Learning Objectives

- Recognize the systems approach as the basic framework for solving problems of all kinds.
- Know how to apply the systems approach in solving systems problems.
- Understand that the systems development life cycle (SDLC) is a methodology—a recommended way to develop systems.
- Be familiar with the main SDLC approaches—the traditional waterfall cycle, prototyping, rapid application development, phased development, and business process redesign.
- Know the basics of modeling processes with data flow diagrams and use cases.
- Understand how systems development projects are managed in a top-down fashion.
Introduction

• Both managers and systems developers can apply the systems approach when solving problems
• The approach consists of three phases of effort:
  – **Preparation** consists of viewing the firm as a system, recognizing the environmental system, and identifying the firm’s subsystems
  – **Definition** involves proceeding from a system to a subsystem level and analyzing system parts in a certain sequence
  – **Solution** involves identifying the alternative solutions, evaluating them, and selecting the best one

THE SYSTEMS APPROACH

• John Dewey identified three series of judgments involved in adequately resolving a controversy
  1. Recognize the controversy
  2. Weigh alternative claims
  3. Form a judgment
• During the late 1960s/early 1970s, interest in systematic problem solving strengthened
• Management scientists and information specialists produced a recommended framework that became known as the **systems approach**—a series of problem-solving steps that ensure the problem is first understood, alternative solutions are considered, and the selected solution works (Figure 7.1)
The System’s Approach (cont.)

1. If a manager can also regard the levels of management as subsystems, the importance of information flows becomes clear.

2. A problem trigger – a signal that things are going better/worse than planned – usually stimulates a definition effort.

3. A top-down analysis then begins of the system for which the manager is responsible.

4. As the manager studies each system level, the system elements are analyzed in sequence (Figure 7.3).
**Figure 7.2** Each Business Area Is a System

![Diagram showing a hierarchy of business areas starting with a President node dividing into Marketing, Manufacturing, and Finance subsystems, further divided into Human Resources and Information Services subsystems.](http://www.deden08m.wordpress.com)

**Figure 7.3** Each Part of the System Is Analyzed in Sequence

1. Standards
2. Outputs
3. Management
4. Information processor
5. Inputs and input resources
6. Transformation processes
7. Output resources

![Diagram showing a sequence analysis of system components.](http://www.deden08m.wordpress.com)
Steps towards a Solution

1. Identify Alternative Solutions
2. Evaluate the Alternative Solutions
3. Selecting the Best Solution Involves:
   • Analysis
   • Judgment
   • Bargaining
4. Implement the Solution
5. Follow Up to Ensure That the Solution Is Effective

THE SYSTEMS DEVELOPMENT LIFE CYCLE

• The system life development cycle (SDLC) is an application of the systems approach methodology to the development of an information system
THE TRADITIONAL SDLC

• It didn’t take the first system developers long to recognize a sequence if the project was to have the best chance of success:
  • Planning
  • Analysis
  • Design
  • Implementation
  • Use

• Figure 7.4 illustrates how the life cycle phases can fit into a circular pattern over time

Figure 7.4 The Circular Pattern of the System Life Cycle
PROTOTYPING

- A **prototype** is a version of a potential system that provides the developers and potential users with an idea of how the system will function when completed.
- In prototyping, a prototype is produced as quickly as possible, perhaps overnight, to obtain user feedback that will enable the prototype to be improved.
- Figure 7.5 shows the four steps involved in developing an evolutionary prototype.
- Figure 7.6 shows the steps involved in developing a requirements prototype.
- As prototyping has proven to be one of the most successful methodologies, it would be difficult to find a development project that didn’t use it to some degree.

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**Figure 7.5** Development of an Evolutionary Prototype

1. Identify user needs
2. Develop a prototype
3. Prototype acceptable? (Y/N)
4. Use the prototype
RAPID APPLICATION DEVELOPMENT

- **Rapid Application Development (RAD)**, is a term coined by James Martin. It refers to a development life cycle intended to produce systems quickly without sacrificing quality.

