Chapter 10
Information Systems Analysis and Design
Computer Concepts 2014

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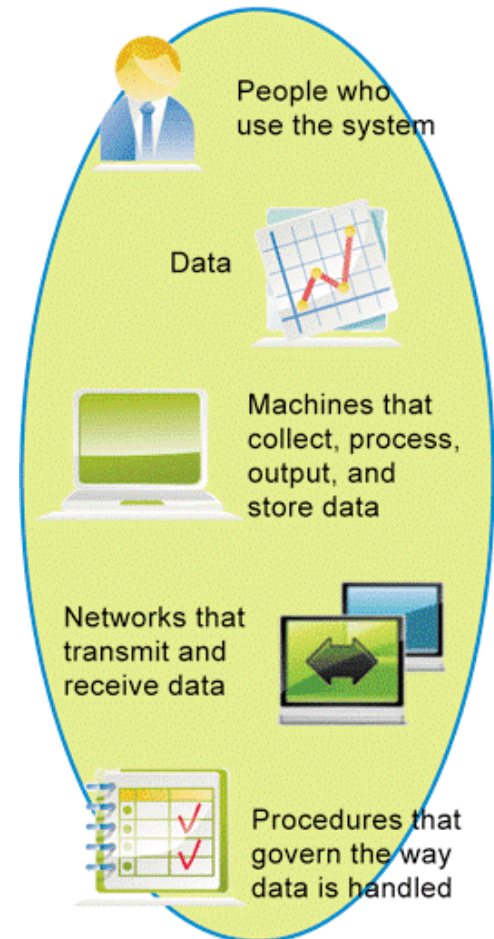
10 Section A: Information Systems

➢ Information Systems in Organizations

➢ Transaction Processing Systems

➢ Management Information Systems

➢ Decision Support Systems

➢ Expert Systems and Neural Networks

10 Information Systems in Organizations

FIGURE 10-1

Information systems encompass many aspects of an organization.

➤ An information system collects, stores, and processes data to provide useful, accurate, and timely information

➤ An organization is a group of people working together to accomplish a goal

   ➤ Business

   ➤ Nonprofit organization

   ➤ Mission

      ➤ Mission statement

People who use the system

Data

Machines that collect, process, output, and store data

Networks that transmit and receive data

Procedures that govern the way data is handled
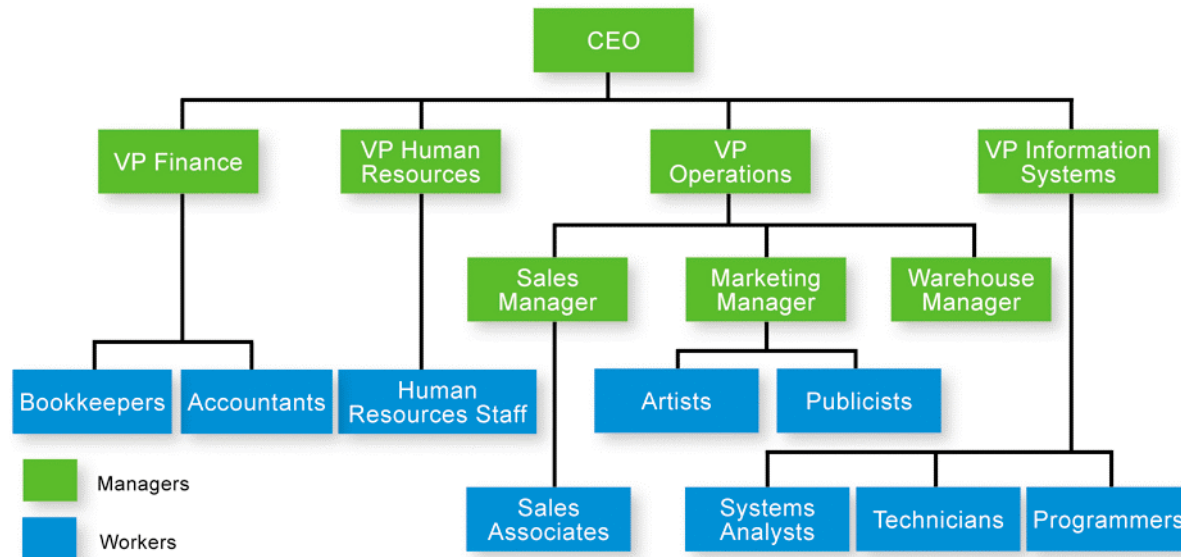
tele52/Shutterstock.com

