

Principles of Information Systems Eighth Edition

Chapter 8

*Systems Development: Design,
Implementation, Maintenance, and Review*

Principles and Learning Objectives

- Designing new systems or modifying existing ones should always help an organization achieve its goals
 - State the purpose of systems design and discuss the differences between logical and physical systems design
 - Describe some considerations in design modeling and the diagrams used during object-oriented design

Principles and Learning Objectives (continued)

- Designing new systems or modifying existing ones should always help an organization achieve its goals (continued)
 - Outline key considerations in interface design and control and system security and control
 - Define the term RFP and discuss how this document is used to drive the acquisition of hardware and software
 - Describe the techniques used to make systems selection evaluations

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 activities associated with this phase of systems development
 - List the advantages and disadvantages of purchasing versus developing software
 - Discuss the software development process and some of the tools used in this process, including object-oriented program development tools

Principles and Learning Objectives (continued)

- Maintenance and review add to the useful life of a system but can consume large amounts of resources; these activities can 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

Why Learn About Systems Development?

- Almost every industry uses information systems
- Getting involved with systems design and implementation directly benefits employees
- Knowledge about systems development can help you:
 - Avoid costly errors
 - Recover from disasters

Systems Design

- Answers the question: how will the information system solve a problem?
- Results in a _____ design
 - Details system outputs, inputs, and user interfaces
 - Specifies hardware, software, databases, telecommunications, personnel, and procedures
 - Shows how these components are related

Logical and Physical Design

- **Logical design:** description of _____ requirements of a system
 - Output, input, process, file, and database
 - Telecommunications, procedures, controls, and security
 - Personnel and job requirements

Logical and Physical Design (continued)

- **Physical design:** specification of characteristics of system components necessary to put logical design into _____
 - Characteristics of hardware, software, database, telecommunications, and personnel
 - Procedure and control specifications

Object-Oriented Design

- Designing key objects and classes of objects in new or updated system
 - Considers problem domain, operating environment, and user interface
 - Determines sequence of events that must happen for the system to function correctly
- _____ : sequence of events
 - Illustrated by sequence diagram

Object-Oriented Design (continued)

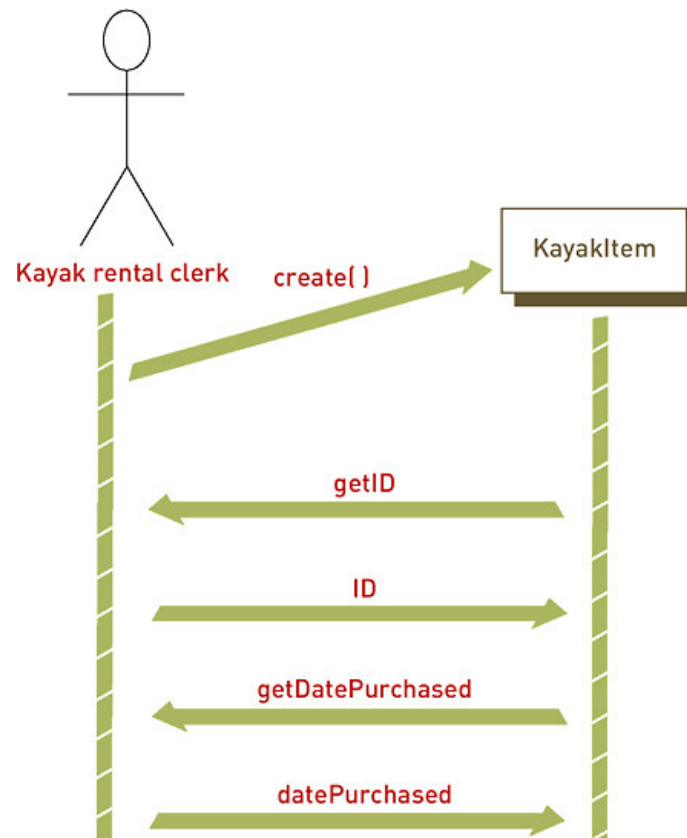


Figure 13.1: A Sequence Diagram to Add a New KayakItem Scenario

Interface Design and Controls

- Characteristics of how user _____ and _____ with system
 - Sign-on procedure
 - Interactive processing
 - Menu-driven system
 - Help facility
 - Lookup tables
 - Restart procedure
 - Good interactive design

Interface Design and Controls (continued)

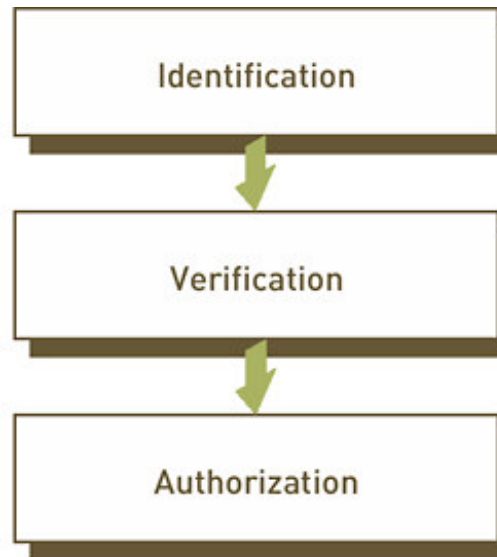


Figure 13.2: The Levels of the Sign-On Procedure

Interface Design and Controls (continued)

