Chapter 4 is the first of four chapters in the systems analysis phase. This chapter describes the process of gathering facts about a systems project, preparing documentation, and creating models that will be used to design and develop the system.

INTRODUCTION

After an overview of the systems analysis phase, this chapter describes requirements modeling techniques and team-based methods that systems analysts use to visualize and document new systems. The chapter then discusses system requirements and fact-finding techniques, which include interviewing, documentation review, observation, surveys and questionnaires, sampling, and research.

Chapter 4 includes a Video Learning Session that shows you how to use a functional decomposition diagram (FDD) to model business functions and processes.
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 requirements modeling tasks and concepts.

Participants: Tina and David
Location: Tina’s office, Monday morning, October 3, 2011
Project status: The project has advanced to the systems analysis phase. Now, Tina and David will work on modeling, fact-finding, and the documentation they need to build a requirements model for the proposed bookstore information system.
Discussion topics: Modeling, team-based development strategies, fact-finding techniques, and documentation

Tina: Before I tell you about the project, look at this Dilbert cartoon. You’ll like it!

David: It’s funny, but scary too. Hope it doesn’t apply to us!

Tina: Me too. That’s why we have to do a good job of requirements modeling.

David: So, what do we do next?

Tina: We need to create a model of the new system. We call this a requirements model, because it will include all the outputs, inputs, processes, and controls for the new system. The model will consist of various diagrams, charts, and documentation.

David: How will we use the model when we’re done?

Tina: We’ll study it carefully and review it frequently with system users.

David: Who are the users?

Tina: Users might include bookstore staff, students, faculty members, and the college business office. External users might include textbook publishers and suppliers of bookstore merchandise. The main thing is to work with users every step of the way. We’ll perform fact-finding, and we’ll document everything carefully. Here’s a task list to get us started:

FIGURE 4-1 Typical requirements modeling task list.
Chapter 4   Requirements Modeling

SYSTEMS ANALYSIS PHASE OVERVIEW

The overall objective of the systems analysis phase is to understand the proposed project, ensure that it will support business requirements, and build a solid foundation for system development. In this phase, you use models and other documentation tools to visualize and describe the proposed system.

Systems Analysis Activities

The systems analysis phase includes the four main activities shown in Figure 4-2: requirements modeling, data and process modeling, object modeling, and consideration of development strategies.

Although the waterfall model shows sequential SDLC phases, it is not uncommon for several phases (or certain tasks within a phase) to interact during the development process, just as they would in an adaptive model. For example, this occurs whenever new facts are learned or system requirements change during the modeling process. Figure 4-2 shows typical interaction among the three modeling tasks: requirements modeling, data and process modeling, and object modeling.

FIGURE 4-2  The systems analysis phase consists of requirements modeling, data and process modeling, object modeling, and consideration of development strategies. Notice that the systems analysis tasks are interactive, even though the waterfall model generally depicts sequential development.

REQUIREMENTS MODELING

This chapter describes requirements modeling, which involves fact-finding to describe the current system and identification of the requirements for the new system, such as outputs, inputs, processes, performance, and security. Outputs refer to electronic or printed information produced by the system. Inputs refer to necessary data that enters the system, either manually or in an automated manner. Processes refer to the logical rules that are applied to transform the data into meaningful information. Performance refers to system characteristics such as speed, volume, capacity, availability, and reliability. Security refers to hardware, software, and procedural controls that safeguard and protect the system and its data from internal or external threats.

DATA AND PROCESS MODELING

In Chapter 5, Data and Process Modeling, you will continue the modeling process by learning how to represent graphically system data and processes using traditional structured analysis techniques. As you learned in Chapter 1, structured analysis identifies the data flowing into a process, the business rules that transform the data, and the resulting output data flow.

OBJECT MODELING

Chapter 6 discusses object modeling, which is another popular modeling technique. While structured analysis treats processes and data as separate components, object-oriented analysis (O-O) combines data and the processes that act on the data into things called objects. These objects represent actual people, things, transactions, and events that affect the system. During the system
development process, analysts often use both modeling methods to gain as much information as possible.

**DEVELOPMENT STRATEGIES** In Chapter 7, Development Strategies, you will consider various development options and prepare for the transition to the systems design phase of the SDLC. You will learn about software trends, acquisition and development alternatives, outsourcing, and formally documenting requirements for the new system.

The deliverable, or end product, of the systems analysis phase is a **system requirements document**, which is an overall design for the new system. In addition, each activity within the systems analysis phase has an end product and one or more milestones. As you learned in Chapter 3, project managers use various tools and techniques to coordinate people, tasks, timetables, and budgets.

**Systems Analysis Skills**

You will need strong analytical and interpersonal skills to build an accurate model of the new system. *Analytical skills* enable you to identify a problem, evaluate the key elements, and develop a useful solution. *Interpersonal skills* are especially valuable to a systems analyst who must work with people at all organizational levels, balance conflicting needs of users, and communicate effectively.

Because information systems affect people throughout the company, you should consider team-oriented strategies as you begin the systems analysis phase.

**Team-Based Techniques: JAD, RAD, and Agile Methods**

The IT department’s goal is to deliver the best possible information system, at the lowest possible cost, in the shortest possible time. To achieve the best results, system developers view users as partners in the development process. Greater user involvement usually results in better communication, faster development times, and more satisfied users.

The traditional model for systems development was an IT department that used structured analysis and consulted users only when their input or approval was needed. Although the IT staff still has a central role, and structured analysis remains a popular method of systems development, most IT managers invite system users to participate actively in various development tasks.

As you learned in Chapter 1, team-based approaches have been around for some time. A popular example is **joint application development (JAD)**, which is a user-oriented technique for fact-finding and requirements modeling. Because it is not linked to a specific development methodology, systems developers use JAD whenever group input and interaction are desired.

Another popular user-oriented method is **rapid application development (RAD)**. RAD resembles a condensed version of the entire SDLC, with users involved every step of the way. While JAD typically focuses only on fact-finding and requirements determination, RAD provides a fast-track approach to a full spectrum of system development tasks, including planning, design, construction, and implementation.

Finally, as you learned in Chapter 1, **agile methods** represent a recent trend that stresses intense interaction between system developers and users. JAD, RAD, and agile methods are discussed in the following sections.

**JOINT APPLICATION DEVELOPMENT**

Joint application development (JAD) is a popular fact-finding technique that brings users into the development process as active participants.
User Involvement

Users have a vital stake in an information system, and they should participate fully in the development process. Until recent years, the IT department usually had sole responsibility for systems development, and users had a relatively passive role. During the development process, the IT staff would collect information from users, define system requirements, and construct the new system. At various stages of the process, the IT staff might ask users to review the design, offer comments, and submit changes.

Today, users typically have a much more active role in systems development. IT professionals now recognize that successful systems must be user-oriented, and users need to be involved, formally or informally, at every stage of system development.

One popular strategy for user involvement is a JAD team approach, which involves a task force of users, managers, and IT professionals that works together to gather information, discuss business needs, and define the new system requirements.

JAD Participants and Roles

A JAD team usually meets over a period of days or weeks in a special conference room or at an off-site location. Either way, JAD participants should be insulated from the distraction of day-to-day operations. The objective is to analyze the existing system, obtain user input and expectations, and document user requirements for the new system.

The JAD group usually has a project leader, who needs strong interpersonal and organizational skills, and one or more members who document and record the results and decisions. Figure 4-3 describes typical JAD participants and their roles. IT staff members often serve as JAD project leaders, but that is not always the case. Systems analysts on the JAD team participate in discussions, ask questions, take notes, and provide support to the team. If CASE tools are available, analysts can develop models and enter documentation from the JAD session directly into the CASE tool.

A typical JAD session agenda is shown in Figure 4-4. The JAD process involves intensive effort by all team members. Because of the wide range of input and constant interaction among the participants, many companies believe that a JAD group produces the best possible definition of the new system.

<table>
<thead>
<tr>
<th>JAD PARTICIPANT</th>
<th>ROLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAD project leader</td>
<td>Develops an agenda, acts as a facilitator, and leads the JAD session</td>
</tr>
<tr>
<td>Top management</td>
<td>Provides enterprise-level authorization and support for the JAD session</td>
</tr>
<tr>
<td>Managers</td>
<td>Provide department-level support for the project</td>
</tr>
<tr>
<td>Users</td>
<td>Provide operational-level input on current operations, desired changes, input and output requirements, user interface issues, and how the project will support day-to-day tasks</td>
</tr>
<tr>
<td>Systems analysts and other IT staff members</td>
<td>Provide technical assistance and resources for JAD team members on issues such as security, backup, hardware, software, and network capability</td>
</tr>
<tr>
<td>Recorder</td>
<td>Documents results of JAD sessions and works with systems analysts to build system models and develop CASE tool documentation</td>
</tr>
</tbody>
</table>

FIGURE 4-3 Typical JAD participants and roles.
JAD Advantages and Disadvantages

Compared with traditional methods, JAD is more expensive and can be cumbersome if the group is too large relative to the size of the project. Many companies find, however, that JAD allows key users to participate effectively in the requirements modeling process. When users participate in the systems development process, they are more likely to feel a sense of ownership in the results, and support for the new system. When properly used, JAD can result in a more accurate statement of system requirements, a better understanding of common goals, and a stronger commitment to the success of the new system.

RAPID APPLICATION DEVELOPMENT

Rapid application development (RAD) is a team-based technique that speeds up information systems development and produces a functioning information system. Like JAD, RAD uses a group approach, but goes much further. While the end product of JAD is a requirements model, the end product of RAD is the new information system. RAD is a complete methodology, with a four-phase life cycle that parallels the traditional SDLC phases. Companies use RAD to reduce cost and development time, and increase the probability of success.
RAD relies heavily on prototyping and user involvement. The RAD process allows users to examine a working model as early as possible, determine if it meets their needs, and suggest necessary changes. Based on user input, the prototype is modified and the interactive process continues until the system is completely developed and users are satisfied. The project team uses CASE tools to build the prototypes and create a continuous stream of documentation.

**RAD Phases and Activities**

The RAD model consists of four phases: requirements planning, user design, construction, and cutover, as shown in Figure 4-5. Notice the continuous interaction between the user design and construction phases.

![Figure 4-5](https://www.cengagebrain.com)

**FIGURE 4-5** The four phases of the RAD model are requirements planning, user design, construction, and cutover. Notice the continuous interaction between the user design and construction phases.

**Requirements Planning**

- Users, managers, and IT staff agree upon business needs, project scope, and systems requirements
- Obtain approval to continue

**User Design**

- Interact with users
- Build models and prototypes
- Conduct intensive JAD-type sessions

**Construction**

- Program and application development
- Coding
- Unit, integration, and system testing

**Cutover**

- Data conversion
- Full-scale testing
- System changeover
- User training

**REQUIREMENTS PLANNING** The requirements planning phase combines elements of the systems planning and systems analysis phases of the SDLC. Users, managers, and IT staff members discuss and agree on business needs, project scope, constraints, and system requirements. The requirements planning phase ends when the team agrees on the key issues and obtains management authorization to continue.

**USER DESIGN** During the user design phase, users interact with systems analysts and develop models and prototypes that represent all system processes, outputs, and inputs. The RAD group or subgroups typically use a combination of JAD techniques and CASE tools to translate user needs into working models. User design is a continuous,
Agile Methods

interactive process that allows users to understand, modify, and eventually approve a working model of the system that meets their needs.

**CONSTRUCTION** The construction phase focuses on program and application development tasks similar to the SDLC. In RAD, however, users continue to participate and still can suggest changes or improvements as actual screens or reports are developed.

**CUTOVER** The cutover phase resembles the final tasks in the SDLC implementation phase, including data conversion, testing, changeover to the new system, and user training. Compared with traditional methods, the entire process is compressed. As a result, the new system is built, delivered, and placed in operation much sooner.

