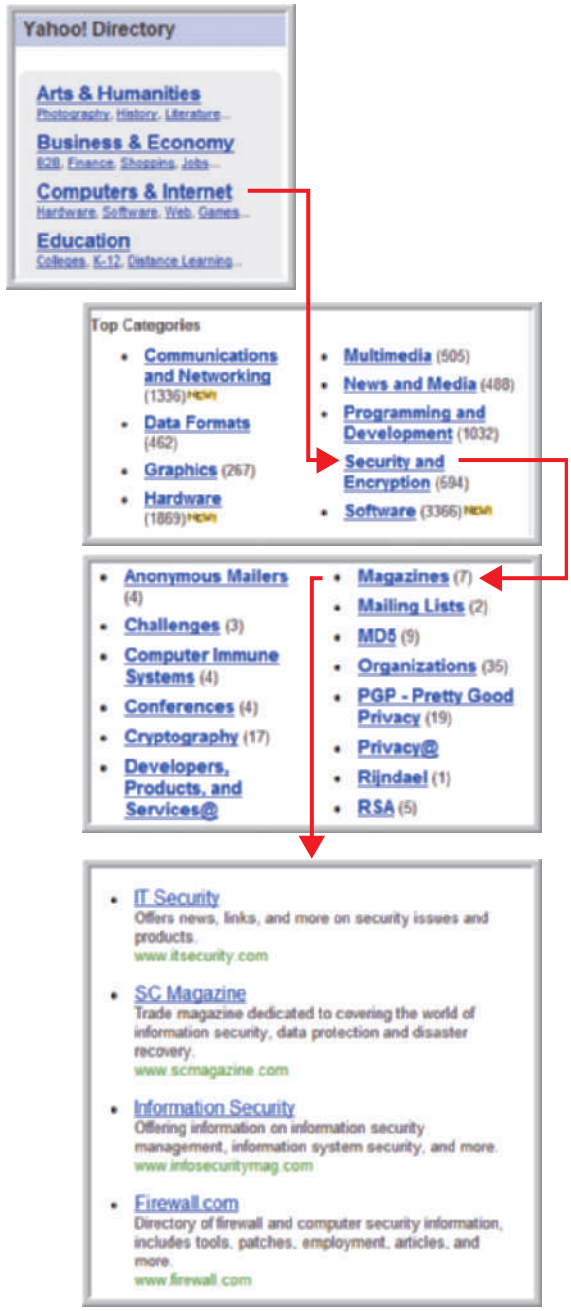


FIGURE TK D-8 In the example shown, the user has visited the Yahoo! Directory, clicked the *Computers & Internet* topic, then clicked the *Security and Encryption* link, and the *Magazines* link, which displays a list of IT security magazines.

ON THE WEB

To learn more about the invisible Web, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part D, and locate the Invisible Web link.

Invisible Web Examples

A few examples of information on the invisible Web include the following:

- Specialized topic databases: subject-specific collections of information, such as corporate financial filings and reports, genealogy records, or Ellis Island immigration data
- Hardware and software vendors: searchable technical support databases for large sites such as Microsoft's or Oracle's knowledge bases
- Publications: databases of published and archived articles
- Libraries: searchable catalogs for thousands of libraries, including the Library of Congress and numerous university and institutional libraries
- Government databases: census data, statutes, patents, copyrights, and trademarks
- Auction sites: searchable listings of items, bidders, and sellers
- Locators: telephone numbers, addresses, and e-mail addresses
- Career opportunities: job listings and résumé postings

Navigation Tools for the Invisible Web

You can access the invisible Web in several ways. One approach is to use a search engine to locate a portal, or entrance, to a searchable database by including the word, database, as a required search term. For example, if you are searching for information about printer drivers, you could specify "printer drivers" AND database. The additional term will narrow the search results and increase the likelihood of finding searchable collections of printer drivers.

You also can access the invisible Web by using specialized portals that list and organize searchable databases. An example of an invisible Web portal is CompletePlanet.com, which is shown in Figure TK D-9. CompletePlanet.com claims to access over 70,000 invisible Web databases that are frequently overlooked by traditional searching, and also offers a special search tool called the Deep Query Manager™.

FIGURE TK D-9 The CompletePlanet site is organized by topics, and has links to many searchable databases whose contents cannot be indexed by traditional search engines.

If you spend a significant amount of time searching the invisible Web, you might want to use special navigation software to assist you. For example, EndNote is an application offered by Thomson Reuters, as shown in Figure TK D-10. EndNote uses a special information transfer method that allows a user to connect directly to hundreds of government and university databases on the invisible Web.

Figure TK D-11 shows a recap of the Internet tools and resources: search engines, subject directories, and the invisible Web. Notice that each has advantages and disadvantages.

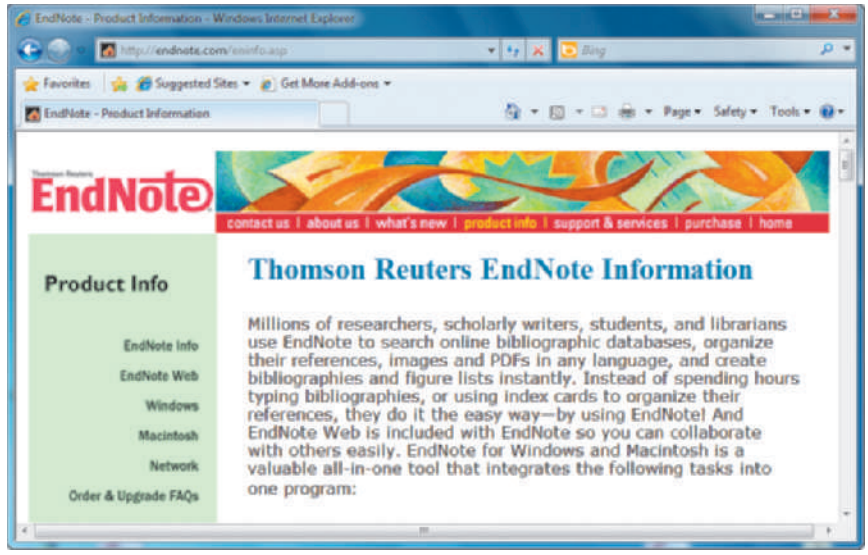


FIGURE TK D-10 Many researchers use EndNote, which is an application that allows you to connect directly to hundreds of government and university databases.

Recap of Internet Search Resources

RESOURCE	POSSIBLE USES	ADVANTAGES	DISADVANTAGES	NOTES
Search Engines	Good initial starting point, especially if you have an overall understanding of the topic. Search engines can lead you to important government, professional, or commercial sites.	Flexibility. You can choose from many different engines with various features. Some allow newsgroup access as well. Meta-search engines can return and rank results from multiple sources. Advanced search techniques can be used.	Frequently produces information overload. Can return many irrelevant or out-of-date links. Without a refined search, it is impossible to examine results carefully. Some sites allow companies to improve their hits by "pay for performance."	You can improve search effectiveness significantly by using advanced search techniques based on logical operators.
Subject Directories	Good way to get a broad overview of a topic before accessing specific sites.	With a subject directory, you can maintain broader focus and perspective, and work from the general to the specific without getting lost in a maze of Web sites.	Material is organized by human intervention; quality, currency, and accuracy might vary.	Once you work your way through the various levels, you might be able to bookmark the resource for more direct future access.
Invisible Web	Information from nonindexed databases and searchable directories such as company financial reports, library holdings, industry reports, and government information.	Very diverse resource. Many more pages on the Web are non-indexed rather than indexed.	Can be difficult to access unless you know where to look. Navigating a searchable database can be more difficult than using a traditional search engine, because no common interface exists.	Portal sites are available to help you navigate the invisible Web. You can use a general search engine to locate searchable databases by searching a subject term and the word *database*.

FIGURE TK D-11 A recap of the three main Internet search resources: search engines, subject directories, and the invisible Web. Notice that each option has advantages and disadvantages.

ON THE WEB

To learn more about social networking, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part D, and locate the Social Networking link.

Internet Communication Channels

Suppose that you are asked to analyze your organization's virus protection requirements. As part of your research you would want to learn about relevant news, developments, and the latest virus threats. You also might want to suggest several specific products. Assume that you performed your research using a search engine. Now you want to check your conclusions by getting feedback from other IT professionals. You can consider using social networking sites, newsgroups, newsletters, blogs, podcasts, Webcasts, RSS feeds, Webinars, mailing lists, Web-based discussion groups, chat rooms, and instant messaging.

Social Networking

Social networking sites such as MySpace, Facebook, Twitter, and LinkedIn have gained enormous popularity in recent years. Many people use these communication channels along with more traditional choices, such as e-mail, blogs, chat rooms, and instant messaging. As a systems analyst, social networking allows you to connect to an extended family of personal and professional contacts, with unlimited opportunities.

FIGURE TK D-12 Google provides easy access to numerous discussion groups.

Newsgroups

Most people are familiar with bulletin boards they see at school, at work, and in their communities. Using thumb tacks or tape, people post information and read what others have posted. A **newsgroup** is the electronic equivalent of the everyday bulletin board. Newsgroups offer online discussion forums that address every conceivable subject and interest area. A newsgroup can put you in touch with the knowledge, experience, and opinions of a large online community.

Some search engines and subject directories allow you to conduct a specific search among newsgroups. Figure TK D-12 shows some of the many newsgroups that can be searched by the Google search engine. This portal provides a convenient entry point for a systems analyst who wants to explore and participate in a wide range of computer-related discussions.

To understand how newsgroups work, consider the following example. In your research on virus protection, which was mentioned in the previous section, assume that you have narrowed the product choices down to two. You are having trouble, however, differentiating between them and would like feedback from current users. You might want to visit individual product sites for user testimonials, but you would be unlikely to find a negative opinion on a vendor's site. You also could poll your professional colleagues, but you want to survey a variety of users that goes beyond your limited circle.

At this point, you might decide to tap into an appropriate newsgroup and see if there have been any postings that are relevant to you. Some newsgroups are moderated, in which articles are sent to a person who approves them before they are posted for the group. Before you post, you should read the FAQ files associated with each newsgroup. The term **FAQs** stands for **frequently asked questions**. FAQs are a common method of providing guidance on questions that users are likely to ask. In many cases, FAQs describe the particular **netiquette**, or Web guidelines for protocol and courtesy, that exist on a particular newsgroup or site. You can learn more about netiquette in Part A of the Systems Analyst's Toolkit.

As you gain experience, you might decide to subscribe to newsgroups that address topics of interest to you, including some of the ones listed in Figure TK D-12.

ON THE WEB

To learn more about newsgroups, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part D, and locate the Newsgroups link.

Newsletters, Blogs, Podcasts, and Webcasts

Newsletters are a convenient way to keep current on topics of interest. Many online magazines and other groups offer free e-mail newsletters to subscribers interested in specific topics. For example, as shown Figure TK D-13, *InfoWorld* readers can access a wide range of newsletters, blogs, and podcasts.

FIGURE TK D-13 InfoWorld offers free newsletters, Webcasts, and other valuable online resources.

A **blog** is a Web-based log, or journal. Computer-related blogs can provide valuable information for a systems analyst. Also, many vendors offer Web-based training options, including podcasts. A **podcast**, sometimes called a **Webcast**, refers to online material that can be delivered as a streaming download to users, who can receive multimedia files and open them on a computer or download them to an iPod®, iPad®, smart phone, or other portable player. Podcasts can be pre-scheduled, made available on demand, or delivered as automatic updates, depending on a user's preference. An advantage of a podcast is that users, called subscribers, can access the material anywhere, anytime.

RSS Feeds

ON THE WEB

To learn more about RSS feeds, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part D, and locate the RSS Feeds link.

The term **RSS** stands for **Really Simple Syndication**. RSS is a format for publishing frequently updated content to users who subscribe to an RSS download, also called a feed, an **RSS feed**, or a **Web feed**. Web publishers such as Yahoo!, Google, CNN, MSNBC, and many other newspapers, magazines, vendors, and blogs use RSS feeds to distribute news and updates to subscribers, who can read the content with software called an **RSS reader**, a **feed reader**, or an **aggregator**.

Figure TK D-14 shows how Yahoo! uses RSS feeds to publish news items, and a sample of the wide variety of available topics. Many main headings, such as *Technology*, also contain a lengthy list of subtopics. In addition, Yahoo! allows you to create a custom RSS feed by typing a term or phrase into a search box, which is shown at the bottom of Figure TK D-14. For example, if you were especially interested in news updates about Cisco routers, you could create a Yahoo! feed that would capture and download all articles on that topic. Yahoo! feeds make it easy for an IT professional to stay well informed on topics of interest. However, notice the important caution regarding the use of the content. Yahoo! states that the feeds are free for individuals and nonprofit organizations for non-commercial use, but that proper attribution is required.

FIGURE TK D-14 Yahoo! uses RSS feeds to publish news about a wide variety of topics. You also can create a custom feed by typing a term or phrase into the search box at the bottom of the Web page.

Webinars

A **Webinar**, which combines the words *Web* and *seminar*, is an Internet-based training session that provides an interactive experience. Most Webinars are scheduled events with a group of pre-registered users and an online presenter or instructor. A prerecorded Webinar session also can be delivered as a Webcast.

Mailing Lists

A **mailing list**, also called a **listserv**, is similar to a newsgroup in that it provides a forum for people who want to exchange information about specific topics. Like a newsgroup, users can post messages and view postings made by others. Instead of a bulletin board approach, however, a mailing list uses e-mail to communicate with users. A computer called a **list server** directs e-mail to people who subscribe to, or join, the mailing list.

When a person subscribes to a list, he or she can receive e-mail messages as they are posted. Subscribers also can access a collection of messages called a **digest**. Many mailing lists maintain Web sites where users can search message archives.

A systems analyst would be interested in mailing lists that focus on information technology. To locate IT-related mailing lists, you can visit the Web sites of professional organizations, and you can try adding the phrase *mailing list or listserv* to your search topic. Also, as shown in Figure TK D-15, you can visit Web sites such as *lsoft.com* and *tile.net* that organize mailing lists by name and subject.

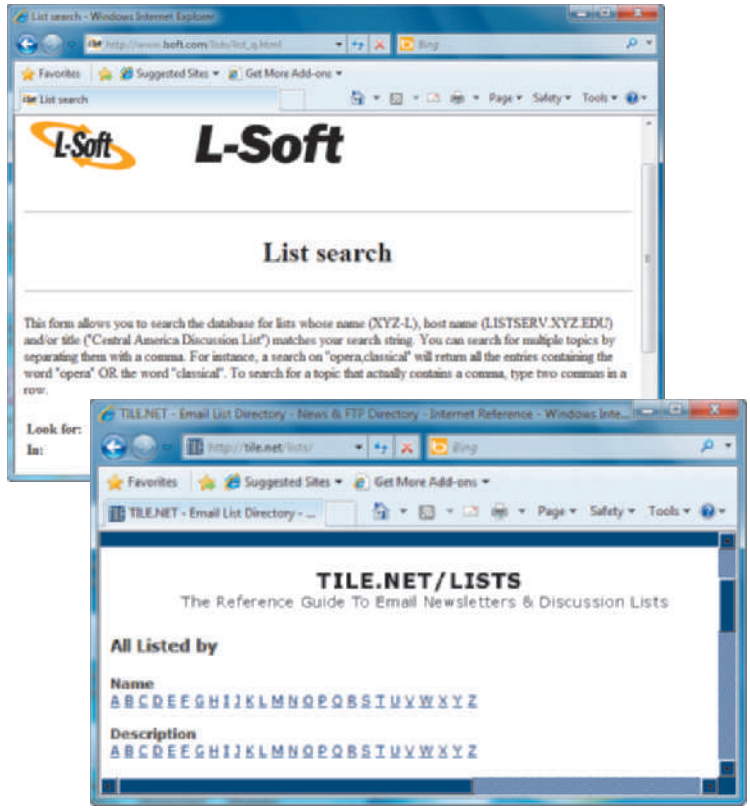


FIGURE TK D-15 Lsoft.com and tile.net are examples of Web sites that organize mailing lists by name and subject.

Web-Based Discussion Groups

Another online communication resource is called a **Web-based discussion group**, which is an online community that combines features of mailing lists and newsgroups. Web-based discussion groups can be accessed through portals, such as Yahoo! or Google, or by visiting vendor sites, such as Cisco, IBM, or Apple. Group members can receive messages either individually or in digest form like a mailing list, and they can browse messages stored on the group's Web site. In addition to text messages, group Web sites often include membership lists and contact information, photo galleries, and links of interest to members.

Web-based discussion groups are popular because they offer a convenient and free meeting place with a graphical interface that makes it easy for users to access information and exchange messages.

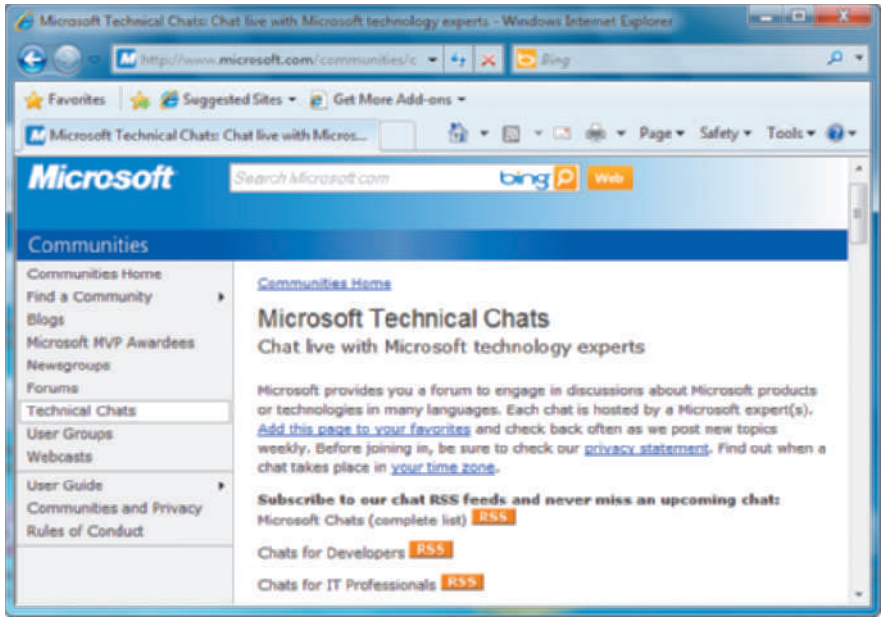


FIGURE TK D-16 Microsoft offers a wide variety of technical chat rooms where users can interact and converse in real time.

Chat Rooms

A **chat room**, also called a **channel**, is an online meeting place where users can interact and converse in real time. The chat room concept originated with **IRC**, which stands for **Internet Relay Chat**. IRC is a multichannel system supported by servers that enable conversations, group or individual, on a worldwide basis. You can learn more about IRC at the Web site *www.irc.org*, and you can follow links to see a list of available IRC channels that might be of interest to you.

Various companies also provide chat rooms that are available to IT professionals interested in specific topics. For example, Microsoft offers a wide variety of technical chat rooms, as shown in Figure TK D-16.

Instant Messaging and Text Messaging

ON THE WEB

To learn more about IM and texting abbreviations, visit the Management Information Systems CourseMate Web site at **www.cengagebrain.com**, navigate to **On the Web Links** for Toolkit Part D, and locate the IM and Texting Abbreviations link.

Instant messaging (IM) allows online users to exchange messages immediately, even while they are working in another program or application. Users are alerted that other members of their group are available online, and users can send and receive messages or enter into a chat with other users.

Although instant messaging began as a popular feature in home-oriented services such as AOL and Yahoo!, it has become an important business communications tool, and many firms use enterprise-wide IM tools such as Microsoft Office Communicator. Corporate use of IM, however, raises serious security and privacy concerns because it is relatively uncontrolled. Also, certain industries such as banking and health care must observe legal regulations that govern all their communications, including IM, which must be logged and documented. Corporate security can be compromised by unauthorized instant messaging and exchange of files. Also, applications such as Skype and other computer-based voice channels add a burden to network bandwidth and efficiency. To combat these threats, as shown in Figure TK D-17, firms such as Blue Coat offer software that can manage instant messaging and provide necessary security and controls.

Many people use **text messaging**, or **texting**, to send brief written messages from one mobile phone or wireless device to another. Users can also send text messages from a computer to a handheld device. The popularity of IM and texting has given rise to numerous abbreviations that reduce message size and speed up the communication process. Some well-known examples are *BTW* (*by the way*), *JMO* (*just my opinion*), and *TIA* (*thanks in advance*).

FIGURE TK D-17 Blue Coat offers software that can manage and control instant messaging, Skype, and other types of communication that use the company's network.

Figure TK D-18 shows a recap of online IT channels that can assist a systems analyst in online research and communication: social networking sites, newsgroups, newsletters, mailing lists, RSS feeds, Web-based discussion groups, chat rooms, and instant messaging. Notice that each resource has advantages and disadvantages.

Recap of Internet Communication Channels

RESOURCE	POSSIBLE USES	ADVANTAGES	DISADVANTAGES	NOTES
Social Networking Sites	Communicating with others who share similar interests.	Opens up new resources that can help you personally and professionally.	Your network can become too large and impersonal. Too much activity can be distracting.	Extremely convenient, popular, and no subscription fees.
Newsgroups	Answers to technical questions, advice, and support.	Can find information on every conceivable subject — good place to exchange views with other analysts.	Cumbersome to search through message threads. Need to assess quality of information carefully.	Some major search engines allow newsgroup access.
Newsletters, Blogs, and Podcasts	Good way to follow trends and developments regarding specific IT topics.	Most newsletters, blogs, and podcasts are free to users who can subscribe to specific topics.	Not interactive, and the amount of information can be overwhelming. Difficult to filter irrelevant items.	Some newsletters, blogs, and podcasts are published daily; others weekly or monthly.
RSS Feeds	Provide news and updates for readers of online newspapers, magazines, and blogs.	Convenient way to keep posted on virtually any topic of interest.	Unless topics are specific, the volume of information might be difficult to sift through.	Rapid growth is expected to continue, as more users discover this valuable resource.
Webinars	Internet-based training that can provide an interactive experience.	Users can plan, schedule, and preregister for online sessions.	Only available when scheduled — otherwise not interactive.	Very popular technique because of convenience and cost-effectiveness.
Mailing Lists	Members can exchange information with others about specific topic of interest.	Messages arrive by e-mail, rather than in the form of bulletin board postings.	Amount of material might be difficult to read and analyze.	Some mailing lists, or listservs, allow members to search archived messages.
Web Discussion Groups	Members form a Web-based community regarding topics of common interest.	Combine many convenient features of newsgroups and mailing lists.	Although free, these groups usually must be accessed through a Web portal.	Web discussion groups offer a mix of features and convenience.
Chat Rooms	Online meeting places where users can interact and converse.	Many IT chat rooms attract professionals who are willing to help each other solve problems.	Discussions take place in real time, which might not be convenient. Dialog might be unfocused and irrelevant to your needs.	Many large vendors, such as Microsoft, offer technical chat rooms.
Instant Messaging and Text Messaging	Users can exchange messages immediately, either online or by cell phone.	Highly efficient means of real-time communication on topics of interest. Good way to collaborate on team projects.	Can be distracting to a busy user, and sheer volume of nonessential messages can be a problem.	IM and text messaging have moved beyond the personal desktop and are acceptable business communication tools.

