



COURSE TECHNOLOGY  
CENGAGE Learning™

# Fundamentals of Information Systems, Fifth Edition

## *Chapter 8* *Systems Development*

# Principles and Learning Objectives

- Effective systems development requires a team effort of stakeholders, users, managers, systems development specialists, and various support personnel, and it starts with careful planning
  - Identify the key participants in the systems development process and discuss their roles
  - Define the term *information systems planning* and discuss the importance of planning a project

# Principles and Learning Objectives (continued)

- Systems development often uses different approaches and tools such as traditional development, prototyping, rapid application development, end-user development, computer-aided software engineering, and object-oriented development to select, implement, and monitor projects
  - Discuss the key features, advantages, and disadvantages of the traditional, prototyping, rapid application development, and end-user systems development life cycles

# Principles and Learning Objectives (continued)

- Discuss the use of computer-aided software engineering (CASE) tools and the object-oriented approach to systems development
- Systems development starts with investigation and analysis of existing systems
  - State the purpose of systems investigation
  - Discuss the importance of performance and cost objectives
  - State the purpose of systems analysis and discuss some of the tools and techniques used in this phase of systems development

# Principles and Learning Objectives (continued)

- Designing new systems or modifying existing ones should always be aimed at helping an organization achieve its goals
  - State the purpose of systems design and discuss the differences between logical and physical systems design
  - Discuss the issues involved in environmental design
  - Define the term RFP and discuss how this document is used to drive the acquisition of hardware and software

# Principles and Learning Objectives (continued)

- The primary emphasis of systems implementation is to make sure that the right information is delivered to the right person in the right format at the right time
  - State the purpose of systems implementation and discuss the various activities associated with this phase of systems development

# Principles and Learning Objectives (continued)

- Maintenance and review add to the useful life of a system but can consume large amounts of resources, so they benefit from the same rigorous methods and project management techniques applied to systems development
  - State the importance of systems and software maintenance and discuss the activities involved
  - Describe the systems review process

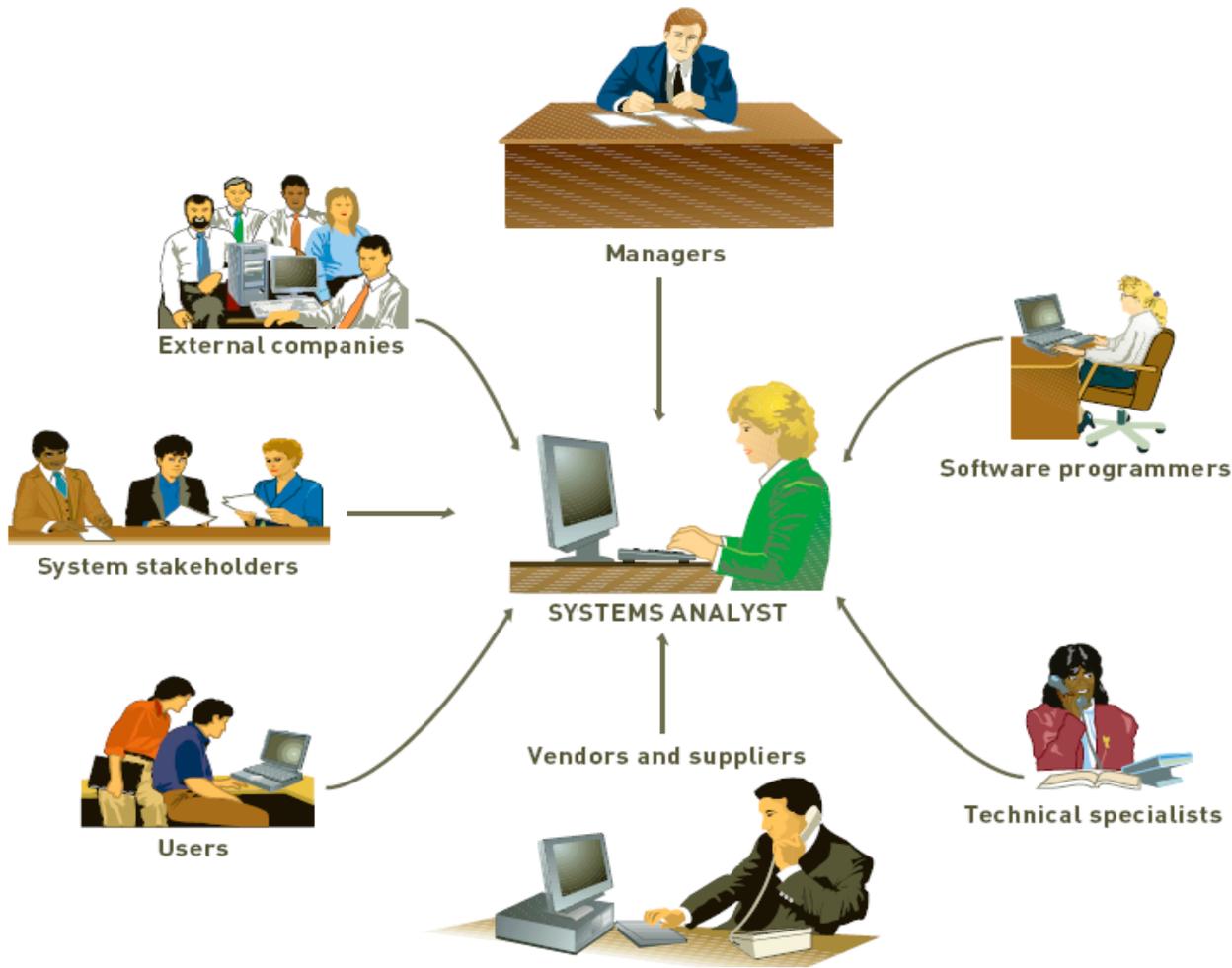
# An Overview of Systems Development

- Corporations and nonprofit organizations
  - Use systems development to achieve their goals
- First Health of the Carolinas
  - Upgraded old imaging system to slash costs and provide better health care for patients
  - Reduced costs by more than 30 percent
  - Offered doctors better radiological images to improve patient care