**RAD Objectives**

The main objective of all RAD approaches is to cut development time and expense by involving users in every phase of systems development. Because it is a continuous process, RAD allows the development team to make necessary modifications quickly, as the design evolves. In times of tight corporate budgets, it is especially important to limit the cost of changes that typically occur in a long, drawn-out development schedule.

In addition to user involvement, a successful RAD team must have IT resources, skills, and management support. Because it is a dynamic, user-driven process, RAD is especially valuable when a company needs an information system to support a new business function. By obtaining user input from the beginning, RAD also helps a development team design a system that requires a highly interactive or complex user interface.

**RAD Advantages and Disadvantages**

RAD has advantages and disadvantages compared with traditional structured analysis methods. The primary advantage is that systems can be developed more quickly with significant cost savings. A disadvantage is that RAD stresses the mechanics of the system itself and does not emphasize the company’s strategic business needs. The risk is that a system might work well in the short term, but the corporate and long-term objectives for the system might not be met. Another potential disadvantage is that the accelerated time cycle might allow less time to develop quality, consistency, and design standards. RAD can be an attractive alternative, however, if an organization understands the possible risks.

**Agile Methods**

In Chapter 1, you learned that agile methods attempt to develop a system incrementally, by building a series of prototypes and constantly adjusting them to user requirements. As the agile process continues, developers revise, extend, and merge earlier versions into the final product. An agile approach emphasizes continuous feedback, and each incremental step is affected by what was learned in the prior steps.

As agile methods become more popular, a large community of agile-related software and services has evolved. For example, Visual Paradigm offers Agilian, which includes a set of agile modeling tools, as shown in Figure 4-6 on the next page. The Agilian modeling toolset includes support for many modeling tools, such as the Unified Modeling Language, entity-relationship diagrams, data flow diagrams, and business process modeling, among others.
Some agile developers prefer not to use CASE tools at all, and rely instead on whiteboard displays and arrangements of movable sticky notes. This approach, they believe, reinforces the agile strategy: simple, rapid, flexible, and user-oriented.

Scrum is another agile approach. The name is derived from the rugby term *scrum* (Figure 4-7), where team members prepare to lunge at each other to achieve their objectives. The systems development version of Scrum involves the same intense interaction, though more mental than physical. In a Scrum session, agile team members play specific roles, including colorful designations as *pigs* or *chickens*. These roles are based on the old joke about the pig and chicken who discuss a restaurant where ham and eggs would be served. However, the pig declines, because that role would require a total commitment, while for the chicken, it would only be a contribution.

In the agile world, the *pigs* include the product owner, the facilitator, and the development team; while the *chickens* include users, other stakeholders, and managers. Scrum sessions have specific guidelines that emphasize time blocks, interaction, and team-based activities that result in deliverable software.
Agile Method Advantages and Disadvantages

Agile, or adaptive, methods are very flexible and efficient in dealing with change. They are popular because they stress team interaction and reflect a set of community-based values. Also, frequent deliverables constantly validate the project and reduce risk.

However, some potential problems exist. For example, team members need a high level of technical and interpersonal skills. Also, a lack of structure and documentation can introduce risk factors. Finally, the overall project may be subject to significant change in scope as user requirements continue to evolve during the project.

CASE IN POINT 4.1:  NORTH HILLS COLLEGE

North Hills College has decided to implement a new registration system that will allow students to register online, as well as in person. As IT manager, you decide to set up a JAD session to help define the requirements for the new system. The North Hills organization is fairly typical, with administrative staff that includes a registrar, a student support and services team, a business office, an IT group, and a number of academic departments. Using this information, you start work on a plan to carry out the JAD session. Who would you invite to the session, and why? What would be your agenda for the session, and what would take place at each stage of the session?

MODELING TOOLS AND TECHNIQUES

Models help users, managers, and IT professionals understand the design of a system. Modeling involves graphical methods and nontechnical language that represent the system at various stages of development. During requirements modeling, you can use various tools to describe business processes, requirements, and user interaction with the system.

In Chapter 1, you learned about CASE tools that offer powerful modeling features. CASE tool modeling is discussed in detail in Part B of the Systems Analyst’s Toolkit.
Systems analysts use modeling and fact-finding interactively — first they build fact-finding results into models, then they study the models to determine whether additional fact-finding is needed. To help them understand system requirements, analysts use functional decomposition diagrams, business process models, data flow diagrams, and Unified Modeling Language diagrams. Any of these diagrams can be created with CASE tools or standalone drawing tools if desired.

### Functional Decomposition Diagrams

A functional decomposition diagram (FDD) is a top-down representation of a function or process. Using an FDD, an analyst can show business functions and break them down into lower-level functions and processes. Creating an FDD is similar to drawing an organization chart — you start at the top and work your way down. Figure 4-8 shows an FDD of a library system drawn with the Visible Analyst CASE tool. FDDs can be used at several stages of systems development. During requirements modeling, analysts use FDDs to model business functions and show how they are organized into lower-level processes. Those processes translate into program modules during application development.

### Business Process Modeling

As you learned in Chapter 1, a business process model (BPM) describes one or more business processes, such as handling an airline reservation, filling a product order, or updating a customer account. During requirements modeling, analysts often create models that use a standard language called business process modeling notation (BPMN). BPMN includes various shapes and symbols to represent events, processes, and workflows.
When you create a business process model using a CASE tool such as Visible Analyst, your diagram automatically becomes part of the overall model. In the example shown in Figure 4-9, using BPMN terminology, the overall diagram is called a pool, and the designated customer areas are called swim lanes. Integrating BPM into the CASE development process leads to faster results, fewer errors, and reduced cost. Part B of the Systems Analyst’s Toolkit describes business process modeling in more detail.

Data Flow Diagrams

Working from a functional decomposition diagram, analysts can create data flow diagrams (DFDs) to show how the system stores, processes, and transforms data. The DFD in Figure 4-10 describes adding and removing books, which is a function shown in the Library Management diagram in Figure 4-8. Notice that the two shapes in the DFD represent processes, each with various inputs and outputs. Additional levels of information and detail are depicted in other, related DFDs. Data and process modeling is described in detail in Chapter 5.

Unified Modeling Language

The Unified Modeling Language (UML) is 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.

UML provides various graphical tools, such as use case diagrams and sequence diagrams. During requirements modeling, a systems analyst can utilize the UML to represent the information system from a user’s viewpoint. Use case diagrams, sequence diagrams, and other UML concepts are discussed in more detail in Chapter 6, along with other object-oriented analysis concepts. A brief description of each technique follows.

USE CASE DIAGRAMS During requirements modeling, systems analysts and users work together to document requirements and model system functions. A use case diagram visually represents the interaction between users and the information system. In a use case diagram, the user becomes an actor, with a specific role that describes how he or she interacts with the system. Systems analysts can draw use case diagrams freehand or use CASE tools that integrate the use cases into the overall system design.

Figure 4-11 shows a simple use case diagram for a sales system where the actor is a customer and the use case involves a credit card validation that is performed by the system. Because use cases depict the system through the eyes of a user, common business
FIGURE 4-11 Use case diagram of a sales system, where the actor is a customer and the use case involves a credit card validation.

<table>
<thead>
<tr>
<th>Name of Use Case:</th>
<th>Credit card validation process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actor:</td>
<td>Customer</td>
</tr>
<tr>
<td>Description:</td>
<td>Describes the credit card validation process</td>
</tr>
</tbody>
</table>
| Successful Completion:     | 1. Customer clicks the input selector and enters credit card number and expiration date  
                              2. System verifies card  
                              3. System sends authorization message |
| Alternative:               | 1. Customer clicks the input selector and enters credit card number and expiration date  
                              2. System rejects card  
                              3. System sends rejection message |
| Precondition:              | Customer has selected at least one item and has proceeded to checkout area |
| Postcondition:             | Credit card information has been validated  
                              Customer can continue with order |
| Assumptions:               | None                            |

FIGURE 4-12 A table documents the credit card validation use case shown in Figure 4-11.

language can be used to describe the transactions. For example, Figure 4-12 shows a table that documents the credit card validation use case, and Figure 4-13 shows a student records system, with several use cases and actors.

SEQUENCE DIAGRAMS A sequence diagram shows the timing of interactions between objects as they occur. A systems analyst might use a sequence diagram to show all possible outcomes, or focus on a single scenario. Figure 4-14 shows a simple sequence diagram of a successful credit card validation. The interaction proceeds from top to bottom along a vertical timeline, while the horizontal arrows represent messages from one object to another.

FIGURE 4-13 Use case diagram of a student records system.
**System Requirements Checklist**

During requirements modeling, systems developers must identify and describe all system requirements. A system requirement is a characteristic or feature that must be included in an information system to satisfy business requirements and be acceptable to users. System requirements serve as benchmarks to measure the overall acceptability of the finished system.

System requirements fall into five general categories: outputs, inputs, processes, performance, and controls. Typical examples of system requirements for each category are listed below.

**Output Examples**

- ✓ The Web site must report online volume statistics every four hours, and hourly during peak periods.
- ✓ The inventory system must produce a daily report showing the part number, description, quantity on hand, quantity allocated, quantity available, and unit cost of all sorted by part number.
- ✓ The contact management system must generate a daily reminder list for all sales reps.
- ✓ The purchasing system must provide suppliers with up-to-date specifications.
- ✓ The sales tracking system must produce a daily fast-moving-item report, listing all products that exceed the forecasted sales volume grouped by style, color, size, and reorder status.
- ✓ The customer analysis system must produce a quarterly report that identifies changes in ordering patterns or trends with statistical comparisons to the previous four quarters.

![Sequence diagram showing a credit card validation process.](image-url)
Input Examples
✓ Manufacturing employees must swipe their ID cards into online data collection terminals that record labor costs and calculate production efficiency.
✓ The department head must enter overtime hours on a separate screen.
✓ Student grades must be entered on machine-scannable forms prepared by the instructor.
✓ Each input form must include date, time, product code, customer number, and quantity.
✓ Data entry screens must be uniform, except for background color, which can be changed by the user.
✓ A data entry person at the medical group must input patient services into the billing system.

Process Examples
✓ The student records system must calculate the GPA at the end of each semester.
✓ As the final step in year-end processing, the payroll system must update employee salaries, bonuses, and benefits and produce tax data required by the IRS.
✓ The warehouse distribution system must analyze daily orders and create a routing pattern for delivery trucks that maximizes efficiency and reduces unnecessary mileage.
✓ The human resources system must interface properly with the existing payroll system.
✓ The video rental system must not execute new rental transactions for customers who have overdue videos.
✓ The prescription system must automatically generate an insurance claim form.

Performance Examples
✓ The system must support 25 users online simultaneously.
✓ Response time must not exceed four seconds.
✓ The system must be operational seven days a week, 365 days a year.
✓ The accounts receivable system must prepare customer statements by the third business day of the following month.
✓ The student records system must produce class lists within five hours after the end of registration.
✓ The online inventory control system must flag all low-stock items within one hour after the quantity falls below a predetermined minimum.

Control Examples
✓ The system must provide logon security at the operating system level and at the application level.
✓ An employee record must be added, changed, or deleted only by a member of the human resources department.
✓ The system must maintain separate levels of security for users and the system administrator.
✓ All transactions must have audit trails.
✓ The manager of the sales department must approve orders that exceed a customer’s credit limit.
✓ The system must create an error log file that includes the error type, description, and time.

**Future Growth, Costs, and Benefits**

In addition to the system requirements, systems analysts must consider scalability, which determines how a system will handle future growth and demands, and the total cost of ownership, which includes all future operational and support costs.

**Scalability**

Scalability refers to a system’s ability to handle increased business volume and transactions in the future. Because it will have a longer useful life, a scalable system offers a better return on the initial investment.

To evaluate scalability, you need information about projected future volume for all outputs, inputs, and processes. For example, for a Web-based order processing system, you would need to know the maximum projected number of concurrent users, the periods of peak online activity, the number and types of data items required for each transaction, and the method of accessing and updating customer files.