10 Information Systems in Organizations

➢ Organizational charts depict the hierarchy of information; e.g. bureaucracy

FIGURE 10-2

An Organizational Chart

10 Information Systems in Organizations

➢ Information systems can:

   ➢ Automate routine tasks

   ➢ Make decisions in response to problems

      ➢ Structured problem

      ➢ Semi-structured problem

      ➢ Unstructured problem

   ➢ Collect and store internal or external information

10 Problem Types

FIGURE 10-4
Problem Classifications

Type of Problem	Example	Methodology
A **structured problem** is an everyday, run-of-the-mill, routine problem. When you make decisions in response to structured problems, the procedure for obtaining the best solution is known, the objective is clearly defined, and the information necessary to make the decision is easy to identify.	Which customers should receive over-due notices?	The information for this decision is usually stored in a file cabinet or computer system. The method for reaching a solution is to look for customers with outstanding balances, and then check whether the due dates for their payments fall before today's date.
A **semi-structured problem** has a known procedure for arriving at a solution; however, the process might involve some degree of subjective judgment. Also, some of the information regarding the problem might not be available, might lack precision, or might be uncertain.	How many mountain bikes should a store stock for the holidays?	The decision can be based on the previous year's sales; but because future consumer spending is uncertain, determining the appropriate amount of holiday inventory might require some guesswork.
An **unstructured problem** requires human intuition as the basis for finding a solution. Information relevant to the problem might be missing, and few parts of the solution can be tackled using concrete models. If experts are presented with a problem but they disagree on a solution, it is likely an unstructured problem.	Should Saks Fifth Avenue stock Japanese-inspired evening gowns?	The purchasing agent for women's clothing makes this decision based on her intuition of customer taste and fashion trends.

10 Transaction Processing Systems

➢ Provide a way to collect, process, store, display, modify, or cancel transactions

  ➢ Payroll, accounting, airline reservations, inventory, point of sale and cellular phone billing