# Participants in Systems Development

- Development team
  - Project managers
  - Stakeholders
  - Users
  - Systems analysts
  - Programmers

# Participants in Systems Development (continued)



**Figure 8.1**

## Role of the Systems Analyst

The systems analyst plays an important role in the development team and is often the only person who sees the system in its totality. The one-way arrows in this figure do not mean that there is no direct communication between other team members. These arrows just indicate the pivotal role of the systems analyst—a person who is often called on to be a facilitator, moderator, negotiator, and interpreter for development activities.

# Information Systems Planning and Aligning Corporate and IS Goals

- Information systems planning
  - Translating strategic and organizational goals into systems development initiatives
- Aligning corporate and IS goals
  - Critical for any successful systems development effort
  - IS plan should guide development of the IS infrastructure over time

# Information Systems Planning and Aligning Corporate and IS Goals (continued)



**Figure 8.2**

#### Information Systems Planning

Information systems planning transforms organizational goals outlined in the strategic plan into specific systems development activities.

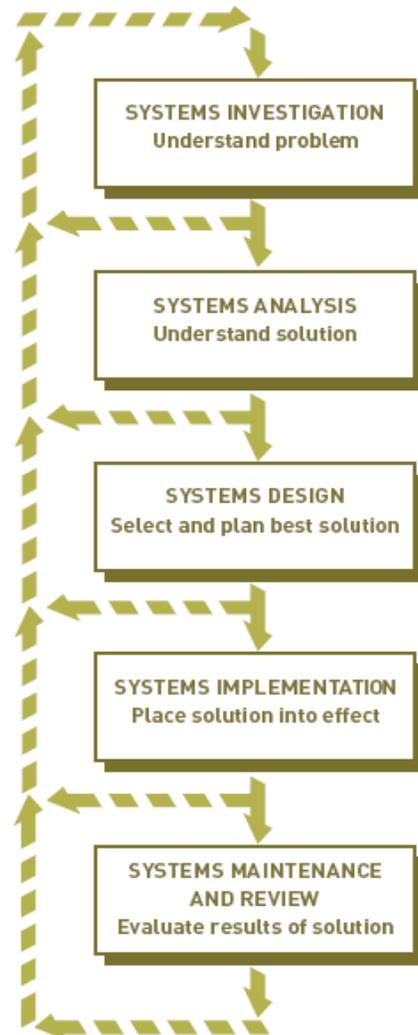
# Systems Development Life Cycles

- The systems development process is also called *systems development life cycle (SDLC)*
- The life of the system continues as it is maintained and reviewed

# The Traditional Systems Development Life Cycle

- Systems investigation
- Systems analysis
- Systems design
- Systems implementation
- Systems maintenance and review

# The Traditional Systems Development Life Cycle (continued)



**Figure 8.4**

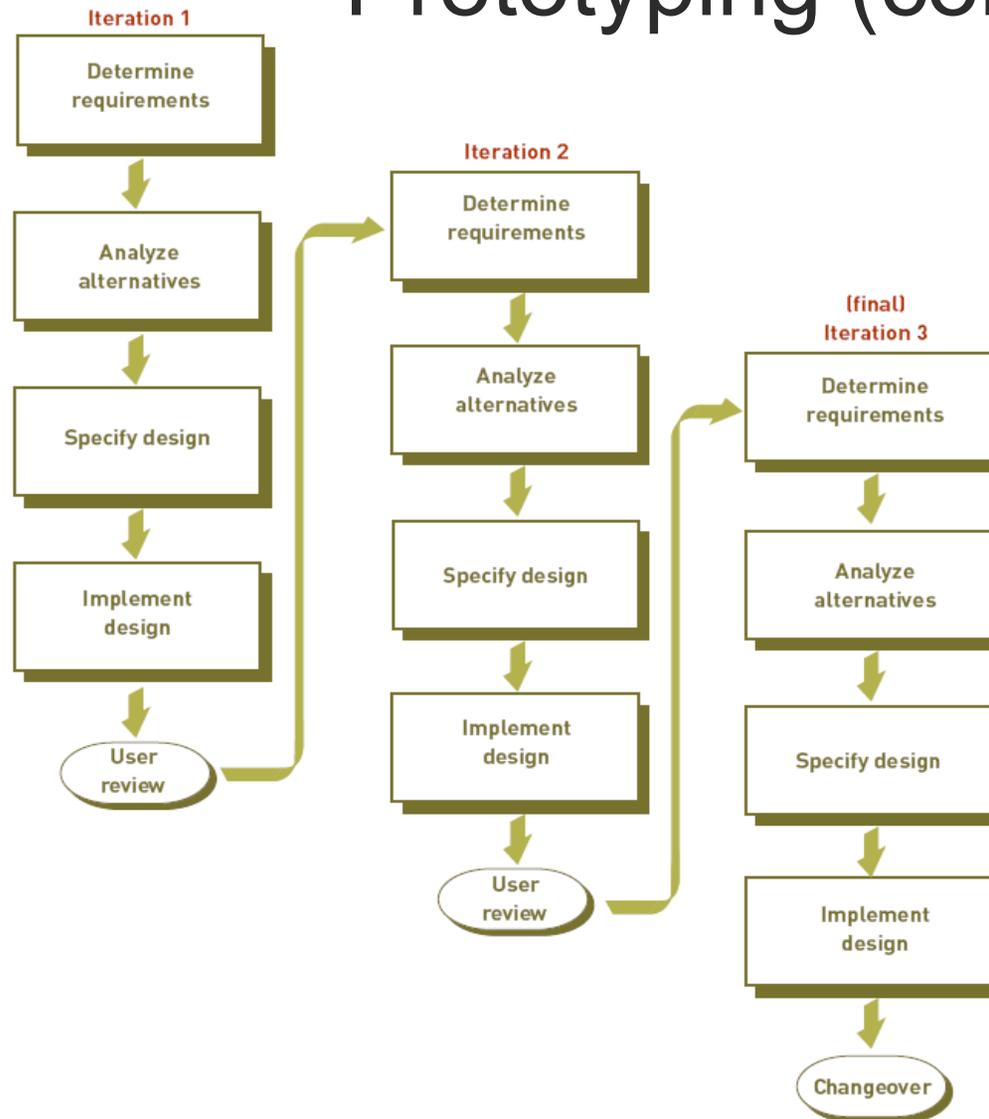
## The Traditional Systems Development Life Cycle