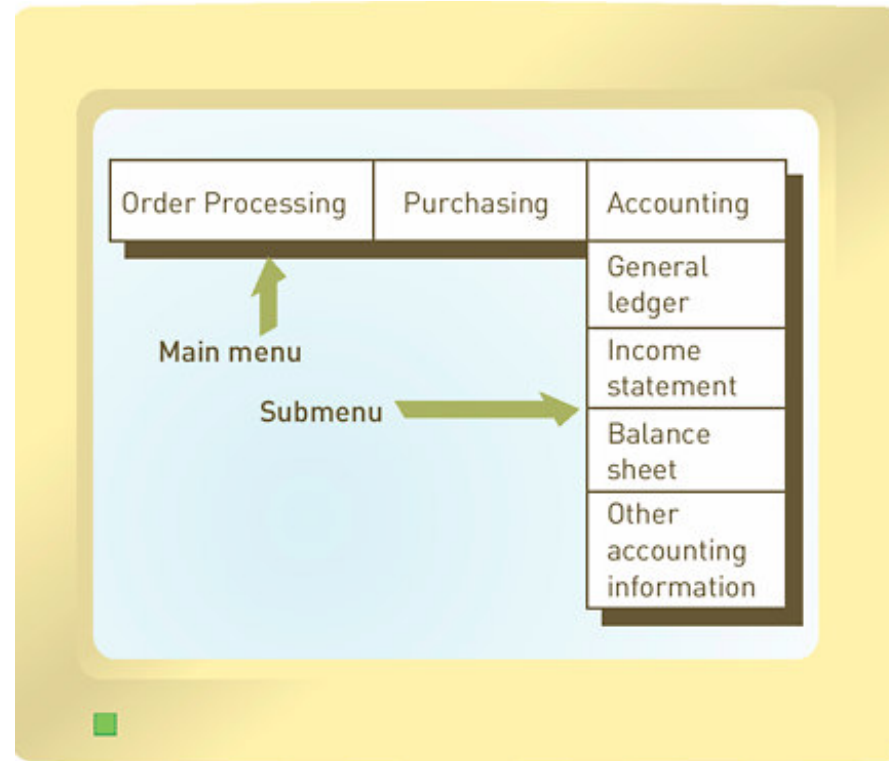


Figure 13.3: Menu-Driven System

Interface Design and Controls (continued)

Element	Description
Clarity	The computer system should ask for information using easily understood language. Whenever possible, the users themselves should help select the words and phrases used for dialogue with the computer system.
Response time	Ideally, responses from the computer system should approximate a normal response time from a human being carrying on the same sort of dialogue.
Consistency	The system should use the same commands, phrases, words, and function keys for all applications. After a user learns one application, all others will then be easier to use.
Format	The system should use an attractive format and layout for all screens. The use of color, highlighting, and the position of information on the screen should be considered carefully and applied consistently.
Jargon	All dialogue should be written in easy-to-understand terms. Avoid jargon known only to IS specialists.
Respect	All dialogue should be developed professionally and with respect. Dialogue should not talk down to or insult the user. Avoid statements such as "You have made a fatal error."

Table 13.1: The Elements of Good Interactive Dialogue

Design of System Security and Controls

- Preventing, detecting, and correcting _____
 - Enterprise-rights management software
- Disaster planning and recovery
 - **Disaster planning:** process of anticipating and providing for disasters
 - **Disaster recovery:** implementation of disaster plan
 - Approaches
 - Hot site
 - Cold site
 - Incremental backup
 - Image log

Design of System Security and Controls (continued)

- **Systems controls:** rules and procedures to maintain data _____
- **Deterrence controls:** rules and procedures to prevent problems before they occur
- Closed shops: only authorized operators can run computers
- Open shops: other personnel, such as programmers and analysts, may also run computers

Design of System Security and Controls (continued)

Controls	Description
Input controls	Maintain input integrity and security. Their purpose is to reduce errors while protecting the computer system against improper or fraudulent input. Input controls range from using standardized input forms to eliminating data-entry errors and using tight password and identification controls.
Processing controls	Deal with all aspects of processing and storage. The use of passwords and identification numbers, backup copies of data, and storage rooms that have tight security systems are examples of processing and storage controls.
Output controls	Ensure that output is handled correctly. In many cases, output generated from the computer system is recorded in a file that indicates the reports and documents that were generated, the time they were generated, and their final destinations.

Table 13.2: Using Systems Controls to Enhance Security

Design of System Security and Controls (continued)