FIGURE TK D-18 A recap of Internet communication channels that can assist a systems analyst in online research and communication. Notice that each option has advantages and disadvantages.

Information Technology Community Resources

If you were asked to check a stock price or research the weather in a distant city for a business trip, you probably would not use a search engine. Instead, you would visit a favorite site you use regularly to access specific information. Similarly, when you require IT information, you can access a huge assortment of sites and resources that can be called the **information technology (IT) community**. This vast collection includes many sites that IT professionals can use to research specific questions or obtain background information. As a systems analyst, you are a member of this community. Like most communities, it offers you resources and support, including answers to technical questions, updates on new products and services, and information about training opportunities. The IT community includes numerous publications and online magazines, searchable databases, Web-based discussion groups, and mailing lists.

Four important components of the IT community are corporate resources, government resources, professional resources, and online learning resources, which are described in the following sections.

Corporate Resources

Corporate resources can provide general IT knowledge and background, as well as help solve specific business challenges. It is very important to evaluate corporate content carefully, because some sites are developed by companies with an interest in selling you a specific solution or product. Figure TK D-19 shows a site that offers product reviews and helpful information.

If you are looking for help on a software application, it is a good idea to start by reviewing the software documentation. In many cases, technical support is included free of charge for a specific period of time. If you are working with an application with expired technical support, the software provider's Web site will describe support options that are available to you, including various fees and charges. Common problems often are addressed in the FAQ section.

FIGURE TK D-19 PC Magazine is an example of a site that offers product guides and reviews.

An important corporate resource to systems analysts is their own internal company Web site or intranet. An intranet must be easy to access and provide access to valuable information. Companies increasingly are using intranets as a means of sharing information and working towards common solutions. Intranets can contain company policies and procedures, lessons-learned files, and financial information. They also enable employees to access and update their personal benefit information. In many organizations, the intranet is reducing the volume of paper memos and reports by serving as an enterprise-wide library and clearinghouse.

Government Resources

The IT needs of the federal government are enormous. Not surprisingly, a number of excellent federal IT resources are available on the Internet. Many sites offer comprehensive, nonbiased information and valuable advice for IT professionals. For example, recent U.S. General Accounting Office (GAO) reports on the IT industry have covered everything from an analysis of the information security practices to a framework for assessing IT investments. Additionally, government sites can provide information on federal, state, and local business policies and regulations. The General Services Administration (GSA) site depicted in Figure TK D-20 is a good source for federal policies and regulations, especially for firms that do business with the government.

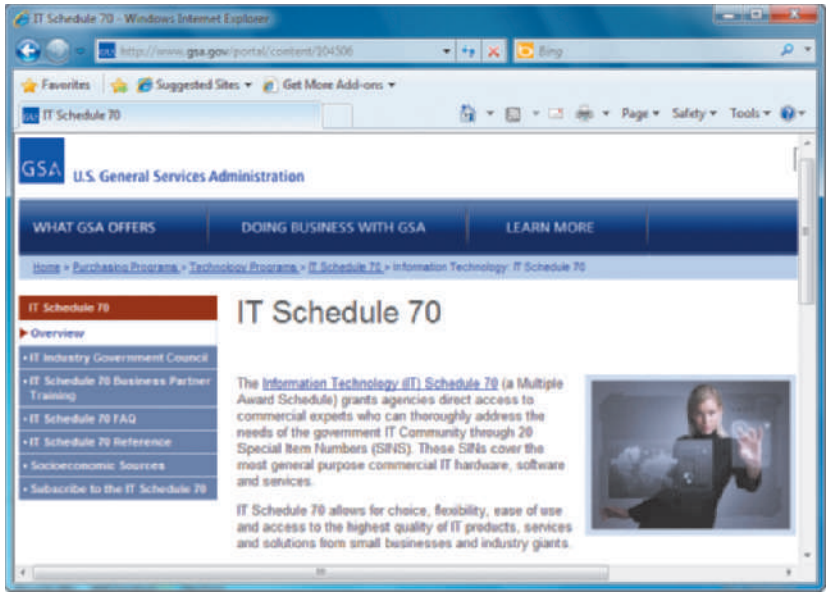


FIGURE TK D-20 The GSA site contains information about federal IT policies, news, and related links. The screen shows a sample from the IT Regulations, Guidelines and Laws section.

Personal and Professional Resources

Most individuals have friends, acquaintances, and other people that they know or would like to meet. Whether the communication channel involves e-mail, chats, newsgroups, or social networking, the goal is to expand contacts and opportunities. Some observers have compared social networks to small virtual communities or neighborhoods, where people can meet and share information. Their objectives might be personal, or might relate to technical matters, career topics, or professional growth.

In addition to social networking, a systems analyst can consider membership in one or more IT-related associations. Many organizations focus on a specific topic such as project management, software engineering, or information security. Membership in some associations is free or relatively inexpensive, and employers often subsidize professional memberships that are directly related to a person's job duties. The links provided by these sites often are quite useful. Professional organizations, such as the **Information Technology Association of America** (**ITAA**) or the **Association for Computing Machinery** (**ACM**), which is shown in Figure TK D-21, also sponsor seminars and training. Many associations offer electronic newsletters that relate to your area of interest and are delivered to you by e-mail on a periodic basis.

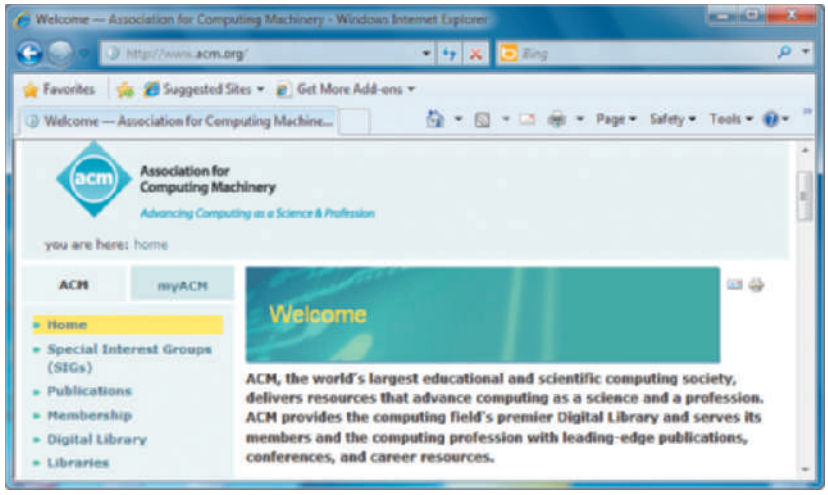


FIGURE TK D-21 The ACM site is one of many resources that a systems analyst can use to keep up with current issues, trends, and opportunities.

Online Learning Resources

It is difficult to keep up with the constantly changing IT landscape. Targeted professional development is a way for IT workers to remain focused and current in their

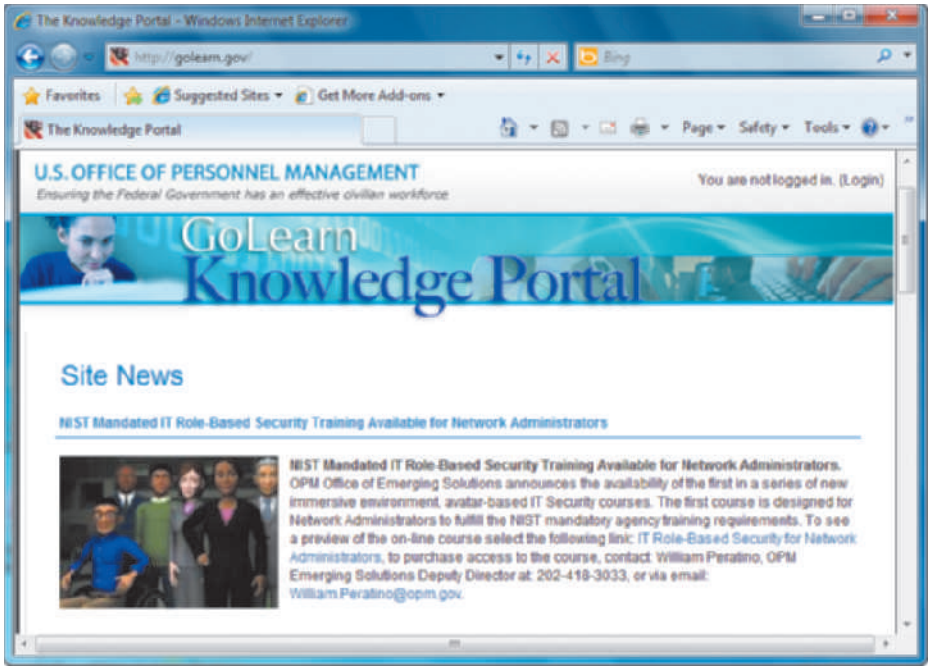


FIGURE TK D-22 The GoLearn.gov Learning Center offers a wide range of online training for federal employees.

chosen areas. In the past, this goal often meant attending lengthy and expensive off-site training courses. Advances in bandwidth and processing power have made online learning an increasingly attractive option for many IT professionals.

Online learning, also referred to as **e-learning**, is a term that refers to the delivery of educational or training content over the public Internet or an intranet. You can locate learning opportunities by searching the Web or through various professional associations. Many schools and colleges have seen a tremendous increase in demand for online learning and have increased their course offerings accordingly. The GoLearn.gov Learning Center shown in Figure TK D-22 is a government site with many online learning information and opportunities for federal employees.

Online learning can take many forms, ranging from individual self-paced instruction with little or no instructor involvement, to interactive, instructor-led groups with streaming audio and video capability. When choosing an online learning method, your learning goals and the quality of the content are the most important considerations. You need to think about your personal learning preferences. For example, you might learn better in a collaborative environment rather than working alone. If that is the case, consider options that include an interactive peer community. The following are some advantages and disadvantages that apply to the use of online resources:

BENEFITS OF ONLINE LEARNING Benefits of online learning include the following:

- Convenient. You can participate in training when and where you want.
- Economical. Online learning options generally are less expensive than traditional face-to-face learning.
- Customizable. Generally, you can tailor the learning experience to your interests and needs.

DISADVANTAGES OF ONLINE LEARNING Disadvantages of online learning include the following:

- Interaction. Although online learning can be highly collaborative, it lacks the face-to-face component that some learners find necessary. Additionally, you are less likely to receive the focused feedback that you would get when participating in traditional classroom training.
- Interface. Although bandwidth and computing power have increased greatly in recent years, the interface in an online learning experience might be a limitation. For example, you might experience slower processing performance, especially if the training uses interactive video, audio, or high-resolution graphics.
- Suitability. Online learning might not be the best option, particularly if the content is complicated and unfamiliar to you.

Figure TK D-23 shows a recap of online IT resources, including possible uses, advantages, and disadvantages.

Recap of Online IT Resources

RESOURCE	POSSIBLE USES	ADVANTAGES	DISADVANTAGES	NOTES
Corporate Resources	Specific technical hardware or software help, training opportunities.	First stop for troubleshooting proprietary software or hardware.	Very often an agenda is associated with the site — for example, advocating a particular product or service.	Vendor sites contain valuable specific product or solution information (check the site's FAQs). Many offer newsletters for interested visitors.
Government Resources	Information on IT regulations.	Wide variety of general topics, from congressional studies to industry-relevant government regulations.	Not all information can be accessed via the Web — sometimes sites refer to a document number for ordering. Information tends to be general and not always relevant.	Suggested sites: Library of Congress, General Accounting Office, Government Computer News.
Personal and Professional Resources	A combination of social networking, access to professional sites, and membership in IT organizations can expand personal and professional resources related to IT ethics, technical issues, and career opportunities.	Social networking is fun, because it involves person-to-person contact. IT industry-related sites often provide valuable links and inform-ation on training opportunities.	Social networking is not a precise tool for specific issues. Conversely, many IT sites are too specialized to be of general interest.	Some IT sites can serve as portals to a collection of online resources.
Online Learning Resources	An IT professional needs to stay current in a constantly changing technology environment. Online learning can provide job-specific skills and support for career advancement.	Convenient, economical, and customizable. You can participate in training when and where you want, and online learning options are generally less expensive than traditional face-to-face learning.	Online learning lacks the face-to-face component that some learners find necessary. Learners are less likely to receive focused feedback. Also, the interface in an online learning experience might be a limitation. Online learning might not be the best option, if the content is complicated and unfamiliar.	When considering online learning, you must know your personal learning style. You should examine the entire range of options, from individual self-paced instruction with little or no instructor involvement, to interactive, instructor-led classes.

FIGURE TK D-23 A recap of online resources that a systems analyst can use to keep up with current issues and trends in IT. Notice that each option has advantages and disadvantages.

Toolkit Summary

The Internet is a worldwide network that integrates many thousands of other networks, which in turn link millions of government, business, educational, and personal users around the globe. The Internet can assist you in your daily work by helping you solve technical problems and in the ongoing development of your career by providing access to training and professional education.

The Internet allows access to the World Wide Web, usually called the Web, which refers to the global collection of electronic documents stored on the Internet. These documents are referred to as Web pages, which are organized and stored on individual Web sites.

An Internet research strategy should use a four-step approach: review your information requirements, use the proper search tools and techniques, evaluate the results, and consider copyright and data integrity issues. Many people find it helpful to prepare for an Internet search by using a checklist to identify key terms, phrases, and characteristics of the topic.

The primary research tools include search engines, subject directories, and a collection of searchable database resources called the invisible Web. A search engine uses keywords and phrases to locate information on the Internet and list the results of the search. Users should be aware that results can be affected if the search engine permits commercial users to achieve higher priority based on payment of fees. Also, search engines access only a portion of the Internet. Meta-search engines are tools that can apply multiple search engines simultaneously.

A subject directory is a Web site that allows you to access topics by using a hierarchy, starting with general headings and proceeding to more specific topics. A subject directory is an excellent starting point when you want an overview of a particular topic before proceeding to specific Web sites.

The invisible Web, or hidden Web, describes numerous text, graphics, and data files stored in collections that are unreachable by search engines.

Many analysts use social networking as a primary online tool to expand personal and professional contacts and communication. Other Internet tools that might be of value to a systems analyst are newsgroups, newsletters, blogs, podcasts, RSS feeds, Webinars, mailing lists, Web-based discussion groups, chat rooms, and instant messaging. Newsgroups, which are part of the Usenet, are online discussion groups that address every conceivable subject and interest area. Newsletters are published by numerous commercial and nonprofit groups that offer membership subscriptions to users who are interested in specific topics. A mailing list, or listserv, allows subscribing members to post and receive messages forwarded to them by a list server. A Web-based discussion group, usually accessed through a portal such as Yahoo!, combines features of newsgroups and mailing lists for its members. A chat room is an online meeting place where users can interact and converse in real time. Instant messaging allows online users to exchange messages immediately, even while they are working in another program or application.

When an IT professional needs to research a topic or seek background information, he or she can turn to an assortment of sites and resources called the information technology (IT) community. The IT community includes corporate, government, professional, and online learning resources.

Professional development through online learning is a way for IT workers to remain current in their chosen areas. Online learning refers to the delivery of educational or training content over the Internet or an intranet. Online learning is convenient, economical, and customizable. Some disadvantages, however, include a lack of face-to-face interaction, limitations of the interface, and the fact that not everyone works well with this type of training.

Key Terms and Phrases

advanced search *697*
aggregator *704*
AND *696*
Association for Computing Machinery (ACM) *709*
blog *704*
Boolean logic *695*
browser *690*
channel *705*
chat room *705*
content *691*
crawler *693*
deep Web *693*
digest *705*
e-learning *709*
FAQs (frequently asked questions) *703*
feed reader *704*
hidden Web *693*
hits *693*
implied Boolean logic *697*
indexed search engine 694
indexing *693*
Information Technology Association of America (ITAA) *709*
information technology (IT) community *708*
instant messaging (IM) *706*
Internet *690*
Internet Relay Chat (IRC) *705*
invisible Web *693*
IRC *705*
keywords *693*
list server *704*
listserv *704*
logical operators *695*
mailing list *704*
malware *692*
meta-search engine *692*
netiquette *703*
newsgroup *702*
newsletters *703*
NOT *696*
online learning *709*
OR *696*
pay for performance *693*
phrase *697*
podcast *704*
portal *698*
RSS (Really Simple Syndication) *704*
RSS feed *704*
RSS reader *704*
search engine *692*
social networking *702*
spider *693*
sponsored links *693*
subject directory *693*
subsearch *691*
text messaging *706*
texting *706*
topic directory *693*
Venn diagram *695*
visible Web *699*
Web *690*
Web-based discussion group *705*
Web browser *690*
Web feed *704*
Web page *690*
Web server *690*
Web site *690*
Webcast *704*
Webinar *704*
World Wide Web *690*

Toolkit Exercises

Review Questions

1. Describe the size and characteristics of the Internet and the World Wide Web.
2. How do search engines differ from subject directories? Compare these approaches and describe their advantages and possible disadvantages.
3. What is the invisible Web, and how can it be accessed?
4. What steps should you follow when planning an Internet research strategy?
5. What questions should you ask when evaluating the quality of Internet research results?
6. What are sponsored links, and how can they affect the quality of your search results?
7. What is Boolean logic? Provide three examples.
8. How do Venn diagrams show the effect of the three logical operators?
9. Describe social networking, newsgroups, newsletters, blogs, podcasts, RSS feeds, Webinars, mailing lists, Web-based discussion groups, chat rooms, and instant messaging. How can these tools be used in Internet research?
10. What is the information technology community, and what resources does it offer for Internet research tasks?

Discussion Topics

1. The textbook explains that some companies pay to obtain a higher ranking when search results are displayed. Is this good, is it bad, or does it not matter to you as a user? Explain your position.
2. Some people rely heavily on social networking, instant messaging, and texting to communicate with friends and business colleagues. Others find these methods distracting. Do you use social networking, instant messaging, or texting? Why or why not?
3. Could Boolean logic and Venn diagrams be useful in everyday life? How might they be used?
4. The Internet has affected many aspects of our society. What are the most important benefits of the Internet, and what problems have been created by it?

Projects

1. Use a search engine and enter the following words: presidential candidates in 2016. Run the search and notice how many results appear. Now place quote marks around the phrase and run the search again. Explain the difference in the results.
2. Will the search phrase "*commercial television*" return the same results as the phrase "*television commercial*"? Experiment with a search engine, and explain the results you obtain.
3. Use the Yahoo! subject directory to identify two dictionaries of technical terms. Begin with the subject *Computers and Internet*, and then follow the appropriate links until you obtain results. Describe the results of your research. What other research strategies could you use for this task?
4. Perform research on the Web to learn more about RSS feeds. Then write a practical, step-by-step guide for users who want to set up RSS feeds at their workstations.

INDEX

– (dash), 227–228, 229
. (decimal point), 213, 219, 364
(pound sign), 356
1:1 A type of entity relationship. A one-to-one relationship, abbreviated 1:1, exists when exactly one of the second entity occurs for each instance of the first entity. 406
1:M A type of entity relationship. A one-to-many relationship, abbreviated 1: M, exists when one occurrence of the first entity can be related to many occurrences of the second entity, but each occurrence of the second entity can be associated with only one occurrence of the first entity. 406, 419
4G (fourth generation) The latest generation of high-speed wireless broadband technologies and devices. 173
6 by 6 rule The 6 by 6 rule suggests that on a slide, no more than six items should be placed on each slide, and each item should have no more than six words. 641, 645
7 by 7 rule The 7 by 7 rule suggests that on a slide, no more than seven items should be placed on each slide, and each item should have no more than seven words. 641, 645
802.11 A family of wireless network specifications developed by the IEEE. 482–485802.11g An IEEE wireless network specification introduced in 2003 based on a frequency of 2.4 GHz and maximum bandwidth of 54 Mbps; compatible with and replaces 802.11b, and will likely be replaced by the 802.11n standard. 483, 485
802.11i A security standard for Wi-Fi wireless networks that uses the WPA2 protocol, currently the most secure encryption method for Wi-Fi networks. 598
802.11n An IEEE wireless network specification adopted in 2009 that uses multiple-input/multiple output (MIMO) technology to achieve speeds of 200+ Mbps while increasing the wireless range, and is
backward-compatible with 802.11 a, b, and g. 483
802.11y An emerging IEEE wireless networking standard that uses multiple input/multiple output (MIMO) technology to increase bandwidth and range. 483
802.16 Specifications developed by the IEEE for broadband wireless communications over MANs (metropolitan area networks). 485
abbreviation codes Alphabetic abbreviations. For example, standard state codes include NY for New York, ME for Maine, and MN for Minnesota. 423
absolute date The total number of days from some specific base date. To calculate the number of days between two absolute dates, you subtract one date from the other. For example, using a base date of January 1, 1900, September 27, 2012 has an absolute date value of 41179 and July 13, 2011 has an absolute date of 40737. If you subtract the earlier date value from the later one, the result is 442 days. 435
acceptance One of four risk control strategies. In acceptance, the risk is accepted and nothing is done. Risk is usually accepted only if protection from risk is clearly not worth the expense. 592
acceptance test Also known as a system test. Acceptance testing involves the entire information system. An acceptance test includes all typical processing situations. During an acceptance test, users enter data, including samples of actual, or live data, perform queries, and produce reports to simulate actual operating conditions. All processing options and outputs are verified by users and the IT project development team to ensure that the system functions correctly. 527
access point A central wireless device that provides network services to wireless clients. 483
Access (Microsoft), 171, 298
  database design and, 405, 426, 428–430, 433
  Help screen, 345
  input masks and, 365–366
  physical storage and, 433
  referential integrity and, 405
  report design tools, 350–351
  system implementation and, 523–524
  user interface design and, 356
action codes Action codes indicate what action is to be taken with an associated item. For example, a student records program might prompt a user to enter or click an action code such as D (to display the student's record), A (to add a record), and X (to exit the program). 424
active voice Active voice refers to using sentences where the actor is the subject of the sentence. For example, "Tom designed the system" is in active voice. 633
activity An activity, or task, is any work that has a beginning and an end, and requires the use of company resources including people, time, and/or money. Examples include conducting a series of interviews, designing a report, selecting software, waiting for the delivery of equipment, and training users. 106
activity diagram A diagram that resembles a horizontal flow chart that shows the actions and events as they occur. Activity diagrams show the order in which actions take place and identify the outcome. 266
actor An external entity with a specific role. In a use-case model, actors are used to model interaction with the system. 151
adaptive maintenance Adaptive maintenance adds new capability and enhancements. 575, 576–577
adaptive method An adaptive method typically uses a spiral development model, which builds on a series of iterations. 21. *See also* agile methods
administrator Account that allows essentially unrestricted access to the application. 601
Adobe Acrobat, 637
Adobe ColdFusion, 401
advanced search An advanced search can include the option to search within returned results and the ability to search within specific areas, such as newsgroups. 697
aesthetics An approach that focuses on how an interface can be made attractive and easy to use. 343
aggregator Client software or Web application that aggregates syndicated Web content such as blogs, podcasts, and RSS feeds in a single location for easy viewing. Also called feed reader or RSS reader. 704
agile development. *See also* agile methods
  future of, 523
  overview, 520–523
agile methods Systems development methods that attempt to develop a system incrementally, by building a series of prototypes and constantly adjusting them to user requirements. Also called adaptive methods. 149, 512. *See also* agile development
  described, 21, 143
  overview, 25–26 147–149
alias Term used in various data dictionaries to indicate an alternate name, or a name other than the standard data element name, that is used to describe the same data element. 219, 222
all-in-one devices, 173
allocated baseline The allocated baseline documents the system at the end of the design phase and identifies any changes since the functional baseline. The allocated baseline includes testing and verification of all system requirements and features. 583
alphabetic codes Alphabetic codes use alphabet letters to distinguish one item from another based on a category, an abbreviation, or an easy-to-remember value, called a mnemonic code. 423
AltaVista, 694
Amazon, 12, 459
amendment Version or variant of the IEEE 802.11 wireless networking standards. 482
American Association for Artificial Intelligence (AAAI), 344
analytical skills Skills that help one recognize a problem, evaluate the key elements, and identify a useful solution. 143
AND The AND operator often is used to narrow a set of search results. 694, described, 696, 697, 698
appendices, in reports, 81
application Part of the information system, an application handles the input, manages the processing logic, and provides the required output.
  security, 601–603
  testing, overview, 306
application development The process of constructing the programs and code modules that are the building blocks of an information system. Application development is handled by an application development group within a traditional IT department that is composed of systems analysts and programmers who handle information system design, development, and implementation. 28, 511–520
application generator An application generator, also called a code generator, allows you to develop computer programs rapidly by translating a logical model directly into code. 654
Application layer, 477
application logic The underlying business rules or logic for an application. 464
application server Application servers serve as "middlemen" between customers and an