Even to print customer statements, you need to know the number of active accounts and have a forecast for one, two, or five years, because that information affects future hardware decisions. In addition, with realistic volume projections, you can provide reliable cost estimates for related expenses, such as postage and online charges.

Similarly, to ensure that a Web-based hotel reservation system is sufficiently scalable, you would need to project activity levels for several years of operation. For example, you might forecast the frequency of online queries about room availability and estimate the time required for each query and the average response time. With that information, you could estimate server transaction volume and network requirements.

Transaction volume has a significant impact on operating costs. When volume exceeds a system’s limitations, maintenance costs increase sharply. Volume can change dramatically if a company expands or enters a new line of business. For example, a new Internet-based marketing effort might require an additional server and 24-hour technical support.

Data storage also is an important scalability issue. You need to determine how much data storage is required currently and predict future needs based on system activity and growth. Those requirements affect hardware, software, and network bandwidth needed to maintain system performance. You also must consider data retention requirements and determine whether data can be deleted or archived on a specific timetable.

**Total Cost of Ownership**

In addition to direct costs, systems developers must identify and document indirect expenses that contribute to the total cost of ownership (TCO). TCO is especially important if the development team is assessing several alternatives. After considering the indirect costs, which are not always apparent, a system that seems inexpensive initially might actually turn out to be the most costly choice. One problem is that cost estimates tend to understate indirect costs such as user support and downtime productivity losses. Even if accurate figures are unavailable, systems analysts should try to identify indirect costs and include them in TCO estimates.
Microsoft has developed a method for measuring total costs and benefits, called **Rapid Economic Justification (REJ)**, which is described in Figure 4-15. According to Microsoft, REJ is a framework to help IT professionals analyze and optimize IT investments. Notice that the primary emphasis is on business improvement, rather than operational efficiency. As the Web site points out, the strategic role of IT investments should be included, even when the specific benefits are difficult to quantify.

**Fact-Finding**

Now that you understand the categories of system requirements, scalability, and TCO, the next step is to begin collecting information. Whether you are working on your own or as a member of a JAD team, during requirements modeling you will use various fact-finding techniques, including interviews, document review, observation, surveys and questionnaires, sampling, and research.

**Fact-Finding Overview**

Although software can help you to gather and analyze facts, no program actually performs fact-finding for you. First, you must identify the information you need. Typically, you begin by asking a series of questions, such as these:

- What business functions are supported by the current system?
- What strategic objectives and business requirements must be supported by the new system?
- What are the benefits and TCO of the proposed system?
- What transactions will the system process?
- What information do users and managers need from the system?
• Must the new system interface with legacy systems?
• What procedures could be eliminated by business process reengineering?
• What security issues exist?
• What risks are acceptable?
• What budget and timetable constraints will affect system development?

To obtain answers to these questions, you develop a fact-finding plan, which can involve another series of questions (who, what, where, when, and how), or use a more structured approach such as the Zachman Framework, which is explained in a following section. Either way, you will develop a strategy, carry out fact-finding techniques, document the results, and prepare a system requirements document, which is presented to management.

Who, What, Where, When, How, and Why?

Fact-finding involves answers to five familiar questions: who, what, where, when, and how. For each of those questions, you also must ask another very important question: why. Some examples of these questions are:

1. **Who?** Who performs each of the procedures within the system? Why? Are the correct people performing the activity? Could other people perform the tasks more effectively?
2. **What?** What is being done? What procedures are being followed? Why is that process necessary? Often, procedures are followed for many years and no one knows why. You should question why a procedure is being followed at all.
3. **Where?** Where are operations being performed? Why? Where could they be performed? Could they be performed more efficiently elsewhere?
4. **When?** When is a procedure performed? Why is it being performed at this time? Is this the best time?
5. **How?** How is a procedure performed? Why is it performed in that manner? Could it be performed better, more efficiently, or less expensively in some other manner?

There is a difference between asking what is being done and what could or should be done. The systems analyst first must understand the current situation. Only then can he or she tackle the question of what should be done. Figure 4-16 lists the basic questions and when they should be asked. Notice that the first two columns relate to the current system, but the third column focuses on the proposed system.

<table>
<thead>
<tr>
<th>CURRENT SYSTEM</th>
<th>PROPOSED SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who does it?</td>
<td>Why does this person do it?</td>
</tr>
<tr>
<td>What is done?</td>
<td>Why is it done?</td>
</tr>
<tr>
<td>Where is it done?</td>
<td>Why is it done there?</td>
</tr>
<tr>
<td>When is it done?</td>
<td>Why is it done then?</td>
</tr>
<tr>
<td>How is it done?</td>
<td>Why is it done this way?</td>
</tr>
</tbody>
</table>

**FIGURE 4-16** Sample questions during requirements modeling as the focus shifts from the current system to the proposed system.
The Zachman Framework

In the 1980s, John Zachman observed how industries such as architecture and construction handled complex projects, and he suggested that the same ideas could be applied to information systems development. His concept, the **Zachman Framework for Enterprise Architecture**, is a model that asks the traditional fact-finding questions in a systems development context, as shown in Figure 4-17. The Zachman Framework is a popular approach, and the Visible Analyst CASE tool now includes a Zachman Framework interface that allows users to view a systems project from different perspectives and levels of detail. The Zachman Framework helps managers and users understand the model and ensures that overall business goals translate into successful IT projects.

**FIGURE 4-17** Visible Analyst uses the Zachman Framework for Enterprise Architecture. The Zachman concept presents traditional fact-finding questions in a systems development context.
**Interviews**

Interviewing is an important fact-finding tool during the systems analysis phase. An interview is a planned meeting during which you obtain information from another person. You must have the skills needed to plan, conduct, document, and evaluate interviews successfully.

After you identify the information you need, as described earlier in the chapter, you can begin the interviewing process, which consists of seven steps for each interview:

1. Determine the people to interview.
2. Establish objectives for the interview.
3. Develop interview questions.
4. Prepare for the interview.
5. Conduct the interview.
6. Document the interview.
7. Evaluate the interview.

**Step 1: Determine the People to Interview**

To get an accurate picture, you must select the right people to interview and ask them the right questions. During the preliminary investigation, you talked mainly to middle managers or department heads. Now, during the systems analysis phase, you might need to interview people from all levels of the organization.

Although you can select your interview candidates from the formal organization charts that you reviewed earlier, you also must consider any informal structures that exist in the organization. Informal structures usually are based on interpersonal relationships and can develop from previous work assignments, physical proximity, unofficial procedures, or personal relationships such as the informal gathering shown in Figure 4-18. In an informal structure, some people have more influence or knowledge than appears on an organization chart. Your knowledge of the company’s formal and informal structures helps you determine the people to interview during the systems analysis phase.

Should you interview several people at the same time? Group interviews can save time and provide an opportunity to observe interaction among the participants. Group interviews also can present problems. One person might dominate the conversation, even when questions are addressed specifically to others. Organization level also can present a problem, as the presence of senior managers in an interview might prevent lower-level employees from expressing themselves candidly.

**Step 2: Establish Objectives for the Interview**

After deciding on the people to interview, you must establish objectives for the session. First, you should determine the general areas to be discussed, and then list the facts you want to gather. You also should try to solicit ideas, suggestions, and opinions during the interview.
The objectives of an interview depend on the role of the person being interviewed. Upper-level managers can provide the big picture and help you to understand the system as a whole. Specific details about operations and business processes are best learned from people who actually work with the system on a daily basis.

In the early stages of systems analysis, interviews usually are general. As the fact-finding process continues, however, the interviews focus more on specific topics. Interview objectives also vary at different stages of the investigation. By setting specific objectives, you create a framework that helps you decide what questions to ask and how to phrase the questions.

**Step 3: Develop Interview Questions**

Creating a standard list of interview questions helps to keep you on track and avoid unnecessary tangents. Also, if you interview several people who perform the same job, a standard question list allows you to compare their answers. Although you have a list of specific questions, you might decide to depart from it because an answer to one question leads to another topic that you want to pursue. That question or topic then should be included in a revised set of questions used to conduct future interviews. If the question proves to be extremely important, you may need to return to a previous interviewee to query him or her on the topic.

The interview should consist of several different kinds of questions: open-ended, closed-ended, or questions with a range of responses. When you phrase your questions, you should avoid **leading questions** that suggest or favor a particular reply. For example, rather than asking, “What advantages do you see in the proposed system?” you might ask, “Do you see any advantages in the proposed system?”

**OPEN-ENDED QUESTIONS** Open-ended questions encourage spontaneous and unstructured responses. Such questions are useful when you want to understand a larger process or draw out the interviewee’s opinions, attitudes, or suggestions. Here are some examples of open-ended questions: What are users saying about the new system? How is this task performed? Why do you perform the task that way? How are the checks reconciled? What added features would you like to have in the new billing system? Also, you can use an open-ended question to probe further by asking: Is there anything else you can tell me about this topic?

**CLOSED-ENDED QUESTIONS** Closed-ended questions limit or restrict the response. You use closed-ended questions when you want information that is more specific or when you need to verify facts. Examples of closed-ended questions include the following: How many personal computers do you have in this department? Do you review the reports before they are sent out? How many hours of training does a clerk receive? Is the calculation procedure described in the manual? How many customers ordered products from the Web site last month?

**RANGE-OF-RESPONSE QUESTIONS** Range-of-response questions are closed-ended questions that ask the person to evaluate something by providing limited answers to specific responses or on a numeric scale. This method makes it easier to tabulate the answers and interpret the results. Range-of-response questions might include these: On a scale of 1 to 10, with 1 the lowest and 10 the highest, how effective was your training? How would you rate the severity of the problem: low, medium, or high? Is the system shutdown something that occurs never, sometimes, often, usually, or always?
Step 4: Prepare for the Interview

After setting the objectives and developing the questions, you must prepare for the interview. Careful preparation is essential because an interview is an important meeting and not just a casual chat. When you schedule the interview, suggest a specific day and time and let the interviewee know how long you expect the meeting to last. It is also a good idea to send an e-mail or place a reminder call the day before the interview.

Remember that the interview is an interruption of the other person’s routine, so you should limit the interview to no more than one hour. If business pressures force a postponement of the meeting, you should schedule another appointment as soon as it is convenient. Remember to keep department managers informed of your meetings with their staff members. Sending a message to each department manager listing your planned appointments is a good way to keep them informed. Figure 4-19 is an example of such a message.

You should send a list of topics to an interviewee several days before the meeting, especially when detailed information is needed, so the person can prepare for the interview and minimize the need for a follow-up meeting. Figure 4-20 shows a sample message that lists specific questions and confirms the date, time, location, purpose, and anticipated duration of the interview.

If you have questions about documents, ask the interviewee to have samples available at the meeting. Your advance memo should include a list of the documents you want to discuss, if you know what they are. Also, you can make a general request for documents, as the analyst did in her e-mail shown in Figure 4-20.

Two schools of thought exist about the best location for an interview. Some analysts believe that interviews should take place in the interviewee’s office, whereas other analysts feel that a neutral location such as a conference room is better.

Supporters of interviews in the interviewee’s office believe that is the best location because it makes the interviewee feel comfortable during the meeting. A second...
argument in favor of the interviewee’s office is that the office is where he or she has the easiest access to supporting material that might be needed during the discussion. If you provide a complete list of topics in advance, however, the interviewee can bring the necessary items to a conference room or other location.

Supporters of neutral locations stress the importance of keeping interruptions to a minimum so both people can concentrate fully. In addition, an interview that is free of interruptions takes less time. If the meeting does take place in the interviewee’s office, you should suggest tactfully that all calls be held until the conclusion of the interview.

**Step 5: Conduct the Interview**

After determining the people to interview, setting your objectives, and preparing the questions, you should develop a specific plan for the meeting. When conducting an interview, you should begin by introducing yourself, describing the project, and explaining your interview objectives.