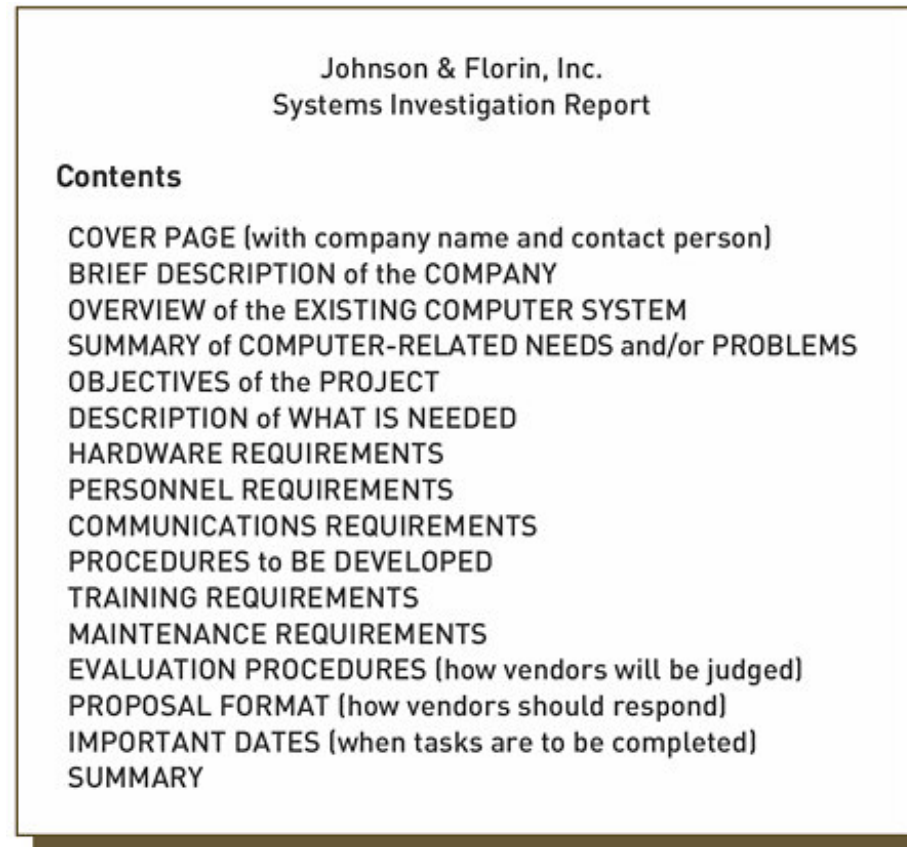
Database controls	Deal with ensuring an efficient and effective database system. These controls include the use of identification numbers and passwords, without which a user is denied access to certain data and information. Many of these controls are provided by database management systems.
Telecommunications controls	Provide accurate and reliable data and information transfer among systems. Telecommunications controls include firewalls and encryption to ensure correct communication while eliminating the potential for fraud and crime.
Personnel controls	Make sure that only authorized personnel have access to certain systems to help prevent computer-related mistakes and crime. Personnel controls can involve the use of identification numbers and passwords that allow only certain people access to particular data and information. ID badges and other security devices (such as smart cards) can prevent unauthorized people from entering strategic areas in the information systems facility.

Table 13.2: Using Systems Controls to Enhance Security (continued)

Generating Systems Design Alternatives

- Consider many factors when selecting a vendor
 - Reliability, stability, services, reviews, etc.
- **Request for _____ (RFP):** document that specifies required resources such as hardware and software in detail
- Financial options: consider scalability
 - Purchase
 - Lease
 - Rent

Generating Systems Design Alternatives (continued)



Johnson & Florin, Inc.
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 13.5: A Typical Table of Contents for a Request for Proposal

Generating Systems Design Alternatives (continued)

- _____ and selecting a systems design
 - Preliminary evaluation
 - To dismiss unwanted proposals
 - Begins after all proposals have been submitted
 - Final evaluation
 - Detailed investigation of proposals remaining after preliminary evaluation

Generating Systems Design Alternatives (continued)

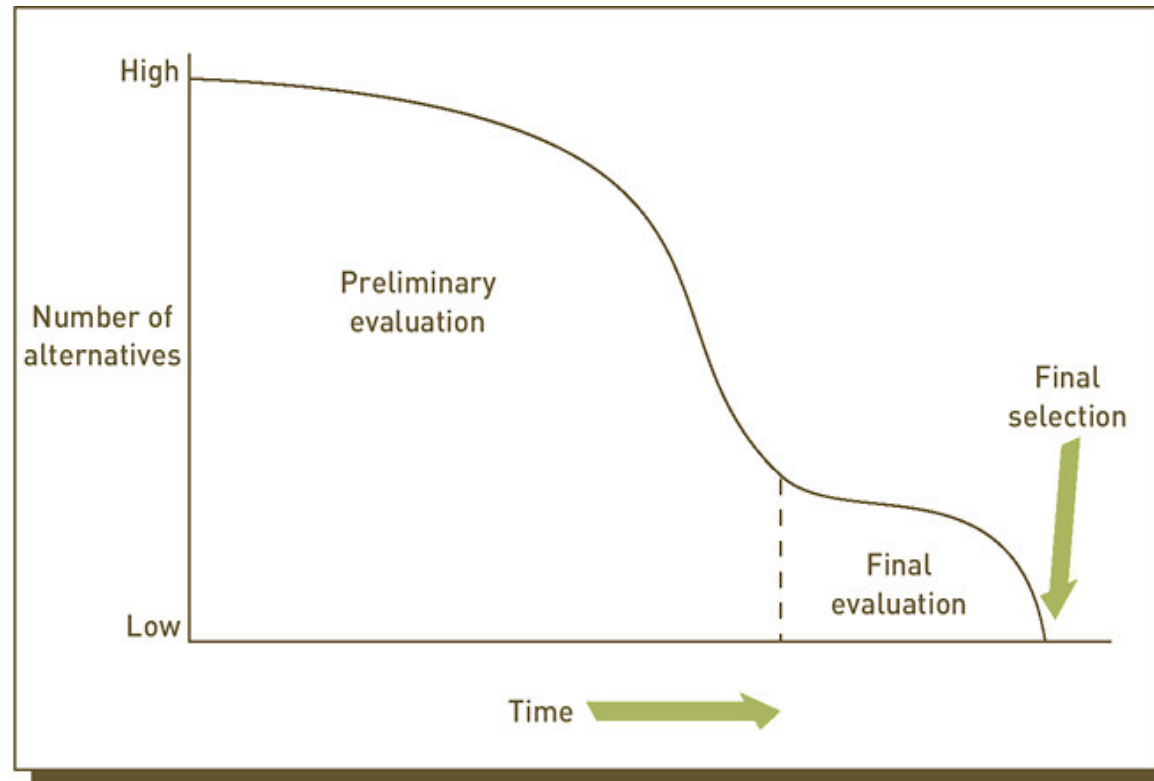


Figure 13.6: The Stages in Preliminary and Final Evaluations

Evaluation Techniques

- Group consensus
- Cost/benefit analysis
- Benchmark tests
- Point evaluation

Evaluation Techniques (continued)