Sometimes, information learned in a particular phase requires cycling back to a previous phase.

# Prototyping

- Takes an iterative approach to the systems development process
- Begins with creating a preliminary model of a major subsystem or a scaled-down version of the entire system

# Prototyping (continued)



**Figure 8.5**

## Prototyping

Prototyping is an iterative approach to systems development.

# Rapid Application Development, Agile Development, Joint Application Development, and Other Systems Development Approaches

- Rapid application development (RAD)
  - Employs tools, techniques, and methodologies designed to speed application development
- Joint application development (JAD)
  - A process for data collection and requirements analysis
  - Originally developed by IBM Canada in the 1970s

# The End-User Systems Development

- Any systems development project in which business managers and users assume the primary effort
- Managers and other users can get the systems they want without having to wait for IS professionals to develop and deliver them

# Outsourcing and On-Demand Computing

- Reasons for using outsourcing and on demand computing:
  - Reducing costs
  - Obtaining state-of-the-art technology
  - Eliminating staffing and personnel problems
  - Increasing technological flexibility

# Use of Computer-Aided Software Engineering (CASE) Tools

- Computer-aided software engineering (CASE) tools
  - Automate tasks required in a systems development effort and encourage adherence to the SDLC
- Upper-CASE tools
  - Focus on activities associated with the early stages of systems development
- Lower-CASE tools
  - Focus on the later implementation stage of systems development

# Use of Computer-Aided Software Engineering (CASE) Tools (continued)

CASE Tool	Vendor
Oracle Designer	Oracle Corporation <i>www.oracle.com</i>
Visible Analyst	Visible Systems Corporation <i>www.visible.com</i>
Rational Rose	Rational Software <i>www.ibm.com</i>
Embarcadero Describe	Embarcadero Describe <i>www.embarcadero.com</i>

**Table 8.1**

Typical CASE Tools

# Use of Computer-Aided Software Engineering (CASE) Tools (continued)

Advantages	Disadvantages
Produce systems with a longer effective operational life	Increase the initial costs of building and maintaining systems
Produce systems that more closely meet user needs and requirements	Require more extensive and accurate definition of user needs and requirements
Produce systems with excellent documentation	Can be difficult to customize
Produce systems that need less systems support	Require more training of maintenance staff
Produce more flexible systems	Can be difficult to use with existing systems

**Table 8.2**

Advantages and Disadvantages  
of CASE Tools

# Object-Oriented Systems Development

- Combines the logic of the systems development life cycle with the power of object-oriented modeling and programming
- Follows a defined systems development life cycle, much like the SDLC

# Object-Oriented Systems Development (continued)

- Object-oriented systems development typically involves:
  - Identifying potential problems and opportunities within the organization that would be appropriate for the OO approach
  - Defining the kind of system users require
  - Designing the system
  - Programming or modifying modules
  - Evaluation by users
  - Periodic review and modification

# Systems Investigation

- What primary problems might a new or enhanced system solve?
- What opportunities might a new or enhanced system provide?
- What new hardware, software, databases, telecommunications, personnel, or procedures will improve an existing system or are required in a new system?
- What are the potential costs (variable and fixed)?
- What are the associated risks?

# Initiating Systems Investigation

- Systems request form
  - Document filled out by someone who wants the IS department to initiate systems investigation
  - Helps rationalize and prioritize the activities of the IS department