During the interview, ask questions in the order in which you prepared them, and give the interviewee sufficient time to provide thoughtful answers. Establishing a good rapport with the interviewee is important, especially if this is your first meeting. If the other person feels comfortable and at ease, you probably will receive more complete and candid answers. Your primary responsibility during an interview is to listen carefully to the answers. Analysts sometimes hear only what they expect to hear. You must concentrate on what is said and notice any nonverbal communication that takes place. This process is called **engaged listening**.

After asking a question, allow the person enough time to think about the question and arrive at an answer. Studies have shown that the maximum pause during a conversation is usually three to five seconds. After that interval, one person will begin talking. You will need to be patient and practice your skills in many actual interview situations to be successful.

When you finish asking your questions, summarize the main points covered in the interview and explain the next course of action. For example, mention that you will send a follow-up memo or that the interviewee should get back to you with certain information. When you conclude the interview, thank the person and encourage him or her to contact you with any questions or additional comments. Also, when the interview ends, it is a good idea to ask the interviewee whether he or she can suggest any additional topics that should be discussed.

After an interview, you should summarize the session and seek a confirmation from the other person. By stating your understanding of the discussion, the interviewee can respond and correct you, if necessary. One approach is to rephrase the interviewee’s answers. For example, you can say, “If I understand you correctly, you are saying that ...” and then reiterate the information given by the interviewee.

**Step 6: Document the Interview**

Although taking notes during an interview has both advantages and disadvantages, the accepted view is that note taking should be kept to a minimum. Although you should write down a few notes to jog your memory after the interview, you should avoid writing everything that is said. Too much writing distracts the other person and makes it harder to establish a good rapport.

After conducting the interview, you must record the information quickly. You should set aside time right after the meeting to record the facts and evaluate the information. For that reason, try not to schedule back-to-back interviews. Studies have shown that 50 percent of a conversation is forgotten within 30 minutes. You, therefore, should use your notes to record the facts immediately so you will not forget
them. You can summarize the facts by preparing a narrative describing what took place or by recording the answers you received next to each question on your prepared question list.

Tape recorders are effective tools for an interview; however, many people feel uncomfortable when recorders are present. Before using a recorder, you should discuss its use with the interviewee. Assure the interviewee that you will erase the tape after you transcribe your notes and that you will stop and rewind the tape anytime during the interview at his or her request. If you ask sensitive questions or the interviewee wants to answer a question without being recorded, explain that you will turn off the tape for a period of time during the interview.

Even with a tape recorder in use, you should listen carefully to the interviewee’s responses so you can ask good follow-up questions. Otherwise, you might have to return for a second visit to ask the questions you missed the first time. Also, remember that each recorded interview takes twice the amount of time, because you must listen to or view the recorded meeting again after conducting the interview itself.

After the interview, send a memo to the interviewee expressing your appreciation for his or her time and cooperation. In the memo, you should note the date, time, location, purpose of the interview, and the main points you discussed so the interviewee has a written summary and can offer additions or corrections.

Step 7: Evaluate the Interview

In addition to recording the facts obtained in an interview, try to identify any possible biases. For example, an interviewee who tries to protect his or her own area or function might give incomplete answers or refrain from volunteering information. Or, an interviewee with strong opinions about the current or future system might distort the facts. Some interviewees might answer your questions in an attempt to be helpful even though they do not have the necessary experience to provide accurate information.

Unsuccessful Interviews

No matter how well you prepare for interviews, some are not successful. One of the main reasons could be that you and the interviewee did not get along well. Such a situation can be caused by several factors. For example, a misunderstanding or personality conflict.
could affect the interview negatively, or the interviewee might be afraid that the new system will eliminate or change his or her job.

In other cases, the interviewee might give only short or incomplete responses to your open-ended questions. If so, you should switch to closed-ended questions or questions with a range of responses, or try rephrasing your open-ended questions into those types of questions. If that still does not help, you should find a tactful way to conclude the meeting.

Continuing an unproductive interview is difficult. The interviewee could be more cooperative later, or you might find the information you seek elsewhere. If failure to obtain specific information will jeopardize the success of the project, inform your supervisor, who can help you decide what action to take. Your supervisor might contact the interviewee’s supervisor, ask another systems analyst to interview the person, or find some other way to get the needed information.

**CASE IN POINT 4.3: FastPak Overnight Package System**

FastPak, the nation’s fourth-largest overnight package system, is headquartered in Los Angeles, California. Jesse Evans is a systems analyst on an IT team that is studying ways to update FastPak’s package tracking system. Jesse prepared well for her interview with Jason Tanya, FastPak’s executive vice president. Mr. Tanya did not ask his assistant to hold his calls during the meeting, however. After several interruptions, Jesse tactfully suggested that she could come back another time, or perhaps that Mr. Tanya might ask his assistant to hold his calls. “No way,” he replied. “I’m a very busy man and we’ll just have to fit this in as we can, even if it takes all day.” Jesse was unprepared for his response. What are her options? Is an analyst always in control of this kind of situation? Why or why not?

**Other Fact-Finding Techniques**

In addition to interviewing, systems analysts use other fact-finding techniques, including document review, observation, questionnaires and surveys, sampling, and research. Such techniques are used before interviewing begins to obtain a good overview and to help develop better interview questions.

**Document Review**

Document review can help you understand how the current system is supposed to work. Remember that system documentation sometimes is out of date. Forms can change or be discontinued, and documented procedures often are modified or eliminated. You should obtain copies of actual forms and operating documents currently in use. You also should review blank copies of forms, as well as samples of actual completed forms. You usually can obtain document samples during interviews with the people who perform that procedure. If the system uses a software package, you should review the documentation for that software.

**Observation**

The observation of current operating procedures is another fact-finding technique. Seeing the system in action gives you additional perspective and a better understanding of system procedures. Personal observation also allows you to verify statements made in interviews and determine whether procedures really operate as they are described.
Through observation, you might discover that neither the system documentation nor the interview statements are accurate.

Personal observation also can provide important advantages as the development process continues. For example, recommendations often are better accepted when they are based on personal observation of actual operations. Observation also can provide the knowledge needed to test or install future changes and can help build relationships with the users who will work with the new system.

Plan your observations in advance by preparing a checklist of specific tasks you want to observe and questions you want to ask. Consider the following issues when you prepare your list:

1. Ask sufficient questions to ensure that you have a complete understanding of the present system operation. A primary goal is to identify the methods of handling situations that are not covered by standard operating procedures. For example, what happens in a payroll system if an employee loses a time card? What is the procedure if an employee starts a shift 10 minutes late but then works 20 minutes overtime? Often, the rules for exceptions such as these are not written or formalized; therefore, you must try to document any procedures for handling exceptions.

2. Observe all the steps in a transaction and note the documents, inputs, outputs, and processes involved.

3. Examine each form, record, and report. Determine the purpose each item of information serves.

4. Consider each user who works with the system and the following questions: What information does that person receive from other people? What information does this person generate? How is the information communicated? How often do interruptions occur? How much downtime occurs? How much support does the user require, and who provides it?

5. Talk to the people who receive current reports to see whether the reports are complete, timely, accurate, and in a useful form. Ask whether information can be eliminated or improved and whether people would like to receive additional information.

As you observe people at work, as shown in Figure 4-21, consider a factor called the Hawthorne Effect. The name comes from a well-known study performed in the Hawthorne plant of the Western Electric Company in the 1920s. The purpose of the study was to determine how various changes in the work environment would affect employee productivity. The surprising result was that productivity improved during observation whether the conditions were made better or worse. Researchers concluded that productivity seemed to improve whenever the workers knew they were being observed.

Although some recent studies have raised questions about the original findings, you should be aware that observation can and does have an effect on normal

FIGURE 4-21 The Hawthorne study suggested that worker productivity improves during observation. Always consider the Hawthorne Effect when observing the operation of an existing system.
operations. With this in mind, always give advance notice to the supervisor in that area. In some situations, it might be helpful to explain the purpose of your visit to the people being observed.

**Questionnaires and Surveys**

In projects where it is desirable to obtain input from a large number of people, a questionnaire can be a valuable tool. A **questionnaire**, also called a **survey**, is a document containing a number of standard questions that can be sent to many individuals.

Questionnaires can be used to obtain information about a wide range of topics, including workloads, reports received, volumes of transactions handled, job duties, difficulties, and opinions of how the job could be performed better or more efficiently. Figure 4-22 shows a sample questionnaire that includes several different question and response formats.

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**PURCHASE REQUISITION QUESTIONNAIRE**

Pat Kline, Vice President, Finance, has asked us to investigate the purchase requisition process to see if it can be improved. Your input concerning this requisition process will be very valuable. We would greatly appreciate it if you could complete the following questionnaire and return it by March 10 to Dana Juarez in information technology. If you have any questions, please call Dana at x2561.

A. **YOUR OBSERVATIONS**
   Please answer each question by checking one box.

   1. How many purchase requisitions did you process in the past five working days? _____________

   2. What percentage of your time is spent processing requisitions?
      [ ] under 20%  [ ] 60–79%
      [ ] 21–39%  [ ] 80% or more
      [ ] 40–59%

   3. Do you believe too many errors exist on requisitions?
      [ ] yes  [ ] no

   4. Out of every 100 requisitions you process, how many contain errors?
      [ ] fewer than 5  [ ] 20 to 29
      [ ] 5 to 9  [ ] 30 to 39
      [ ] 10 to 14  [ ] 40 to 49
      [ ] 15 to 19  [ ] 50 or more

   5. What errors do you see most often on requisitions? (Place a 1 next to the most common error, place a 2 next to the second, etc.)
      [ ] incorrect charge number  [ ] missing authorization
      [ ] missing charge information  [ ] other (please explain) ___________________________
      [ ] arithmetic errors  [ ] incorrect discount percent used

B. **YOUR SUGGESTIONS**
   Please be specific, and give examples if possible.

   1. If the currently used purchase requisition form were to be redesigned, what changes to the form would you recommend?

      ____________________________________________________________
      ____________________________________________________________
      ____________________________________________________________
      (If necessary, please attach another sheet)

   2. Would you be interested in meeting with an information technology representative to discuss your ideas further? If so, please complete the following information:

      Name ___________________________  Department ___________________________
      Telephone ______________________  E-mail address _______________________

---

**FIGURE 4-22** Sample questionnaire. Does it follow the suggested guidelines?
A typical questionnaire starts with a heading, which includes a title, a brief statement of purpose, the name and telephone number of the contact person, the deadline date for completion, and how and where to return the form. The heading usually is followed by general instructions that provide clear guidance on how to answer the questions. Headings also are used to introduce each main section or portion of the survey and include instructions when the type of question or response changes. A long questionnaire might end with a conclusion that thanks the participants and reminds them how to return the form.

What about the issue of anonymity? Should people be asked to sign the questionnaire, or is it better to allow anonymous responses? The answer depends on two questions. First, does an analyst really need to know who the respondents are in order to match or correlate information? For example, it might be important to know what percentage of users need a certain software feature, but specific usernames might not be relevant. Second, does the questionnaire include any sensitive or controversial topics? Many people do not want to be identified when answering a question such as “How well has your supervisor explained the system to you?” In such cases, anonymous responses might provide better information.

When designing a questionnaire, the most important rule of all is to make sure that your questions collect the right data in a form that you can use to further your fact-finding. Here are some additional ideas to keep in mind when designing your questionnaire:

- Keep the questionnaire brief and user-friendly.
- Provide clear instructions that will answer all anticipated questions.
- Arrange the questions in a logical order, going from simple to more complex topics.
- Phrase questions to avoid misunderstandings; use simple terms and wording.
- Try not to lead the response or use questions that give clues to expected answers.
- Limit the use of open-ended questions that are difficult to tabulate.
- Limit the use of questions that can raise concerns about job security or other negative issues.
- Include a section at the end of the questionnaire for general comments.
- Test the questionnaire whenever possible on a small test group before finalizing it and distributing to a large group.