		System A			System B		
<i>Factor's importance</i>		<i>Evaluation</i>	<i>Weighted evaluation</i>	<i>Evaluation</i>	<i>Weighted evaluation</i>	<i>Evaluation</i>	<i>Weighted evaluation</i>
Hardware	35%	95	33.25	75	26.25	95	38.00
Software	40%	70	28.00	95	38.00	90	36.00
Vendor support	25%	85	21.25	90	22.50		
Totals	100%		82.5				86.75

Figure 13.7: An Illustration of the Point Evaluation System

Freezing Design Specifications

- User agrees in writing that design is acceptable

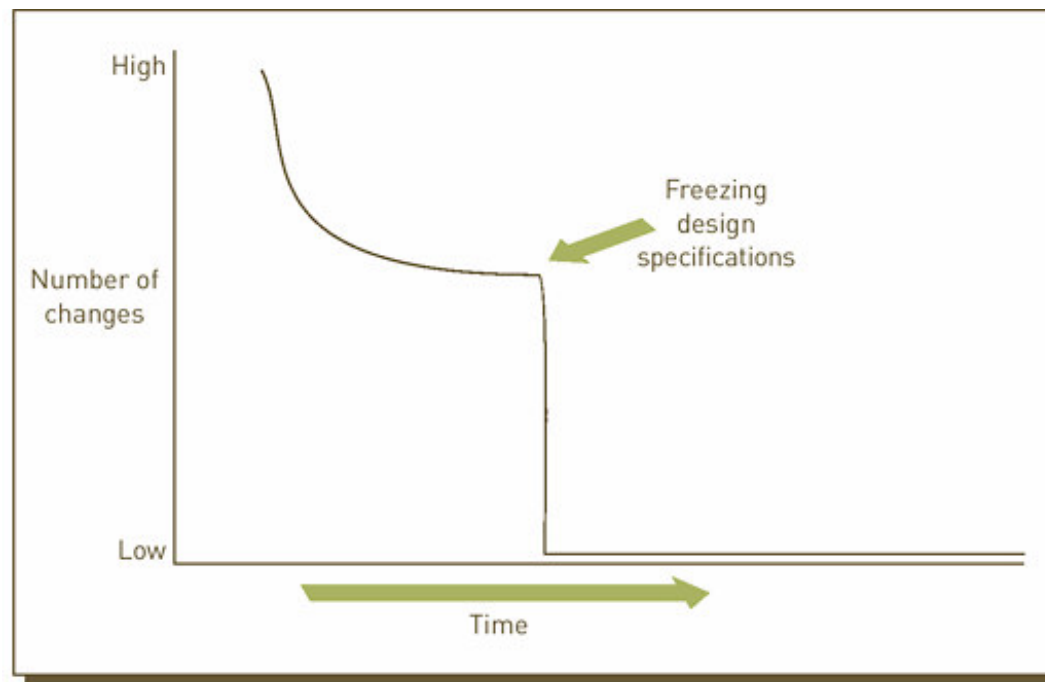


Figure 13.8: Freezing Design Specifications

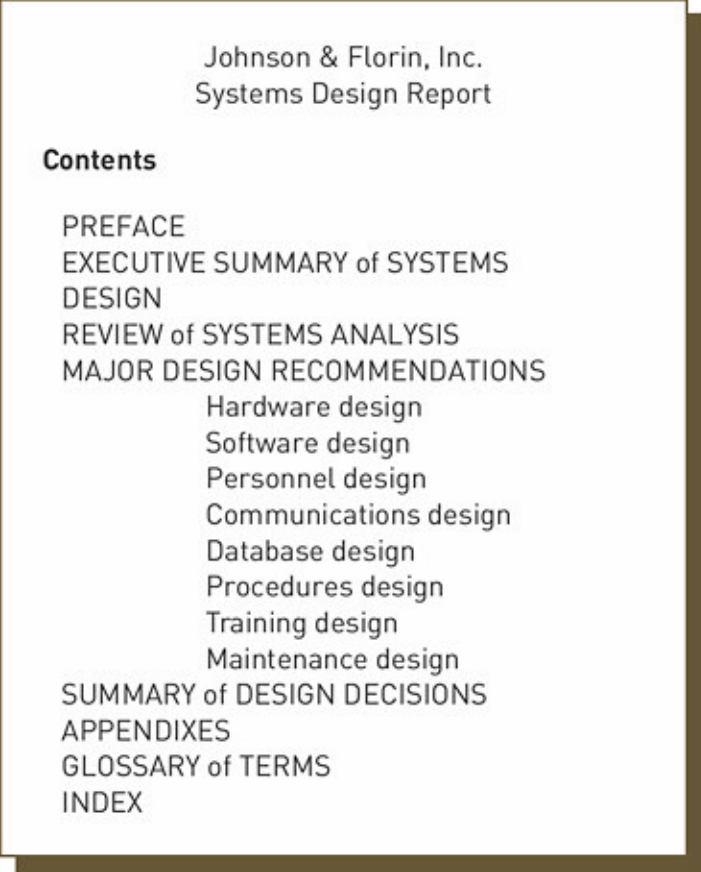
The Contract

- Vendors provide standard contracts to _____ themselves
- Organizations often use outside consultants and legal firms to develop contracts that state:
 - All equipment specifications, software, training, installation, maintenance, etc.
 - Deadlines for various stages
 - Actions that vendor will take in case of delays or problems
 - Penalty clauses