organization's databases and applications. They are often used to facilitate complex business transactions. 464, 465
application software Software such as e-mail, word processors, spreadsheets, and graphics packages used by employees. 8
application service provider (ASP) A firm that delivers a software application, or access to an application, by charging a usage or subscription fee. 291, 299, 302, 469–470
  described, 291
  user references supplied by, 306
applications programmer A person who works on new systems development and maintenance. 579
archived The storage of previous version of a system when a new version is installed. 583
ASCII Stands for American Standard Code for Information Interchange, a data storage coding method used on most personal computers and workstations. 433, 544
asset Hardware, software, data, networks, people, or procedures that provide tangible or intangible benefit to an organization. 590
Association for Computing Machinery (ACM) A professional association for the IT industry that sponsors seminars and training and has a Web site where members can keep up with current issues, trends, and opportunities. 709
associative entity An entity that has its own set of attributes and characteristics. Associative entities are used to link between many-to-many (M:N) relationships. 407
attack A hostile act that targets an information system, or an organization itself.
  described, 592
  overview, 592–593
  profiles, 592
attribute A single characteristic or fact about an entity. An attribute, or field, is the smallest piece of data that has meaning within an information system. For example, a Social Security number or company name could be examples of an attribute. In object-oriented analysis, an attribute is part of a class diagram that describes the characteristics of objects in the class. Also known as a data element. 254, 402, 519
  database design and, 402
  described, 222, 250
  representing objects and, 252, 253
audiences, defining, 640
audit fields Special fields within data records to provide additional control or security information. Typical audit fields include the date the record was created or modified, the name of the user who performed the action, and the number of times the record has been accessed. 436
audit log files Audit log files record details of all accesses and changes to a file or database and can be used to recover changes made since the last backup. 436
audit trail An audit trail records the source of each data item and when it entered a system. In addition to recording the original source, an audit trail must show how and when data is accessed or changed, and by whom. All these actions must be logged in an audit trail file and monitored carefully. 313
authorization zone Part of a form that contains any required signatures. 361
automated facsimile A system that allows a customer to request a fax using e-mail, the company Web site, or a telephone. The response is transmitted in a matter of seconds back to the user's fax machine. 358
automatic update service Enables an application to contact the vendor's server and check for a needed patch. 602
availability One of the three main elements of system security: confidentiality, integrity, and availability (CIA). Availability ensures that authorized users have timely and reliable access to necessary information. 590
avoidance One of four risk control strategies. In avoidance, the risk is eliminated by adding protective safeguards. 592
B2B (business-to-business) A commercial exchange (e.g. products or services) between businesses, typically enabled by the internet or electronic means. 14, 400
B2C (business-to-consumer) A commercial exchange (e.g. products or services) between businesses and consumers conducted over the Internet. 13
back door attacks, 593
backup The process of saving a series of file or data copies to be retained for a specified period of time. Data can be backed up continuously, or at prescribed intervals. 436, 607, 608–609
backup media Data storage options, including tape, hard drives, optical storage, and online storage. 607
backup policy A backup policy contains detailed instructions and procedures for all backups. 607, 608
balancing A process used to maintain consistency among an entire series of diagrams, including input and output data flows, data definition, and process descriptions.
  described, 212
  examples, 214–216
bandwidth The amount of data that the system can handle in a fixed time period. Bandwidth requirements are expressed in bits per second.
  described, 586, 587
  network standards and, 482, 483
  system architecture and, 472, 482
baseline A formal reference point that measures system characteristics at a specific time. Systems analysts use baselines as yardsticks to document features and performance during the systems development process. 583
Basic Service Set (BSS) A wireless network configuration in which a central wireless device called an access point is used to serve all wireless clients; also called infrastructure mode. 483
batch A group of data, usually inputted into an information system at the same time. 369
batch control A total used to verify batch input. Batch controls might check data items such as record counts and numeric field totals. For example, before entering a batch of orders, a user might calculate the total number of orders and the sum of all the order quantities. When the batch of orders is entered, the order system also calculates the same two totals. If the system totals do not match the input totals, then a data entry error has occurred. 368
batch input A process where data entry is performed on a specified time schedule, such as daily, weekly, monthly, or longer. For example, batch input occurs when a payroll department collects time cards at the end of the week and enters the data as a batch. 368, 369
batch processing In a batch processing system, data is collected and processed in groups, or batches. Although online processing is used for interactive business systems that require immediate data input and output, batch processing can handle other situations more efficiently. 475–476
Bay Systems, 481
benchmark A benchmark measures the time a package takes to process a certain number of transactions.
  described, 306
  development strategies and, 296, 306–307
  prototyping and, 315
benchmark testing Benchmark testing is used by companies to measure system performance. 585
best-case estimate The most optimistic outcome is called the best-case estimate. 107
binary digit The smallest unit of data is one binary digit, called a bit. 433
binary storage format A format that offers efficient storage of numeric data. For example, when you specify numeric data types using Microsoft Access, you can choose from a variety of storage formats, including integer and long integer, among others. 434
Bing, 694
biometric devices Devices that identify a person by a retina scan or by mapping a facial pattern. 60
biometric scanning systems Mapping an individual's facial features, handprint, or eye characteristics for identification purposes. 60, 594
BIOS-level password A password that must be entered before the computer can be started. It prevents an unauthorized person from booting a computer by using a USB device or a CD-ROM. Also called a power-on password or a boot-level password. 595
bit The smallest unit of data is one binary digit, called a bit. 433
black box A metaphor for a process or action that produces results in a non-transparent or non-observable manner. In data flow diagrams, a process appears as a black box where the inputs, outputs, and general function of the process are known, but the underlying details are not shown.
  balancing and, 216
  described, 201, 256
  overview, 201–202
  viewing objects as, 256
black hole A process is said to be a "black hole" if it has no output. 203
BlackBerry (Research in Motion), 173–174
block A block, or physical record, is the smallest unit of data that is accessed by the operating system. 433
block sequence codes Block sequence codes use blocks of numbers for different classifications. 423
blocking factor The number of logical records in one physical record. 433
blog A Web-based log, or journal. 289, 703
  described, 704
  development strategies and, 305, 317
Bluetooth A form of wireless transmission very popular for short-distance wireless

communication that does not require high power. 173, 371, 485
body zone The main part of the form. It usually takes up at least half of the space on the form and contains captions and areas for entering variable data. 361
Boolean logic A system named after British mathematician George Boole and refers to the relationships among search terms. 695, 697
boot-level password A password that must be entered before the computer can be started. It prevents an unauthorized person from booting a computer by using a USB device or a CD-ROM. Also called a BIOS-level password or a boot-level password. 595
bottom-up technique A bottom-up technique analyzes a large, complex project as a series of individual tasks, called project tasks. 105
brainstorming A fact-finding technique for gaining information, through the use of a small group discussion of a specific problem, opportunity, or issue. 159
brick-and-mortar Is used to describe traditional companies whose business model predated electronic commerce. Many brick-and-mortar companies have successfully established profitable Internet storefronts. 12
Brooks, Frederick, 124
Brooks' Law This interesting concept was stated by Frederick Brooks, Jr., an IBM engineer, who observed that adding manpower to a late software project only makes it later. 124
browser A Web browser, or browser, is a software program that allows you to access and display Web pages that are delivered to you by a Web server. 399, 690
buffer A segment of computer memory used for temporary storage. 433
bug tracking software System developers use defect tracking software, sometimes called bug tracking software, to document and track program defects, code changes, and replacement code, called patches. 529
Bugzilla, 529
build or buy Choice between developing in-house software and purchasing software, often called a build or buy, or make or buy, decision. 293, 294
bus network In a bus network, a single communication path connects the mainframe computer, server, workstations, and peripheral devices. Information is transmitted in either direction from any workstation to another workstation, and any message can be directed to a specific device. 479
business case Refers to the reasons, or justification, for a proposal. 52, 58–59
business case analysis
  feasibility studies and, 66–69
  overview, 52–99
  project management and, 64
  setting priorities, 69–71
business continuity plan (BCP) A plan that defines how critical business functions can continue in the event of a major disruption. 608–609
business information systems, 15–18
business logic Business logic determines how a system handles data and produces useful information. Business logic, also called business rules, reflect the operational requirements of the business. Examples include adding the proper amount of sales tax to invoices, calculating customer balances and finance charges, and determining whether a customer is eligible for a volume-based discount. 201, 464
business model A business model graphically represents business functions that consist of business processes, such as sales, accounting, and purchasing. 10
business process A business process describes specific events, tasks, and desired results. 10, 150
business process model (BPM) A graphical representation of one or more business processes. 10, 150
business process modeling notation (BPMN) A standard set of shapes and symbols used to represent events, processes, and workflows in computer-based modeling tools. 10, 150
business process outsourcing (BPO) The outsourcing of a basic business process. 290
business process reengineering (BPR) An attempt by companies to simplify operations or reduce costs. 18
business profile A business profile defines a company's overall functions, processes, organization, products, services, customers, suppliers, competitors, constraints, and future direction. 10
business requirements
  development strategies and, 294–295
  system architecture and, 467
business rules Business rules determine how a system handles data and produces useful information. Business rules, also called business logic, reflects the operational requirements of the business. Examples include adding the proper amount of sales tax to invoices, calculating customer balances and finance charges, and determining whether a customer is eligible for a volume-based discount. 201
business support systems Business support systems (BSS) provide job-related information support to users at all levels of a company. 16
byte A group of eight bits is called a byte, or a character. A set of bytes forms a field, which is an individual fact about a person, place, thing, or event. 433
C (high-level language), 318
C++ (high-level language), 25, 250, 318, 523
C# (high-level language), 523
CAIT (Center for the Application of Information Technologies), 537, 538
calendar control A calendar control allows the user to select a date that the system will display and store as a field value. 348
Camtasia, 543
candidate key Sometimes it is possible to have a choice of fields or field combinations to use as the primary key. Any field that could serve as a primary key is called a candidate key. For example, if every employee has a unique employee number, then you could use either the employee number or the Social Security number as a primary key. 402, 403
Capability Maturity Model (CMM) A model developed by SEI that integrates software and systems development into the process improvement framework. 508
Capability Maturity Model Integration (CMMI) An SEI-developed process to improve quality, reduce development time, and cut costs. A CMM tracks an organization's software development goals and practices, using five maturity levels, from Level 1 (relatively unstable, ineffective software) to Level 5 (software that is refined, efficient, and reliable). 508–509
capacity planning A process that monitors current activity and performance levels, anticipates future activity, and forecasts the resources needed to provide desired levels of service. 587, 588
cardinality A concept that describes how instances of one entity relate to instances of another entity. Described in entity-relationship diagrams by notation that indicates combinations that include zero or one-to-many, one-to-one, and many-to-many. 263, 408
cardinality notation Notation that shows relationships between entities. 408, 409–410
career opportunities, 32–33
CASE environment A CASE environment is more than a set of CASE tools; it includes any use of computer-based support in the software development process.
  agile methods and, 148
  described, 653
  requirements modeling and, 144, 149–153, 158, 170
  Zackman Framework for Enterprise Architecture and, 158
case for action A part of the preliminary investigation report to management that summarizes project requests and makes specific recommendations. 81
CASE tools Powerful software used in computer-aided systems engineering to help systems analysts develop and maintain information systems.
  construction tools, 654–656
  data dictionaries and, 218
  described, 20, 648
  DFDs and, 215
  documentation and, 217–224, 653–654
  engineering tools, 654–655
  example, 57
  history, 651
  marketplace for, 651–652
  method-specific, 662–663
  modeling tools, 653
  O-O analysis and, 266, 267
  overview, 648–666
  system architecture and, 481, 486
  system implementation and, 511–512, 520, 525
  user interface design and, 342
category codes Category codes identify a group of related items. For example, a local department store may use a two-character category code to identify the department in which a product is sold. 423
certification A credential an individual earns by demonstrating a certain level of knowledge and skill on a standardized test. 32
Certiport, 32
change control (CC) A process for controlling changes in system requirements during software development; also an important tool for managing system changes and costs after a system becomes operational. 582
channel A chat room, also called a channel, is an online meeting place where users can interact and converse in real time. 705
character A group of eight bits is called a character, or a byte. A set of bytes forms a field, which is an individual fact about a person, place, thing, or event. 432
character-based report A character-based report is created using a single mono-spaced character set. 351

chargeback method A technique that uses accounting entries to allocate the indirect costs of running the IT department. Most organizations adopt one of four chargeback methods: no charge, a fixed charge, a variable charge based on resource usage, or a variable charge based on volume. 673
charts, 78–79, 105–106, 150, 341, 511, 513
chat room A chat room, also called a channel, is an online meeting place where users can interact and converse in real time. 705
check box A check box is used to select one or more choices from a group. Selected options are represented by a check mark, or an X. 348
child In inheritance, a child is the object that derives one or more attributes from another object, called the parent. 216, 258
child diagram A child diagram is the lower-level diagram in an exploded data flow diagram.
  balancing and, 214–215
  described, 211
CIA triangle The three main elements of system security: confidentiality, integrity, and availability. 589, 590
cipher codes Cipher codes use a keyword to encode a number. A retail store, for example, may use a 10-letter word, such as CAMPGROUND, to code wholesale prices, where the letter C represents 1, A represents 2, and so on. Thus, the code, GRAND, would indicate that the store paid $562.90 for the item. 424
Cisco, 32, 481, 531–532
class A term used in object oriented modeling to indicate a collection of similar objects.
  described, 24
  O-O design and, 25
  overview, 256–257
  relationships, 258
  sequence diagrams and, 264
class diagram A class diagram represents a detailed view of a single use case, shows the classes that participate in the use case, and documents the relationship among the classes. 262–263
clicks to close The average number of page views to accomplish a purchase or obtain desired information. 432
clickstream storage Recording Web visitor behavior and traffic trends for later data mining use. 432
clients Workstations that users interact with in a client/server design. These workstations, or computers, are supplied data, processing services, or other support from other computers, called servers.
  LANs and, 460–461
  system architecture and, 459–461
client/server architecture Generally refers to systems that divide processing between one or more networked clients and a central server. In a typical client/ server system, the client handles the entire user interface, including data entry, data query, and screen presentation logic. The server stores the data and provides data access and database management functions. Application logic is divided in some manner between the server and the clients. 395, 400–401, 427
  described, 461
  styles, 463
  system architecture and, 461–467
closed-ended questions Questions that limit or restrict the range of responses. Used in the interview process when specific information or fact verification is desired. 160
cloud computing An overall online software and data environment in which applications and services are accessed and used through an Internet connection rather than on a local computer; refers to the cloud symbol for the Internet. 289, 470–471
COBOL, 651
code A set of letters or numbers that represents a data item. Codes can be used to simplify output, input, and data formats. 422–426, 433–434, 523–525
code generator A code generator, also called an application generator, allows you to develop computer programs rapidly by translating a logical model directly into code. 523–524
code review A code review, or structured walkthrough, is a review of a project team member's work by other members of the team to spot logic errors. Generally, systems analysts review the work of other systems analysts, and programmers review the work of other programmers, as a form of peer review. Structured walkthroughs should take place throughout the SDLC and are called requirements reviews, design reviews, code reviews, or testing reviews, depending on the phase in which they occur. 114
Cognetics Corporation, 343
cohesion Cohesion measures a module's scope and processing characteristics. A module that performs a single function or task has a high degree of cohesion, which is desirable.
  described, 516, 517
  object-oriented, 520
color, in user interface design, 347
columns, format of, 355
combination check A type of data validation check that is performed on two or more fields to ensure that they are consistent or reasonable when considered together. Even though all the fields involved in a combination check might pass their individual validation checks, the combination of the field values might be inconsistent or unreasonable. 368
combination key Sometimes it is necessary for a primary key to consist of a combination of fields. In that case, the primary key is called a combination key, composite key, concatenated key, or multi-valued key. 402
command. *See* message
command button Command buttons initiate an action such as printing a form or requesting Help. 348
common field An attribute that appears in more than one entity. Common fields can be used to link entities in various types of relationships. 402
communication(s)
  oral, 639–644
  skills, 31, 644
  strategies, 632–633
  tools, 630–647
  written, 633–639
Compaq, 292
composite key Sometimes it is necessary for a primary key to consist of a combination of fields. In that case, the primary key is called a combination key, composite key, concatenated key, or multi-valued key. 402
computer output to microfilm (COM) Scanning and storing images of paper documents. Often used by large firms to provide high-quality records management and archiving. 357
computer resources committee A group of key managers and users responsible for evaluating systems requests. The term "systems review committee" is also used. 65
computer-aided software engineering (CASE) A technique that uses powerful programs called CASE tools to provide an overall framework for systems development and support a wide variety of design methodologies, including structured analysis and object-oriented analysis. Also referred to as computer-aided systems engineering. 20
computer-aided systems engineering (CASE) A technique that uses powerful programs called CASE tools to provide an overall framework for systems development and support a wide variety of design methodologies, including structured analysis and object-oriented analysis. Also referred to as computer-aided software engineering. 20
Computrace, 596
concatenated key Sometimes it is necessary for a primary key to consist of a combination of fields. In that case, the primary key is called a combination key, composite key, concatenated key, or multi-valued key. 402
concurrent task If tasks can be completed at the same time they are said to be concurrent, or parallel. 111
condition A specified action or state in a structure chart.
  adding, 517–518
  decision tables with, 226–227
  described, 515
confidentiality One of the three main elements of system security: confidentiality, integrity, and availability (CIA). Confidentiality protects information from unauthorized discloser and safeguards privacy. 589, 590
configuration management (CM) A process for controlling changes in system requirements during the development phases of the SDLC. Configuration management also is an important tool for managing system changes and costs after a system becomes operational. 582
connect time The total time that a user is connected actively to a remote server. Some Internet service providers use this as a basis for charges. 673
constraint A constraint or requirement is a condition that the system must satisfy or an outcome that the system must achieve.
  described, 74
  development strategies and, 295
  examples of, 75
  personnel, 302
  risk management and, 108–109
construction phase A phase that focuses on program and application development tasks similar to the SDLC. 147
content The information actually contained in a Web page. 691
context diagram A top-level view of an information system that shows the boundaries and scope.
  described, 209
  drawing, 208–209, 210
context-sensitive A feature that is sensitive to the current conditions when it is invoked. For example, context-sensitive help offers assistance for a task in progress. 345, 346
contingency plans, 123
continuous backup A real-time streaming backup method that records all system activity as it occurs. 607, 608
control(s)