➢ Batch processing vs. online processing

  ➢ OLTP system

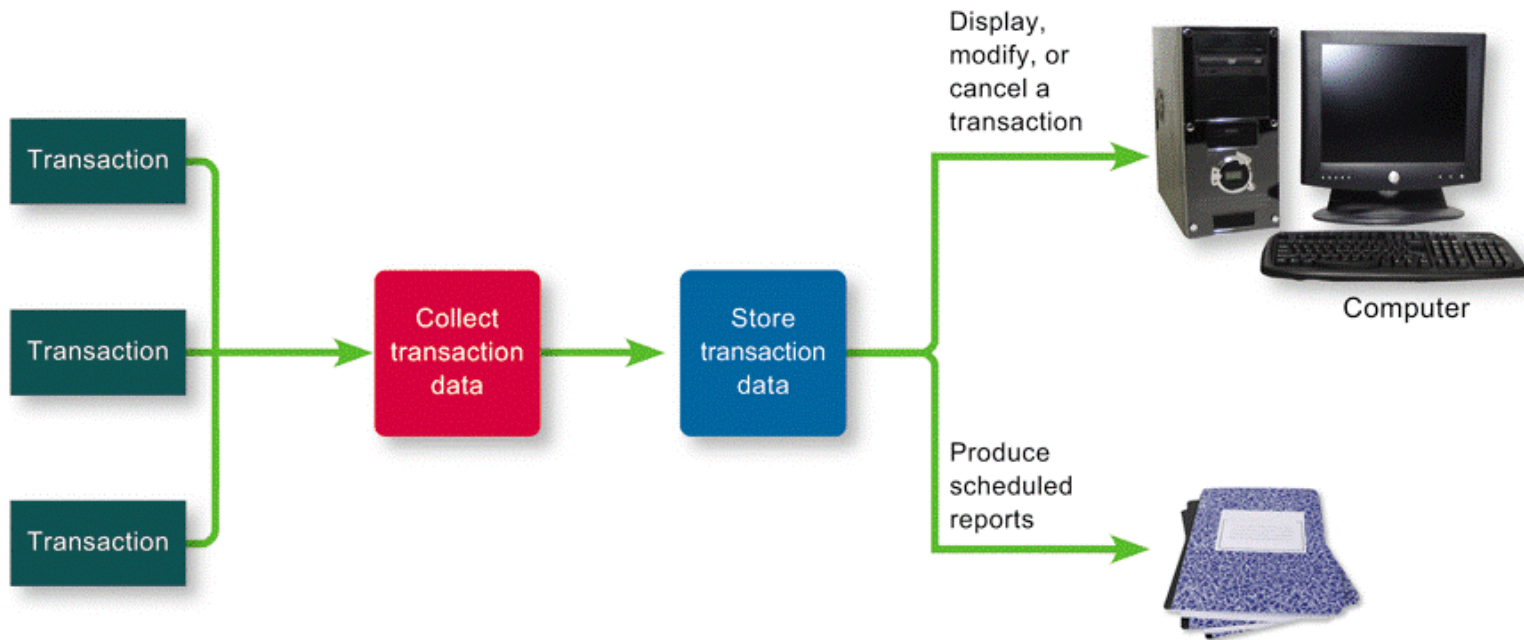   ➢ Commit or rollback strategy

➢ Detail reports

FIGURE 10-6

A transaction processing system is characterized by its ability to:

▶ Collect, display, and modify transactions

▶ Store transactions

▶ List transactions

▶ Scroll down and start the video to see how a TPS processes an ATM transaction.

Transaction

Transaction

Transaction

Collect transaction data

Store transaction data

Display, modify, or cancel a transaction

Computer

Produce scheduled reports

Management Information Systems

FIGURE 10-7

A management information system is characterized by its ability to:

- Produce routine and on-demand reports
- Provide useful information for managerial activities
- Increase managerial efficiency
- Provide information used for structured, routine decisions

▶ Use your interactive eBook to find out how ATM data would be used in an MIS.

10 Management Information Systems

FIGURE 10-9

A library's TPS performs different functions than its MIS.

TPS

© Hill Street Studios/Getty Images

Purpose: Track books by maintaining a database of titles, checkout dates, and so forth.

Users: Library patrons locate books and librarians check books in and out.

Key characteristic: Manage transactions as books are checked in and out.

MIS

© Jupiterimages/Getty Images

Purpose: Provide librarians with summary and exception reports needed to manage the collection.

Users: Librarians request and analyze reports.

Key characteristics: Summary reports indicate how many books are checked out each day, each week, each month, or each year; exception reports list long-overdue books.

10 Decision Support Systems

➢ Helps people make decisions by directly manipulating data, analyzing data from external sources, generating statistical projections, and creating data models of various scenarios