The Design Report

- Primary result of systems design
- Reflects decisions made and prepares the way for systems implementation

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
APPENDIXES
GLOSSARY of TERMS
INDEX

Figure 13.9: A Typical Table of Contents for a Systems Design Report

Quick Quiz 1

1. What is the question that systems design answers?
 - _____
2. What procedure consists of identification numbers, passwords, and other safeguards needed for an individual to gain access to computer resources?
 - _____
3. _____ is the process of anticipating and providing for disasters.
4. What term is used to describe rules and procedures that prevent problems before they occur?
 - _____
5. True or False: A benchmark test is an examination that compares computer systems operating under the same conditions.
 - _____

Systems Implementation



Figure 13.10: Typical Steps in Systems Implementation

Acquiring Hardware from an IS Vendor

- Buying
- Leasing
- Renting
- “Pay-as-you-go,” “on-demand,” or “utility” computing”
- Purchasing used computer equipment
- Application service provider (ASP)

Acquiring Software: Make or Buy?

- Make-or-buy decision: decision regarding whether to obtain software from external or internal sources
 - Today, most software is _____
- Externally acquired software
 - Commercial off-the-shelf (COTS) development process

Acquiring Software: Make or Buy? (continued)

Factor	Off the Shelf (Buy)	Developed (Make)
Cost	Low Cost	High Cost
Needs	Might not get what you need	Custom software to satisfy your needs
Quality	Usually high quality	Quality can vary depending on the programming team
Speed	Can acquire it now	Can take years to develop
Competitive advantage	Other organizations can have the same software and same advantage	Can develop a competitive advantage with good software

Table 13.5: Comparison of Off the Shelf and Developed Software

Acquiring Software: Make or Buy? (continued)

- _____ developed software tools and techniques
 - Chief programmer teams
 - Structured programming
 - CASE and object-oriented approaches
 - Cross-platform development
 - Integrated development environment
 - Structured walkthroughs
 - Documentation

Acquiring Software: Make or Buy? (continued)

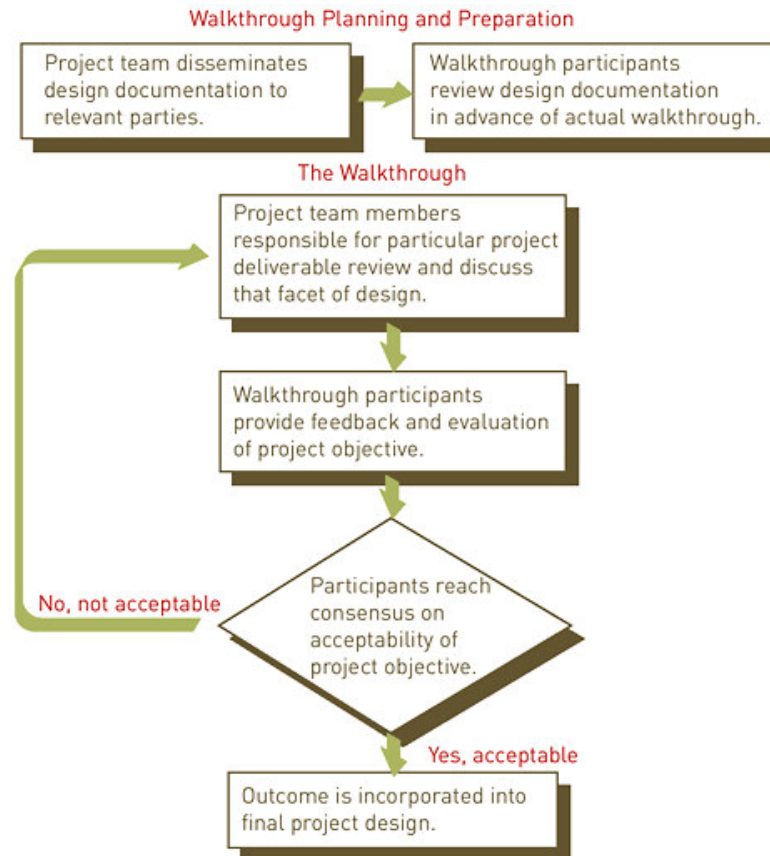


Figure 13.11: Structured Walkthrough

Acquiring Database and Telecommunications Systems

- Databases are a blend of hardware and software
- Telecommunications systems require a blend of hardware and software
- Earlier discussion on acquiring hardware and software also applies to acquisition of:
 - Database systems
 - Telecommunications hardware and software

User Preparation

- Ready managers, decision makers, employees, other users, and stakeholders for new systems
- _____ users