requirements modeling and, 154–155
risk management and, 114–115
stronger, systems requests for, 60
control break A control break usually causes specific actions to occur, such as printing subtotals for a group of records. 354
control break report A detail report that focuses on control breaks. 354
control couple In a structure chart, a control couple shows a message, also called a flag, which one module sends to another. 515
control field A control field controls report output. For example, when the value of a control field changes, a control break could occur automatically. 354
control field order In a control break report, the records are arranged or sorted in the same order as the control fields. 354
control module In a structure chart, a control module is a higher-level module that directs lower-level modules, called subordinate modules. 514
control structures Control structures, also called logical structures, serve as the building blocks for a process. Control structures have one entry and exit point. They may be completed in sequential order, as the result of a test or condition, or repeated until a specific condition changes. 224
control zone The control zone contains codes, identification information, numbers, and dates that are used for storing completed forms. 360
copyright issues, 691–592
Corel, 297, 537
corporate culture A set of beliefs, rules, traditions, values, and attitudes that define a company and influence its way of doing business. 33, 633
corrective maintenance Corrective maintenance is performed to fix errors. 575, 576–577 cost. *See also* cost-benefit analysis
analyzing, 80–81
of software packages, 295
system architecture and, 455–456, 464, 465–466, 486
systems requests and, 61
cost center An element that generates charges with no offsetting credits. 673
cost-avoidance benefits Expenses that would be necessary if the new system is not installed. Examples include handling the work with existing staff, and not replacing existing hardware or software. 674
cost-benefit analysis The process of comparing the anticipated costs of an information system to the anticipated benefits.
business case analysis and, 80
checklist, 300
described, 674
development strategies and, 299–300
overview, 299, 674–684
performing, 307
requirements modeling and, 155–156
system architecture and, 465–466
coupling Coupling measures relationships and interdependence among modules. 516–518, 520
crawler Search engines use a specialized computer program called a spider or crawler that travels from site to site indexing, or cataloging, the contents of the pages based on keywords. 693
credentials Credentials include formal degrees, diplomas, or certificates granted by learning institutions to show that a certain level of education has been achieved successfully. 32, 35, 318, 610, 611, 612
critical path A series of events and activities with no slack time. If any activity along the critical path falls behind schedule, the entire project schedule is similarly delayed. As the name implies, a critical path includes all activities that are vital to the project schedule. 113–114
Critical Path Method (CPM) The Critical Path Method (CPM) was developed by private industry, and shows a project as a network diagram. The activities are shown as vectors, and the events are displayed graphically as nodes. Although CPM developed separately from the Program Evaluation Review Technique (PERT), the two methods are essentially identical. 105
critical risk When risks are categorized and prioritized, critical risks (those with the highest vulnerability and impact ratings) head the list. 591
critical success factors Vital objectives that must be achieved for the enterprise to fulfill its mission. 57
critical thinking skills The ability to compare, classify, evaluate, recognize patterns, analyze cause and effect, and apply logic. Such skills are valued in the IT industry. 31
crow's foot notation A type of cardinality notation. It is called crow's foot notation because of the shapes, which include circles, bars, and symbols, that indicate various possibilities. A single bar indicates one, a double bar indicates one and only one, a circle indicates zero, and a crow's foot indicates many. 408, 409
Crystal Reports, 350–351
customer Primary user of a system, service, or product. *See also* customer relationship management (CRM)
business case analysis and, 63
use of the term, 520
customer relationship management (CRM) Many companies implement CRM systems that integrate all customer-related events and transactions including marketing, sales, and customer service activities. 63, 454–455
cutover phase A phase that resembles the final tasks in the SDLC implementation phase, including data conversion, testing, changeover to the new system, and user training. 147
cyberterrorism, 592. *See also* terrorism
Dartmouth University, 292
dash (-), 227–228, 229
data The raw material or basic facts used by information systems.
analyzing, 78
business case analysis and, 62, 78
considerations for systems design, 313–314
control, 435–436
deleting, 345
described, 7
duplication, 314
logging, 313
overview, 9
storage, 430–435
verifying, 313
data capture The identification and recording of source data. 364
data conversion During data conversion, existing data is loaded into the new system. Depending on the system, data conversion can be done before, during, or after the operational environment is complete. 543, 544
data couple In a structure chart, a data couple shows data that one module passes to another. 515
data dictionary A central storehouse of information about a system's data.
analyzing, 518
described, 217
overview, 217–224
reports, 223–224
data element A single characteristic or fact about an entity. A data element, field, or attribute is the smallest piece of data that has meaning within an information system. For example, a Social Security number or company name could be examples of a data element. The term, data item, is also used. 217, 219, 432–433
data entry The process of converting source data into computer-readable form and entering it into the information system. 313, 314, 346, 363–365
described, 363
user interface design and, 343, 347, 348, 363–365
data flow A path for data to move from one part of the information system to another. 202–203, 206
data flow diagram (DFD) Diagram that shows how the system stores, processes, and transforms data into useful information. 21–22, 151, 202
balancing and, 212, 214–215
creating sets of, 206–217
data dictionaries and, 217–224
database design and, 426
described, 200
development strategies and, 314
guidelines for, 206–207
leveling and, 212–217
reviewing, 517
symbols, 200–202
system architecture and, 486
system implementation and, 511, 512, 517
data frames Traffic on a computer network consists of data frames. 480–481
data integrity Refers to the validity of data. Data integrity can be compromised in a number of ways: human errors when data is entered, errors that occur when data is transmitted from one computer to another, software bugs or viruses, hardware malfunctions, such as disk crashes and natural disasters, such as fires and floods. 394, 691–592
data item The smallest piece of data that has meaning within an information system. For example, a Social Security number or company name could be examples of a data element. The terms data, element and field are used interchangeably. 217
Data link layer, 477
data manipulation language (DML) A data manipulation language (DML) controls database operations, including storing, retrieving, updating, and deleting data. Most commercial DBMSs, such as Oracle and IBM's DB/2, use a DML. 398
data mart A data mart is designed to serve the needs of a specific department, such as sales, marketing, or finance. Each data mart includes only the data that users in that department require to perform their jobs. 431
data mining Data mining software looks for meaningful patterns and relationships among data. For example, data mining software could help a consumer products firm identify potential customers based on their prior purchases. 431, 432
data model A data model describes data structures and design. 198–247

data processing center A central location where systems perform all data input and output. Data processing centers were common in 1960s-style mainframe architecture design. 459
data redundancy Data redundancy occurs when data common to two or more information systems is stored in several places. Data redundancy requires more storage space, and maintaining and updating data in several locations is expensive.
controlled, 395
database design and, 394, 395, 410
described, 394
normalization and, 410
data replication Data replication means that in normal operating conditions, any transaction that occurs on the primary system must automatically propagate to the hot site. 609
data repository A symbol used in data flow diagrams to represent a situation in which a system must retain data because one or more processes need to use that stored data at a later time. Used interchangeably with the term, data store. 203–205, 221–222
data security Data security protects data from loss or damage and recovers data when it is lost or damaged. 371, 372
data store A symbol used in data flow diagrams to represent a situation in which a system must retain data because one or more processes need to use that stored data at a later time. Used interchangeably with the term, data repository. 203–205, 221–222
data structure A meaningful combination of related data elements that is included in a data flow or retained in a data store. A framework for organizing and storing data. 392
data type check A type of data validation check that is used to ensure that a data item fits the required data type. For example, a numeric field must have only numbers or numeric symbols, and an alphabetic field can contain only the characters A through Z or the characters a through z. 367
data validation rule A data validation rule improves input quality by testing the data and rejecting any entry that fails to meet specified conditions. 366, 367, 368
data warehouse An integrated collection of data that can support management analysis and decision making. 425–426, 430–431
database(s). *See also* database design
connecting, to the Web, 400–401
punched card technology and, 5
system architecture and, 463
database administration Database administration involves database design, management, security, backup, and user access, and is usually performed by members of the IT department. 29
database administrator (DBA) A database administrator (DBA) typically manages a database management system (DBMS). The DBA assesses overall requirements and maintains the database for the benefit of the entire organization rather than a single department or user.
described, 395
overview, 397
security and, 396
database design
concepts, 392–396
data control and, 435–436
data stores and, 430–435
database models and, 427–430
normalization and, 410–422
overview, 390–451
terminology, 401–405
using codes during, 424–426
Web-based design, 398–401
database management system (DBMS) A collection of tools, features, and interfaces that enables users to add, update, manage, access, and analyze data in a database. 392–396, 544
data control and, 435–436
overview, 395–396
security and, 396
system architecture and, 456
database programmer A person who focuses on creating and supporting large-scale database systems. 579
database servers, 400, 463
dates, storing, 434
DBMS (database management system). *See* database management system (DBMS)
DDBMS (distributed database management system). *See* distributed database management system (DDBMS)
decimal point (.), 213, 219, 364
decision table A table that shows a logical structure, with all possible combinations of conditions and resulting actions. 226–229, 513
decision tree A graphical representation of the conditions, actions, and rules found in a decision table. 230, 513
decomposing Another way of conveying a process or system that has been broken down from a general, top-level view to more detail. The terms, exploded and partitioned, also can be used. 213. *See also* leveling
deep Web The terms invisible Web, hidden Web, or deep Web, are used to describe this valuable information source, which includes numerous text, graphics, and data files stored in collections that are unreachable by search engines. 693, 699–701
default A value that a system displays automatically. 219, 312, 344, 364
defect tracking software System developers use defect tracking software, sometimes called bug tracking software, to document and track program defects, code changes, and replacement code, called patches. 529
deliverable A polished, deliverable product, suitable for its intended use. End products or deliverables often coincide with the completion of each SDLC phase. 22
denial of service (DOS) An online attack that occurs when an attacking computer makes repeated requests to a service or services running on certain ports. 593, 599, 600
dependent task A task is said to be dependent when it has to be completed in a serial sequence. 111, 112, 113
deployment team The deployment team installs and configures workstations. 29
derivation codes Derivation codes combine data from different item attributes, or characteristics, to build the code. Most magazine subscription codes are derivation codes. 424
description and comments section, of documentation, 220
design prototyping Prototyping of user requirements, after which the prototype is discarded and implementation continues. Also called throwaway prototyping. 315, 316
design review A design review, or structured walkthrough, is a review of a project team member's work by other members of the team. Generally, systems analysts review the work of other systems analysts, and programmers review the work of other programmers, as a form of peer review. Structured walkthroughs should take place throughout the SDLC and are called requirements reviews, design reviews, code reviews, or testing reviews, depending on the phase in which they occur. 114
design walkthrough A session with users to review the interface with a cross-section of people who will work with the new system. This is a continuation of the modeling and prototyping effort that began early in the systems development process. 525
desk checking The process of reviewing the program code to spot logic errors, which produce incorrect results. 525
detail line Each line of printed output in a detail report is called a detail line. 352, 355–356
detail report A detail report produces one or more lines of output for each record processed. 352, 354, 355–356
developmental costs Costs incurred only once, at the time a system is developed or acquired. Examples include salaries of people involved in system development or initial user training. 672–673
development strategies
impact of the Internet on, 286–289
in-house options, 293–298
outsourcing and, 290
overview, 284–332
recommendations for, preparing, 307–308
role of the systems analyst in, 298–299
software development trends and, 317–318
DFD. *See* data flow diagram (DFD)
diagram 0 A diagram depicting the first level of detail below the initial context diagram. Diagram 0 (zero) zooms in on the context diagram and shows major processes, data flows, and data stores, as well as repeating the external entities and data flows that appear in the context diagram.
balancing and, 214–215
overview, 209–212
dialog box A dialog box allows a user to enter information about a task that a system will perform. 348
differential backup Backup that backs up only the files that have changed since the last full backup. 607, 608
digest Digest describes the format of a mailing list. 705
digital audio, 358
digital images, 358
digital video, 358
dimensions Dimensions, or characteristics, might include the time, customer, and sales representative in a consumer products data warehouse. By selecting values for each characteristic, a user can obtain multidimensional information from the stored data. 431
direct costs Direct costs can be associated with the development of a specific system. Examples include the salaries of project team members and the purchase of hardware that is used only for the new system. 672
direct cutover The direct cutover approach causes the changeover from the old system to the new system to occur immediately when the new system becomes operational. 544, 545
disaster recovery plan A disaster recovery plan consists of an

overall backup and recovery plan. 607
discretionary projects Projects where management has a choice in implementing them are called discretionary projects. For example, creating a new report for a user is an example of a discretionary project. 70
diskless workstation A network terminal that supports a full-featured user interface, but limits the printing or copying of data, except to certain network resources that can be monitored and controlled more easily. 371
distributed systems Company-wide systems that connect one or more LANs or WANs are called distributed systems. The capabilities of a distributed system depend on the power and capacity of the underlying data communication network. 460
distributed database management system (DDBMS) A system for managing data stored at more than one location. Using a DDBMS offers several advantages: data stored closer to users can reduce network traffic; the system is scalable, so new data sites can be added without reworking the system design; and with data stored in various locations, the system is less likely to experience a catastrophic failure. A potential disadvantage of distributed data storage involves data security. It can be more difficult to maintain controls and standards when data is stored in various locations. 467–468
distributed denial of service (DDOS) A service attack involving multiple attacking computers that can synchronize DOS attacks on a server. 599
diverging data flow A data flow in which the same data travels to two or more different locations. 211
DNS poisoning, 593
document review A review of baseline documentation. A useful fact-finding technique that helps an analyst understand how the current system is supposed to work. 77, 164
documentation Documentation explains a system, helps people interact with it, and includes program documentation, system documentation, operations documentation, and user documentation.
  business case analysis and, 77
  data stores and, 221–222
  data dictionaries and, 218–222
  described, 528
  interviews and, 162–163
  overview, 170–174
  requirements modeling and, 170–174
  system implementation and, 528–533
  user interface design and, 342
domain The set of values permitted for a data element. 220
DOS attack. *See* denial of service (DOS)
dot-com (.com) Company that bases its primary business on the Internet, rather than using traditional business channels. Internet-dependent is also used to describe this type of firm. 12
drop-down list box A drop-down list box displays the current selection; when the user clicks the arrow, a list of the available choices displays. 348
dumpster diving Raiding desks or trash bins for valuable information. 593, 606
duration The amount of time it will take to complete a task. 110
eBay, 12, 13
EBCDIC A data storage method used on most mainframe computers. 433
Eclipse IDE, 523
e-commerce (electronic commerce) Transactions (e.g. buying and selling of goods and information) that occur on the internet. Includes both business-to-consumer, and business-to-business. Used interchangeably with I-commerce.
  described, 13
  service providers, 469–470
  solutions, developing, 468–469
  system architecture and, 457–458, 468–469
economic feasibility Economic feasibility is achieved if the projected benefits of the proposed system outweigh the estimated costs involved in acquiring, installing, and operating it. 68, 670
economically useful life The period between the beginning of systems operation and the point when operational costs are rapidly increasing. 675
economy of scale The inherent efficiency of high-volume processing on larger computers. Database design allows better utilization of hardware. If a company maintains an enterprise-wide database, processing is less expensive using a powerful mainframe server instead of using several smaller computers. 395
education, of systems analysts, 30–32. *See also* e-learning
Educational Testing Service (ETS), 32
e-learning Online learning, also referred to as e-learning, is a term that refers to the delivery of educational or training content over the public Internet or intranet. 696–698. 710, 711
electronic data interchange (EDI) A process that involves the computer-to-computer transfer of data between companies. 14, 63, 400
electronic product code (EPC) Electronic product code (EPC) technology uses RFID tags to identify and monitor the movement of each individual product, from the factory floor to the retail checkout counter. 62
electronic proof of delivery (EPOD) Using EPOD, a supplier uses RFID tags on each crate, case, or shipping unit to create a digital shipping list. 63
e-mail, 357–358
empowerment A trend that places more responsibility and accountability throughout all levels of an organization. 19
encapsulation The idea that all data and methods are self-contained, as in a black box. 256
encrypted Data that is encrypted is coded so that only those with the required authorization can access the data. 372, 597
Encrypting File System (EFS) A Microsoft file system that can be used to encrypt and limit access to data. EFS can be enabled or disabled at the folder or document level. EFS is fully implemented in Windows 7. 603
encryption A process where data is coded (converted into unreadable characters) so that only those with the required authorization can access the data (usually via decoding software). 435, 603
  database design and, 435
  described, 60
  overview, 372
end product A polished, deliverable product, suitable for its intended use. End products or deliverables often coincide with the completion of each SDLC phase. 22
end users Employees, customers, vendors, and others who interact with an information system. 10. *See also* users
EndNote, 701
engaged listening The ability to really concentrate on what someone is saying, and avoid the temptation to hear what is expected. Also includes noticing non-verbal communication. 162
enhancement A new feature or capability. 576, 577
enterprise applications Examples of company-wide applications, called enterprise applications, include order processing systems, payroll systems, and company communications networks. 8
enterprise computing Information systems that support company-wide data management requirements, such as airline reservation, or credit card billing systems. 15
enterprise resource planning (ERP) A process that establishes an enterprise-wide strategy for IT resources. ERP defines a specific architecture, including standards for data, processing, network, and user interface design. 15, 454–455
  development strategies and, 302
  IBM WebSphere and, 457
entity A person, place, thing, or event for which data is collected and maintained. For example, an online sales system may include entities named CUSTOMER, ORDER, PRODUCT, and SUPPLIER. 205, 401
  alternate name, 223
  balancing and, 214–215
  database design and, 401
  documenting, 223
  external, 205
  input data flow, 223
  name, described, 223
  output data flow, 223
  symbol, 205
entity-relationship diagram (ERD) A graphical model of the information system that depicts the relationships among system entities.
  creating, 426
  described, 406
  drawing, 406
  overview, 405–410, 512
  system implementation and, 511
environment A specific hardware and software configuration that supports IT business goals such as hardware connectivity and easy integration of future applications. Also called a platform. 454. *See also* software platform
ergonomics Ergonomics describes how people work, learn, and interact with computers. 343
Ergosoft Laboratories, 337–338
ERP (enterprise resource planning). *See* enterprise resource planning (ERP)
errors. *See also* testing
  business case analysis and, 62
  development strategies and, 317
  O-O analysis and, 256
  user interface design and, 343, 345, 346, 366–368
ESS (Extended Service Set). *See* Extended Service Set (ESS)
evaluation and selection team An evaluation and selection team is involved in selecting hardware and software, and includes systems analysts and users. A team approach ensures that critical factors are not overlooked and that a sound choice is made. 299
evaluation model A technique that uses a common yardstick to measure and compare vendor ratings. 303, 304

event An event, or milestone, is a reference point that marks a major occurrence. Events are used to monitor progress and manage a project. 106
event-driven programming language Instead of writing a series of sequential instructions, a programmer defines the actions that the program must perform when certain events occur. Also called non-procedural. 651
Excel (Microsoft), 78, 171, 297, 587–588, 678
exception report An exception report displays only those records that meet a specific condition or conditions. Exception reports are useful when the user wants information only on records that might require action, but does not need to know the details. 352, 353
existence check A type of data validation check that is used for mandatory data items. For example, if an employee record requires a Social Security number, an existence check would not allow the user to save the record until he or she enters a suitable value in the SSN field. 367
expert systems Systems that simulate human reasoning by combining a knowledge base and inference rules that determine how the knowledge is applied. Is sometimes used interchangeably with knowledge management systems. 16–17
exploding A diagram is said to be exploded if it "drills down" to a more detailed or expanded view. 213
exploit An attack that takes advantage of a system vulnerability, often due to a combination of one or more improperly configured services. 591
exporting The process of moving data from one application or environment to another. 544
Expression Studio (Microsoft), 317
Extended Service Set (ESS) A wireless network configuration made up of two or more Basic Service Set (BSS) networks, which allows wireless clients to roam from BSS to BSS. 483, 484
extensibility Refers to a system's ability to expand, change, or downsize easily to meet the changing needs of a business enterprise. Also known as scalability
  described, 155, 395, 456
  development strategies and, 288
  requirements modeling and, 155
extensible markup language (XML) XML is a flexible data description language that allows Web-based communication between different hardware and software environments.
  described, 14
  development strategies and, 318
  risk management and, 118
  system implementation and, 523
extranet An extension of a company intranet that allows access by external users, such as customers and suppliers. 400
Extreme Programming (XP), 26, 512, 520–523
Facebook, 289, 702
fact-finding, 75–79, 156–159, 164–170
FAQs (frequently asked questions) FAQs are a common method of providing guidance on questions that users are likely to ask. 531, 708
  described, 703
  help desks and, 573
fast-find features, 344
fat client A fat client design, also called a thick client design, locates all or most of the application processing logic at the client. 464
fault management The timely detection and resolution of operational problems. Fault management includes monitoring a system for signs of trouble, logging all system failures, diagnosing the problem, and applying corrective action. 585
fault tolerant A system or application is said to be fault tolerant if the failure of one component does not disable the rest of the system or application. 607
faxback A system that allows a customer to request a fax using e-mail, the company Web site, or a telephone. The response is transmitted in a matter of seconds back to the user's fax machine. 358
feasibility study An initial investigation to clearly identify the nature and scope of the business opportunity or problem. Also called a preliminary investigation. 23, 66–69, 80
Federal Trade Commission, 605
feed reader Client software or Web application that aggregates syndicated Web content such as blogs, podcasts, and RSS feeds in a single location for easy viewing. Also called aggregator or RSS reader. 704
feedback, providing, to users, 342, 346
field A single characteristic or fact about an entity. A field, or attribute, is the smallest piece of data that has meaning within an information system. For example, a Social Security number or company name could be examples of a field. The terms data element, data item, and field are used interchangeably.
  captions, 364
  database design and, 398, 402, 410–412, 432–433
  described, 402
  logical storage and, 432–433
  normalization and, 410–412
  order, 355
  repeating, 356
file Each file or table contains data about people, places, things, or events that interact with the information system.
  processing, overview, 393–394
  security, 603
file server In a file server design, also called a file sharing architecture, an individual LAN client has a copy of the application program, but not the data, which is stored on the server. The client requests a copy of the data file and the server responds by transmitting the entire file to the client. After performing the processing, the client returns the data file to the server where it is stored. 460, 462, 465
file sharing architecture In a file sharing architecture, an individual LAN client has a copy of the application program, but not the data, which is stored on the server. The client requests a copy of the data file and the server responds by transmitting the entire file to the client. After performing the processing, the client returns the data file to the server where it is stored. 460
File Transfer Protocol (FTP) A familiar example of a TCP/IP protocol. FTP provides a reliable means of copying files from one computer to another over a TCP/IP network, such as the Internet or an intranet. 477, 601
file-oriented system A file-oriented system, also called a file processing system, stores and manages data in one or more separate files. 392
fill-in form Form used to collect data on the Internet or a company intranet. 167, 171, 697
financial analysis tools, 668–687
finish day/date The time that task is scheduled to be finished. 110, 116–117
firewall The main line of defense between a local network, or intranet, and the Internet. 599, 600
FireWire, 371
first normal form (1NF) A record is said to be in first normal form (1NF) if it does not contain a repeating group (a set of data items that can occur any number of times in a single record). 412–418
fishbone diagram Also called a Ishikawa diagram. It is an analysis tool that represents the possible causes of a problem as a graphical outline. 73
fixed charge method With this method, the indirect IT costs are divided among all the other departments in the form of a fixed monthly charge. 673
fixed costs Costs that are relatively constant and do not depend on a level of activity or effort. Many fixed costs recur regularly, such as salaries and hardware rental charges. 672
fixed fee model A service model that charges a set fee based on a specified level of service and user support. 291
Flesch Reading Ease score The Flesch Reading Ease score measures the average sentence length and the average number of syllables per word and rates the text on a 100-point scale. 634
Flesch-Kincaid Grade Level score The Flesch-Kincaid Grade Level score uses the same variables as the Flesch Reading Ease score, but in a different formula that produces a rating keyed to a U.S. grade-school level. 634
flexibility, providing, 312
flowchart A diagram used to describe program logic that represents logical rules and interaction graphically using a series of symbols connected by arrows. Flowcharts can be useful in visualizing modular program designs. 513
focus In a sequence diagram, a focus indicates when an object sends or receives a message. It is indicated by a narrow vertical rectangle that covers the lifeline. 265
fonts, for presentations, 641
foreign key A field in one table that must match a primary key value in another table in order to establish the relationship between the two tables. 403, 404
form(s)
  database design and, 400–401
  security and, 371
  specialized, 359
  wizard, 298
form filling A very effective method of online data entry where a blank form that duplicates or resembles the source document is completed on the screen. The user enters the data and then moves to the next field. 364
form layout The physical appearance and placement of data on a form. Form layout makes the form easy to complete and provides enough space, both vertically and horizontally, for users to enter the data. 360
form painter An interactive tool that helps you design a custom interface, create screen forms, and handle data entry format and procedures. Also called a screen generator. 297, 342, 654, 655