 ➢ Executive information system

➢ DSSs design decision models and make decision queries

10 Decision Support Systems

Decision makers

External Data

Stock Market

Census Bureau

Weather Bureau

United States Geological Survey

© PhotoDisc/Getty Images, Creative

Data from transaction processing system

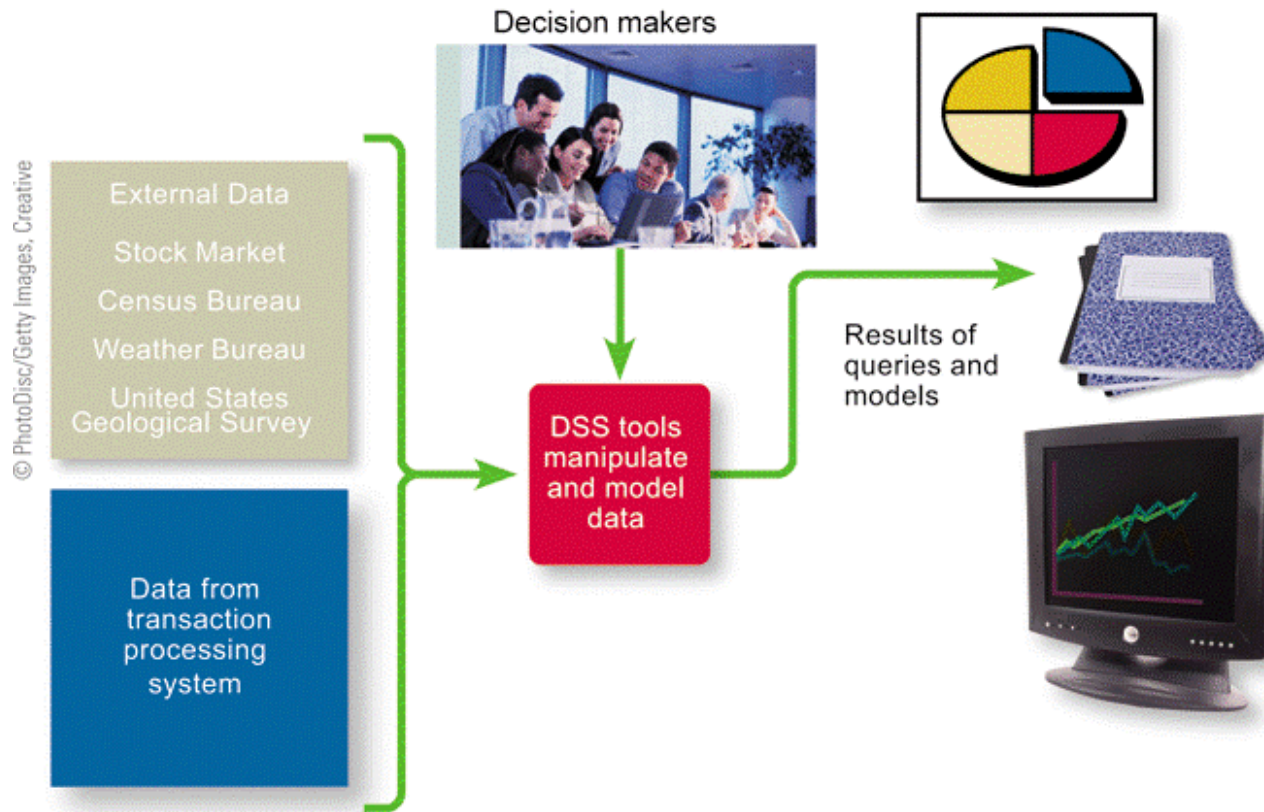DSS tools manipulate and model data

Results of queries and models

FIGURE 10-10

A decision support system is characterized by its ability to:

▸ Support, rather than replace, managerial judgment

▸ Create decision models

▸ Improve the quality of decisions

▸ Help solve semi-structured problems

▸ Incorporate external data

▶ Use your interactive eBook to learn how a DSS helps decision makers at a fast food franchise.

10 Expert Systems and Neural Networks

➢ Expert systems are designed to analyze data and produce a recommendation, diagnosis, or decision based on a set of facts and rules

  ➢ Knowledge base
    ➢ Inference engine
    ➢ Knowledge engineering
  ➢ Expert system shell
  ➢ Fuzzy logic

➢ Neural networks use computer circuitry to simulate how a brain may process info, learn, and remember
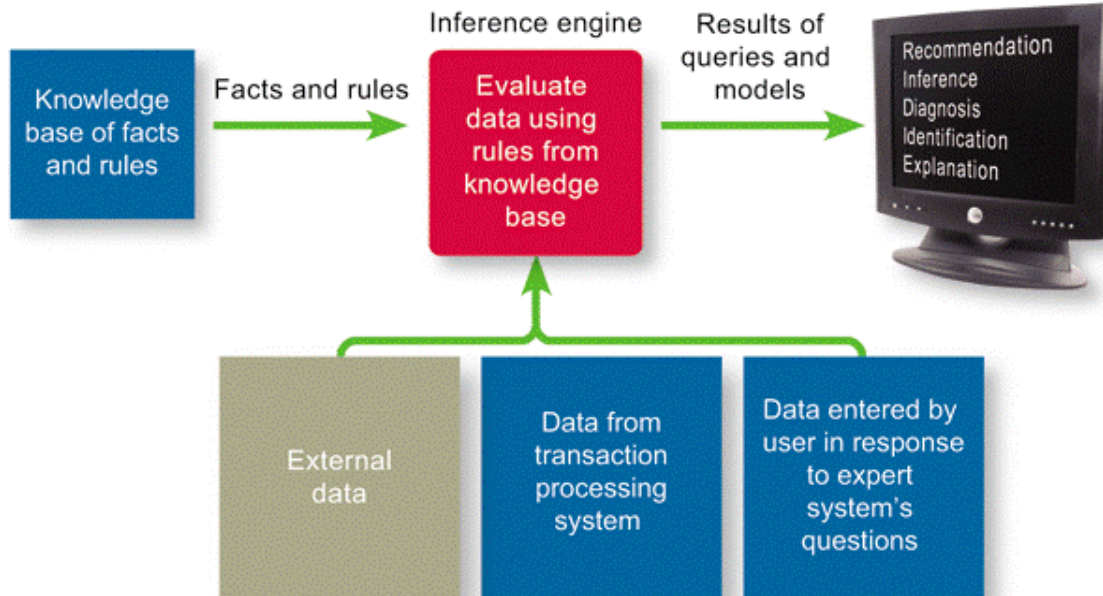
10 Expert Systems and Neural Networks

FIGURE 10-12

An expert system is characterized by its ability to:

- Replicate the reasoning of a human expert
- Work with internal or external data
- Produce a recommendation or decision

▶ Watch how an expert system determines if a student should be admitted to graduate school.