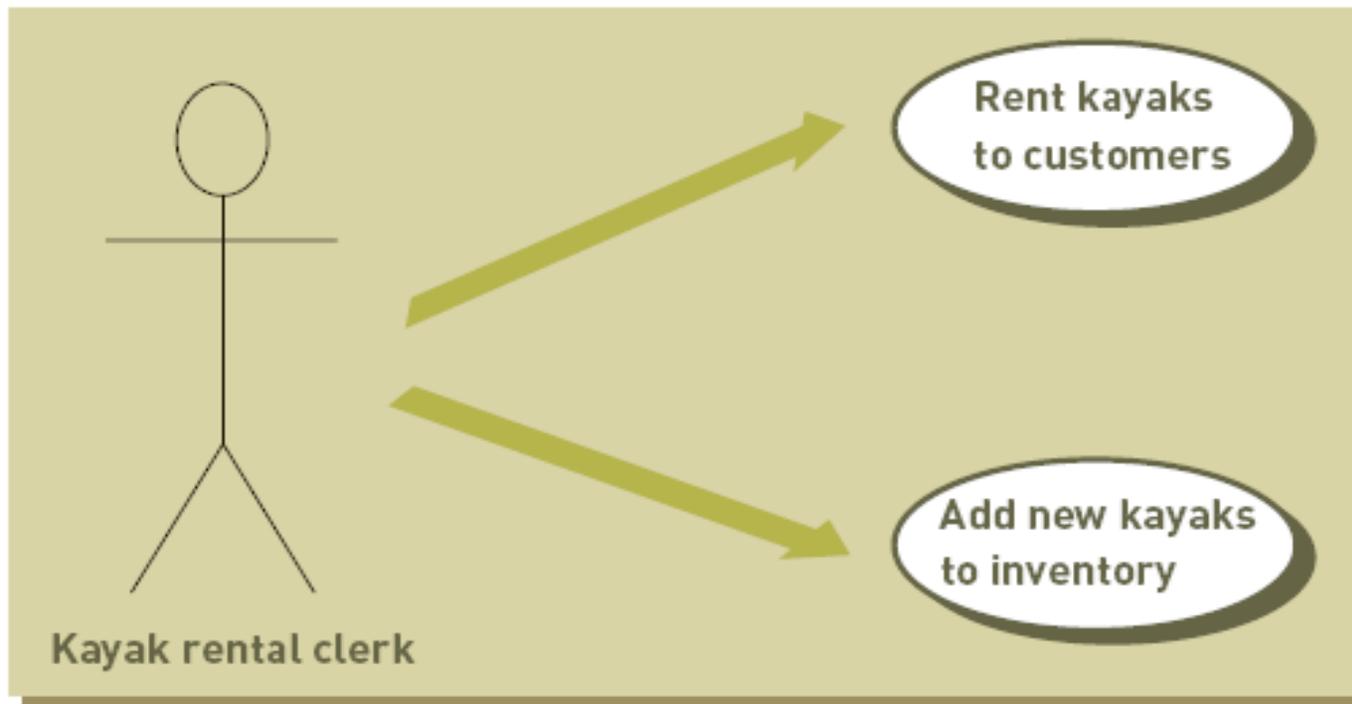
# Feasibility Analysis

- Technical feasibility
  - Hardware, software, and other system components
- Economic feasibility
  - Predicted benefits vs. cost and time
- Legal feasibility
  - Limitations of laws and regulations on project
- Operational feasibility
  - Logistical and motivational considerations
- Schedule feasibility
  - Completion of project in reasonable amount of time

# Object-Oriented Systems Investigation

- Use case diagram
  - Part of the Unified Modeling Language (UML) used in object-oriented systems development
  - Actors represent objects
  - Use cases represent events

# Object-Oriented Systems Investigation (continued)



**Figure 8.8**

Use Case Diagram for a Kayak Rental Application

# The Systems Investigation Report

- Primary outcome of systems investigation
- Steering committee
  - Advisory group consisting of senior management and users

# The Systems Investigation Report (continued)



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Systems Investigation Report

**CONTENTS**

EXECUTIVE SUMMARY  
REVIEW of GOALS and OBJECTIVES  
SYSTEM PROBLEMS and OPPORTUNITIES  
PROJECT FEASIBILITY  
PROJECT COSTS  
PROJECT BENEFITS  
RECOMMENDATIONS