IS Personnel: Hiring and Training

- Personnel that might be needed for new system
 - IS manager
 - Systems analysts
 - Computer programmers
 - Data-entry operators
- Training programs should be conducted for IS personnel who will be using the system

Site Preparation

- Preparation of the _____ of a new system
- May involve:
 - Making room for a computer in an office
 - Special wiring and air conditioning
 - Renovation of entire room
 - Special floor
 - Additional power circuits

Data Preparation

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

Installation

- Process of _____ placing computer equipment on the site and making it operational
- Normally, manufacturer is responsible for installing computer equipment
- Someone from the organization (usually IS manager) should oversee the process

Testing

- **Unit testing:** testing of individual programs
- _____ **testing:** testing entire system of programs
- **Volume testing:** testing the application with a large amount of data
- _____ **testing:** testing all related systems together
- **Acceptance testing:** conducting any tests required by user

Testing (continued)

- _____ **testing**: testing an incomplete or early version of system
- _____ **testing**: testing a complete and stable system by end users

Start-Up

- Process of making the final tested information system _____ operational
- Approaches
 - Direct conversion (plunge, direct cutover)
 - Phase-in approach (piecemeal)
 - Pilot start-up
 - Parallel start-up

Start-Up (continued)

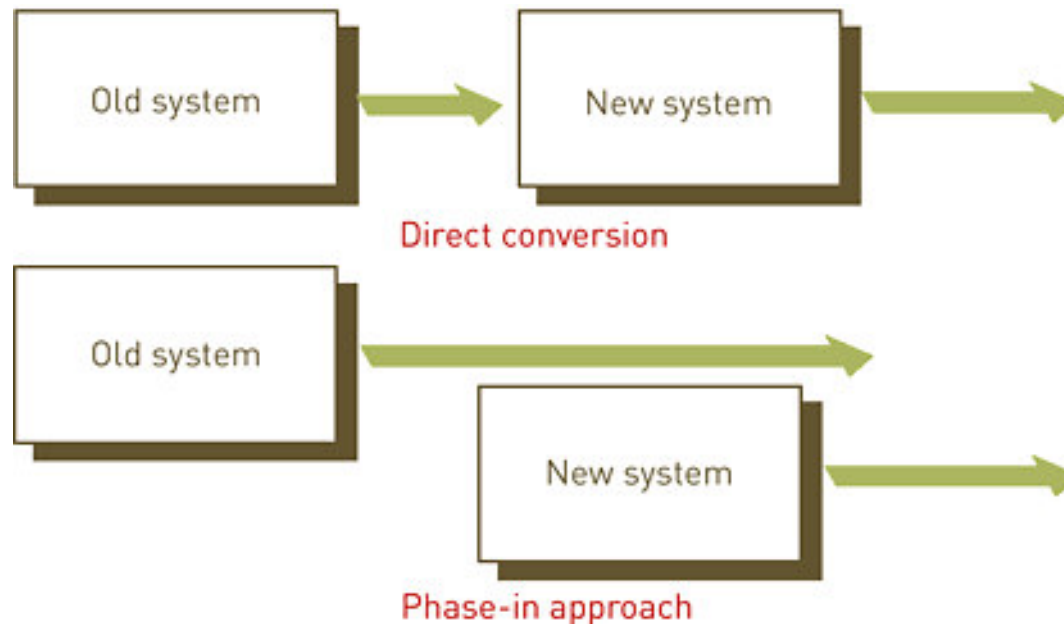


Figure 13.13: Start-Up Approaches

Start-Up (continued)

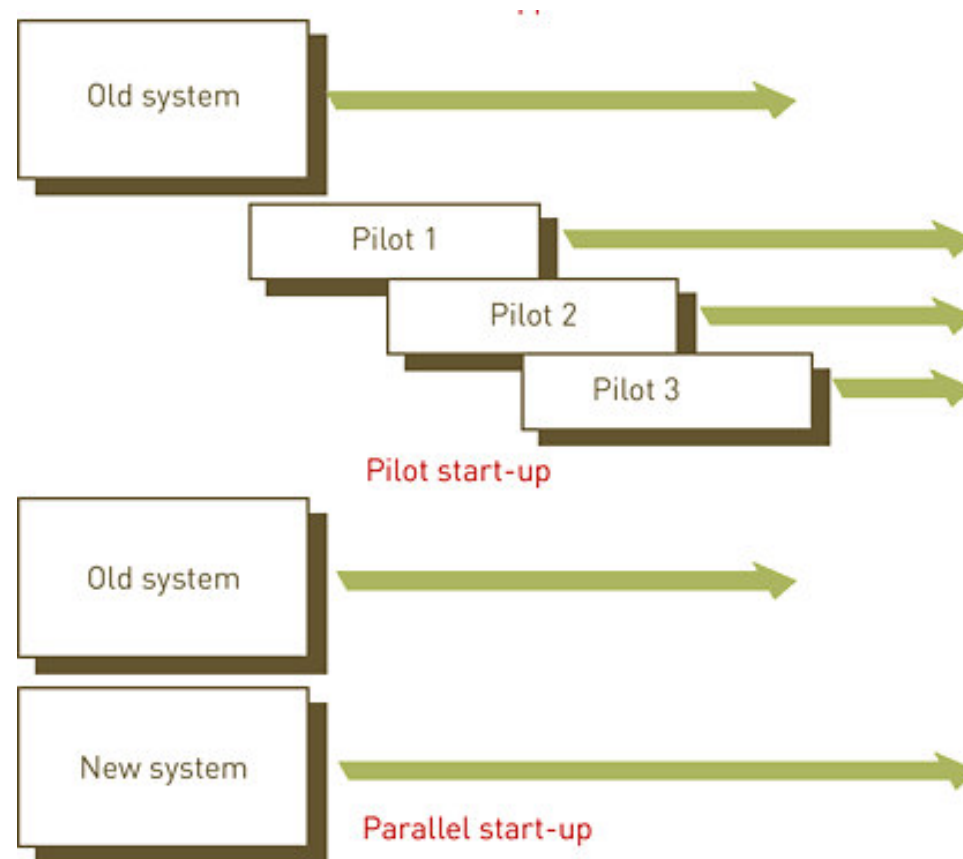


Figure 13.13: Start-Up Approaches (continued)