forward engineering Forward engineering means translating business processes and functions into applications. 654
four-model approach Using the four-model approach means that a physical model of the current system, a logical model of the current system, a logical model of the new system, and a physical model of the new system are all developed. 231
fourth-generation environment Term used to describe an efficient software development environment that is created through the use of powerful CASE tools, application generators, report generators, screen generators, and fourth-generation languages (4GLs) during prototyping. 316
fourth-generation language (4GL) Non-procedural programming languages that are especially valuable in implementing an object-oriented system design. 316, 651
framework Conceptual structure that organizes and documents system development tasks. 661
frequency, of records, 222
FTP (File Transfer Protocol). *See* File Transfer Protocol (FTP)
full backup A complete backup of every file on the system. 607, 608
functional baseline The functional baseline is the configuration of the system documented at the beginning of the project. It consists of all the necessary system requirements and design constraints. 583
functional decomposition diagram (FDD) A top-down representation of business functions and processes. Also called a structure chart. 150, 341, 511
functional primitive A process that consists of a single function that is not exploded further. The logic for functional primitives is documented in a data dictionary process description. 211
functionally dependent Functional dependence is an important concept for understanding the second normal form (2NF). The field X is said to be functionally dependent on the field Y if the value of X depends on the value of Y. For example, an order date is dependent on an order number; for a particular order number, there is only one value for the order date. In contrast, the product description is not dependent on the order number. For a particular order number, there might be several product descriptions, one for each item ordered. 413
future needs, anticipating, 312
fuzzy logic An approach used in knowledge management systems that allows logical inferences to be drawn from imprecise relationships. 17
Gane and Sarson A popular symbol set used in data flow diagrams. Processes, data flows, data stores, and external entities all have a unique symbol. 200–201
Gantt chart A horizontal bar chart that illustrates a schedule. Gantt charts were developed many years ago by Henry L. Gantt as a production control technique and still are in common use. 104–106, 109, 119
garbage in garbage out (GIGO) The concept that the quality of the output is only as good as the quality of the input. 360
Gartner, Inc., 292, 299
gateway A router or other network device used to connect to a larger, dissimilar type of network, such as the Internet. 481
Gbps (gigabits per second) A bandwidth or throughput measurement. 586
global outsourcing The practice of shifting IT development, support, and operations to other countries. 292, 293
Goal Seek feature, 587–588
Google, 12, 693–694, 697, 702, 704–705
  Apps, 472
  Desktop, 605–606
  Docs, 171, 637
government regulations, 64
grammar checker A software tool that can detect usage problems and offer suggestions. 634
graphic modeling software, 171
graphical user interface (GUI) A graphical user interface (GUI) uses graphical objects and techniques that allow users to communicate with a system. A well-designed GUI can help users learn a new system rapidly, and work with the system effectively. 338, 365, 459
gray hole A process is said to be a "gray hole" if an input is obviously insufficient to generate the shown output. 203
group footer A group footer appears after the last detail line of a group. Group footers could include items such as a subtotal, an average, or a count of the records in that group. 355, 356
group header A group header appears above the first detail line of a group. 355, 356
groupware Programs that run on a company intranet that enable users to share data, collaborate on projects, and work in teams. Also called workgroup software. 17
GroupWise (Novell), 17
growth, future, estimating, 301–302
hackers, 592
hardening Making a system more secure by removing unnecessary accounts, services, and features. 601
hardware The physical layer of the information system, to include computers, networks, communications equipment, and other technology-based infrastructure.
  described, 8
  development strategies and, 295, 302
Harris Corporation, 121
hash totals Hash totals, or batch control totals, are not meaningful numbers themselves, but are useful for comparison purposes. 368
Hawthorne Effect A phenomenon where employees who know they are being observed are more productive. 165
HCI (human-computer interaction). *See* human-computer interaction (HCI)
heading zone Area of a form that usually contains the company name or logo and the title and form number. 360
help, navigating, 345
help desk A centralized resource staffed by IT professionals that provides users with the support they need to do their jobs. A help desk has three main objectives: to show people how to use system resources more effectively, to provide answers to technical or operational questions, and to make users more productive by teaching them how to meet their own information needs. 29, 572–574
  described, 297, 572
  development strategies and, 297
  outsourcing, 573
Help dialog box, 345
Hewlett-Packard, 292, 300, 470–471, 481, 537, 538, 670–671
hidden Web The terms invisible Web, hidden Web, or deep Web, are used to describe this valuable information source, which includes numerous text, graphics, and data files stored in collections that are unreachable by search engines. 693, 699–701
hierarchical network In a hierarchical network, one computer (typically a mainframe) controls the entire network. Satellite computers or servers control lower levels of processing and network devices. 478
histogram A common tool for showing the distribution of questionnaire or sampling results. It takes the form of a vertical bar chart. 171
history file In a typical file processing environment, a history file is a file copy created and saved for historical or archiving purposes. New history files, unlike new security files, do not replace the old files. 394
hits Although search engine indexes are incomplete and often dated, they are capable of delivering an overwhelming number of results, or hits. 693
horizontal application A software package that can be used by many different types of organizations. 293
horizontal system A basic system, such as an inventory or payroll package that is commonly used by a variety of companies. 8
hot site A separate IT location, which might be in another state or even another country, that can support critical business systems in the event of a power outage, system crash, or physical catastrophe. 609
HTML (Hypertext Markup Language) The language used to write Web pages for the Internet. 289, 318, 400–401
  described, 399
  system architecture and, 467
  system implementation and, 523
hub A hub is at the center of a star network. The hub is the central computer or device that manages the network. 480, 483
human-computer interaction (HCI) describes the relationship between computers and the people who use them to perform business-related tasks. HCI concepts apply to everything from a PC desktop to the main menu for a global network. 338–341
IBM (International Business Machines), 11, 124, 656–658, 662, 705
  changes in the world foreseen by, 5, 6
  DB/2, 398, 426
  history of, 4–5
  Lotus Organizer, 173
  outsourcing and, 292
  RUP and, 27
  system architecture and, 457, 466–467, 481
  training solutions, 537, 538
  user interface design and, 336, 338–340
  WebSphere, 287, 288, 289, 457, 523
I-commerce (Internet commerce) Transactions (e.g. buying and selling of goods and information) that occur on the internet. Includes both business-to-consumer, and business-to-business. Used interchangeably with e-commerce. 13. See also e-commerce (electronic commerce)
Ideas International, 296–297
identity management Controls and procedures necessary to identify legitimate users and system components. 604
IEEE (Institute of Electrical and Electronics Engineers) A

professional organization that establishes standards for telecommunications. 482–483, 598. *See also specific standards*
IEEE 802.11 A family of wireless network specifications developed by the IEEE. 482–485
802.11g An IEEE wireless network specification introduced in 2003 based on a frequency of 2.4 GHz and maximum bandwidth of 54 Mbps; compatible with and replaces 802.11b, and will likely be replaced by the 802.11n standard. 483, 485
IEEE 802.11i A security standard for Wi-Fi wireless networks that uses the WPA2 protocol, currently the most secure encryption method for Wi-Fi networks. 598
IEEE 802.11n An IEEE wireless network specification adopted in 2009 that uses multiple-input/multiple output (MIMO) technology to achieve speeds of 200+ Mbps while increasing the wireless range, and is backward-compatible with 802.11 a, b, and g. 483
IEEE 802.11y An emerging IEEE wireless networking standard that uses multiple input/multiple output (MIMO) technology to increase bandwidth and range. 483
IEEE 802.16 Specifications developed by the IEEE for broadband wireless communications over MANs (metropolitan area networks). 485
implied Boolean Logic In implied Boolean logic, symbols are used to represent Boolean operators, such as a plus sign (+) for AND, and a minus sign (?) for NOT. 697
in-house application An information system developed internally by a company's IT department. 7
in-house software An information center or help desk within the IT department responsible for providing user support and offering services such as hotline assistance, training, and guidance to users who need technical help. 293–295
incremental backup An incremental backup is faster than a full backup because it backs up only the files that have changed since the last full backup. 607, 608
Independent Service Set (ISS) A wireless networking topology in which no access point is used. Instead, wireless clients connect to each other directly. Also called peer-to-peer mode. 484
indexed search engine An indexed search engine organizes and ranks the results of a search. 694
indexing Search engines use a specialized computer program called a spider that travels from site to site indexing, or cataloging, the contents of the pages based on keywords. 693
indirect costs Indirect costs or overhead expenses cannot be attributed to the development of a particular information system. The salaries of network administrators and copy machine rentals are examples of indirect costs. 672
inference rules Rules that identify data patterns and relationships within a knowledge management system. 17
informal structure An informal structure usually is based on interpersonal relationships and can develop from previous work assignments, physical proximity, unofficial procedures, or personal relationships. 159
information Data that has been changed into a useful form of output. 7
information center (IC) An information center or help desk supports users by training them on application software. User support specialists answer questions, troubleshoot problems, and serve as a clearinghouse for user problems and solutions. 29, 287, 572, 573
information system System that combines information technology, people, and data to support business requirements. The five key components are hardware, software, data, processes, and people. 7, 17–18
information technology (IT) A combination of hardware, software, and telecommunications systems that support business operations, improve productivity, and help managers make decisions. 4–7
Information Technology Association of America (ITAA) A professional organization that sponsors seminars and training. 709
information technology (IT) community When you require IT information, you can access a huge assortment of sites and resources that can be called the information technology (IT) community. 708
Infotivity Technologies, 302, 303
InfoWorld, 168, 289, 703
infrastructure mode A wireless network configuration in which a central wireless device called an access point is used to serve all wireless clients; also called Basic Service Set (BSS). 483
inheritance A type of object relationship. Inheritance enables an object to derive one or more of its attributes from another object (e.g., an INSTRUCTOR object may inherit many traits from the EMPLOYEE object, such as hire date). 258
input Necessary data that enters a system, either manually or in an automated manner.
  described, 142
  hardware, 368–369
  requirements modeling and, 142, 154
  security, 371–372
  user interface design and, 368–369
  validation, 602
  volume reduction, 370
input control Input control includes the necessary measures to ensure that input data is correct, complete, and secure. A systems analyst must focus on input control during every phase of input design, starting with source documents that promote data accuracy and quality. 371
input masks Templates or patterns that make it easier for users to enter data. Often used in automated forms to guide an unfamiliar user. 346, 365–366
instance A specific member of a class. 251
instant messaging (IM) Instant messaging allows online users to exchange messages immediately, even while they are working in another program or application. 357–358, 706, 707
Institute of Electrical and Electronics Engineers (IEEE) A professional organization that establishes standards for telecommunications. 482–483, 598. *See also specific standards*
instruction zone The instruction zone contains instructions for completing a form. 361
intangible benefits Benefits that are difficult to measure in dollars. However, intangible benefits can be very important in the calculation of economic feasibility. An example of an intangible benefit might be a new Web site that improves a company's image. 68
intangible costs Intangible costs involve items that are difficult to measure in dollar terms, such as employee dissatisfaction. 672
integer format A type of binary storage format. The integer format requires two bytes to store numbers from 32,768 to 32,767. 434
integrated development environment (IDE) An integrated development environment (IDE) uses a built-in CASE tool that a software vendor has included to make it easier to plan, construct, and maintain a specific software product. An IDE is designed to allow the easy integration of system components with less time being spent on developing code for interactive modules. 523, 656, 656–658
integration testing Testing two or more programs that depend on each other is called integration testing, or link testing. 526
integrity One of the three main elements of system security: confidentiality, integrity, and availability (CIA). Integrity prevents unauthorized users from creating, modifying, or deleting information. 590
Intel, 11
interactive model In an interactive model planning, analysis, and design tasks interact continuously to produce prototypes that can be tested and implemented. 25
interface technology Technology that provides the operational structure required to carry out the design objectives. 343
International Organization for Standardization (ISO) A network of national standards institutes from 140 countries working in partnership with international organizations, governments, industry, business and consumer representatives. The ISO acts as a bridge between public and private sectors. 434, 509–510
Internet A worldwide network that integrates many thousands of other networks, which in turn link millions of government, business, educational, and personal users around the globe.
  -based architecture, 467–473
  -based information delivery, 357
  communication channels, 702–707
  described, 690
  development strategies and, 304–306
  impact of, 12–13, 286–289
  as a platform, concept of, 473
  research, 168–169, 690–692
  resources, overview of, 688–714
  terminology, 399–400
  user interface design and, 357–359
Internet business services (IBS) Services that provide powerful Web-based support for transactions such as order processing, billing, and customer relationship management. 291
Internet operating system Part of the Web 2.0 model, an online computing environment created by online communities and services, based on layers of shared information that can contain text, sound bytes, images, and video clips. 473
Internet Relay Chat (IRC) The chat room concept originated with Internet Relay Chat, or IRC. IRC is a multi-channel system supported by servers that enable group and individual

conversations to occur on a worldwide basis. 705
Internet-dependent Company that bases its primary business on a commercial Web site, rather than using traditional business channels. Dot-com (.com) is also used to describe this type of firm. 12
interpersonal skills "People" skills that help a systems analyst work with personnel at all organizational levels, and balance sometimes conflicting user needs. 143
Intershop, 469
interview A planned meeting during which information is obtained from another person.
conducting, 76–77
described, 159
documenting, 162–163
evaluating, 163
objectives, 159–160
preparation for, 161–162
questionnaires versus, 169
questions, 160–161
requirements modeling and, 159–164
unsuccessful, 163–164
intranet A private, company-owned network that provides Web-based access to internal users. 399–400
invisible Web The terms invisible Web, hidden Web, or deep Web, are used to describe this valuable information source, which includes numerous text, graphics, and data files stored in collections that are unreachable by search engines. 693, 699–701
IP (Internet Protocol) packets, 481
iPhone (Apple), 173–174
IRC IRC, or Internet Relay Chat, is a multi-channel system supported by servers that enable group and individual conversations to occur on a worldwide basis. 705
Ishikawa diagram Also called a fishbone diagram. It is an analysis tool that represents the possible causes of a problem as a graphical outline.
ISO (International Organization for Standardization). *See* International Organization for Standardization (ISO)
ISO 90003:2004 A set of guidelines established and updated by the International Organization for Standardization (ISO) to provide a quality assurance framework for developing and maintaining software. 510
iteration The completion of a process step that is repeated until a specific condition changes. 225
iteration cycle An agile development cycle that includes planning, designing, coding, and testing one or more features based on user stories. 522
iteration planning meeting In agile development, a meeting held at the beginning of each iteration cycle to break down user stories into specific tasks that are assigned to team members. 522
iterative An adaptive method typically uses a spiral development model, which builds on a series of iterations. 25
Java, 25, 318, 651
O-O analysis and, 250
system architecture and, 457
system implementation and, 523
JDBC (**Java database connectivity**) JDBC enables Java applications to exchange data with any database that uses SQL statements and is JDBC-compliant. 398
job titles, 33
Johnson, Jim, 102
joint application development (**JAD**) A popular systems development technique that uses a cross-matrixed task group of users, managers and IT professionals that work together to gather information, discuss business needs, and define the new system requirements. 26–27, 58, 143–145
just-in-time (**JIT**) The exchange or delivery of information when and where it is needed. For example, just-in-time inventory systems rely on computer-to-computer data exchange to minimize unnecessary inventory. 63
Karat, Clare-Marie, 340–341
Kbps (**kilobits per second**) A bandwidth or throughput measurement. 586
key fields Key fields are used during the systems design phase to organize, access, and maintain data structures. The four types of key fields are primary keys, candidate keys, foreign keys, and secondary keys. 402–404
Keynote (Apple), 171
keystroke logger A device that can be inserted between a keyboard and a computer to record keystrokes. 594
keywords Words used by a spider to catalog or index pages from Web sites. 693
knowledge base A large database that allows users to find information by clicking menus, typing keywords, or entering text questions in normal phrases. 17
knowledge management systems Systems that simulates human reasoning by combining a knowledge base and inference rules that determine how the knowledge is applied. Is sometimes used interchangeably with expert systems. 16–17
knowledge workers Includes professional staff members such as systems analysts, programmers, accountants, researchers, trainers, and human resource specialists. 19
Kyocera, 173
LAN. *See* local area network (LAN)
language compilers, 525
leading questions Questions that suggest or favor a particular reply. 160
legacy data Data associated with an older, less technologically advanced legacy system. 462
legacy systems Term used to describe older systems that are typically less technologically advanced than currently available systems.
database design and, 392–394
described, 9, 457
development strategies and, 295
system architecture and, 457, 462, 466
length The maximum number of characters for an alphabetic or character data element, or the maximum number of digits and number of decimal positions for a numeric data element. 219
letters, tips for writing, 634–635
leveling The process of drawing a series of increasingly detailed diagrams to reach the desired level of detail. 212–217
library module In a structure chart, a library module is a module that is reusable and can be invoked from more than one point in the chart. 514
lifeline In a sequence diagram, a lifeline is used to represent the time during which the object above it is able to interact with the other objects in the use case. An x marks the end of a lifeline. 264
limit check A limit check occurs when a validation check involves a minimum or a maximum value, but not both. Checking that a payment amount is greater than zero, but not specifying a maximum value, is an example of a limit check. 367
link testing Testing two or more programs that depend on each other is called link testing, or integration testing. 526
LinkedIn, 702
Linux, 318
list box A list box displays a list of choices that the user can select. 348
list server A computer that directs e-mail to people who subscribe to, or join, a particular mailing list. 704
listserv A listserv, also called a mailing list, is similar to a newsgroup in that it provides a forum for people who want to exchange information about specific topics. 704
local area network (**LAN**) A local area network (LAN) allows the sharing of data and hardware, such as printers and scanners. Advances in data communication technology have made it possible to create powerful networks that use satellite links, high-speed fiber-optic lines, or the Internet to share data.
described, 460
file sharing architecture and, 360
protocols and, 477
routers and, 481
security, 592, 600
topology, 478, 479, 483
log Record typically kept by operating systems and applications that documents all events, including dates, times, and other specific information. Logs can be important in understanding past attacks and preventing future intrusions. 313, 602
logic errors Errors in the underlying logic that produce incorrect results. 525
logical design The logical design of an information system defines the functions and features of a system and the relationships among its components. 311
logical model A logical model shows what a system must do, regardless of how it will be implemented physically. 175, 198, 200–205, 231–232
logical operators The logical operators OR, AND, and NOT are used to create combinations of search terms to improve search success greatly. 695, 696
logical record A logical record contains field values that describe a single person, place, thing, or event. Application programs see a logical record as a set of fields, regardless of how or where the data is stored physically. 433
logical rules, 225
logical storage Refers to information as seen through a user's eyes, regardless of how or where that information is organized or stored. 432, 433
logical structures Logical structures, or control structures, serve as the building blocks for a process. Logical structures have one entry and exit point. They may be completed in sequential order, as the result of a test or condition, or repeated until a specific condition changes. 224
logical topology A view of a network that describes the way the components interact, rather than the actual network cabling and connections. 477
long integer format A type of binary storage format. The long integer format can store numbers from 2,147,483,647 to

2,147,483,647 using only four bytes of storage. 434
loop In a structure chart, a loop indicates that one or more modules are repeated. 318, 515, 517–518
looping Looping, or repetition, refers to a process step that is repeated until a specific condition changes. For example, a process that continues to print paychecks until it reaches the end of the payroll file is looping. 225
loose coupling Loose coupling means that the objects can interact, but are essentially independent. 318
loosely coupled Modules that are relatively independent. Loosely coupled modules are easier to maintain and modify, because the logic in one module does not affect other modules. 516
Lowe's, 12, 13
lower-level diagrams, 212–217
Macintosh, 341
magnetic data strip A magnetic data strip is used for automated data input. 369
mail bombing, 593
mailing list A mailing list, also called a listserv, is similar to a newsgroup in that it provides a forum for people who want to exchange information about specific topics. 704
mainframe architecture A system design where the server performs all the processing.
  client/server architecture and, comparison of, 462
  described, 458
  history of, 459
  overview, 458–459
maintenance
  management, 578–584
  requests, 580–582
  system architecture and, 464, 471
  tasks, 574–578
  tools, 588–589
maintenance activities Maintenance activities include changing programs, procedures, or documentation to ensure correct system performance; adapting the system to changing requirements; and making the system operate more efficiently. Those needs are met by corrective, adaptive, perfective, and preventive maintenance. 574
maintenance agreement A maintenance agreement specifies the conditions, charges and time frame for users to contact the vendor for assistance when they have system problems or questions. 307
maintenance expenses Maintenance expenses vary significantly during the system's operational life and include spending to support maintenance activities. 574
maintenance release A formal release of a new system version that contains a number of changes. 583
maintenance release methodology A system of numbered releases used by organizations (especially software vendors) that helps organize maintenance changes and updates. 583
maintenance team A maintenance team consists of one or more systems analysts and programmers. 578, 579–580
make or buy (build or buy) decision The choice between developing in-house software and purchasing software often is called a make or buy, or build or buy, decision. 293, 294
malware Malicious software that might jeopardize your security or privacy. 593, 601, 692
man in the middle attacks, 593
MAN (metropolitan area network) MANs (metropolitan area networks) use 802.16 standards, which are broadband wireless communications protocols. 485
managed hosting Another term for Internet business services (IBS). An operation is managed by the outside firm, or host. 291
management. *See also* managers
  information systems, described, 16
  presentation of systems analysis to, 309–310, 311
  system implementation and, 533, 549
managers. *See also* management
  interaction with, 71–72
  middle, 18–19
  preliminary investigation and, 71–72
  presenting results/recommendations to, 81
  requirements modeling and, 144
  top, 18
many-to-many relationship A type of entity relationship. A many-to-many relationship, abbreviated M:N, exists when one instance of the first entity can be related to many instances of the second entity, and one instance of the second entity can be related to many instances of the first entity. 407, 419
market basket analysis Market basket analysis can detect patterns and trends in large amounts of data. 432
master file In a typical file processing environment, a master file stores relatively permanent data about an entity. For example, a PRODUCT master file might contain one logical record for each product a company sells. 394
MAU (Multistation Access Unit), 480
Mbps (megabits per second) A bandwidth or throughput measurement. 482, 586
memory, 433
menu bar A bar of user-selectable software application options, usually located across the top of the screen. 344, 347, 348
mergers, 292
mesh network A network design in which each node connects to every other node. While this design is very reliable, it is also expensive to install and maintain. 480–481
message An object-oriented command that tells an object to perform a certain method. 255–256, 346
  described, 25, 250
  O-O design and, 25
  sequence diagrams and, 264
meta-search engine A tool that can use multiple search engines simultaneously. 692, 694
method A method defines specific tasks that an object must perform. A method describes what and how an object does something.
  described, 25, 250
  overview, 519, 254–255
  representing objects and, 253
metrics Workload measurements, also called metrics, include the number of lines printed, the number of records accessed, and the number of transactions processed in a given time period. 585
Microsoft. See also specific applications
  certifications and, 32
  development strategies and, 305, 317
  network diagrams and, 105
  outsourcing and, 292
  turnkey systems, 469
  user interface design and, 338–339, 341
Microsoft Access, 171, 298
  database design and, 405, 426, 428–430, 433
  Help screen, 345
  input masks and, 365–366
  physical storage and, 433
  referential integrity and, 405
  report design tools, 350–351
  system implementation and, 523–524
  user interface design and, 356
Microsoft Dynamics, 454–455
Microsoft Excel, 78, 171, 297, 587–588, 678
Microsoft Expression Studio, 317
Microsoft Live Meeting, 643
Microsoft Management Console (MMC) A collection tools for administering networks, computers, services, and other components. The MMC includes built-in security tools such as password and lockout policies, user rights, audit policies, and more. 590
Microsoft Office, 170–171, 293, 297, 298. *See also specific applications*
Microsoft Outlook, 173, 635, 637
Microsoft PowerPoint, 171, 537, 640–641, 643
Microsoft Project A powerful, full-featured program that holds the dominant share of the project management software market. 64, 109, 113
  described, 118
  network diagrams and, 119–120
  risk management and, 122
Microsoft Solutions Framework (MSF) A Microsoft approach to systems development. The objective of MSF is to define and analyze business requirements and provide IT solutions. 27
Microsoft Visio, 10, 19–20, 172, 481
Microsoft Visual Basic, 318, 523, 651
Microsoft Visual Studio, 317, 656–657
Microsoft Web Apps, 171
Microsoft Windows
  Azure, 472
  Event Viewer, 602
  Live MovieMaker, 541
  user interface design and, 347
Microsoft Word, 167, 171, 297
middleware Software that connects dissimilar applications and enables them to communicate and exchange data. For example, middleware can link a departmental database to a Web server that can be accessed by client computers via the Internet or a company intranet, 289, 400–401, 457, 465, 466
milestone A milestone, or event, is a reference point that marks a major occurrence. Milestones are used to monitor progress and manage a project. 106
military computers, 477, 480
mission statement A document or statement that describes the company for its stakeholders and briefly states the company's overall purpose, products, services, and values. 55–56
mission-critical system An information system that is vital to a company's operations. 7
mitigation One of four risk control strategies. Mitigation reduces the impact of a risk by careful planning and preparation. For example, a company can prepare a disaster recovery plan to mitigate the effects of a natural disaster should one occur. 122, 592
M:N A type of entity relationship. A many-to-many relationship, abbreviated M. 407, 419
mnemonic codes Mnemonic codes use a specific combination of letters that are easy to remember. Many three-character