A questionnaire can be a traditional paper form, or you can create a fill-in form and collect data on the Internet or a company intranet. For example, you can use Microsoft Word, as shown in Figure 4-23, to create form fields, including text boxes, date pickers, and drop-down lists where users can click selections. Before you publish the form, you should protect it so users can fill it in but cannot change the layout or design. Forms also can be automated, so if a user answers no to question three, he or she goes directly to question eight, where the form-filling resumes.

**Sampling**

When studying an information system, you should collect examples of actual documents using a process called sampling. The samples might include records, reports, operational logs,
data entry documents, complaint summaries, work requests, and various types of forms. Sampling techniques include systematic sampling, stratified sampling, and random sampling.

Suppose you have a list of 200 customers who complained about errors in their statements, and you want to review a representative sample of 20 customers. A **systematic sample** would select every tenth customer for review. If you want to ensure that the sample is balanced geographically, however, you could use a **stratified sample** to select five customers from each of four zip codes. Another example of stratified sampling is to select a certain percentage of transactions from each zip code, rather than a fixed number. Finally, a **random sample** selects any 20 customers.

The main objective of a sample is to ensure that it represents the overall population accurately. If you are analyzing inventory transactions, for example, you should select a sample of transactions that are typical of actual inventory operations and do not include unusual or unrelated examples. For instance, if a company performs special processing on the last business day of the month, that day is not a good time to sample **typical** daily operations. To be useful, a sample must be large enough to provide a fair representation of the overall data.

You also should consider sampling when using interviews or questionnaires. Rather than interviewing everyone or sending a questionnaire to the entire group, you can use a sample of participants. You must use sound sampling techniques to reflect the overall population and obtain an accurate picture.

**Research**

Research is another important fact-finding technique. Your research can include the Internet, IT magazines, and books to obtain background information, technical material, and news about industry trends and developments. In addition, you can attend professional meetings, seminars, and discussions with other IT professionals, which can be very helpful in problem solving.

The Internet is an extremely valuable resource. Part D of the Systems Analyst’s Toolkit describes a variety of Internet resource tools. Using the Internet, you also can access information from federal and state governments, as well as from publishers, universities, and libraries around the world. Online forums and newsgroups are good resources for exchanging information with other professionals, seeking answers to questions, and monitoring discussions that are of interest to you.

All major hardware and software vendors maintain sites on the Web where you can obtain information about products and services offered by the company and send e-mail with specific questions to company representatives. In addition to contacting specific firms, you can access Web sites maintained by publishers and independent firms that provide links to hundreds of hardware and software vendors, as shown in Figure 4-24. Such sites are one-stop information centers where IT professionals can find information, share ideas, and keep posted on developments in technology.
Other Fact-Finding Techniques

Research also can involve a visit to a physical location, called a site visit, where the objective is to observe a system in use at another location. If you are studying your firm’s human resources information system, for example, you might want to see how another company’s system works. Site visits also are important when considering the purchase of a software package. If the software vendor suggests possible sites to visit, be aware that such sites might constitute a biased sample. A single site visit seldom gives you true pictures, so you should try to visit more than one installation.

Before a site visit such as the one shown in Figure 4-25, prepare just as you would for an interview. Contact the appropriate manager and explain the purpose of your visit. Decide what questions you will ask and what processes you will observe. During your visit, observe how the system works and note any problems or limitations. You also will want to learn about the support provided by the vendor, the quality of the system documentation, and so on.

Interviews versus Questionnaires

When you seek input from a large group, a questionnaire is a very useful tool. On the other hand, if you require detailed information from only a few people, then you probably should interview each person individually. Is it better to interview or use a questionnaire? Each situation is different, and you must consider the type of information, time constraints, and expense factors.

The interview is more familiar and personal than a questionnaire. People who are unwilling to put critical or controversial comments in writing might talk more freely in person. Moreover, during a face-to-face interview, you can react immediately to anything the interviewee says. If surprising or confusing statements are made, you can pursue the topic with additional questions. In addition, during a personal interview, you can watch for clues to help you determine if responses are knowledgeable and unbiased. Participation in interviews also can affect user attitudes, because people who are asked for their opinions often view the project more favorably.

Interviewing, however, is a costly and time-consuming process. In addition to the meeting itself, both people must prepare, and the interviewer has to do follow-up work. When a number of interviews are planned, the total cost can be quite substantial. The personal interview usually is the most expensive fact-finding technique.

In contrast, a questionnaire gives many people the opportunity to provide input and suggestions. Questionnaire recipients can answer the questions at their convenience and do not have to set aside a block of time for an interview. If the questionnaire allows anonymous responses, people might offer more candid responses than they would in an interview.

Preparing a good questionnaire, however, like a good interview, requires skill and time. If a question is misinterpreted, you cannot clarify the meaning as you can in a face-to-face interview. Furthermore, unless questionnaires are designed well, recipients might view them as intrusive, time-consuming, and impersonal. As an analyst, you should select the technique that will work best in a particular situation.

Another popular method of obtaining input is called brainstorming, which refers to a small group discussion of a specific problem, opportunity, or issue. This technique encourages new ideas, allows team participation, and enables participants to build on each other’s inputs and thoughts. Brainstorming can be structured or unstructured. In structured brainstorming, each participant speaks when it is his or her turn, or passes. In unstructured brainstorming, anyone can speak at any time. At some point, the results are recorded and made part of the fact-finding documentation process.
CASE IN POINT 4.4: CYBERSTUFF

Ann Ellis is a systems analyst at CyberStuff, a large company that sells computer hardware and software via telephone, mail order, and the Internet. CyberStuff processes several thousand transactions per week on a three-shift operation and employs 50 full-time and 125 part-time employees. Lately, the billing department has experienced an increase in the number of customer complaints about incorrect bills. During the preliminary investigation, Ann learned that some CyberStuff representatives did not follow established order entry procedures. She feels that with more information, she might find a pattern and identify a solution for the problem.

Ann is not sure how to proceed. She came to you, her supervisor, with two separate questions. First, is a questionnaire the best approach, or would interviews be better? Second, whether she uses interviews, a questionnaire, or both techniques, should she select the participants at random, include an equal number of people from each shift, or use some other approach? As Ann’s supervisor, what would you suggest, and why?

DOCUMENTATION

Keeping accurate records of interviews, facts, ideas, and observations is essential to successful systems development. The ability to manage information is the mark of a successful systems analyst and an important skill for all IT professionals.

The Need for Recording the Facts

As you gather information, the importance of a single item can be overlooked or complex system details can be forgotten. The basic rule is to write it down. You should document your work according to the following principles:

- Record information as soon as you obtain it.
- Use the simplest recording method possible.
- Record your findings in such a way that they can be understood by someone else.
- Organize your documentation so related material is located easily.

Often, systems analysts use special forms for describing a system, recording interviews, and summarizing documents. One type of documentation is a narrative list with simple statements about what is occurring, apparent problems, and suggestions for improvement. Other forms of documentation that are described in Chapter 4 include data flow diagrams, flowcharts, sample forms, and screen captures.

Software Tools

Many software programs are available to help you record and document information. Some examples are described here.

CASE TOOLS You can use CASE tools at every stage of systems development. This chapter contains several examples of CASE tools. Part B of the Systems Analyst’s Toolkit describes other features and capabilities of CASE tools.

PRODUCTIVITY SOFTWARE Productivity software includes word processing, spreadsheet, database management, presentation graphics, and collaboration software programs. Although Microsoft Office is the best-known set of productivity software programs, other vendors offer products in each of these categories.
Using word processing software such as Microsoft Word, Corel WordPerfect, or OpenOffice.org Writer, you can create reports, summaries, tables, and forms. In addition to standard document preparation, the program can help you organize a presentation with templates, bookmarks, annotations, revision control, and an index. You can consult the program’s Help system for more information about those and other features. You also can create fill-in forms to conduct surveys and questionnaires, as described earlier in this chapter.

Spreadsheet software, such as Microsoft Excel, Corel Quattro Pro, or OpenOffice.org Calc, can help you track and manage numeric data or financial information. You also can generate graphs and charts that display the data and show possible patterns, and you can use the statistical functions in a spreadsheet to tabulate and analyze questionnaire data. A graphical format often is used in quality control analysis because it highlights problems and their possible causes, and it is effective when presenting results to management. A common tool for showing the distribution of questionnaire or sampling results is a vertical bar chart called a **histogram**. Most spreadsheet programs can create histograms and other charts that can display data you have collected. Figure 4-26 displays a typical histogram that might have resulted from the questionnaire shown in Figure 4-22 on page 166.

**FIGURE 4-26** This histogram displays results from Question 2 in the questionnaire shown in Figure 4-22 on page 166.
Database management software allows you to document and organize fact-finding results such as events, observations, and data samples. You can use a database program such as Microsoft Access to manage the details of a complex project, create queries to retrieve specific information, and generate custom reports.

Presentation graphics software, such as Microsoft PowerPoint, Apple Keynote, or OpenOffice.org Impress, is a powerful tool for organizing and developing your formal presentation. Presentation graphics programs enable you to create organization charts that can be used in a preliminary investigation and later during requirements modeling. These high-quality charts also can be included in written reports and management presentations.

Collaboration software is the latest weapon in the struggle to boost productivity. More than ever, people work in teams and use Web-based software such as Google Docs and Microsoft Web Apps to access data and share files. Google and others are betting that cloud computing will create a virtual workplace, where people will be able to interact in real time, with all the benefits of a traditional face-to-face workplace, but none of the limitations.

**GRAPHIC MODELING SOFTWARE** Microsoft Visio is a popular graphic modeling tool that can produce a wide range of charts and diagrams. Visio includes a library of templates, stencils, and shapes. An analyst can use Visio to create many types of visual models, including business processes, flowcharts, network diagrams, organization charts, and Web site maps, such as the one shown in Figure 4-27.

![Figure 4-27](image)
PERSONAL INFORMATION MANAGERS  A busy analyst needs to keep track of meetings, interviews, appointments, and deadlines. A personal information manager (PIM), such as Microsoft Outlook or IBM’s Lotus Organizer, can help manage those tasks using a personal calendar and a to-do list, with priorities and the capability to check off completed items.

In addition to desktop-based organizers, handheld computers are popular. Some handheld computers, also called personal digital assistants (PDAs), accept handwritten input, while others have small keyboards. These devices can handle calendars, schedules, appointments, telephone lists, and calculations. A PDA can be standalone, Bluetooth-capable to synchronize with a desktop, or fully wireless-enabled, such as the HP iPAQ shown in Figure 4-28.

![HP iPAQ](image)

FIGURE 4-28 HP’s iPAQ is a powerful wireless device that HP describes as a mobile handheld computer.

WIRELESS COMMUNICATION DEVICES  Even in the dynamic world of IT, the recent explosion in wireless technology is almost unprecedented. The latest wireless standard, called 4G (fourth generation), is opening new frontiers in broadband Web access, e-mail, social networking, file exchange, and streaming multimedia. Users enjoy new hardware and software, easy synchronization with office networks, and innovative services designed for a wired generation.

The rapid growth of wireless communication has resulted in a merger of various technologies. Many people swear by all-in-one devices such as Research in Motion’s BlackBerry or smart phones, such as the Apple iPhone. Others are devoted to products that use Google’s Android operating system, which is a mobile device platform adopted by many hardware vendors, including Motorola, Kyocera, and LG. Figure 4-29 on the next page shows some examples of these products.
Beyond hardware choices, users can select from literally thousands of portable applications for business and personal use. No one can predict the future with certainty, but it is apparent that portable wireless technology is having an enormous impact on business practices, everyday communications, and social interaction.

FIGURE 4-29 Three popular examples of current wireless technology.
PREVIEW OF LOGICAL MODELING

At the conclusion of requirements modeling, systems developers should have a clear understanding of business processes and system requirements. The next step is to construct a logical model of the system.