**Figure 8.9**

A Typical Table of Contents for a  
Systems Investigation Report

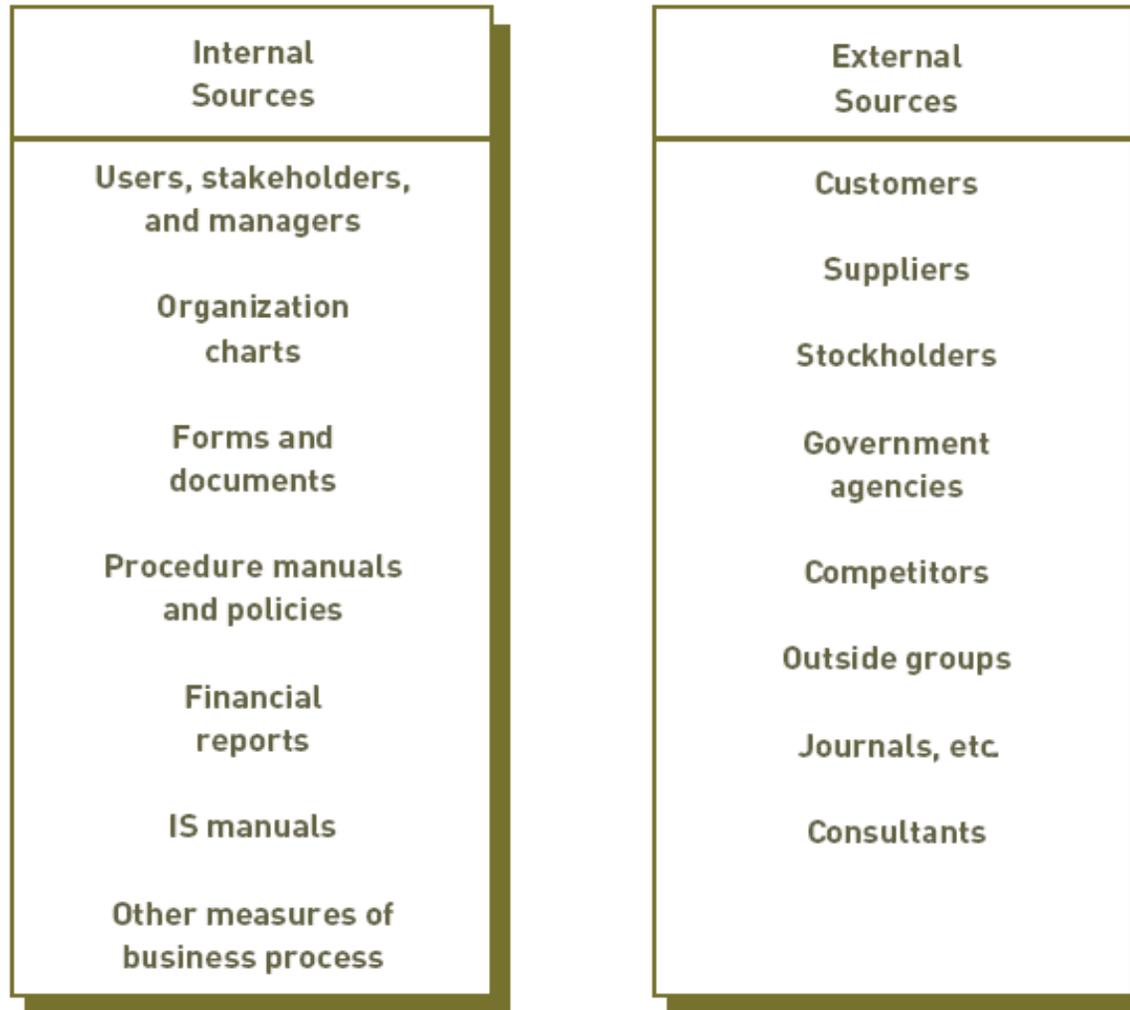
# Systems Analysis

- Answers the question:
  - “What must the information system do to solve the problem?”
- Overall emphasis of systems analysis
  - Gathering data on the existing system
  - Determining requirements for the new system
  - Considering alternatives within these constraints
  - Investigating the feasibility of the solutions

# Data Collection

- Identifying sources of data
  - Internal and external sources
- Collecting data
  - Tools and techniques include **interviews, direct observation, and questionnaires**

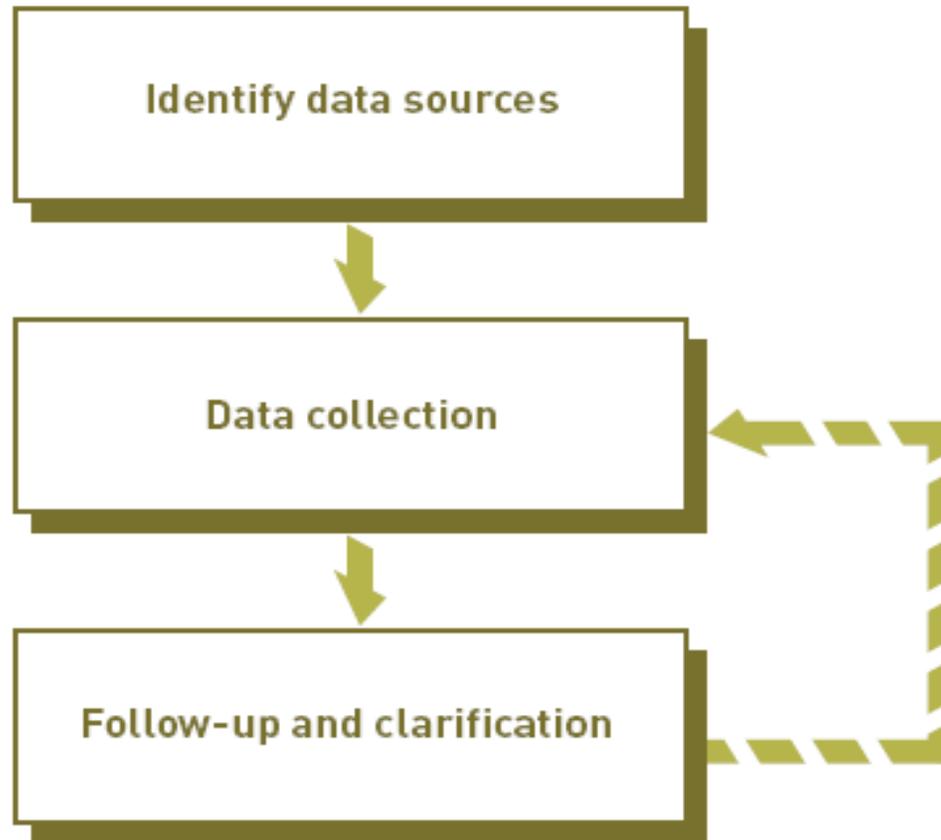
# Data Collection (continued)



**Figure 8.10**

Internal and External Sources of  
Data for Systems Analysis

# Data Collection (continued)



**Figure 8.11**

The Steps in Data Collection

# Data Analysis

- Manipulation of collected data so that systems development team can use the data
- Data modeling
  - Often accomplished through the use of **entity-relationship (ER) diagrams**
- Activity modeling
  - Often accomplished through the use of **data-flow diagrams**

# Requirements Analysis

- Overall purpose
  - To determine user, stakeholder, and organizational needs
- Techniques
  - **Asking directly:** Best for stable systems
  - **Critical success factors:** Ask for critical factors in interviewee's area
  - **IS plan:** Translates strategic plan into initiatives
  - **Requirements analysis tools:** CASE tools