10 **Section B: Systems Analysis**

- ➢ System Development Life Cycle
- ➢ Planning Phase
- ➢ Analysis Phase
- ➢ Documentation Tools

System Development Life Cycle

➢ Systems analysis and design is a discipline that focuses on developing information systems according to the phases of an SDLC

FIGURE 10-14

System Development Life Cycle
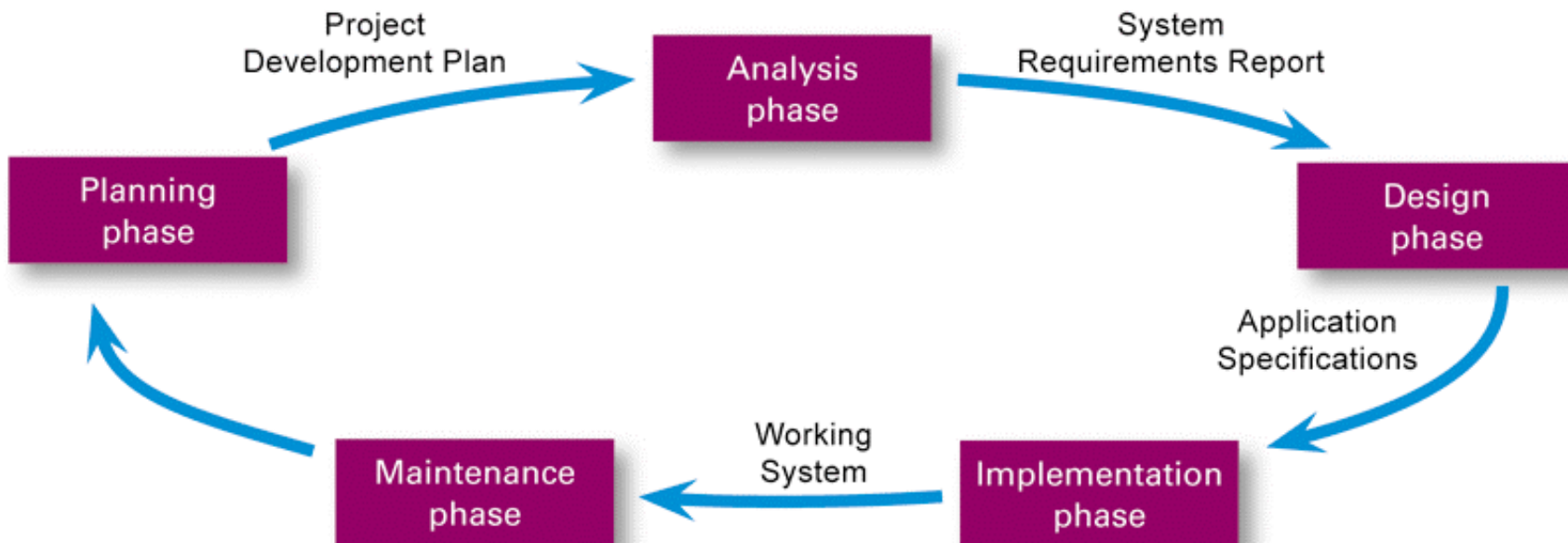
10 Planning Phase