- **Information engineering** is the name that Martin gave to his overall approach to system development, which treats it as a firm-wide activity, while the term **enterprise** is used to describe the entire firm.

- Figure 7.7 illustrates the top-down nature of information engineering, involving both data (the left face of the pyramid) and activities (the right face).
RAD (cont.)

- RAD requires four essential ingredients:
  - Management
  - People
  - Methodologies
  - Tools
- Of all the components of information engineering, RAD has probably enjoyed the greatest support
PHASED DEVELOPMENT

- This is an approach for developing information systems that consists of six stages:
  1. Preliminary investigation
  2. Analysis
  3. Design
  4. Preliminary construction
  5. Final construction
  6. System test and installation

- The analysis, design, and preliminary construction stages are taken for each system module

- The six phased development stages are illustrated in Figure 7.8

- Figure 7.9 illustrates how the module phases are integrated into the system development

Figure 7.8 The Stages of the Phased Development Methodology
BUSINESS PROCESS REDESIGN

- The process of reworking the systems has been called **reengineering** or **business process redesign (BPR)**

- BPR affects the firm’s IT operation in two ways:
  1. IT can apply BPR to the redesign of **legacy systems** that can no longer be kept alive by ordinary maintenance
  2. When a firm applies BPR to its major operations, the effort invariably has a ripple effect that results in the redesign of information systems

- IT has devised **reverse engineering**, **restructuring**, and **reengineering** that can be applied separately or in combination for applying BPR
Three Techniques for Applying BPR

1. As used in computing, **reverse engineering** is the process of analyzing an existing system to identify its elements and their interrelationships, as well as to create documentation in a higher level of abstraction than currently exists.

2. **Restructuring** is the transformation of a system into another form without changing its functionality.

3. **Reengineering** is the complete redesign of a system with the objective of changing its functionality.
   - The proper mix depends on the current state of the system in terms of its functional and technical quality. Figure 7.10 is a diagram that shows these two influences.

![Figure 7.10 BPR Component Selection Is Based on Both Functional and Technical Quality](http://www.deden08m.wordpress.com)


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PUTTING THE TRADITIONAL SDLC, PROTOTYPING, RAD, PHASED DEVELOPMENT, AND BPR IN PERSPECTIVE

• The traditional SDLC, prototyping, RAD, and BPR are methodologies that are recommended ways of developing an information system
• Currently, firms are revamping many systems that were implemented with computer technology that is now obsolete
• The name BPR is used for this. Prototyping, RAD, and phased development can be utilized in a BPR project to meet users’ needs in a responsive way

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Process Modeling

• As developers perform analysis and design, they model the system data, processes, and objects
• A data flow diagram (DFD) is a graphic representation of a system that uses four symbol shapes representing: (1) environmental elements with which the system interfaces, (2) processes, (3) data flows, and (4) storage of data – to illustrate how data flows through interconnected processes
• Figure 7.11 illustrates a DFD system that a firm might use to compute commissions for its sales representatives
• Figure 7.12 is a context diagram of the sales commission system
• Figure 7.13 shows a Figure 4 diagram

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Figure 7.11 A Data Flow Diagram of a Sales Commission System

Figure 7.12 A Context Diagram of a Sales Commission System
Use Cases

- A **use case** is a narrative description in an outline form of the dialog that occurs between a primary (usually a computer program) and a secondary system (a person interacting with the computer program).

There are two use case formats:

- A continuous narrative with each action numbered sequentially; and
- The other is called the **ping pong format** because it consists of two narratives and the numbering indicates how the tasks alternate between the primary and secondary systems (Figure 7.14).