# Requirements Analysis (continued)



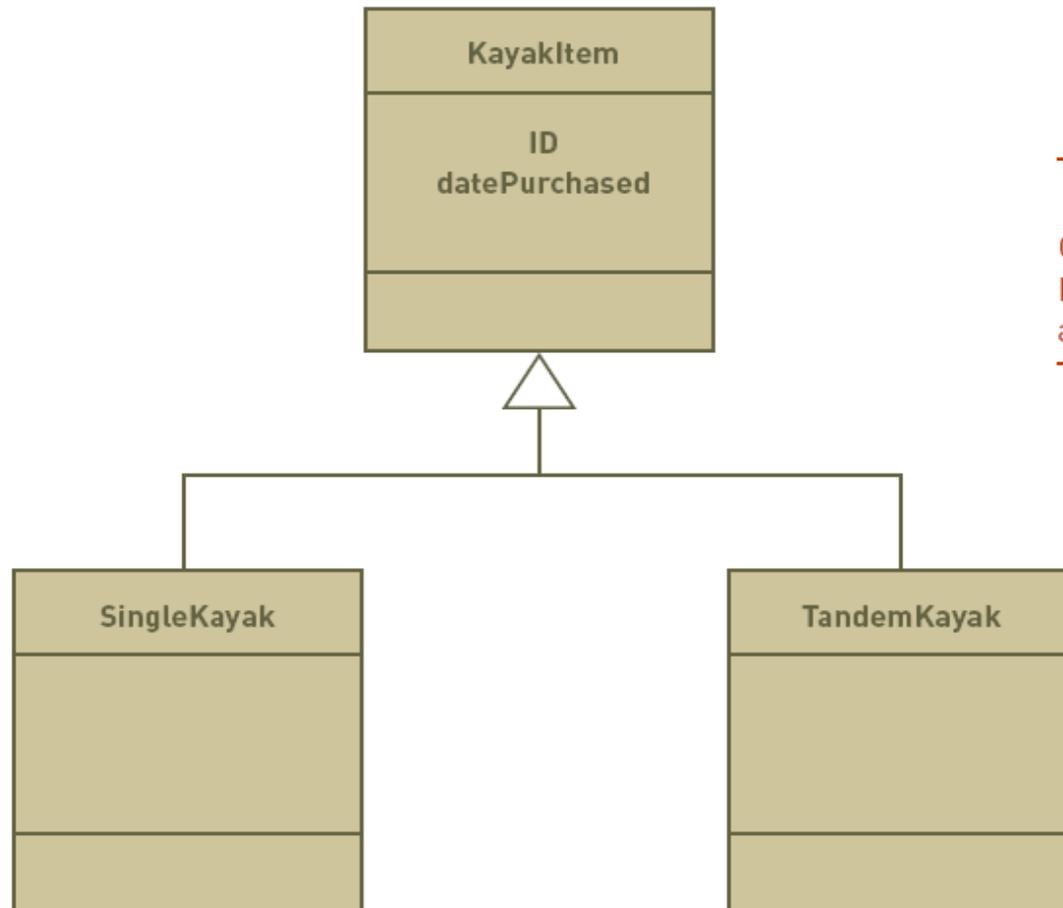
**Figure 8.13**

Converting Organizational  
Goals into Systems  
Requirements

# Object-Oriented Systems Analysis

- Problems or potential opportunities are identified during object-oriented analysis
- Key participants are identified
- Data is collected