airport codes are mnemonic codes. For example, LAX represents Los Angeles International Airport or DFW for Dallas/Ft. Worth Airport. 423
mobile device platforms, 173–174
mock-up When designing a report, you should prepare a sample report, which is a mock-up, or prototype, for users to review. The sample should include typical field values and contain enough records to show all the design features. 656
mock-up report A mock-up report is a report that contains sample field values for users to review and approve. 656
modeling A process that produces a graphical representation of a concept or process that systems developers can analyze, test, and modify. 19–20, 342
modular design A design that can be broken down into logical blocks. Also known as partitioning, or top-down design. 224, 314, 514
module A module consists of related program code organized into small units that are easy to understand and maintain. A complex program could have hundreds or even thousands of modules. 511–512, 517
Moore, Gordon, 8
Moore's Law Accurately predicted that computer processing power would double every 18 to 24 months. 7, 8
Motorola, 173
multipath design A network design that relies on multiple data paths to increase bandwidth and range, using MIMO (multiple input/multiple output) technology. 483
multiple input/multiple output (MIMO) A wireless networking technology incorporated in the IEEE 802.11n standard that uses multiple data streams and multiple antennas to achieve maximum speeds of 200+ Mbps and substantially increase wireless range over earlier standards. 483
Multistation Access Unit (MAU) A networking device that allows the physical wiring of a ring network to resemble a star pattern by internally wiring clients into a logical ring and managing data flow among clients. 480
multivalued key Sometimes it is necessary for a primary key to consist of a combination of fields. In that case, the primary key is called a combination key, composite key, concatenated key, or multivalued key. 403
MySpace, 289, 702
natural language A software feature that allows users to type commands or requests in normal English (or other language) phrases. 344, 396
net present value (NPV) The NPV of a project is the total value of the benefits minus the total value of the costs, with both the costs and benefits being adjusted to reflect the point in time at which they occur. 299, 682.
.NET Microsoft's Web-based development environment. 287, 288, 289, 317, 523, 654–658, 662
NetBeans IDE, 523
NetBIOS, 477
Netflix, 12
netiquette A term that combines the words Internet and etiquette. Web guidelines for protocol and courtesy that exist on a particular newsgroup or site. In many cases, FAQs describe the netiquette of a given newsgroup or site. 635, 636, 703
network Two or more devices that are connected for the purpose of sending, receiving, and sharing data. *See also specific types*
  black boxes and, 201–202
  cloud computing and, 289
  described, 597
  licensing issues, 482
  managers, 19
  security overview, 597–601
  software acquisition and, 301
  standards, 482–483
  Web 2.0 and, 289
network administration An IT function that includes hardware and software maintenance, support, and security. In addition to controlling user access, network administrators install, configure, manage, monitor, and maintain network applications. 29
network diagram A PERT chart also is referred to as a network diagram. 105, 119
network interface A combination of hardware and software that allows the computer to interact with the network. 597
network intrusion detection system (NIDS) Software that monitors network traffic to detect attempted intrusions or suspicious network traffic patterns, and sends alerts to network administrators. Can be helpful in documenting the efforts of attackers and analyzing network performance. 600, 601, 602
Network layer, 477
network model A network model portrays the design and protocols of telecommunications links. 476–482
network topology The way a network is configured. LAN and WAN networks typically are arranged in one of four patterns: hierarchical, bus, star, and ring. 477, 478, 483–484
neural architectures Computer and database models that aim to resemble human brain functions. 427
newsgroup The electronic equivalent of the everyday bulletin board. 305, 702, 703
newsletters Newsletters are published by numerous commercial and non-profit groups that offer membership subscriptions to users who are interested in specific topics. 703
no charge method Some organizations treat information systems department indirect expenses as a necessary cost of doing business. 673
node A physical device, wired or wireless, that can send, receive, or manage network data. 456
nondiscretionary projects Projects where no choice exists are called nondiscretionary projects. An example of such a project is adding a report required by a new federal law. 70
nonkey field Any field that is not a primary key or a candidate key is called a nonkey field. 402, 403, 416
non-procedural programming language Instead of writing a series of sequential instructions, a programmer defines the actions that the program must perform when certain events occur. Also called event-driven. 651
normalization A process by which analysts identify and correct inherent problems and complexities in their record designs. 410–422
North Carolina State University, 432
NOT The NOT operator can be used to exclude certain records. 694, 696, 697–698
notebook computers, 595–596
Novell, 32, 477, 637
n-tier The term, n-tier, indicates a multi-level design or architecture. For example, three-tier designs also are called n-tier designs, to indicate that some designs use more than one intermediate layer. 464, 465
object An object represents a real person, place, event, or transaction.
  described, 24
  managers, 19
  relationships among, described, 258
  representation of, 251–254
  state, 254
object model An object model describes objects, which combine data and processes. Object models are the end product of object-oriented analysis.
  described, 250
organization, 267
overview, 248–283
  requirements modeling and, 142–143
object-oriented (O-O) analysis Object-oriented (O-O) analysis describes an information system by identifying things called objects. An object represents a real person, place, event, or transaction. Object-oriented analysis is a popular approach that sees a system from the viewpoint of the objects themselves as they function and interact with the system. 21, 24–25, 224, 250–251, 519–520
object-oriented analysis and design (OOAD) Object-oriented analysis and design (OOAD) is used to create objects called actors, which represent the human users who will interact with the system. 663
object-oriented development (OOD) The process of translating an object model directly into an object-oriented programming language. 518
object-oriented programming languages (OOPL) Non-procedural programming languages that are especially valuable in implementing an object-oriented system design. 518–520, 651
objectives, defining, 640
observation A fact-finding technique where an analyst sees a system in action. Observation allows the verification of statements made in interviews. 164–166
obsolete A system is said to be obsolete when users no longer require its functions or when the platform becomes outmoded. 609
ODBC (open database connectivity). *See* open database connectivity (ODBC)
Office (Microsoft), 170–171, 293, 297, 298. *See also specific applications*
offshore outsourcing The practice of shifting IT development, support, and operations to other countries. 292, 293
offsiting Offsiting refers to the practice of storing backup media away from the main business location, in order to mitigate the risk of a catastrophic disaster such as a flood, fire, or earthquake. 607
one-to-many relationship A type of entity relationship. A one-to-one relationship, abbreviated 1:1, exists when exactly one of the second entity occurs for each instance of the first entity. 406, 419
one-to-one relationship A type of entity relationship. A one-to-many relationship, abbreviated 1:M, exists when one occurrence of the first entity can be related to many occurrences of the second entity, but each occurrence of the second entity can be associated with only one occurrence of the first entity. 406

online data entry A data entry method used for most business activity. The online method offers major advantages, including the immediate validation and availability of data. 369
online documentation Online documentation provides immediate help when users have questions or encounter problems. 531
online learning Online learning, also referred to as e-learning, is a term that refers to the delivery of educational or training content over the public Internet or intranet. 710, 711
online presentation A presentation delivered to an online audience, usually through a Web browser and/or a third-party application such as Cisco's WebEx or Microsoft's Live Meeting. 643, 644
online system An online system handles transactions when and where they occur and provides output directly to users. Because it is interactive, online processing avoids delays and allows a constant dialog between the user and the system. 474, 475–476
open database connectivity (ODBC) An industry-standard protocol that makes it possible for software from different vendors to interact and exchange data. 398, 544
Open Workbench Open Workbench project management software is available as free software, complete with manuals and sample projects. 118–120
open-ended questions Questions that allow for a range of answers. They encourage spontaneous and unstructured responses, and are useful in understanding a larger process. 160
open-source software Software that is supported by a large group of users and developers. 118, 318
OpenOffice.org, 171, 537
operational costs Operational costs are incurred after a system is implemented and continue while the system is in use. Examples include system maintenance, supplies, equipment rental, and annual software license fees. 574, 673
operational environment The environment for the actual system operation. It includes hardware and software configurations, system utilities, and communications resources. Also called the production environment. 534, 535
operational feasibility A system that has operational feasibility is one that will be used effectively after it has been developed. 67, 80
operational security Also called procedural security, is concerned with managerial policies and controls that ensure secure operations. 606, 607
operations documentation Operations documentation contains all the information needed for processing and distributing online and printed output. 529, 530
option button Option buttons, or radio buttons, represent groups of options. The user can select only one option at a time; a selected option contains a black dot. 348
OR The OR operator can be used when you need a wide search net. 694, 696, 697
Oracle, 290–291, 300, 398, 426
oral presentation A presentation that is presented orally and is required at the end of the preliminary investigation and again at the conclusion of the systems analysis phase. 639, 640–644
O'Reilly, Tim, 473
organization charts, 76
organizational models, 18–19
orphan An unassociated or unrelated record or field. An orphan could be created if you entered a customer order in an order table where that customer did not already exist in the customer table. Referential integrity would prevent the creation of this orphan. 404
OSI (Open Systems Interconnection) model OSI describes how data actually moves from an application on one computer to an application on another networked computer. The OSI consists of seven layers, and each layer performs a specific function. 476–477, 481
output Electronic or printed information produced by an information system. 142
output control Methods to maintain output integrity and security. For example, every report should include an appropriate title, report number or code, printing date, and time period covered. Reports should have pages that are numbered consecutively, identified as Page xx of xx, and the end of the report should be labeled clearly. 370, 371–372
output security Output security protects privacy rights and shields the organization's proprietary data from theft or unauthorized access. 370, 371–372
outsourcing The transfer of information systems development, operation, or maintenance to an outside firm that provides these services, for a fee, on a temporary or long-term basis.
  described, 290
  fees, 291
  growth of, 290–293
  issues/concerns, 291–292
  offshore/global, 292, 293
  options, identifying, 304–306
  technical support, 573
overhead expenses Overhead expenses or indirect costs cannot be attributed to the development of a particular information system. The salaries of network administrators and copy machine rentals are examples of indirect costs. 672
page footer A page footer appears at the bottom of the page and is used to display the name of the report and the page number. 355
page header A page header appears at the top of the page and includes the column headings that identify the data. 341, 355
parallel operation The parallel operation changeover method requires that both the old and the new information systems operate fully for a specified period. Data is input into both systems, and output generated by the new system is compared with the equivalent output from the old system. 545
parallel programming A practice in Extreme Programming in which two programmers work on the same task on the same computer; one drives (programs) while the other navigates (watches). 522
parameter In system design, a parameter is a value that the user enters when a query or report is run, which provides flexibility, enables users to access information easily, and costs less than hard-coding all possible report or query values. 312
parent In inheritance, a parent is the object from which the other object, the child, derives one or more attributes. 256
parent diagram The higher or more top-level diagram in an exploded data flow diagram. 211
parent process, 214–215
Pareto chart Named for a 19th century economist, a Pareto chart is drawn as a vertical bar graph. The bars, which represent various causes of a problem, are arranged in descending order, so the team can focus on the most important causes. 78
partitioning The breaking down of overall objectives into subsystems and modules. 213, 514
passive voice Passive voice refers to using sentences with the actor being the direct object. For example, "The system was designed by Tom" is in passive voice. 633
password A method of limiting access to files and databases to protect stored data.
  cracking, 593
  described, 435
  protection, overview of, 604
  social engineering attacks and, 604
patch Replacement code that is applied to fix bugs or security holes in software. 529, 576, 602
pay for performance An arrangement between a search engine company and a commercial site that boosts a sites ranking in search results in return for a fee. 693
payback analysis Payback analysis determines how long it takes an information system to pay for itself through reduced costs and increased benefits. 299, 675, 676–678, 683
payback period The time it takes to recover a system's cost. 675, 676–677
PC Magazine, 708
PCMICIA slots, 371
PDAs (personal digital assistants). *See* personal digital assistants (PDAs)
PDF (Portable Document Format), 637, 692
peer-to-peer mode A wireless networking topology in which no access point is used. Instead, wireless clients connect to each other directly. also called Independent Service Set (ISS). 484
perfective maintenance Perfective maintenance improves efficiency. 575, 577
performance System characteristics such as speed, volume, capacity, availability, and reliability. *See also* benchmark
  described, 142
  requirements modeling and, 142, 154
  system architecture and, 466–467
  systems requests for better, 60
Perl, 25, 250, 318, 523
permissions User-specific privileges that determine the type of access a user has to a database, file, or directory. Also called user rights. 435, 601, 603
person-days The amount of work that one person can complete in one day. 107
personal digital assistants (PDAs) Handheld computers that accept handwritten input or may have small keyboards. 173, 358, 485
personal information manager (PIM) A tool such as Microsoft Outlook or Lotus Organizer that helps manage tasks and schedules. Many handheld devices also are available for this function. 173
PERT/CPM The Program Evaluation Review Technique (PERT)

was developed by the U.S. Navy to manage very complex projects, such as the construction of nuclear submarines. At approximately the same time, the Critical Path Method (CPM) was developed by private industry to meet similar project management needs. The important distinctions between the two methods have disappeared over time, and today the technique is called either PERT, CPM, or PERT/CPM. 105–106, 110, 115–117, 119–120
phased operation The phased operation method allows you to implement a new system in stages, or modules. 546
phrase A phrase is more specific than an AND operator, because it specifies an exact placement of terms. 697
physical design The physical design of an information system is a plan for the actual implementation of the system. 311
Physical layer, 477
physical model A model that describes how a system will be constructed. 198, 231–232
physical record A physical record, or a block, is the smallest unit of data that is accessed by the operating system. 433
physical security, 594–597
physical storage Storage that is strictly hardware-related, because it involves the process of reading and writing binary data to physical media such as a hard drive or CD-ROM. 432, 433
physical topology, 477
pilot operation The pilot operation changeover method involves implementing the complete new system at a selected location of the company. 546
pilot site In a pilot operation, the group that uses the new system first is called the pilot site. 546
plain text Data that is not encrypted. 597
plain text passwords, 597
platform A specific hardware and software configuration that supports IT business goals such as hardware connectivity and easy integration of future applications. Also called an environment. 454
podcast A Web-based broadcast that allows a user to receive audio or multimedia files using music player software such as iTunes, and listen to them on a PC or download them to a portable MP3 player or smart phone. 358, 537, 703–704
point-of-sale (POS) The part of an information system that handles daily sales transactions and maintains the online inventory file. 475, 476
polymorphism The concept that a message gives different meanings to different objects (e.g., a GOOD NIGHT message might produce different results depending if it is received by a child or the family dog). 255
port A positive integer that is used for routing incoming traffic to the correct application on a computer. 599
port protector Network-based security application that controls access to and from workstation interfaces. 371
port scan An attempt to detect the services running on a computer by trying to connect to various ports and recording the ports on which a connection was accepted. 599
portal An entrance to a multifunction Web site. After entering a portal, a user can navigate to a destination, using various tools and features provided by the portal designer. 470, 698, 700
positive benefits Positive benefits increase revenues, improve services, or otherwise contribute to the organization as a direct result of the new information system. Examples include improved information availability, faster customer service, and higher employee morale. 674
post-implementation evaluation A post-implementation evaluation assesses the overall quality of the information system. The evaluation verifies that the new system meets specified requirements, complies with user objectives, and achieves the anticipated benefits. In addition, by providing feedback to the development team, the evaluation also helps improve IT development practices for future projects. 547, 548–549
pound sign (#), 356
power-on password A password that must be entered before the computer can be started. It prevents an unauthorized person from booting a computer by using a USB device or a CD-ROM. Also called a BIOS-level password or a boot-level password. 595
PowerPoint (Microsoft), 171, 537, 640–641, 643
predecessor task Often, two or more concurrent tasks depend on a single prior task, which is called a predecessor task. 111, 112, 113
predictive Because structured analysis is based on a detailed plan, similar to a blueprint for constructing a building, it is called a predictive approach. 22
preliminary investigation An initial investigation to clearly identify the nature and scope of the business opportunity or problem. Also called a feasibility study.
  described, 23, 71
  overview, 71–82
  planning, 72–73
present value The present value of a future dollar is the amount of money that, when invested today at a specified interest rate, grows to exactly one dollar at a certain point in the future. 681
present value analysis A technique that allows analysts to plan for future growth goals based on present value. 680, 681–683
present value tables Tables that help analysts perform value analysis. 681
Presentation layer, 477
presentation software Presentation software is used to create slides with sounds, animation, and graphics. 640, 641
presentations, 309–311, 487
pretexting Obtaining personal information under false pretenses. 604
preventive maintenance Preventive maintenance reduces the possibility of future system failure. 575, 577–578
primary key A field or combination of fields that uniquely and minimally identifies a particular member of an entity. For example, in a customer table the customer number is a unique primary key because no two customers can have the same customer number. That key also is minimal because it contains no information beyond what is needed to identify the customer. 402, 403, 411–414
priorities, setting, 69–71, 582
private key encryption A common encryption technology called public key encryption (PKE). The private key is one of a pair of keys, and it decrypts data that has been encrypted with the second part of the pair, the public key. 597
private network A dedicated connection, similar to a leased telephone line. 599
privilege escalation attack An unauthorized attempt to increase permission levels. 593, 603
probable-case estimate The most likely outcome is called a probable case estimate. 107
problems, understanding, 73
procedural A procedural language requires a programmer to create code statements for each processing step. 651
procedural security Also called operational security, is concerned with managerial policies and controls that ensure secure operations. 606, 607
process Procedure or task that users, managers, and IT staff members perform. Also, the logical rules of a system that are applied to transform data into meaningful information. In data flow diagrams, a process receives input data and produces output that has a different content, form, or both.
  described, 9, 200
  documenting, 222
  names/labels, 222
  numbers, 222
  requirements modeling and, 142, 154
process control Process control allows users to send commands to a system. A process control screen (also known as a dialog screen) is part of the user interface, and enables a user to initiate or control system actions. 336
process description A documentation of a functional primitive's details, which represents a specific set of processing steps and business logic. 222, 224–230
process improvement The framework used to integrate software and systems development by a new SEI model, Capability Maturity Model Integration (CMMI). 509
process model A process model describes system logic and processes that programmers use to develop necessary code modules. 198–247
process 0 In a data flow diagram, process 0 (zero) represents the entire information system, but does not show the internal workings. 208, 216
process-centered An analytic approach that describes processes that transform data into useful information. 22
product baseline The product baseline describes the system at the beginning of system operation. The product baseline incorporates any changes made since the allocated baseline and includes the results of performance and acceptance tests for the operational system. 583
product-oriented Product-oriented firms manufacture computers, routers, or microchips. 11
production environment The environment for the actual system operation. It includes hardware and software configurations, system utilities, and communications resources. Also called the operational environment. 534, 535
productivity software Software such as word processing, spreadsheet, database management, and presentation graphics programs. 170