- A set of guidelines for preparing a use case in the ping pong format is shown in Figure 7.15.
Figure 7.14 A Use Case

<table>
<thead>
<tr>
<th>Data Entry Operator</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Operator logs on with a password</td>
<td>2.0 System verifies operator and prompts operator to enter additional information</td>
</tr>
<tr>
<td>1.1-A Go to 7.0-A</td>
<td>2.0-A System does not verify operator and prompts to reenter</td>
</tr>
<tr>
<td>3.0 Operator enters customer number, item number, and item quantity</td>
<td>2.1-A Go to 1.0</td>
</tr>
<tr>
<td>3.0-A Return to main menu</td>
<td>4.0 System verifies customer number and item number</td>
</tr>
<tr>
<td>3.1-A Go to 7.0-A</td>
<td>4.0-A System does not verify customer number and item number</td>
</tr>
<tr>
<td>5.0 Go to 3.0</td>
<td>4.1-A System displays an error message and prompts operator to reenter</td>
</tr>
<tr>
<td>6.0-A Return to main menu</td>
<td>4.2-A Go to 3.0</td>
</tr>
<tr>
<td>6.0-A Log off</td>
<td>5.0 System saves order data</td>
</tr>
<tr>
<td>7.0 System logs employee off</td>
<td>7.0-A System displays main menu</td>
</tr>
</tbody>
</table>

Figure 7.15 Use Case Guidelines

1. Begin numbering with 1.0 on the left-hand side to represent the first user action.
   Example: 1.0 Operator logs on with a password
2. The first entry in the right-hand side should be 2.0, for the first system action.
3. Use decimal numbers to indicate steps taken in a sequence that are all part of a particular action.
   Otherwise, use ascending whole numbers (3.4.5, etc.).
   Example: 2.0 System verifies user
   2.1 System prompts user to enter additional information
4. Append an alphabetical letter to a sequence number for an alternate event.
   Example: 2.0-A System does not verify user
   2.1-A System prompts user to reenter password
5. When there are mutually exclusive alternate events, use multiple alphabetical letters.
6. For subsidiary actions, use a whole number for the basic action, followed by decimal numbers
   for the subsidiary actions.
   Example: 3.0 User creates report
   3.1 User specifies starting and ending dates
   3.2 User specifies report type
7. For optional actions, use a whole number for the basic action, followed by decimal numbers and
   alphabetical letters for the optional actions.
   Example: 3.2 User specifies report type
   3.2-A User specifies summary tabular report
   3.2-A User specifies detailed tabular report
   3.2-A User specifies graphical report
8. At the end of the process, the user should choose to repeat the process or log off.
   Example: 10.0 User returns to the main menu
   10.0-A User logs off
9. When the user logs off, the system should respond by logging the user off.
   Example: 11.0-A System logs user off
PROJECT MANAGEMENT

• Today, it is possible for life cycle management to span several organizational levels and involve managers outside of IT
• Figure 7.16 shows the hierarchical nature of project management
• In this example, there are five development projects going at the same time, all managed by the MIS steering committee
The MIS Steering Committee

- The MIS Steering Committee performs three main functions:
  - It establishes policies that ensure computer support for achieving the strategic objectives of the firm
  - It provides fiscal control by serving as the approval authority for all requests for computer-related funds
  - It resolves conflicts that arise concerning priorities for computer use

Project Leadership

- A project team includes all of the persons who participate in the development of an information system
- A team might have as many as a dozen members, consisting of some combination of users, information specialists, and may include an internal auditor
- A team or project leader, who provides direction throughout the life of the project, directs the team activity
The Project Management Mechanism

- The basis for project management is the project plan
- A popular format for a detailed plan is a Gantt chart, which identifies the tasks, who will perform them, and when they will be performed
- A **Gantt chart** is a horizontal bar chart that includes a bar for each task to be performed arranged in a time sequence
- Figure 7.17 is the first part of a Gantt chart, prepared using a Microsoft Excel spreadsheet
- A complement to the Gantt chart is the **network diagram**. Figure 7.18 is a high-level network diagram that identifies the phases of a project
Figure 7.18 A Network Diagram

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END OF CHAPTER 7