User Acceptance

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

Quick Quiz 2

1. What is a term used to describe a group of skilled IS professionals with the task of designing and implementing a set of programs?

•

2. What is the process of physically placing the computer equipment on the site and making it operational called?

•

3. What is the process of making sure that all files and databases are ready to be used with new computer software and systems called?

•

4. True or False: Unit testing involves testing all related systems together.

•

5. True or False: Pilot start-up involves running the new system for one group of users rather than all users.

•

Systems Operation and Maintenance

- **Systems operation:** _____ 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
 - Autonomic computing allows computers to manage themselves

Reasons for Maintenance

- Changes in business processes
- New requests from stakeholders, users, and managers
- _____ or errors in program
- Technical and hardware problems

Reasons for Maintenance (continued)

- Corporate mergers and acquisitions
- Government regulations
- Change in operating system or hardware on which the application runs
- _____ events

Types of Maintenance

- Slipstream upgrade: minor upgrade
- _____ : fix a problem or make small enhancement
- Release: significant program change requiring new documentation
- Version: major program change with new features

The Request for Maintenance Form

- **Request for maintenance form:** form authorizing modification of programs
 - Usually signed by a business manager
- IS group
 - Reviews form
 - Identifies programs to be changed
 - Determines programmer to be assigned to task
 - Estimates expected completion date
 - Develops a technical description of change

Performing Maintenance

- Approaches
 - Team who designs and builds the system also performs maintenance
 - Separate maintenance team is responsible for modifying, fixing, and updating existing software
- Maintenance tools and software
 - Example: RescueWare

The Financial Implications of Maintenance

- Total maintenance expenditures increase in time and money as programs age
 - For older programs, total cost of maintenance can be up to _____ times greater than total cost of development
- Determining factor in decision to replace a system
 - Costs more to fix than replace system

The Financial Implications of Maintenance (continued)