Data and process modeling, which is described in Chapter 5, uses a structured analysis approach. Structured analysis is a popular, traditional technique that describes the system in terms of data and the processes that act on that data.

An alternative to structured analysis modeling is object modeling, which is described in Chapter 6. Object modeling is a methodology that combines data and processes into things called objects that represent actual people, things, transactions, and events. Systems analysts use object models to visualize and document real-world business processes and operations.

IT professionals have differing views about systems development methodologies, and no universally accepted approach exists. By studying both structured analysis and object-oriented methods, you gain valuable knowledge, skills, and perspective. You then can use that information to determine what method, or combination of methods, is best for the different situations you will face in your career.

A QUESTION OF ETHICS

Your supervisor manages the corporate office where you work as a systems analyst. Several weeks ago, after hearing rumors of employee dissatisfaction, he asked you to create a survey for all IT employees. After the responses were returned and tabulated, he was disappointed to learn that many employees assigned low ratings to morale and management policies.

This morning he called you into his office and asked whether you could identify the departments that submitted the lowest ratings. No names were used on the individual survey forms. However, with a little analysis, you probably could identify the departments, because several questions were department-related.

Now you are not sure how to respond. The expectation was that the survey would be anonymous. Even though no individuals would be identified, would it be ethical to reveal which departments sent in the low ratings? Would your supervisor’s motives for wanting this information matter?

CHAPTER SUMMARY

The systems analysis phase includes three activities: requirements modeling, data and process modeling, and consideration of development strategies. The main objective is to understand the proposed project, ensure that it will support business requirements, and build a solid foundation for the systems design phase.

During requirements modeling, you identify the business-related requirements for the new information system, including outputs, inputs, processes, performance, and controls. You consider scalability to ensure that the system can support future growth and expansion. You also estimate total cost of ownership (TCO) to identify all costs, including indirect costs.

Popular team-based approaches include JAD, RAD, and agile methods. Joint application development (JAD) is a popular, team-based approach to fact-finding and requirements modeling. JAD involves an interactive group of users, managers, and IT professionals who participate in requirements modeling and develop a greater commitment to the project and to their common goals.
Rapid application development (RAD) is a team-based technique that speeds up information systems development and produces a functioning information system. RAD is a complete methodology, with a four-phase life cycle that parallels the traditional SDLC phases.

Agile methods attempt to develop a system incrementally, by building a series of prototypes and constantly adjusting them to user requirements.

Systems analysts use various tools and techniques to model system requirements. Unified Modeling Language (UML) is a widely used method of visualizing and documenting software design through the eyes of the business user. UML tools include use case diagrams and sequence diagrams to represent actors, their roles, and the sequence of transactions that occurs.

A functional decomposition diagram (FDD) is a model of business functions and processes. A CASE tool can generate a set of data flow diagrams directly from a FDD.

The fact-finding process includes interviewing, document review, observation, questionnaires, sampling, and research. Successful interviewing requires good planning and strong interpersonal and communication skills. The systems analyst must decide on the people to interview, set interview objectives, and prepare for, conduct, and analyze interviews. The analyst also might find it helpful to use one or more software tools during fact-finding.

Systems analysts should carefully record and document factual information as it is collected, and various software tools can help an analyst visualize and describe an information system. The chapter concluded with a preview of logical modeling. Data and process modeling is a structured analysis approach that views the system in terms of data and the processes that act on that data. Object modeling is an approach that views the system in terms of data and the processes that act on that data.
# Key Terms and Phrases

<table>
<thead>
<tr>
<th>Term</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4G (fourth generation)</td>
<td>173</td>
</tr>
<tr>
<td>actor</td>
<td>151</td>
</tr>
<tr>
<td>agile methods</td>
<td>143</td>
</tr>
<tr>
<td>analytical skills</td>
<td>143</td>
</tr>
<tr>
<td>brainstorming</td>
<td>169</td>
</tr>
<tr>
<td>business process model (BPM)</td>
<td>150</td>
</tr>
<tr>
<td>business process modeling notation (BPMN)</td>
<td>150</td>
</tr>
<tr>
<td>closed-ended questions</td>
<td>160</td>
</tr>
<tr>
<td>construction phase</td>
<td>147</td>
</tr>
<tr>
<td>cutover phase</td>
<td>147</td>
</tr>
<tr>
<td>data flow diagram (DFD)</td>
<td>151</td>
</tr>
<tr>
<td>document review</td>
<td>164</td>
</tr>
<tr>
<td>engaged listening</td>
<td>162</td>
</tr>
<tr>
<td>fill-in form</td>
<td>167</td>
</tr>
<tr>
<td>functional decomposition diagram (FDD)</td>
<td>150</td>
</tr>
<tr>
<td>Hawthorne Effect</td>
<td>165</td>
</tr>
<tr>
<td>histogram</td>
<td>171</td>
</tr>
<tr>
<td>informal structure</td>
<td>159</td>
</tr>
<tr>
<td>inputs</td>
<td>142</td>
</tr>
<tr>
<td>interpersonal skills</td>
<td>143</td>
</tr>
<tr>
<td>interview</td>
<td>159</td>
</tr>
<tr>
<td>joint application development (JAD)</td>
<td>143</td>
</tr>
<tr>
<td>leading questions</td>
<td>160</td>
</tr>
<tr>
<td>observation</td>
<td>164</td>
</tr>
<tr>
<td>open-ended questions</td>
<td>160</td>
</tr>
<tr>
<td>outputs</td>
<td>142</td>
</tr>
<tr>
<td>performance</td>
<td>142</td>
</tr>
<tr>
<td>personal digital assistant (PDA)</td>
<td>173</td>
</tr>
<tr>
<td>personal information manager (PIM)</td>
<td>173</td>
</tr>
<tr>
<td>pool</td>
<td>151</td>
</tr>
<tr>
<td>processes</td>
<td>142</td>
</tr>
<tr>
<td>productivity software</td>
<td>170</td>
</tr>
<tr>
<td>questionnaire</td>
<td>166</td>
</tr>
<tr>
<td>random sample</td>
<td>168</td>
</tr>
<tr>
<td>range-of-response questions</td>
<td>160</td>
</tr>
<tr>
<td>rapid application development (RAD)</td>
<td>143</td>
</tr>
<tr>
<td>Rapid Economic Justification (REJ)</td>
<td>156</td>
</tr>
<tr>
<td>requirements modeling</td>
<td>142</td>
</tr>
<tr>
<td>requirements planning phase</td>
<td>146</td>
</tr>
<tr>
<td>research</td>
<td>168</td>
</tr>
<tr>
<td>sampling</td>
<td>167</td>
</tr>
<tr>
<td>scalability</td>
<td>155</td>
</tr>
<tr>
<td>Scrum</td>
<td>148</td>
</tr>
<tr>
<td>security</td>
<td>142</td>
</tr>
<tr>
<td>sequence diagram</td>
<td>152</td>
</tr>
<tr>
<td>site visit</td>
<td>169</td>
</tr>
<tr>
<td>smart phone</td>
<td>173</td>
</tr>
<tr>
<td>stratified sample</td>
<td>168</td>
</tr>
<tr>
<td>structured brainstorming</td>
<td>169</td>
</tr>
<tr>
<td>survey</td>
<td>166</td>
</tr>
<tr>
<td>swim lanes</td>
<td>151</td>
</tr>
<tr>
<td>system requirement</td>
<td>153</td>
</tr>
<tr>
<td>system requirements document</td>
<td>143</td>
</tr>
<tr>
<td>systematic sample</td>
<td>168</td>
</tr>
<tr>
<td>total cost of ownership</td>
<td>155</td>
</tr>
<tr>
<td>Unified Modeling Language (UML)</td>
<td>151</td>
</tr>
<tr>
<td>unstructured brainstorming</td>
<td>169</td>
</tr>
<tr>
<td>use case diagram</td>
<td>151</td>
</tr>
<tr>
<td>user design phase</td>
<td>146</td>
</tr>
<tr>
<td>Zachman Framework for Enterprise</td>
<td>158</td>
</tr>
<tr>
<td>Architecture</td>
<td>158</td>
</tr>
</tbody>
</table>
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.
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 4

As you begin the requirements modeling process, you receive specific directions from your supervisor, Jesse Baker. She wants you to conduct a survey of former and prospective students, lead a JAD group session, and draft a list of system requirements based on the results of the JAD session. She also wants to see a functional decomposition diagram showing the main TIMS functions.

Task List

1. Group managers said it was OK for their people to attend a three-day JAD session next week. Send a message to the JAD team members, with a brief explanation of JAD methods and a proposed agenda.

2. Design a questionnaire for former and potential students in SCR’s training classes. Also, reply to Jesse’s message about sampling. Give her a recommendation and reasons.

3. Read the JAD session summary in the Data Library and put together a list of system requirements, including outputs, inputs, processes, performance, and controls.

4. Draw an FDD of the main functions for TIMS and send it to Jesse. Be sure to show at least one or two levels of detail.

FIGURE 4-30 Task list: Session 4.
Chapter 4 Requirements Modeling

Chapter Exercises

Review Questions

1. What are the five questions typically used in fact-finding? What additional question can be asked during this process?
2. What is a systems requirement, and how are systems requirements classified?
3. What are JAD and RAD, and how do they differ from traditional fact-finding methods? What are their pros and cons?
4. What is total cost of ownership (TCO), and why is it important?
5. Provide examples of closed-ended, open-ended, and range-of-response questions.
6. What are three types of sampling, and why would you use them?
7. What is the Hawthorne Effect? Why is it significant?
8. What is a functional decomposition diagram (FDD) and why would you use one? Explain how to create an FDD.
9. What are agile methods, and what are some pros and cons of this approach?
10. To what three different audiences might you have to give a presentation? How would the presentation differ for each?

Discussion Topics

1. A group meeting sometimes is suggested as a useful compromise between interviews and questionnaires. In such a group meeting, one systems analyst meets with and asks questions of a number of users at one time. Discuss the advantages and disadvantages of such a group meeting.
2. JAD requires strong interpersonal and communication skills on the part of the systems analyst. Are those skills different from the ones that an analyst needs when conducting one-to-one interviews? Explain your answer.
3. Research the Internet, magazines, or textbooks to find examples of each of the following types of visual aids: bar chart, pie chart, line chart, table, diagram, and bulleted list of key points. How effective do you think each aid is? Find at least one example that you feel could be improved. Discuss its shortcomings and prepare an improved version.
4. Review the presentations section in Part A of the Systems Analyst’s Toolkit, then attend a speech or presentation and analyze its effectiveness. Consider the speaker’s delivery and how he or she organized the material, used visual aids, and handled audience questions. Describe specifically how the speech or presentation was most effective, as well as how it could have been improved.

Projects

1. Design a questionnaire to learn more about the registration process at your school or how customers place orders at a local business. Apply the guidelines you learned in this chapter.
2. Use Microsoft Word or another word processing program to design a simple form, using the program’s form-filling feature.
3. Create a functional decomposition diagram similar to the one in Figure 4-8 on page 150, but showing a typical U.S. post office.
4. Use the Internet to find a Web site that contains current IT industry news, information, and links. Bookmark the site and print a copy of the initial screen.
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. Elmwood College
   Situation:
   The school is considering a new system that will speed up the registration process. As a systems analyst, you are asked to develop a plan for fact-finding.
   1. List all the possible techniques that you might use.
   2. Describe an advantage for each technique.
   3. Suppose the development budget is tight. How might that affect the fact-finding process?
   4. What are five important questions to use during fact-finding?