➢ Assemble the project team

➢ Justify the project

➢ Choose a development methodology

➢ Develop a project schedule

➢ Produce a Project Development Plan

10 Planning Phase

Justification for new system

➢ serious problem with the current system,

➢ a threat to the organization's success,

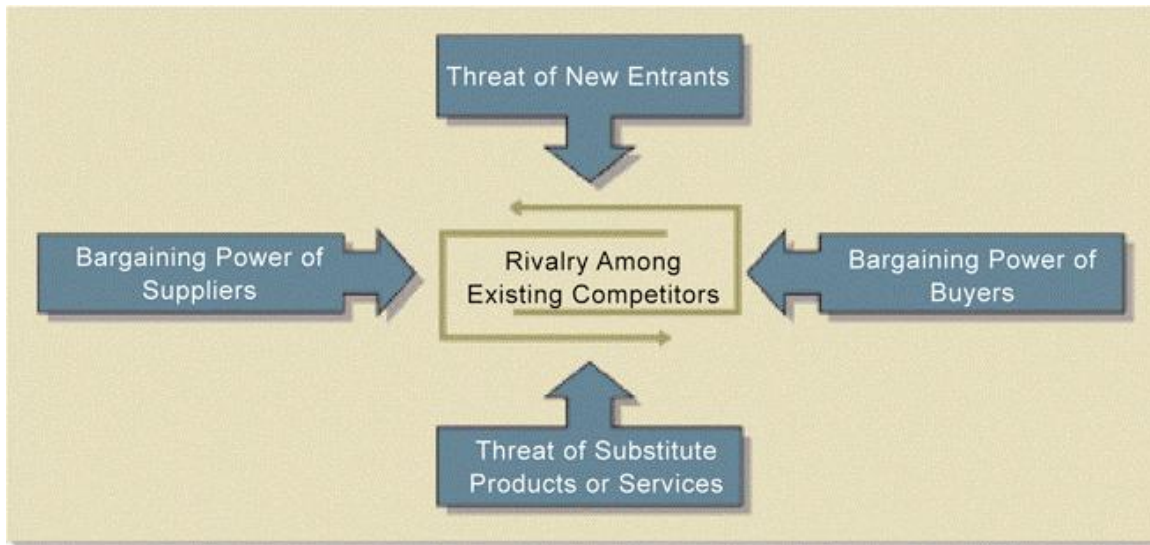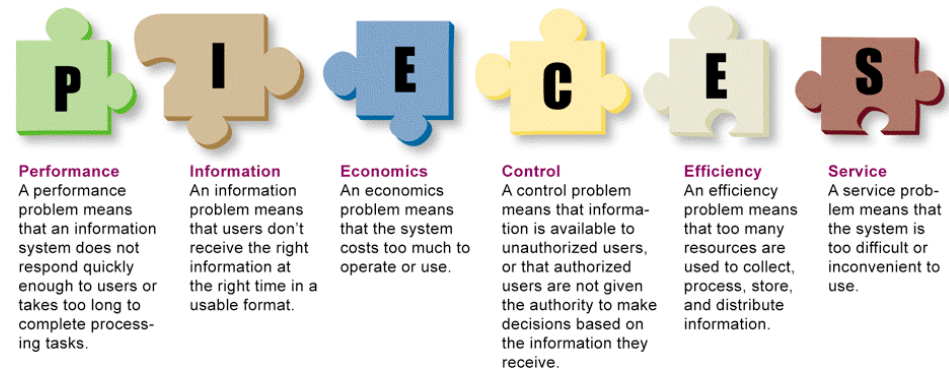➢ an opportunity to improve an organization's products or services through technology

FIGURE 10-16

Michael Porter's Five Forces model illustrates the factors that affect competition among business rivals. ▶ Watch the video to find out how these forces affect such diverse products as videogames, fur coats, and televisions.

Planning Phase

➤ An organization must be able to:

  ➤ Make improvements

  ➤ Change the industry

  ➤ Create new products

➤ The PIECES framework helps classify problems in an information system

FIGURE 10-18

Wetherbe's PIECES

P   I   E   C   E   S

Performance
A performance problem means that an information system does not respond quickly enough to users or takes too long to complete processing tasks.

Information
An information problem means that users don't receive the right information at the right time in a usable format.

Economics
An economics problem means that the system costs too much to operate or use.

Control
A control problem means that information is available to unauthorized users, or that authorized users are not given the authority to make decisions based on the information they receive.

Efficiency
An efficiency problem means that too many resources are used to collect, process, store, and distribute information.

Service
A service problem means that the system is too difficult or inconvenient to use.