products, support for new, 60
profit center A department expected to break even, or show a profit. 673
program documentation Program documentation starts in the systems analysis phase and continues during systems implementation. Systems analysts prepare overall documentation, such as process descriptions and report layouts, early in the SDLC. Programmers provide documentation by constructing modules that are well-supported by internal and external comments and descriptions that can be understood and maintained easily. 529
Program Evaluation Review Technique (PERT) The Program Evaluation Review Technique (PERT) was developed by the U.S. Navy to manage very complex projects, such as the construction of nuclear submarines. At approximately the same time, the Critical Path Method (CPM) was developed by private industry to meet similar project management needs. The important distinctions between the two methods have disappeared over time, and today the technique is called either PERT, CPM, or PERT/ CPM. 105–106
programmer/analyst A designation for positions that require a combination of systems analysis and programming skills. 579
Project (Microsoft), 64, 109, 113
  described, 118
  network diagrams and, 119–120
  risk management and, 122
project coordinator The project coordinator handles administrative responsibilities for the development team and negotiates with users who might have conflicting requirements or want changes that would require additional time or expense. 103
project creep The process by which projects with very general scope definitions expand gradually, without specific authorization. 74, 123
project management The process of planning, scheduling, monitoring, controlling, and reporting upon the development of an information system. 22, 28, 101–138, 514
project manager The project manager, or project leader, usually is a senior systems analyst or an IT department manager if the project is large. An analyst or a programmer/analyst might manage smaller
projects. 103, 115–116, 144–145
project monitoring Project monitoring requires guiding, supervising, and coordinating the project team's workload. 103, 114–115
project planning Project planning includes identifying project tasks and estimating completion time and costs. 103–104
project reporting Project reporting tasks include regular progress reports to management, users, and the project team itself. 103, 115–116
project scope A specific determination of a project's boundaries or extent. 74
project scheduling Project scheduling involves the creation of a specific timetable to facilitate completion of a project. Scheduling also involves selecting and staffing the project team and assigning specific tasks to team members. 103
properties Characteristics that objects inherit from their class or possess on their own. 24–25
protocol A set of standards that govern network data transmission. Also, preset conditions used by firewalls to determine whether or not to allow traffic to pass. 400, 477
prototype An early, rapidly constructed working version of the proposed information system. 20, 315
  agile methods and, 25
  limitations of, 317
  user interface design and, 342
prototyping The method by which a prototype is developed. It involves a repetitive sequence of analysis, design, modeling, and testing. It is a common technique that can be used to design anything from a new home to a computer network. 315–317
proxy server A networking device that provides Internet connectivity for internal LAN users. 481
pseudocode A technique for representing program logic. 225, 513
public key encryption (PKE) A common encryption technique. Each user on the network has a pair of keys: a public key and a private key. The public key encrypts data that can be decrypted with the private key. 597
punched card system, 4–5
Python, 25, 318, 523
qualitative risk analysis Evaluating risk by estimating the probability that it will occur and the degree of impact. 121
quality assurance (QA) A process or procedure for minimizing errors and ensuring quality in products. Poor quality can result from inaccurate requirements, design problems, coding errors, faulty documentation, and ineffective testing. A quality assurance (QA) team reviews and tests all applications and systems changes to verify specifications and software quality standards. 29, 508–510
quantitative risk analysis Evaluating risk in terms of the actual impact in terms of dollars, time, project scope, or quality. 122
Quanttro Pro (Corel), 171
query by example (QBE) A query-by-example (QBE) language allows the user to provide an example of the data requested. 396, 397
query language A query language allows a user to specify a task without specifying how the task will be accomplished. Some query languages use natural language commands that resemble ordinary English sentences. 396
questionnaire A document containing a number of standard questions that can be sent to many individuals. Also called a survey. 166–167, 169, 171
radio button A radio button, or option button, represents a group of options. The user can select only one option at a time; a selected option contains a black dot. 348
radio frequency identification (RFID) Radio frequency identification (RFID) technology uses high-frequency radio waves to track physical objects. 16, 62, 454
RAID (redundant array of independent disks) A RAID system may be part of an organizations backup and recovery plans. A RAID system mirrors the data while processing continues. RAID systems are called fault-tolerant, because a failure of any one disk does not disable the system. 607
random sample A random sample is taken in a random, unplanned manner. For example, a random sample might be a sample that selects any 20 customers. 168
range check A type of data validation check that tests data items to verify that they fall between a specified minimum and maximum value. The daily hours worked by an employee, for example, must fall within the range of 0 to 24. 367
range-of-response questions Closed-ended questions that ask the person to evaluate something by providing limited answers to specific responses or on a numeric scale. 160
rapid application development (RAD) A team-based technique that speeds up information systems development and produces a functioning information system. RAD is similar in concept to joint application development (JAD), but goes further by including all phases of the System Development Life Cycle (SDLC). 58, 143, 315
  described, 26–27
  objectives, 147
  overview, 145–147
Rapid Economic Justification (REJ), 156
Rational System Architect, 658–660
Rational Unified Process (RUP) According to IBM, RUP offers a flexible, iterative process for managing software development projects that can minimize risk, ensure predictable results. 26
read-only properties Elements of an application that can be configured so users can view, but not change the data. 298
readability Readability analyzes ease of comprehension by measuring specific characteristics of syllables, words, and sentences. 634
reasonableness check A type of data validation check that identifies values that are questionable, but not necessarily wrong. For example, input payment values of $0.05 and $5,000,000.00 both pass a simple limit check for a payment value greater than zero, and yet both values could be errors. 367
record A record, also called a tuple, is a set of related fields that describes one instance, or member of an entity, such as one customer, one order, or one product. A record might have one or dozens of fields, depending on what information is needed.
  alternate name, 223
  attributes, 223
  definition/description, 223
  documenting, 223
  name, 223
  overview, 217, 402
  security and, 372
  user interface design and, 365
records retention policy A records policy that is designed to meet all legal requirements and business needs for keeping records. 372
recovery The process of restoring data and restarting a system after an interruption. 607
recovery procedures Recovery procedures involve restoring data and restarting a system after an interruption. Recovery procedures can be used to restore a file or database to its current state at the
time of the last backup. 607
referential integrity A type of validity check. Referential integrity is a set of rules that avoids data inconsistency and quality problems. 367, 404, 405

relational database A database in which tables are related by common fields, creating a unified data structure that provides improved data quality and access. 392, 427–430
relational model A model used in relational databases. The relational model was introduced during the 1970s and became popular because it was flexible and powerful. 427–430
relationships Relationships enable objects to communicate and interact as they perform the business functions and transactions required by a system. Relationships describe what objects need to know about each other, how objects respond to changes in other objects, and the effects of membership in classes, superclasses, and subclasses. 258, 406–408, 517
release plan In agile development, a plan that specifies when user stories will be implemented and the timing of the releases. Releases are relatively frequent, and each release is treated as a system prototype that can be tested and modified as needed. 521
reliability, of software packages, 296
remote control software Software that allows IT staff to take over a user's workstation and provide support and troubleshooting. 573
repeating group A set of one or more fields that can occur any number of times in a single record, with each occurrence having different values. 411
report(s)
  data dictionary, 223–224
  design, 350–357
  to management, 81
  risk management and, 115–116
  security and, 370–372
  system implementation and, 549
  types of, 352–354
report analysis form A report analysis form contains information about the fields, data types and lengths, report frequency and distribution, and other comments. 353
report footer The report footer, which appears at the end of the report, can include grand totals for numeric fields and other end-of-report information. 354
report generator A report generator, also called a report writer, is a tool for designing formatted reports rapidly. 297, 298, 656
report header A report header appears at the beginning of a report and identifies the report as well as the report title, date, and other necessary information. 354
Report Wizard, 298, 350–351
report writer A report writer, also called a report generator, is a tool for designing formatted reports rapidly. 637–639
repository A repository is a database that serves as a central storage location for all information about a system being developed. 653
request for proposal (RFP) A written list of features and specifications given to prospective vendors before a specific product or package has been selected. 302–307, 536
request for quotation (RFQ) A request for quotation (RFQ) is used to obtain a price quotation or bid on a specific product or package. 304, 536
requirements model A requirements model describes business functions that an information system must support. 16
requirements modeling Modeling that is used in the systems planning phase of the SDLC. It involves fact-finding to describe the current system and identify the requirements for the new system. Requirements modeling involves various fact-finding techniques, such as interviews, surveys, observation, and sampling.
  fact-finding and, 156–159, 164–170
  described, 23–24, 142
  interviews and, 159–164
  techniques, 149–153
  overview, 140–197
  system requirements and, 153–155
  tools, 149–153
requirements planning phase A phase that combines elements of the systems planning and systems analysis phases of the SDLC. 146
research An important fact-finding technique. Research can include the review of journals, periodicals, and books to obtain background information, technical material, and news about industry trends and developments. 168–169
resource allocation The charging of indirect costs based on the resources used by an information system. 673
response time The overall time between a request for system activity and the delivery of the response. In the typical online environment, response time is measured from the instant the user presses the ENTER key or clicks a mouse button until the requested screen display appears or printed output is ready. 586
responsible user, use of the term, 220. *See also* users
retention period Backups are stored for a specific retention period after which they are either destroyed or the backup media is reused. 608
return on investment (ROI) A percentage rate that measures profitability by comparing the total net benefits (the return) received from a project to the total costs (the investment) of the project. ROI - (total benefits – total costs) / total costs. 299, 678, 679–680
reverse engineering Reverse engineering allows you to examine an existing application and break it down into a series of diagrams, structure charts, and, in some cases, source code. 654
RFID scanners, 313
RFID tag An input device used in source data automation. 369
ring network A ring network resembles a circle of computers that communicate with each other. A ring network often is used when processing is performed at local sites rather than at a central location. 479, 480
risk An event that could affect the project negatively.
  analysis, 26
  described, 591
risk assessment Measures the likelihood and impact of risks. 590–591
risk control Develops safeguards that reduce the likelihood and impact of risks. 590, 592
risk identification Listing each risk and assessing the likelihood that it could affect a project. 121, 590, 591–592
risk management The process of identifying, evaluating, tracking, and controlling risks to minimize their impact. 121–123, 590
risk management plan Includes a review of the project's scope, stakeholders, budget, schedule, and any other internal or external factors that might affect the project. The plan should define project roles and responsibilities, risk management methods and procedures, categories of risks, and contingency plans. 121
risk response plan A proactive effort to anticipate a risk and describe an action plan to deal with it. An effective risk response plan can reduce the overall impact by triggering a timely and appropriate action. 122
roaming A process that allows wireless clients to move from one access point to another, automatically associating with the stronger access point and allowing for uninterrupted service. 483
router A device that connects network segments, determines the most efficient data path, and guides the flow of data. 481
RSS (Really Simple Syndication) A format for publishing frequently updated content to users who subscribe to an RSS download, also called a feed, RSS feed, or a Web feed. 704
RSS feed Data format for providing users with frequently updated Web content on all kinds of topics, available by subscription. Also called a feed or Web feed. 704
RSS reader Client software or Web application that aggregates syndicated Web content such as blogs, podcasts, and RSS feeds in a single location for easy viewing. Also called feed reader or aggregator. 704
Ruby, 318, 523
SaaS (Software as a Service). *See* Software as a Service (SaaS)
salaries, 33, 108
sampling As it relates to information systems, sampling is a process where an analyst collects examples of actual documents which could include records, reports, or various forms. 167–168
SAP, 470, 471
scalability Scalability means that a system can be expanded, modified, or downsized easily to meet the rapidly changing needs of a business enterprise. 24, 155, 395, 456
  development strategies and, 288
  requirements modeling and, 155
scalable A design is said to be scalable if it can expand to meet new business requirements and volumes. 24
scaling on demand The ability to match network resources to needs at any given time; a feature of cloud computing. For example, during peak loads, additional cloud servers might come on line automatically to support increased workloads. 472
scannable text In Web-based form design, scannable text is text that is created with the idea that readers of online material scan the text rather than reading it. Scannable text is created with this in mind. 361
scatter diagram Also called an XY chart, a tool used by system analysts to graphically show the correlation between two variables. 78–79
schedule(s). *See also* schedule feasibility
  business case analysis and, 80
  evaluating, 80
  risk management and, 115, 123–124
schedule feasibility Schedule feasibility means that a project

can be implemented in an acceptable time frame. 69
schema The complete definition of a database, including descriptions of all fields, records, and relationships. 398
SCM (supply chain management). *See* supply chain management
screen generator A screen generator is an interactive tool that helps you design a custom interface, create screen forms, and handle data entry format and procedures. Also called a form painter. 297, 342, 654, 655
script kiddies, 592
scroll bar In user interface design, a scroll bar allows the user to move through the available choices for an input field. 348
Scrum A popular process with agile developers; refers to a powerful effort to achieve short-term goals, derived from a rugby term. In Scrum, team members play specific roles and interact in intense sessions. 26, 148
SDLC (systems development life cycle). *See* systems development life cycle (SDLC)
search engine An application that uses keywords and phrases to locate information on the Internet and list the results of the search. 693–698, 701
second normal form (2NF) A record design is in second normal form (2NF) if it is in 1NF and if all fields that are not part of the primary key are dependent on the entire primary key. If any field in a 1NF record depends on only one of the fields in a combination primary key, then the record is not in 2NF. A 1NF record with a primary key that is a single field is automatically in 2NF. 413–418, 420, 421
secondary key A field or combination of fields that can be used to access or retrieve records. Secondary key values are not unique. For example, if you need to access records for only those customers in a specific ZIP code, you would use the ZIP code field as a secondary key. 404
security Hardware, software, and procedural controls that safeguard and protect a system and its data from internal or external threats.
  concepts, 589–590
  data conversion and, 544
  data dictionaries and, 220
  database design and, 396, 399, 401
  described, 142, 220, 589
  development strategies and, 288, 317, 318
  levels, 594–600
  overview, 589–593
  requirements modeling and, 142
  system architecture and, 458, 485
  user interface design and, 370–372
  wireless networks and, 485
security file A file that is created and saved for backup and recovery purposes. Examples of security files include audit trail files and backups of master, table, and transaction files. 394
security hole Created by a combination of one or more improperly configured services. 601
security policy A policy that addresses the three main elements of system security: confidentiality, integrity, and availability. 590
security token A physical device that authenticates a legitimate user, such as a smart card or keychain device. 605
SEI (Software Engineering Institute), 508, 650
selection A control structure in modular design, it is the completion of two or more process steps based on the results of a test or condition. 224
separator A character such as a slash (/) that is used to format inputted data. 364
sequence The completion of steps in sequential order, one after another. 224, 231
sequence check A type of data validation check that is used when the data must be in some predetermined sequence. If the user must enter work orders in numerical sequence, for example, then an out-of-sequence order number indicates an error. If the user must enter transactions chronologically, then a transaction with an out-of-sequence date indicates an error. 367
sequence codes Numbers or letters assigned in a specific order. Sequence codes contain no additional information other than an indication of order of entry into a system. 423
sequence diagram A diagram that shows the timing of transactions between objects as they occur. 152–153, 264–265
server Computer in a client/server design that supplies data, processing, and services to client workstations.
  -based processing, 459
  described, 458
  security and, 594–595
  system architecture and, 458–459
server processing time The time that the server actually requires to respond to client requests for processing. 673
service An application that monitors, or listens on, a particular port.
  described, 599
  security and, 601
  support for new, 60
service pack A maintenance release supplied by commercial software suppliers. 583
service provider A firm that offers outsourcing solutions. Two popular outsourcing options involve application service providers and firms that offer Internet business services. 290
service-oriented A company that primarily offers information or services, or sells goods produced by others. 11
service-oriented architecture (SOA) Service oriented architecture (SOA) is an architectural style whose goal is to achieve loose coupling among interacting software objects that can provide services. 318
Session layer, 477
significant digit codes Significant digit codes distinguish items by using a series of subgroups of digits. ZIP codes, for example, are significant digit codes. 424
simulation A simulation is a dress rehearsal for users and IT support staff. Organizations typically include all procedures, such as those that they execute only at the end of a month, quarter, or year, in their simulations. 543
sink An external entity that receives data from an information system. 205
site visit A visit to a physical location to observe a system in use at another location. 169
skills
  communication, 31, 644
  of systems analysts, 30–31
slack time The slack time for an event is the amount of time by which an event can be late without delaying the project. The slack time for an event is the difference between its latest completion time (LCT) and earliest completion time (ECT). 114
Slaughter, Matthew, 292
Smalltalk, 25, 250
smart phone A cell phone with built-in applications and Internet access. 173
sniffing, 593
social engineering An intruder uses social interaction to gain access to a computer system. 593, 604
social networking Using online communication channels such as Facebook, MySpace, Twitter, and LinkedIn to connect to personal and professional contacts and groups. 289, 702
soft skills Skills such as communications, interpersonal skills, and perceptive abilities, and critical thinking skills. IT professionals must have soft skills as well as technical skills. 31, 644
software A program run by computers for a specific function or task.
  acquisition process, 301–308
  described, 8
  development trends, 317–318
  documentation, 170–171
  overview, 8–9
  upgrades, 296
  usability studies, 338–339
software engineering A software development process that stresses solid design, effective structure, accurate documentation, and careful testing. 508
Software Engineering Institute, 508, 650
software license A software license gives users the right to use the software under certain terms and conditions. 307
software package Software that is purchased or leased from another firm; a commercially produced software product, or family of products.
  customizing, 296–297
  described, 7, 293
  development, 293–294
  purchasing, 295–297, 310
software reengineering Uses analytical techniques to identify potential quality and performance improvements in an information system. 577
software requirements specification A software requirements specification, or system requirements document, contains the requirements for the new system, describes the alternatives that were considered, and makes a specific recommendation to management. It is the end product of the systems analysis phase. 309
Software as a Service (SaaS) Software as a Service (SaaS) is redefining the way that companies develop and deploy their information systems. SaaS is a model of software delivery that cuts across all market segments, including homes and business of all sizes.
  cloud computing and, 289
  described, 286
  overview, 472
  trends, 286–287
software vendor Company that develops software for sale. 293, 536
  evaluating, 306–307
  identifying, 304–306
  purchasing software from, 295–297
source An external entity that supplies data to an information system. 205, 220
source data automation A popular online input method that combines online data entry and automated data capture using

input devices such as magnetic data strips, or swipe scanners. 369
source document A form used to request and collect input data, trigger or authorize an input action, and provide a record of the original transaction. During the input design stage, you develop source documents that are easy to complete and inexpensive. 360–362
spam, 593
spell checker A component of most word processing programs, a spell checker is a tool that identifies words in a document that do not appear in the program's dictionary. 634
spider Search engines use a specialized computer program called a spider or crawler which travels from site to site indexing, or cataloging, the contents of the pages based on keywords. 693
spiral model A spiral model represents a series of iterations, or revisions, based on user feedback. 26
sponsored links Links that are subsidized by companies are called sponsored links. 693
spontaneous generation A term used to describe an unexplained generation of data or information. With respect to data flow diagrams, processes cannot spontaneously generate data flows. They must have an input to have an output. 203
spoofing, 593
spreadsheets
  computing payback analysis with, 677–679
  present value and, 683
SQL (Structured Query Language) A query language that allows PC users to communicate with servers and mainframe computers. 397, 463, 465, 523
stakeholder Anyone who is affected by the company's performance, such as customers, employees, suppliers, stockholders, and members of the community. 10
stand-alone When an individual user works in a stand-alone mode, the workstation performs all the functions of a server by storing, accessing, and processing data, as well as providing a user interface. 460
standard notation format A standard notation format makes designing tables easier as it clearly shows a table's structure, fields, and primary key. 411
Standish Group, 102
star network A star network has a central computer with one or more workstations connected to it in a way that forms a star pattern. The central computer could be a mainframe, a midrange computer, or a server. 480–481
start day/date The time that a task is scheduled to begin. 110, 116–117
state An adjective that describes an object's current status (e.g. a student could be a CURRENT, FUTURE, or PAST student). 254
state transition diagram A state transition diagram shows how an object changes from one state to another, depending on the events that affect the object. 265
status flag In structured application development, an indicator that allows one module to send a message to another module. 515
storyboard Sketches used during prototyping to show the general screen layout and design. 342
strategic plans The long-range plans that define the corporate mission and goals. Typically defined by top management, with input from all levels. 18, 54, 62
stratified sample A sample where a set metric is collected across functional areas. For example, a certain percentage of transactions from every work shift, or five customers from each of four zip codes, could be a stratified sample. 168
structure chart A top-down representation of business functions and processes. Also called a functional decomposition diagram. 514–515, 517–518
structured analysis A traditional systems development technique that uses phases to plan, analyze, design, implement, and support an information system. Processes and data are treated as separate components. 21, 663
structured brainstorming A group discussion where each participant speaks when it is his or her turn, or passes. 159
structured English A subset of standard English that describes logical processes clearly and accurately. 225–226
structured walkthrough A review of a project team member's work by other members of the team. Generally, systems analysts review the work of other systems analysts, and programmers review the work of other programmers, as a form of peer review. Structured walkthroughs should take place throughout the SDLC and are called requirements reviews, design reviews, code reviews, or testing reviews, depending on the phase in which they occur. 114, 525
stub testing In stub testing, the programmer simulates each program outcome or result and displays a message to indicate whether or not the program executed successfully. Each stub represents an entry or exit point that will be linked later to another program or data file. 526
subclass A further division of objects in a class. Subclasses are more specific categories within a class. 256
subject directory A subject directory or topic directory is a Web site that allows you to access topics by using a hierarchy, starting with general headings and proceeding to more specific topics. 693, 698–699, 701
subordinate module A lower-level module in a structure chart. 514
subschema A view of the database used by one or more systems or users. A subschema defines only those portions of the database that a particular system or user needs or is allowed to access. 398
subscribers Users of podcasts who listen to them anywhere, anytime. 537
subscription model A service model that charges a variable fee for an application based on the number of users or workstations that have access to the application. 291
subsearch A subsearch can include the option to search within returned results and the ability to search within specific areas, such as newsgroups. 691
successor task Each of the concurrent tasks of a predecessor task is called a successor task. 111, 112, 113
summary report A report used by individuals at higher levels in the organization that includes less detail than reports used by lower-level employees. 353
Sun Microsystems, 32
superclass A more generalized category to which objects may belong (e.g., a NOVEL class might belong to a superclass called BOOK). 257
superuser Account that allows essentially unrestricted access to the application. 601
supplier relationship management (SRM) Supplier relationship management (SRM) allows online B2B interaction where buyers, sellers, distributors, and manufacturers can offer products, submit specifications, and transact business. 14
supply chain management The coordination, integration, and management of materials, information, and finances as they move from suppliers to customers, both within and between companies. In a totally integrated supply chain, a customer order could cause a production planning system to schedule a work order, which in turn could trigger a call for certain parts from one or more suppliers. 14, 454–355
survey A document containing a number of standard questions that can be sent to many individuals. Also called a questionnaire. 78, 80
swim lanes In a business process diagram, the overall diagram is called a pool, and the designated customer areas are called swim lanes. 151
switch Central networking device in a star network, which manages the network and acts as a conduit for all network traffic. 480
switchboard In a user interface, a switchboard uses command buttons that enable users to navigate a system and select from groups of related tasks. 348, 349
SWOT analysis It examines a company's strengths (S), weaknesses (W), opportunities (O), and threats (T). 54–67
Sybase, 470
symbols, 200–202, 207–217
syntax errors Programming language grammar errors. 525
system A set of related components that produces specific results.
  described, 7
  installation, 534
  obsolescence, 609
  performance management, 584–589
  requests, evaluation of, 65–66
system administrator A person who is responsible for the configuration management and maintenance of an organization's computer networks. 578, 579
system architecture System architecture translates the logical design of an information system into a physical structure that includes hardware, software, network support, and processing methods.
  checklist, 454–458
  completion, 485–486
  Internet-based, 467–473
  network models and, 476–482
  overview, 452–503
  planning, 458–461
  processing methods, 474–476
  system implementation and, 511
  processing options, 458
  Web integration and, 456–457
system boundary A system boundary shows what is included and excluded from a system. It is depicted by a shaded rectangle in use case diagrams. 262
system changeover The process of putting the new information