# Object-Oriented Systems Analysis (continued)



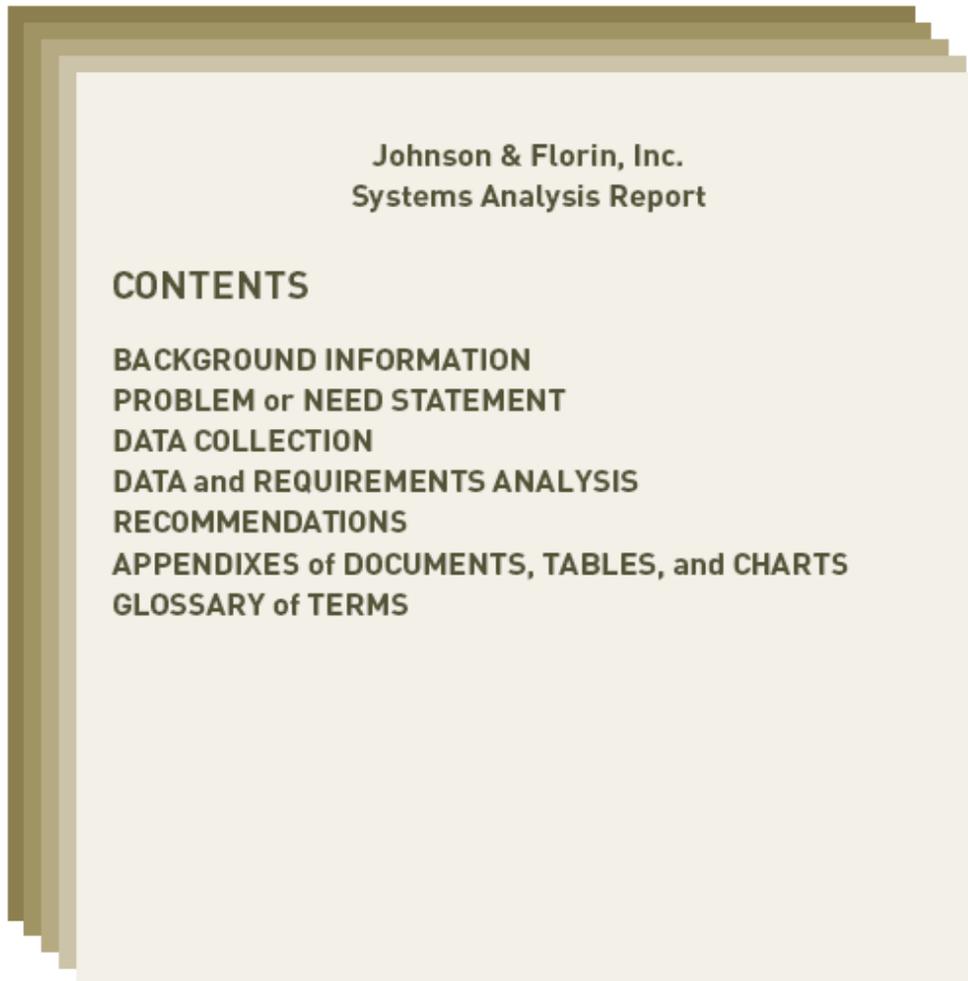
**Figure 8.14**

Generalization/Specialization  
Hierarchy Diagram for Single  
and Tandem Kayak Classes

# The Systems Analysis Report

- Systems analysis report should cover:
  - Strengths and weaknesses of the existing system from a stakeholder's perspective
  - User/stakeholder requirements for the new system (also called the *functional requirements*)
  - Organizational requirements for the new system
  - Description of what the new information system should do to solve the problem

# The Systems Analysis Report (continued)



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Systems Analysis Report

**CONTENTS**

BACKGROUND INFORMATION  
PROBLEM or NEED STATEMENT  
DATA COLLECTION  
DATA and REQUIREMENTS ANALYSIS  
RECOMMENDATIONS  
APPENDIXES of DOCUMENTS, TABLES, and CHARTS  
GLOSSARY of TERMS

**Figure 8.15**

A Typical Table of Contents for a  
Report on an Existing System

# Systems Design

- Answers the question:
  - “How will the information system solve a problem?”
- Two key aspects of systems design:
  - Logical and physical design

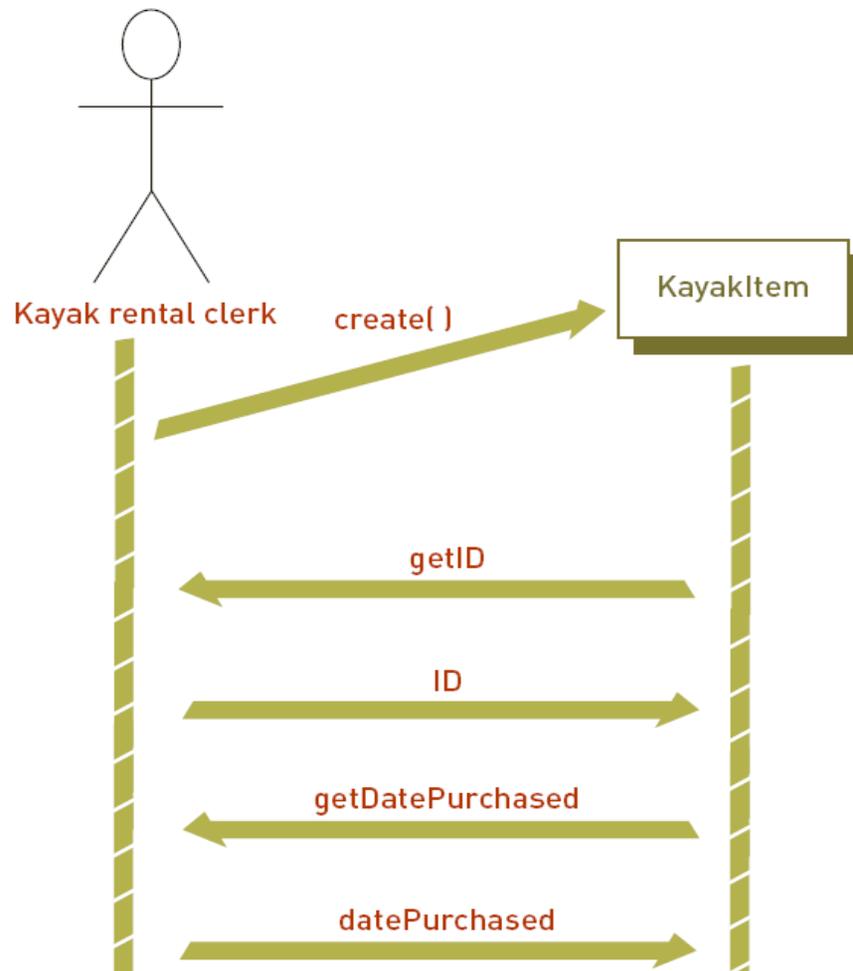
# Logical and Physical Design

- Logical design
  - Describes the functional requirements of a system
- Physical design
  - Refers to how the tasks are accomplished, including how the components work together and what each component does

# Object-Oriented Design

- Design key objects and classes of objects in the new or updated system
  - Consider the problem domain, the operating environment, and the user interface
  - Consider the sequence of events that must happen for the system to function correctly
- Sequence of events
  - Can be diagrammed in a sequence diagram

# Object-Oriented Design (continued)



**Figure 8.16**

A Sequence Diagram to Add a New KayakItem Scenario

# Environmental Design Considerations

- Environmental design
  - Also called *green design*
  - Involves systems development efforts that:
    - Slash power consumption
    - Require less physical space, and r
    - Result in systems that can be disposed in a way that does not negatively affect the environment