10 Planning Phase

➢ Development methodologies
  ➢ Structured methodology
  ➢ Information engineering methodology
  ➢ Object-oriented methodology
➢ PERT (Program Evaluation and Review Technique)
➢ WBS (Work Breakdown Structure)
➢ Gantt chart

Planning Phase

FIGURE 10-19

PERT chart elements are arranged to show which tasks must be completed before subsequent dependent tasks can begin. By tracing paths through the diagram, project managers can determine the best-case and worst-case scheduling scenarios. The longest path through the tasks, shown in purple, is called the critical path.
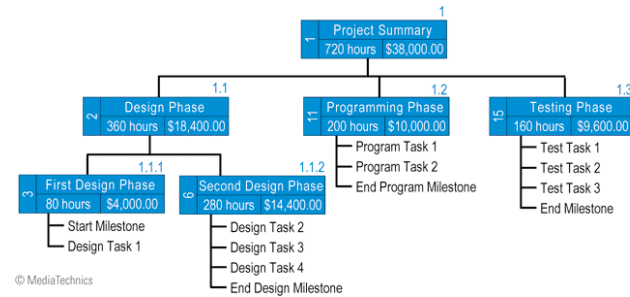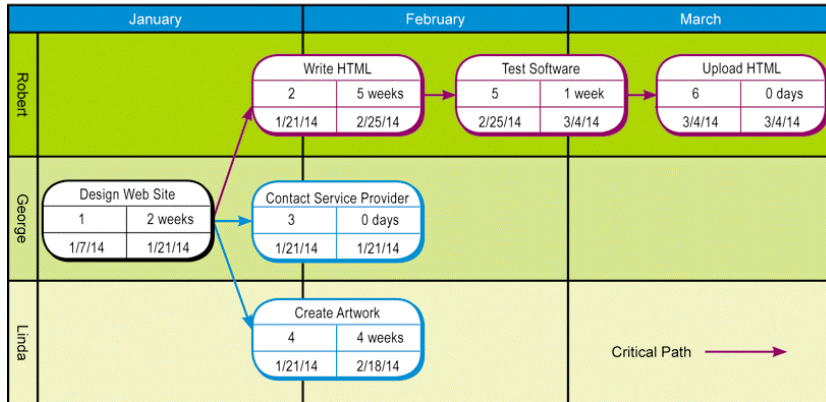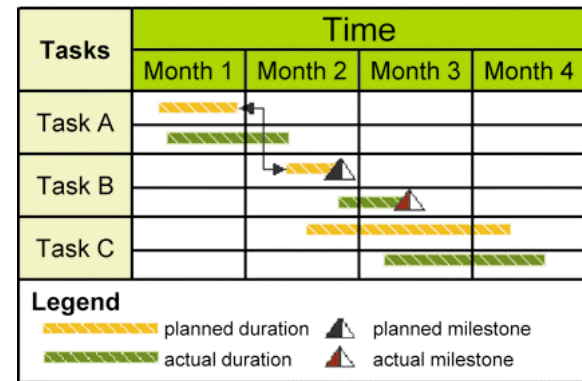
FIGURE 10-20

The top element on a WBS chart represents the entire project. At the next level, the project is broken down into subtasks, and those tasks are in turn broken down into even smaller tasks.

FIGURE 10-21

Gantt charts indicate the duration of each task. They can also show milestones and compare planned completion dates with actual completion dates.

10 **Analysis Phase**

➢ Produce a list of requirements for a new or revised information system

➢ Analysis phase activities:

    ➢ Study the current system

    ➢ Determine system requirements

    ➢ Write System Requirements Report

➢ System requirements are the criteria for successfully solving problems identified in an information system

    ➢ Success factors

10 Documentation Tools

➢ The core documentation tool for project teams using structured methodology is the data flow diagram (DFD)