2. JAD Session 1
   Situation:
   You are an IT advisor to a JAD team that is studying a new inventory system. The proposed system will provide more information and faster updates, and automatically monitor fast- or slow-moving items. Some controversy exists about whether to use an on-site or off-site location for the JAD sessions.
   1. How would you advise the project leader?
   2. Who should be on the JAD team, and what would be their roles as team members?
   3. The JAD project leader asked for advice about how to get the first session started. How would you reply?
   4. You invited the senior vice president to the opening JAD session, but she says she is quite busy and might not be able to attend unless it is really important. What would you say to her?
3 JAD Session 2

Situation:
The JAD team wants you to draw up a checklist of requirements for the new system.
1. List the five main categories of system requirements.
2. Use your imagination and provide at least one example per category of a system requirement that might be appropriate for an inventory system.
3. The project leader wants you to explain the concept of scalability to the team. How will you do that?
4. Several managers on the team have heard of TCO but are not quite sure what it is. How will you explain it to them?

4 Better Hardware Marketing System

Situation:
Your boss, the IT director, wants you to explain the UML to a group of company managers and users who will serve on a systems development team for the new marketing system.
1. Describe the Unified Modeling Language (UML) and how it can be used during systems development.
2. Explain use case diagrams to the group, and provide a simple example.
3. Explain sequence diagrams to the group, and provide a simple example.
4. During the meeting, a manager asks you to explain why it is desirable to describe the system through the eyes of a user. How would you answer?
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

New Century Health Clinic has decided to computerize its office systems. The associates hired you, a local computer consultant, to perform a preliminary investigation. You had several meetings with Dr. Tim Jones to discuss the various office records and accounting systems. Anita Davenport, New Century’s office manager, participated in those meetings.

In a report to the associates at the end of your investigation, you recommended conducting a detailed analysis of the patient record system, the patient and insurance billing systems, and the patient scheduling system. You believe that New Century would benefit most from implementing those three systems. Although the systems could be developed independently, you recommended analyzing all three systems together because of the significant interaction among them.

You presented your findings and recommendations at a late afternoon meeting of the associates. After answering several questions, you left the meeting so they could discuss the matter privately. Dr. Jones began the discussion by stating that he was impressed with your knowledge and professionalism, as well as your report and presentation.

Dr. Jones recommended accepting your proposal and hiring you immediately to conduct the systems analysis phase. Dr. Garcia, however, was not as enthusiastic and pointed out that such a study would certainly disrupt office procedures. The staff already had more work than they could handle, she argued, and taking time to answer your questions would only make the situation worse. Dr. Jones countered that the office workload was going to increase in any event, and that it was important to find a long-term solution to the problem. After some additional discussion, Dr. Garcia finally agreed with Dr. Jones’s assessment. The next morning, Dr. Jones called you and asked you to go ahead with the systems analysis phase of the project.

Assignments

1. Review the office organization chart you prepared in Chapter 1 for New Century.
2. List the individuals you would like to interview during the systems analysis phase.
3. Prepare a list of objectives for each of the interviews you will conduct.
4. Prepare a list of specific questions for each individual you will interview.
5. Conduct the interviews. (Consult your instructor regarding how to accomplish this. One possibility is through role-playing.)
6. Prepare a written summary of the information gained from each of the interviews. (Your instructor may want you to use a standard set of interview results.)
7. Design a questionnaire that will go to a sample of New Century patients to find out if they were satisfied with current insurance and scheduling procedures. Your questionnaire should follow the suggestions in this chapter. Also, decide what sampling method you will use and explain the reason for your choice.
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

During requirements modeling for the new system, Susan Park met with fitness center managers at several Personal Trainer locations. She conducted a series of interviews, reviewed company records, observed business operations, analyzed the BumbleBee accounting software, and studied a sample of sales and billing transactions. Susan’s objective was to develop a list of system requirements for the proposed system.

Fact-Finding Summary

- A typical center has 300–500 members, with two membership levels: full and limited. Full members have access to all activities. Limited members are restricted to activities they have selected, but they can participate in other activities by paying a usage fee. All members have charge privileges. Charges for merchandise and services are recorded on a charge slip, which is signed by the member. At the end of each day, cash sales and charges are entered into the BumbleBee accounting software, which runs on a computer workstation at each location. Daily cash receipts are deposited in a local bank and credited to the corporate Personal Trainer account. The BumbleBee program produces a daily activity report with a listing of all sales transactions. At the end of the month, the local manager uses BumbleBee to transmit an accounts receivable summary to the Personal Trainer headquarters in Chicago, where member statements are prepared and mailed. Members mail their payments to the Personal Trainer headquarters, where the payment is applied to the member account.

- The BumbleBee program stores basic member information, but does not include information about member preferences, activities, and history.

- Currently, the BumbleBee program produces one local report (the daily activity report) and three reports that are prepared at the headquarters location: a monthly member sales report, an exception report for inactive members and late payers, and a quarterly profit-and-loss report that shows a breakdown of revenue and costs for each separate activity.

During the interviews, Susan received a number of “wish list” comments from local managers and staff members. For example, many managers wanted more analytical features so they could spot trends and experiment with what-if scenarios for special promotions and discounts. The most frequent complaint was that managers wanted more frequent information about the profitability of the business activities at their centers.

To enhance their business, managers wanted to offer a computerized activity and wellness log, a personal coach service, and e-mail communication with members. Managers also wanted better ways to manage information about part-time instructors and staff. Several staff members suggested a redesign for the charge slips or scannable ID cards.

Assignments

1. List the system requirements, with examples for each category. Review the information that Susan gathered, and assume that she will add her own ideas to achieve more effective outputs, inputs, processes, performance, and controls.
2. Are there scalability issues that Susan should consider? What are they?
3. If Susan wants to conduct a survey of current or prospective members to obtain their input, what type of sampling should she use? Why?
4. Draw an FDD that shows the main operations described in the fact statement.
BAXTER COMMUNITY COLLEGE

Baxter Community College is a two-year school in New Jersey. Twice a year, the records office at Baxter mails requests for donations to the alumni. The staff uses a word processing merge file to create personalized letters, but the data on past contributions and other alumni information is stored manually. The registrar, Mary Louise, recently submitted a systems request asking the college’s IT department to develop a computerized alumni information system. The school does not have a formal systems review committee, and each department head has an individual budget for routine information services.

Todd Wagner, a systems analyst, was assigned to perform a preliminary investigation. After reading his report, Mary asked him to proceed with the systems analysis phase, saying that a formal presentation was unnecessary. Todd has scheduled an interview tomorrow with her, and he asked you to help him prepare for the meeting.

Assignments
1. Make a list of the topics that you think Todd should cover during the interview.
2. Prepare a list of specific questions that Todd should ask. Include open-ended, closed-ended, and range-of-response questions.
3. Conduct student-to-student interviews, with half the students assuming Todd’s role and the other half playing the registrar.
4. Document the information covered during the interviews.

TOWN OF EDEN BAY

The town of Eden Bay owns and maintains a fleet of vehicles. You are a systems analyst reporting to Dawn, the town’s IT manager.

Background

In Chapter 2, you learned that the town’s maintenance budget has risen sharply in recent years. Based on a preliminary investigation, the town has decided to develop a new information system to manage maintenance information and costs more effectively. The new system will be named RAVE, which stands for Repair Analysis for Vehicular Equipment.

Dawn has asked you to perform additional fact-finding to document the requirements for the new system.

Assignments
1. Review the interview summaries in Chapter 2. For each person (Marie, Martin, Phil, Alice, and Joe), develop three additional questions: an open-ended question, a closed-ended question, and a range-of-response question.
2. Based on what you know so far, list the system requirements for the new system. You can use your imagination if the facts are insufficient. Consider outputs, inputs, processes, performance, and controls. Include at least two examples for each category.
3. You decide to analyze a sample of vehicle records. What sampling methods are available to you? Which one should you use, and why?
4. Dawn thinks it would be a good idea to conduct a JAD session to perform additional fact-finding. Draft a message to the participants, with a brief explanation of JAD methods and a proposed agenda.
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 Chapter 2, you learned that SWL’s vice president of finance, Michael Jeremy, requested an investigation into problems with the company’s payroll system. Jane Rossman, applications manager, assigned systems analyst Rick Williams to conduct a preliminary investigation.

Rick found several problems, including input errors and a need for manual preparation of reports. The payroll department often required overtime to correct those errors and produce the reports.

The IT department recommended an in-depth analysis of the problem areas and Mr. Jeremy approved the study. Now, as the systems analysis phase begins, the next step is requirements modeling.

**Human Resources Department Interview**

During the preliminary investigation phase, Rick prepared the organization chart of the human resources department shown in Figure 4-31.

![Human resources department organization chart](image)

Rick learned that some errors involved employee stock purchase deductions, so he decided to study that process. He knew that the human resources department initiates stock purchase deductions, so he decided to interview Meredith Rider, manager of human resources administration. Meredith is responsible for completing the paperwork for newly hired employees and sending the forms to the payroll department.

Rick called Meredith to make an appointment and sent her the confirmation message shown in Figure 4-32 that described the topics and requested copies of related forms.
In the interview, Meredith explained that new employees fill in the top portion of a Payroll Master Record Form (Form PR-1). The human resources department then adds the pay rate and other data and sends a copy of the PR-1 form to the payroll department. Meredith showed Rick a blank copy of an online PR-1 form shown in Figure 4-33. She explained that because payroll and personnel information is confidential, she could not give Rick a completed form.
Also, when an employee’s pay rate or status changes, the human resources department completes the online Payroll Status Change Form (Form PR-2) shown in Figure 4-34 and sends a copy to the payroll department.

Meredith also explained that after a 90-day probationary period, employees can participate in the SWL Credit Union. An employee submits the Payroll Deduction Change Form (Form PR-3) shown in Figure 4-35 to the human resources department, which forwards it to the payroll department.

![Payroll Status Change Form (Form PR-2)](image)

![Payroll Deduction Change Form (Form PR-3)](image)
SWL also has an Employee Stock Purchase Plan, which an employee can join after 180 days. To enroll, the employee completes an Employee Stock Purchase Plan Enrollment and Change Form (Form PR-4). The human resources department prepares a weekly report of all stock plan enrollments and changes on the Employee Stock Purchase Plan Weekly Deduction Summary Report (Form PR-5) shown in Figure 4-36 and sends a copy to the payroll department.

![Employee Stock Purchase Plan Weekly Deduction Summary Report (Form PR-5).](image)

**FIGURE 4-36** Employee Stock Purchase Plan Weekly Deduction Summary Report (Form PR-5).

After the interview with Meredith, Rick sent the follow-up message shown in Figure 4-37 and attached a copy of the interview documentation shown in Figure 4-37.

![Follow-up message from Rick Williams to Meredith Rider, with a request for her comments on the interview summary.](image)

**FIGURE 4-37** Follow-up message from Rick Williams to Meredith Rider, with a request for her comments on the interview summary.
## Payroll Department Interview

Rick’s next interview was with the lead payroll clerk, Nelson White. Nelson confirmed that when an employee is hired, a PR-1 form is completed in the human resources department, and a copy is sent to payroll. He also explained that each week, the payroll department sends a time sheet to every SWL department manager. The time sheet lists the employees with space to record regular hours, vacation, sick leave, jury duty, and other codes.

After each pay period, SWL managers complete the time sheets and return them to the payroll department. Payroll then enters the pay rates and deduction information, and delivers the sheets to Business Information Systems (BIS), the service bureau that prepares SWL’s payroll.

After BIS runs the payroll, it returns the time sheets, paychecks, and the payroll register to SWL. The director of payroll, Amy Calico, sends the paychecks to SWL department heads for distribution to employees.

Nelson uses the weekly payroll register to prepare a report of credit union deductions and a check to the credit union for the total amount deducted. Stock purchases, on the other hand, are processed monthly, based on the stock’s closing price on the last business day of the month.