# Generating Systems Design Alternatives

- Request for proposal (RFP)
  - Specifies in detail required resources such as hardware and software
- Evaluating and selecting a systems design
  - Preliminary evaluation
    - To dismiss unwanted proposals
    - Begins after all proposals have been submitted
  - Final evaluation
    - Detailed investigation of the proposals offered by the vendors remaining after the preliminary evaluation

# Generating Systems Design Alternatives (continued)

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Systems Investigation Report

## Contents

COVER PAGE (with company name and contact person)  
BRIEF DESCRIPTION of the COMPANY  
OVERVIEW of the EXISTING COMPUTER SYSTEM  
SUMMARY of COMPUTER-RELATED NEEDS and/or PROBLEMS  
OBJECTIVES of the PROJECT  
DESCRIPTION of WHAT IS NEEDED  
HARDWARE REQUIREMENTS  
PERSONNEL REQUIREMENTS  
COMMUNICATIONS REQUIREMENTS  
PROCEDURES to BE DEVELOPED  
TRAINING REQUIREMENTS  
MAINTENANCE REQUIREMENTS  
EVALUATION PROCEDURES (how vendors will be judged)  
PROPOSAL FORMAT (how vendors should respond)  
IMPORTANT DATES (when tasks are to be completed)  
SUMMARY

**Figure 8.17**

A Typical Table of Contents for a Request for Proposal

# The Design Report

- Reflects decisions made and prepares the way for systems implementation
- Technical description details
  - System outputs
  - Inputs
  - User interfaces
  - Hardware

# The Design Report (continued)

Johnson & Florin, Inc.  
Systems Design Report

**Contents**

PREFACE  
EXECUTIVE SUMMARY of SYSTEMS  
DESIGN  
REVIEW of SYSTEMS ANALYSIS  
MAJOR DESIGN RECOMMENDATIONS  
    Hardware design  
    Software design  
    Personnel design  
    Communications design  
    Database design  
    Procedures design  
    Training design  
    Maintenance design  
SUMMARY of DESIGN DECISIONS  
APPENDICES  
GLOSSARY of TERMS  
INDEX

**Figure 8.18**

A Typical Table of Contents for a  
Systems Design Report

# Systems Implementation

- Includes:
  - Hardware acquisition
  - Programming and software acquisition or development
  - User preparation
  - Hiring and training of personnel
  - Site and data preparation
  - Installation
  - Testing, start-up
  - User acceptance

# Acquiring Hardware from an IS Vendor

- IS vendor
  - Company that offers hardware, software, telecommunications systems, databases, IS personnel, and/or other computer-related resources

# Acquiring Software

- Make-or-buy decision
  - Whether to obtain software from external or internal sources
- Software as a Service (SaaS)
  - Allows businesses to subscribe to Web-delivered application software by paying a monthly service charge or a per-use fee

# Acquiring Database and Telecommunications Systems

- Virtual databases and database as a service (DaaS)
  - Popular way to acquire database capabilities
- Telecommunications
  - One of the fastest-growing applications for today's organizations

# User Preparation

- Process of readying managers, decision makers, employees, other users, and stakeholders for new systems
- Provide users with proper training

# IS Personnel: Hiring and Training

- Personnel that might be needed for the new system
  - IS manager
  - Systems analysts
  - Computer programmers
  - Data-entry operators

# Site Preparation

- Preparation of the location of a new system
- Making room for equipment
- Special wiring and air conditioning
- Security system
- Additional power circuits

# Data Preparation

- Also called data conversion
- Ensures all files and databases are ready to be used with new computer software and systems

# Installation

- Physically placing the computer equipment on the site and making it operational
- Someone from the organization (usually the IS manager) should oversee the process

# Testing

- Forms of testing:
  - Unit testing
  - System testing
  - Volume testing
  - Integration testing
  - Acceptance testing

# Start-Up

- Process of making the final tested information system fully operational
- Approaches
  - Direct conversion
  - Phase-in approach
  - Pilot start-up
  - Parallel start-up

# User Acceptance

- User acceptance document
  - Formal agreement signed by the user that states that a phase of the installation or the complete system is approved
  - Legal document that removes or reduces IS vendor's liability

# Systems Operation and Maintenance

- Systems operation
  - Use of a new or modified system
  - Help desk provides support
- Systems maintenance
  - Checking, changing, and enhancing the system to make it more useful in achieving user and organizational goals
  - Difficult and costly for legacy systems

# Systems Review

- Process of analyzing systems to make sure that they are operating as intended
- Often compares:
  - The performance and benefits of the system as it was designed with the actual performance and benefits of the system in operation

# System Performance Measurement

- Monitoring the system
  - The number of errors encountered
  - The amount of memory required
  - The amount of processing or CPU time needed
  - Other problems
- System performance products
  - Software that measures all components of the computer-based information system

# Summary

- Systems development team
  - Stakeholders, users, managers, systems development specialists, and various support personnel
- Five phases of the traditional SDLC:
  - Investigation, analysis, design, implementation, and maintenance and review
- Prototyping
  - Iterative development approach

# Summary (continued)

- Systems request form
  - Initiates the investigation process
- Purpose of systems design
  - To prepare the detailed design needs for a new system or modifications to an existing system
- Environmental design
  - Also called green design
- Purpose of systems implementation
  - To install a system and make everything, including users, ready for its operation

# Summary (continued)

- Software
  - Can be purchased from external vendors or developed in-house (make-or-buy decision)
- Systems maintenance
  - Checking, changing, and enhancing the system to make it more useful in obtaining user and organizational goals
- Systems review
  - Analyzing systems to make sure that they are operating as intended