system online and retiring the old system. Changeover can be rapid or slow, depending on the method. 545–547
system design specification The system design specification, also called the technical design specification or the detailed design specification, is a document that presents the complete design for the new information system, along with detailed costs, staffing, and scheduling for completing the next SDLC phase, systems implementation. 24, 311, 486, 511
system documentation System documentation describes a system's functions and how they are implemented. The analyst prepares most of the system documentation during the systems analysis and systems design phases. System documentation includes data dictionary entries, data flow diagrams, object models, screen layouts, source documents, and the systems request that initiated the project. 529
system prototyping System prototyping produces a full-featured, working model of the information system being developed. 315, 316
system requirement A characteristic or feature that must be included in an information system to satisfy business requirements and be acceptable to users.
checklist, 153–155
described, 143, 153
review of, 311
system requirements document A system requirements document, or software requirements specification, contains the requirements for the new system, describes the alternatives that were considered, and makes a specific recommendation to management. It is the end product of the systems analysis phase.
described, 24
formal, 307–308
system software Software that controls the computer and includes the operating system, device drivers that communicate with hardware, and utilities. 8
system testing System testing involves an entire information system and includes all typical processing situations. During a system test, users enter data, including samples of actual, or live data, perform queries, and produce reports to simulate actual operating conditions. All processing options and outputs are verified by users and the IT project development team to ensure that the system functions correctly. Also known as an acceptance test. 527, 528
systematic sample A sample that occurs at a predetermined periodicity. For example, every tenth customer record might be selected as a systematic sample for review. 168
systems analysis and design The process of developing information systems that effectively use hardware, software, data, processes, and people to support the company's business objectives. 7, 310–311
systems analysis phase The second SDLC phase. The purpose of this phase is to build a logical model of the new system. 7, 23–24, 142–145, 309–310
systems analyst A person who plans, analyzes, and implements information systems. He or she may work internally within a company's IT department, or be hired by a company as an independent consultant. 30–33, 298–299, 340, 530, 579
Systems Analyst's Toolkit
CASE tools, overview of, 648–666
communications tools, 630–647
financial analysis tools, 668–687
Internet resource tools, 688–714
overview, 629–714
parts of, 299
systems design The goal of systems design is to build a system that is effective, reliable, and maintainable. 311–314
systems design phase The third SDLC phase. The purpose of systems design is to create a blueprint for the new system that will satisfy all documented requirements, whether the system is being developed in-house or purchased as a package. 24, 313–314
systems development life cycle (SDLC) Activities and functions that systems developers typically perform, regardless of how those activities and functions fit into a particular methodology. The SDLC model includes the following steps: 1. Systems planning, 2. Systems analysis, 3. Systems design, 4. Systems implementation, 5. Systems support and security. 21–24, 231
systems evaluation An assessment conducted during the systems implementation phase to determine whether the system operates properly and if costs and benefits are within expectations. 24
systems implementation phase The fourth phase of SDLC. During this phase the new system is constructed - programs are written, tested, and documented, and the system is installed.
described, 24
documentation and, 528–533
managing, 506–567
system changeover and, 544–547
tasks after, 547–550
testing and, 525–528
training and, 535–543
systems planning phase Begins with a formal request to the IT department that describes problems or desired changes in an information system or a business process. 23
systems programmer A person who concentrates on operating system software and utilities. 579
systems request A formal request to the IT department that describes problems or desired changes in an information system or business process. It might propose enhancements for an existing system, the correction of problems, or the development of an entirely new system. 59–61, 65, 81
systems review committee A group of key managers and users responsible for evaluating systems requests. The term computer resources committee is also used. 65, 66, 581–582
systems support and security Systems support and security provides vital protection and maintenance services for system hardware and software, including enterprise computing systems, networks, transaction processing systems, and corporate IT infrastructure. 24, 29, 570–628
systems support and security phase During the systems operation, support, and security phase, the IT staff maintains, enhances, and protects the system. 24, 570–628
table Each file or table contains data about people, places, things, or events that interact with the information system. 402
table design A table design specifies the fields and identifies the primary key in a particular table or file. 410
table file In a typical file processing environment, a table file contains reference data that is used by the information system. As with master files, table files are relatively permanent and are not updated by the information system. Examples of table files include tax tables and postage rate tables. 394
tags Markup language codes. Tags are the building blocks of HTML and XML. 399
tamper-evident case A case designed to show any attempt to open or unlock the case. 595
tangible benefits Benefits that can be measured in dollars. Tangible benefits result from a decrease in expenses, an increase in revenues, or both. 68
tangible costs Costs that have a specific dollar value. Examples include employee salaries and hardware purchases. 672
Target, 12
task A task, or activity, is any work that has a beginning and an end, and requires the use of company resources including people, time, and/or money. Examples include conducting a series of interviews, designing a report, selecting software, waiting for the delivery of equipment, and training users.
duration estimates, 107–108, 110
identifying, 106
listing, 106
task box In project management, a task box is a component of a PERT/CPM chart that contains important scheduling and duration information about a task. Each task in a project is represented by its own task box in the PERT/CPM chart. 110
task group In task groups, each task represents several activities. 104
task pattern In any project, large or small, tasks depend on each other and must be performed in a sequence, not unlike the commands in a software program. Task patterns can involve sequential tasks,
multiple successor tasks, and multiple predecessor tasks. 110–112
task ID A number or code that uniquely identifies a task. 110
task name A brief descriptive name for a task, which does not have to be unique in the project. For example, a task named Conduct Interviews might appear in several phases of the project. 110
TCP/IP (Transmission Control Protocol/Internet Protocol). *See* Transmission Control Protocol/Internet Protocol (TCP/IP)
technical feasibility A project or request is said to have technical feasibility if the organization has the resources to develop or purchase, install, and operate the system. 67–68
technical support Technical support is necessary to support the wide variety of IT systems and users. It includes six main functions: application development, systems support, user support, database administration, network administration, and Web support. These functions overlap considerably and often have different names in different companies. 28, 66, 155, 357
TechRepublic Web site, 31
template A standard format for documents, presentations and

other output, with specific layouts, fonts, margin and other formatting settings. Templates are used to give work a consistent look. 635
terminal A keyboard and display screen that are used to handle input and output from a remote location to a central computer. A terminal lacks independent processing capability. 459
terminator A data flow diagram symbol that indicates a data origin or final destination. Also called an external entity. 205
terrorism, 317, 592
test data Data that is used in unit testing. Test data should contain both correct data and erroneous data and should test all possible situations that could occur. 526
test environment The environment that analysts and programmers use to develop and maintain programs. 534, 535
test plan A plan designed by a systems analyst that includes test steps and test data for integration testing and system testing. 526, 608, 609
test-driven design An Extreme Programming (XP) concept that unit tests are designed before code is written, focusing on end results and preventing programmers from straying from their goals. 522, 523
testing. *See also* system testing; testing review; unit testing
  development strategies and, 317, 318
  system implementation and, 525–528
testing review A testing review, or structured walkthrough, is a review of a project team member's work by other members of the team. Generally, systems analysts review the work of other systems analysts, and programmers review the work of other programmers, as a form of peer review. Structured walkthroughs should take place throughout the SDLC and are called requirements reviews, design reviews, code reviews, or testing reviews, depending on the phase in which they occur. 114
text box A text box can display messages or provide a place for a user to enter data. 348
text messaging Sending text messages via cell phone. Also called texting. 706
texting Sending text messages via cell phone. 706
thick client A thick client design, also called a fat client design, locates most or all of the application processing logic at the client. 464
thin client A thin client design locates most or all of the processing logic at the server. 464
third normal form (3NF) A record design is in third normal form (3NF) if it is in 2NF and if no nonkey field is dependent on another nonkey field. A nonkey field is a field that is not a candidate key for the primary key. 416, 417, 419, 421
third-party software An application that is not developed in-house. 602
threat In risk management, an internal or external or external entity that could endanger an asset. 590
three-tier In a three-tier design, the user interface runs on the client and the data is stored on the server, just as in a two-tier design. A three-tier design also has a middle layer between the client and server that processes the client requests and translates them into data access commands that can be understood and carried out by the server. 464, 465
throughput Throughput measures actual system performance under specific circumstances and is affected by network loads and hardware efficiency. Throughput, like bandwidth, is expressed as a data transfer rate, such as Kbps, Mbps, or Gbps. 586
throwaway prototyping Prototyping of user requirements, after which the prototype is discarded and implementation continues. Also called design prototyping. 315, 316
tightly coupled If modules are tightly coupled, one module refers to internal logic contained in another module. 516
time value of money A concept that recognizes that a given sum of money, over time, historically will increase in value. 680
toggle button A toggle button is used to represent on or off status. Clicking the toggle button switches to the other status. 348
toolbar A toolbar contains icons or buttons that represent shortcuts for executing common commands. 348
top-down approach A design approach, also called modular design, where the systems analyst defines the overall objectives of the system, and then breaks them down into subsystems and modules. This breaking-down process also is called partitioning. 514
topic directory A subject directory or topic directory is a Web site that allows you to access topics by using a hierarchy, starting with general headings and proceeding to more specific topics. 693, 698–699, 701
total cost of ownership (TCO) A number used in assessing costs, which includes ongoing support and maintenance costs, as well as acquisition costs. 68, 155–156, 293, 455–456, 464, 670–671
  calculating, 307
  development strategies and, 295
  forecasts, importance of, 299–300
totals zone If a form has data totals, they will appear in this section of the form. 361
trade barriers, 6
train-the-trainer A strategy where one group of users has been trained and can assist others. Users often learn more quickly from coworkers who share common experience and job responsibilities. 539
training. *See also* education; training plan
  interactive, 539–540
  system implementation and, 535–543
training plan A successful information system requires training for users, managers, and IT staff members. The entire systems development effort can depend on whether or not people understand the system and know how to use it effectively. The training plan is a document that details these requirements. 535
transaction file In a typical file processing environment, a transaction file stores records that contain day-to-day business and operational data. A transaction file is an input file that updates a master file; after the update is completed, the transaction file has served its purpose. 394
transaction model A service model that charges a variable fee for an application based on the volume of transactions or operations performed by the application. Also called a usage model. 291
transaction processing (TP) systems Operational systems used to process day-to-day recurring business transactions, such as customer billing. 15–19
Transaction Processing Performance Council (TPC), 307, 308
transference One of four risk control strategies. In transference, risk is shifted to another asset or party, such as an insurance company. 592
Transmission Control Protocol/Internet Protocol (TCP/IP) A popular network protocol. TCP/IP is the backbone of the Internet. 477, 599
transparent A network is transparent if a user sees the data as if it were stored on his or her own workstation. 460
Transport layer, 477
tunnel A secure network connection established between the client and the access point of the local intranet. 599
tuple A tuple (rhymes with couple), or record, is a set of related fields that describes one instance, or member of an entity, such as one customer, one order, or one product. A tuple might have one or dozens of fields, depending on what information is needed. 402
turnaround document Output document that is later entered back into the same or another information system. A telephone or utility bill, for example, might be a turnaround document printed by the company's billing system. When the bill is returned with payment, it is scanned into the company's accounts receivable system to record the payment accurately. 350
turnaround time Turnaround time applies to centralized batch processing operations, such as customer billing or credit card statement processing. Turnaround time measures the time between submitting a request for information and the fulfillment of the request. Turnaround time also can be used to measure the quality of IT support or services by measuring the time from a user request for help to the resolution of the problem. 587
turnkey systems, 293, 469
tutorial A series of online interactive lessons that present material and provide a dialog with users. 537
Twitter, 289, 702
two-tier In a two-tier design, the user interface resides on the client, all data resides on the server, and the application logic can run either on the server or on the client, or be divided between the client and the server. 464, 465
type In data dictionaries, type refers to whether a data element contains numeric, alphabetic, or character values. 219
Undo key, 345
unencrypted Data that is not encrypted. 597
Unicode Unicode is a relatively recent coding method that represents characters as integers. Unlike EBCDIC and ASCII, which use eight bits for each character, Unicode requires 16 bits per character, which allows it to represent more than 65,000 unique characters. 434
Unicode Consortium, 434
Unified Modeling Language (UML) a widely used method of visualizing and documenting software systems design. UML uses object-oriented design concepts, but it is independent of any specific programming language and can be used to

describe business processes and requirements generally. 151, 250, 663
cardinality and, 263, 408
overview, 259–266
representation of objects, 251–54
requirements modeling and, 151–152
use case modeling overview, 259–261
uninterruptible power supply (UPS) Battery-powered backup power source that enables operations to continue during short-term power outages and surges. 595
unit testing The testing of an individual program or module. The objective is to identify and eliminate execution errors that could cause the program to terminate abnormally, and logic errors that could have been missed during desk checking. 525, 526
Universal Security Slot (USS) Can be fastened to a cable lock or laptop alarm. 595
unnormalized An unnormalized record is one that contains a repeating group, which means that a single record has multiple occurrences of a particular field, with each occurrence having different values. 411
unstructured brainstorming A group discussion where any participant can speak at any time. 159
U.S. Commerce Department, 121
U.S. Defense Department, 477
U.S. Navy, 105
usability metrics Data that interface designers can obtain by using software that can record and measure user interactions with the system. 342
usage model A service model that charges a variable fee for an application based on the volume of transactions or operations performed by the application. Also called a transaction model. 291
USB (Universal Serial Bus), 371
use case A use case represents the steps in a specific business function or process in UML (Unified Modeling Language). 259–261
use case description A description in UML (Unified Modeling Language) that documents the name of the use case, the actor, a description of the use case, a step-by-step list of the tasks required for successful completion, and other key descriptions and assumptions. 260
use case diagram A visual representation that represents the interaction between users and the information system in UML (Unified Modeling Language). 151–152, 261–262
user(s) Employees, customers, vendors, and others who interact with an information system. Sometimes referred to as end users.
business case analysis and, 71–72
considerations, for systems design, 312–313
database design and, 396–397
described, 10
groups, 603
involvement, 71–72, 144, 315, 346, 353, 487
notification, 582
prototypes and, 315, 316
requirements modeling and, 144
responsible, use of the term, 220
security and, 603–606
surveys, 78
"thinking like," 341–342
user application User applications utilize standard business software, such as Microsoft Office 2003, that has been configured in a specific manner to enhance user productivity. 297–298
user design phase In this phase, users interact with systems analysts and develop models and prototypes that represent all system processes, outputs, and inputs. 146
user documentation Instructions and information to users who will interact with the system. It includes user manuals, help screens, and tutorials. 510–533
user ID A method of limiting access to files and databases to protect stored data. 435
user interface A user interface includes screens, commands, controls, and features that enable users to interact more effectively with an application. *See also* graphical user interface (GUI)
consistency in, 356
control features, 347–349
described, 297
development strategies and, 297–298
easy to learn, 344
evolution of, 336–337
guidelines, 342–249
overview, 334–388
security issues, 370–372
transparent, 343
user productivity systems Systems that provide employees of all levels a wide array of tools to improve job performance. Examples include e-mail, word processing, graphics, and company intranets. 17
user rights User-specific privileges that determine the type of access a user has to a database, file, or directory. Also called permissions. 435, 601, 603
user story In agile development, a short, simple requirements definition provided by the customer. Programmers use user stories to determine a project's requirements, priorities, and scope. 521
user support A function typically performed by individuals within an IT department. User support provides users with technical information, training, and productivity support. 29, 572–574
user training package The main objective of a user training package is to show users how the system can help them perform their jobs. 572
user-centered A term that indicates the primary focus is upon the user. In a user-centered system, the distinction blurs between input, output, and the interface itself. 337, 341–342
user-selected Under the control of the system or application user. For example, user-selected help displays information when the user requests it. 345
validation, 367, 404–405, 602
validity check A type of data validation check that is used for data items that must have certain values. For example, if an inventory system has 20 valid item classes, then any input item that does not match one of the valid classes will fail the check. 367
validity rules Rules that are applied to data elements when data is entered to ensure that the value entered is valid. For example, a validity rule might require that an employee's salary number be within the employer's predefined range for that position. 220
value-added reseller (VAR) A firm that enhances a commercial package by adding custom features and configuring it for a particular industry. 293
variable charge method based on resource usage Resource allocation that is based upon the connect time, the server processing time, the network resources required, printer use, or a combination of similar factors. 673
variable charge method based on volume In this method, the indirect information systems department costs are allocated to other departments based on user-oriented activity, such as the number of transactions or printing volume. 674
variable costs Costs that vary depending on the level of activity. For example, the cost of printer paper or telephone line charges are variable costs. 672
vendor. *See* software vendor
Venn diagram A Venn diagram uses circular symbols to illustrate Boolean logic. Venn diagrams are named after John Venn, a nineteenth-century scholar who devised a scheme for visualizing logical relationships. 695
version control The process of tracking system releases. 583, 584
vertical application A software package that has been developed to handle information requirements for a specific type of business. 294
vertical system A system designed to meet the unique requirements of a specific business or industry, such as a Web-based retailer or video rental chain. 8
video tutorials, 540–543
virtual private network (VPN) Uses a public network to connect remote users securely. Allows remote clients to use a special key exchange that must be authenticated by the VPN. 599
Visible Analyst, 10, 20, 57, 215, 218–224, 658–660
ERDs and, 409, 410
process models and, 22
requirements modeling and, 151, 158
visible Web Refers to Web sites that are indexed by major search engines and are publicly accessible. 699
Visio (Microsoft), 10, 19–20, 172, 481
visual aids Tools such as whiteboards, flip charts, overhead transparencies, slides, films, and videotapes used to enhance a presentation. 640
Visual Basic (Microsoft), 318, 523, 651
Visual Studio (Microsoft), 317, 656–657
volume
of records, described, 222
of transactions, estimating, 301–302
vulnerability A security weakness or soft spot. 591
Wal-Mart, 12, 15
waterfall model A type of graph that depicts the result of each SDLC phase flowing down into the next phase. 22–23
Web The Internet allows you to visit the World Wide Web, usually referred to as the Web, which contains billions of text and multimedia documents called Web pages. 690
Web 2.0 A second generation of the World Wide Web that enables people to collaborate, interact, and share information much more dynamically, based on continuously available user applications rather than static HTML Web pages. Interactive experience is a hallmark of Web 2.0. 289, 472–473
Web browser An application that enables the user to navigate, or browse the Internet and display Web pages on his or her local computer. 399, 690
Web feed Data format for providing users with frequently

updated Web content on all kinds of topics, available by subscription. Also called a feed or RSS feed. 704
Web Host Industry Review (WHIR), 287
Web page Text and multimedia documents that are found on the World Wide Web. 399, 690
Web server A computer that is used to store and house Web sites. 400, 465, 467
  described, 399, 690
  system architecture and, 463
Web services Internet-based support programs that can be executed as an integral part of an information system; Web-based modular applications that can perform functions that can be quite simple or more complex. 318
Web site A collection of related Web pages. 399, 690
Web support Web support involves design and construction of Web pages, monitoring traffic, managing hardware and software, and linking Web-based applications to the company's existing information systems. 29
Web-based database design, 398–401
Web-based discussion group An online community that combines features of mailing lists and newsgroups. 705
Webcast A one-way transmission of information or training materials, such as a Webinar session, available on demand or for a specific period to online participants. 305, 537
Web-centric A strategy or approach that emphasizes a high degree of integration with other Web-based components. A Web-centric architecture follows Internet design protocols and enables a company to integrate the new application into its e-commerce strategy. 400
WebEx (Cisco), 643
Webinar A Webinar, which combines the words Web and seminar, is an Internet-based training session that provides an interactive experience. 537, 704
WebSphere IBM's Web-based development environment. 287, 288, 289, 457, 523
weight Weight is an important value that managers add to estimates so they can be analyzed. 107
what-if A feature of business support systems that allows analysis to define and account for a wide variety of issues (including issues not completely defined). 16–18, 31
what-if analysis What-if analysis allows you to vary one or more elements in a model in order to measure the effect on other elements. 587
why, who, what, when, and how of communications Good communications must answer these basic questions: Why is one communicating? Who is the target audience? What is expected? When is detail required? How does one communicate effectively? 157, 632
Wi-Fi (wireless fidelity) Family of popular IEEE local area network wireless networking standards, also known as 802.11, including 802.11a, b, g, and n. 802.11n is the most recent standard. 371, 482–484
Wi-Fi Alliance A nonprofit international association formed in 1999 to certify interoperability of wireless network products based on IEEE 802.11 specifications. 484, 598
Wi-Fi Protected Access (WPA) A common method used to secure a wireless network. This approach requires each wireless client be configured manually to use a special, pre-shared key, rather than key pairs. The most recent and more secure version is WPA2. 598
wide area network (WAN) A wide area network (WAN) spans long distances and can link users who are continents apart. 460, 478, 481
wiki A Web-based repository of information that anyone can access, contribute to, or modify. 289, 473, 531–532
Wikipedia, 432, 597
WiMAX IEEE 802.16 specifications, which are expected to enable wireless multimedia applications with a range of up to 30 miles. 485
Windows (Microsoft)
  Azure, 472
  Event Viewer, 602
  Live MovieMaker, 541
  user interface design and, 347
Wired Equivalent Privacy (WEP) One of the earliest methods used to secure a wireless network, superceded by WPA and WPA2. 598
wireless access point (WAP) A central wireless device that provides network services to wireless clients. Also called an access point. 483
wireless local area network (WLAN) A wireless network that is relatively inexpensive to install and is well-suited to workgroups and users who are not anchored to a specific desk or location. 482, 483, 484
wireless network(s)
  communication devices, 173–174
  overview, 482–485
  security, 598
  standard, 482–483
  topologies, 483–484
  user interface design and, 357–358
Word (Microsoft), 167, 171, 297
WordPerfect (Corel), 171
work breakdown structure (WBS) Breaking a project down into a series of smaller tasks. 104, 106, 109, 116–119
work file In a typical file processing environment, a work file is a temporary file created by an information system for a single task. Most often a work file is created by one process in the information system and used by another process within the same system. Work files also are called scratch files. 394
workgroup software Workgroup software offers many features in addition to basic e-mail capability. These features include calendars, task lists, schedules, contact lists, and document management, among others. Also called groupware. 637
World Wide Web The Internet allows you to visit the World Wide Web, usually referred to as the Web, which contains billions of text and multimedia documents called Web pages. 690
worst-case estimate The most pessimistic outcome is called the worst-case estimate. 107
WPA2 WPA2 is based on a new standard called 802.11i that provides a significant increase in protection over WEP and WPA. 598
written communications, 633–639. *See also* communication
XML. *See* Extensible Markup Language (XML)
XP (Extreme Programming), 26, 512, 520–523
XY chart Also called a scatter diagram, a tool used by system analysts to graphically show the correlation between two variables. 78–79
Y2K issue A problem faced by many firms in the year 2000 because their computer systems used only two digits to represent the year; most dates now use a four-digit format for the year (YYYYMMDD). 312, 434
Yahoo!, 12, 694, 698, 704–705
Yourdon A type of symbol set that is used in data flow diagrams. Processes, data flows, data stores, and external entities each have a unique symbol in the Yourdon symbol set. 200–201
Zachman Framework for Enterprise Architecture A model that asks the traditional fact-finding questions in a systems development context. 157, 158, 661
zero or many relation, 263

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