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### Five basic forms are used by the human resources department that relate to the payroll system:

1. Payroll Master Record Form (Form PR-1)
2. Payroll Status Change Form (Form PR-2)
3. Payroll Deduction Change Form (Form PR-3)
4. Employee Stock Purchase Plan Enrollment and Change Form (Form PR-4)
5. Employee Stock Purchase Plan Weekly Deduction Summary Report (Form PR-S)

When an employee is hired, the following takes place:

1. The human resources department prepares a Payroll Master Record Form (Form PR-1) with employee data, including Social Security number, name, address, telephone, emergency contact, and information about the position, title, and initial pay rate.
2. A copy of this form is sent to the payroll department, where it is filed and maintained.
3. Subsequent pay rate or status changes are submitted by the human resources department to the payroll department on a Payroll Status Change Form (Form PR-2). Payroll then files these change forms with the employee’s PR-I form.

After 180 days of employment, the employee is eligible to enroll in the SWL Stock Purchase Plan.

1. To enroll, an employee completes an Employee Stock Purchase Plan Enrollment and Change Form (Form PR-4).
2. The human resources department prepares an Employee Stock Purchase Plan Weekly Deduction Summary Report Form (Form PR-S) and sends it to the payroll department with copies of the PR-4 forms, which then are filed with the employee’s PR-I form.

I have identified several problems with the current procedures:

1. Data errors can occur when the human resources staff prepares the weekly summary of employee stock purchase deductions, and no system verification takes place until incorrect deductions are reported.
2. The system performs no verification of employment dates, and it is possible that the 90- and 180-day eligibility periods are applied incorrectly.
3. The filing of the PR-2, PR-3, and PR-4 forms with the Payroll Master Record Forms in the payroll department could lead to problems. If any of the forms are lost or misfiled, incorrect data is entered into the system.

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**FIGURE 4-38** Documentation of the interview with Meredith Rider.
Chapter Capstone Case: SoftWear, Limited (continued)

the month. Using the weekly payroll registers, Nelson manually prepares a monthly report
of employee stock purchases and forwards a copy of the report and a funds transfer authori-
tization to Carolina National Bank, which is SWL's stock transfer agent.

Rick asked Nelson why BIS did not produce a report on employee stock purchase deduc-
tions. Nelson replied that although the payroll is run weekly, the stock deductions are
invested only once a month. Because the two cycles do not match, the BIS system could not
handle the task.

Nelson then referred Rick to the SWL Systems and Procedures Manual page that describes
how monthly Employee Stock Purchase Plan investment amounts are calculated, as shown in
Figure 4-39. After blanking out the employee's name and Social Security number, Nelson also
gave Rick a sample of two monthly deduction registers, as shown in Figure 4-40.

To enroll in the SWL stock purchase plan, an employee submits a PR-4
form. Human resources sends a copy of the form to the payroll
department. At the end of the month, accumulated deductions for that
month are invested in shares of SWL stock at the current market price.

However, because weeks and months do not match up exactly, the
following calculation must be used:

a. Divide the weekly deduction by seven to get a daily deduction rate.
b. Then multiply the number of days in the month times the daily
deduction rate. The result is the total stock investment amount for
that month.

Here is an example for the month of January:

- Employee A authorizes a weekly stock plan deduction of $20.00.
- $20.00 divided by 7 = a $2.857 daily deduction rate.
- January has 31 calendar days, so 31 × $2.857 = $88.57, which
  will be the stock investment amount for January.

At the end of each month, the payroll department prepares a deduction
register (PR-6) that shows weekly deductions and monthly totals.

Rick began to see why it was taking so much effort to prepare the reports. The interview with Nelson provided much more detail than the general description that Rick had received during the preliminary investigation.

**BIS Interview**

Rick decided that he should talk with someone at the BIS service bureau to find out more about its operations. He learned from Nelson that Linda DeMarco was BIS’s customer relations manager, so he scheduled an appointment with her.

When Rick arrived at BIS, Linda greeted him warmly. She explained that she had planned to meet with members of SWL’s payroll department within the next month or two to discuss the latest developments. Because Rick now was working on SWL’s payroll system, however, this meeting would save her a trip. Rick temporarily abandoned his interview plan and asked Linda what she had in mind.

![Sample of the ESIP Monthly Deduction Register for July and August, 2009.](image)
“The payroll system that your company is using, which we call GAPP, for Generalized Automated Payroll Program, originally was developed here at BIS about eight years ago,” Linda began. “In fact, SoftWear, Limited was one of our very first customers. We’ve worked together for a long time, and we are very committed to your firm. As you know, GAPP was modified and updated many times. But let’s face it, even with the patches, GAPP is an antique! Anyway, I have some exciting news. We decided to develop a new, state-of-the-art payroll system. We are going to call it CHIPS, for Comprehensive High-powered Interactive Payroll System. I’m looking forward to working with SWL when you switch over to CHIPS,” Linda said.

Rick took a few moments to consider this surprising development. He then asked what would happen with GAPP. Linda stated that GAPP would be available to customers for another year or two, but that BIS would make no further enhancements to the system. Using BIS resources to maintain an obsolete system would not make sense, she explained.

Before this meeting, Rick had hoped that BIS could make some minor changes to solve SWL’s payroll problems. He now realized that was impossible, so he decided to learn more about CHIPS.

Rick described the problem with the mismatched deduction cycles and asked if CHIPS would handle that. Linda said that she already had looked into the matter. She pointed out that SWL was their only customer with more than one deduction application cycle. From BIS’s point of view, programming CHIPS to handle multiple cycle reports did not make sense. Linda suggested that perhaps a special add-on module could be written, once CHIPS was up and running. BIS could do that kind of job on a contract basis, she added.

Rick then asked when the new system would be available and what the cost would be. Linda stated that current plans were to begin offering CHIPS sometime in the following year. She explained that the system was still in development, and she could not be more specific about timetables and costs. She was sure, however, that the monthly fee for CHIPS would not increase more than 30 percent above the current GAPP charges.

As Rick was preparing to leave, Linda urged him to keep in touch. In the next few months, she explained, plans for CHIPS would become more specific, and she would be able to answer all his questions.

New Developments

When Rick returned from his meeting with Linda, he immediately went to his manager, Jane Rossman. After he described his visit to BIS, Jane telephoned Ann Hon, director of information technology. Within the hour, Jane and Rick held a meeting with Ann in her office. Rick repeated the details of his visit, and Ann asked for his opinion on how the developments at BIS would affect SWL’s current systems analysis.

Rick explained that one of the problems — possible input errors when transferring data from the human resources summary list — might be solved easily by developing a new form or procedure. Nevertheless, he saw no obvious solutions for the stock purchase deduction problems, except to change the scope of the payroll project.

Jane, Rick, and Ann then analyzed the situation. They all agreed that because of the upcoming changes at BIS, the current payroll system project would produce very limited results and should be expanded in scope. They totaled the costs of the SWL project to that point and prepared estimates for a detailed investigation of the entire payroll system in order to meet SWL’s current and future needs.

Later that week, Ann met with Michael Jeremy, vice president of finance, to discuss the situation and present her proposal to expand the project. Before she even started, however, Mr. Jeremy filled her in on the latest announcement from SWL’s top management: The company had decided to move forward with the new Employee Savings and Investment Plan (ESIP)
under consideration. He said that in December, Robert Lansing, SWL's president, would announce a target date of April 1, 2012, for the new ESIP plan. Mr. Jeremy explained that the new plan would be a 401(k) plan with tax advantages for employees.

Facing the new constraints on top of the existing payroll system problems, it looked like SWL would need a new payroll system after all.

The Revised Project

Jane Rossman assigned Carla Moore, a programmer-analyst, to work with Rick Williams on the revised system project. Because they now had to determine the requirements for the complete payroll system, Rick and Carla conducted follow-up interviews with Nelson White and Meredith Rider, as well as Allison Friendly, a human resources representative, and both payroll clerks, Britton Ellis and Debra Williams. During the payroll department interviews, the payroll staff prepared samples of all the existing payroll reports. At the end of the fact-finding process, Rick and Carla decided to prepare the functional decomposition diagram shown in Figure 4-41. The diagram shows the main functions identified during the interviews.

The Payroll Register is shown in Figure 4-42. Each employee is listed on a separate line, along with his or her earnings, deductions, and net pay. BIS creates three copies of this report each week. One copy is sent to Michael Jeremy, and one copy goes to Amy Calico. The third copy is used by the payroll department for determining SWL’s obligation for tax withholding and FICA payments and for applying credit union and stock purchase plan deductions.
Mr. Jeremy receives a weekly overtime report from BIS that lists every employee who worked overtime that week. When Carla asked him about that report, he stated that he consulted it occasionally but admitted that he did not need the report every week. He also receives an accounting report, but he routinely forwards it to the accounting department. He mentioned that an overall financial summary was more valuable to him.

**SWL Team Tasks**

1. When Rick Williams met with Meredith Rider in the human resources department, he asked for copies of actual reports and forms that contained confidential information, but Meredith declined to provide them. Rick has asked you to suggest a reasonable compromise between confidentiality requirements and the need for analysts to review actual records, instead of fictitious data. Think about this, and write a message to Rick with your views.

2. Assume that you were with Rick at the meeting with Linda DeMarco. Review the fact statement, then write an interview summary that documents the main topics that Rick and Linda discussed.

3. Rick asked you to design a questionnaire that would measure employee satisfaction with the current payroll deduction system. Review the sample questionnaire in the chapter, and prepare a draft for Rick. Rick also wants you to suggest various sampling methods so he can make a choice. Include a brief description of various methods, and be sure to include your recommendation and reasons.

4. Rick wants you to interview several employees to learn more about their levels of satisfaction with the current system. Prepare a set of interview questions, and be sure to include at least examples of open-ended, closed-ended, and range-of-response questions. If possible, conduct role-play interviews with other students.

**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 Identify people to interview, and Task 6 might be to Conduct interviews.
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 4-43, Tasks 1, 2, 3, 4, and 5 are concurrent tasks, and could begin at the same time if resources were available.

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 need to identify the people to interview before you conducted the interviews, so Task 6 cannot begin until Task 3 is completed, as Figure 4-43 shows.

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.
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.

As a leader in the game development field, Game Technology has many customers. The company wants to add a customer contact management feature to the sales system, and you will assist the IT team on this project. One of your first tasks is to interview users to find out what functions they want. When you have this information, you can construct a functional decomposition diagram (FDD) to list and organize the functions.

Before you talk to the users, you decide to practice your interviewing skills. Specifically, you want to use a mix of open-ended, closed-ended, and range-of-response questions. To test yourself, you ask a team member to develop some practice questions for you to identify, as follows:

<table>
<thead>
<tr>
<th>Question</th>
<th>Code:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you foresee any problems with this system?</td>
<td>O = open-ended</td>
</tr>
<tr>
<td>Do you maintain current e-mail addresses for customers?</td>
<td>C = closed-ended</td>
</tr>
<tr>
<td>Who is responsible for entering these records?</td>
<td>R = range-of-response</td>
</tr>
<tr>
<td>What would be some benefits of the new feature?</td>
<td></td>
</tr>
</tbody>
</table>

After you finish the interviews, you study the following results before preparing the FDD.

**Interview results**
The starting point should be an overview screen that allows users to look up a customer, add a customer, edit a customer, delete a customer, or get help. The Help option should allow a user to search a knowledge base or contact the IT Help Desk. If users select the knowledge base option, they can search by keyword or by topic. If they select the IT Help Desk, they can either select e-mail or a telephone call-back option.

**Practice Tasks**
A. For each question listed, enter a code that correctly identifies the question.
B. Draw an FDD that follows the guidelines in the textbook.

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**
The interviews were successful, but you want more details. Specifically, you want to learn more about the user interface, built-in error checking, and reports that could be generated for users. Using these topics, or others you think would be relevant, prepare two samples of each type of question.

Also, your FDD was good, but now you must add a Reports function to the overview screen. By selecting that option, users should be able to list all reports by name or by type. Users also should be able to view or print a report. If they select the Print option, they should be able to print the full report, the current page, or selected pages.

**Challenge Tasks**
A. Prepare the six questions described above (two of each type), indicating the type for each question.
B. Draw an FDD that shows the Reports function and subfunctions.