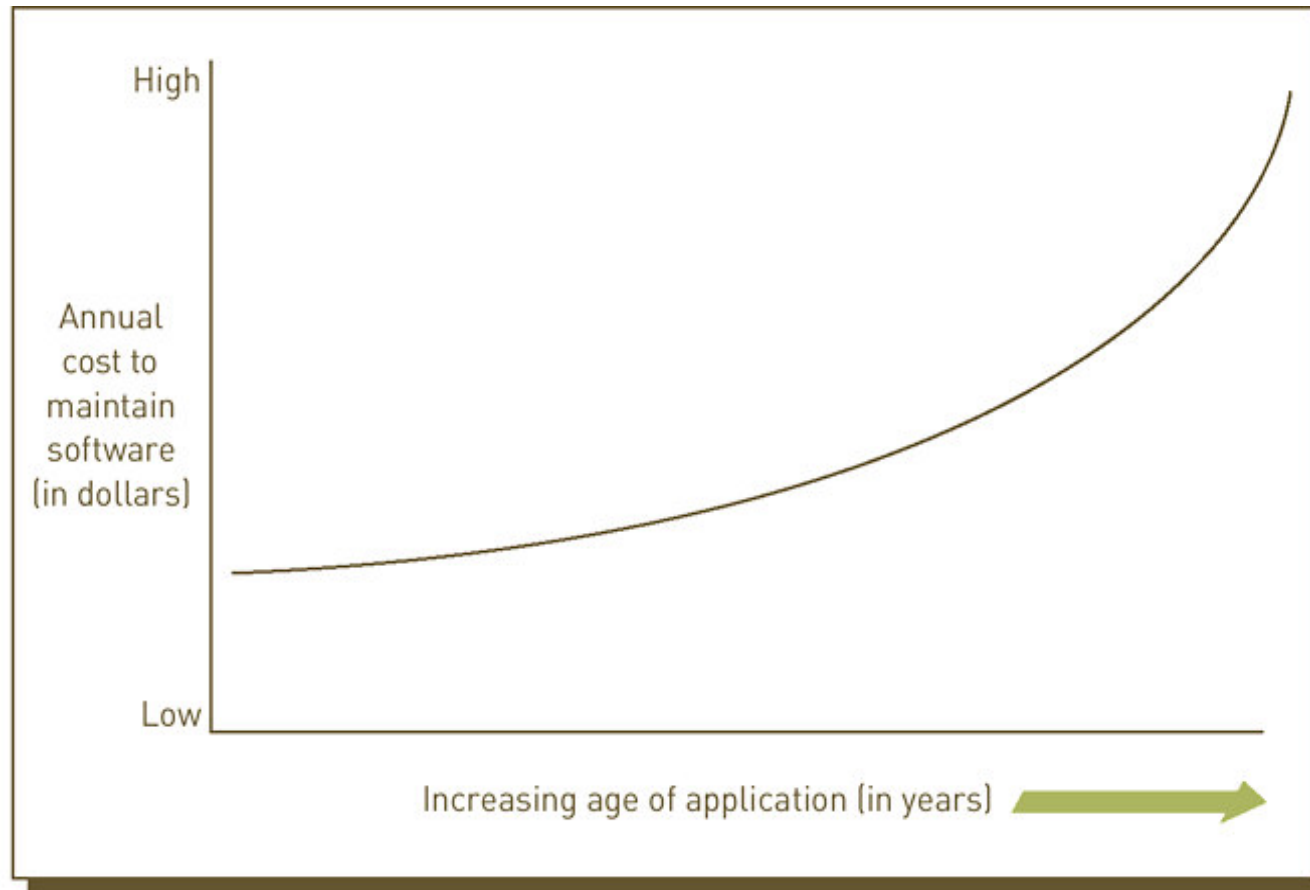


Figure 13.14: Maintenance Costs as a Function of Age

The Relationship Between Maintenance and Design

- More time and money spent on design means less time and money spent on maintenance

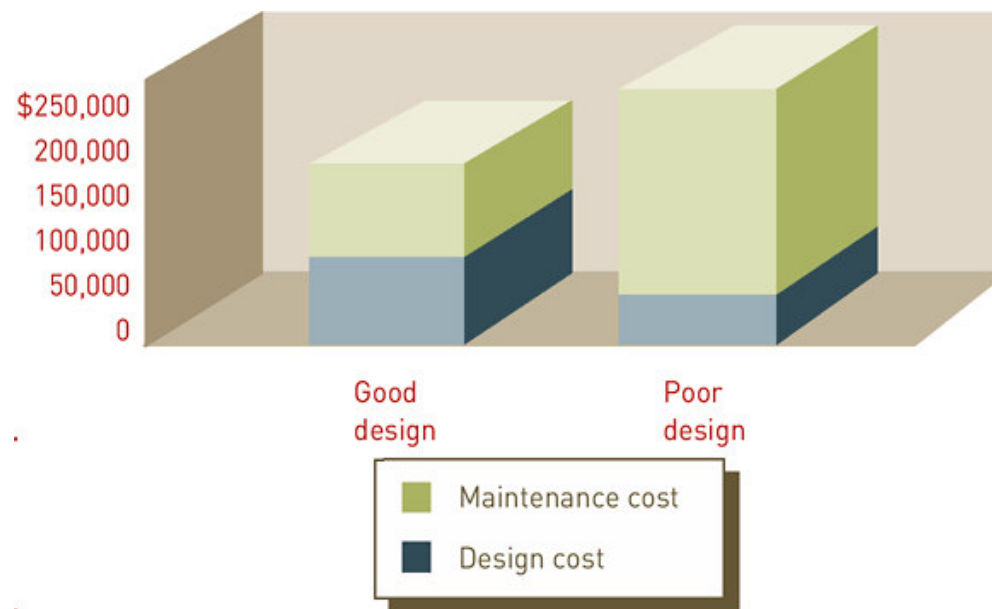


Figure 13.15: The Value of Investment in Design

Quick Quiz 3

1. Systems _____ refers to the use of a new or modified system.
2. A new _____ is a significant program change that often requires changes in the documentation of the software.
3. True or False: As programs get older, total maintenance expenditures in time and money increase.
- _____
4. A(n) _____ is a minor change to correct a problem or make a small enhancement.

Systems Review

- Analysis of systems to make sure that they are operating as intended
- Often compares _____ and _____ of designed system with actual performance and benefits of operational system

Types of Review Procedures

Event Driven	Time Driven
Problem with an existing system	Monthly review
Merger	Yearly review
New accounting system	Review every few years
Executive decision that an upgraded Internet site is needed to stay competitive	Five-year review

Table 13.6: Examples of Review Types

Factors to Consider During Systems Review

- Mission
- Organizational goals
- Hardware and software
- Database
- Telecommunications

Factors to Consider During Systems Review (continued)

- Information systems personnel
- _____
- Training
- Costs
- Complexity

Factors to Consider During Systems Review (continued)

- _____
- Efficiency
- Response time
- Documentation

System Performance Measurement

- **System performance measurement:** monitoring the system
 - Number of errors encountered
 - Amount of _____ required
 - Amount of processing or CPU time needed
 - Other problems
- **System performance products:** software that measures all components of computer-based information system

Quick Quiz 4

1. What type of review would be used after a system error occurred?

- _____

2. What is the final step in systems development?

- _____

3. What type of review is conducted periodically?

- _____

Summary

- Systems design answers the question: “How will the information system solve a problem?”
- Logical design: description of functional requirements of a system
- Physical design: specification of characteristics of the system components necessary to put the logical design into action
- Object-oriented design: uses scenarios, or sequences of events

Summary (continued)

- Steps of systems implementation: hardware acquisition, software acquisition, user preparation, personnel hiring and training, site preparation, data preparation, installation, testing, start-up, and user acceptance
- Systems operation: use of a new or modified system
- Systems maintenance: checking, changing, and enhancing the system to make it more useful in achieving user and organizational goals

Summary (continued)

- Systems maintenance (continued):
 - For older programs, total cost of maintenance can be up to five times greater than total cost of development
 - More time and money spent on design means less time and money spent on maintenance
- Systems review: analysis of systems to make sure that they are operating as intended