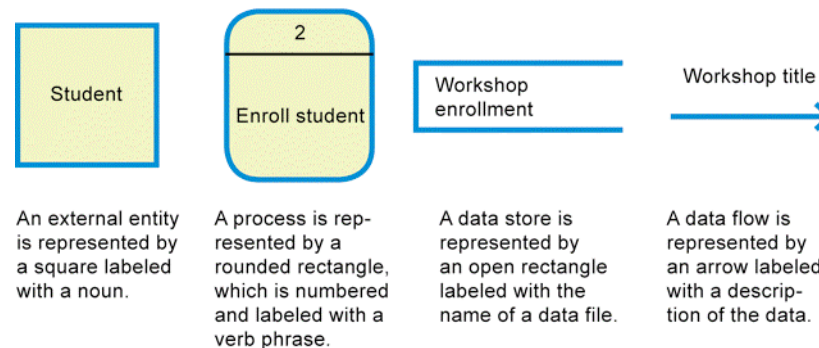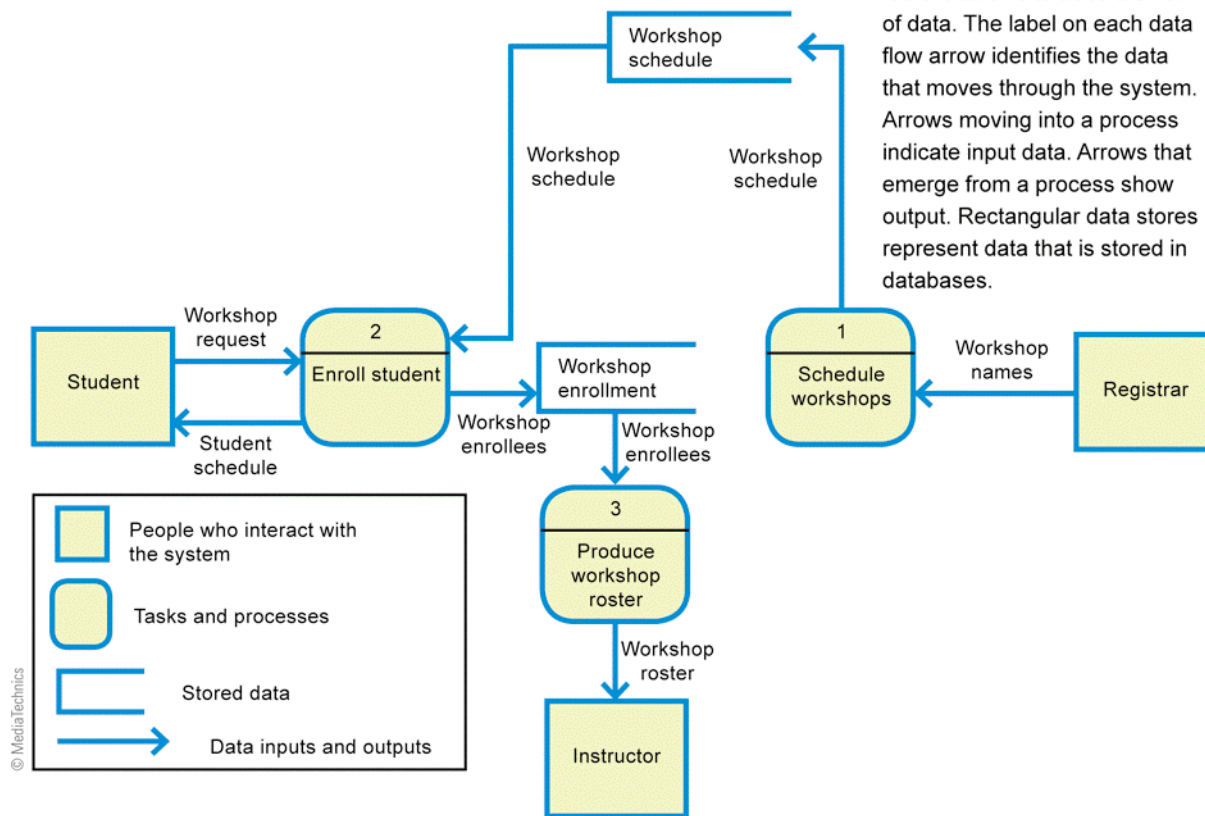 ➢ External entity

  ➢ Data store

  ➢ Process

  ➢ Data flow

FIGURE 10-24
Data Flow Diagram Symbols

An external entity is represented by a square labeled with a noun.

A process is represented by a rounded rectangle, which is numbered and labeled with a verb phrase.

A data store is represented by an open rectangle labeled with the name of a data file.

A data flow is represented by an arrow labeled with a description of the data.

FIGURE 10-25

To read a DFD, begin at any one of the square entities and follow the arrows to trace the flow of data. The label on each data flow arrow identifies the data that moves through the system. Arrows moving into a process indicate input data. Arrows that emerge from a process show output. Rectangular data stores represent data that is stored in databases.

10 Section C: System Design

➢ Design Phase

➢ Evaluation and Selection

➢ Application Specifications

10 Design Phase

➢ How the new system will fulfill the requirements specified in the System Requirements Report

FIGURE 10-30

Design Phase Activities:

✓ Identify potential solutions

✓ Evaluate solutions and select the best

✓ Select hardware and software

✓ Develop application specifications

✓ Obtain approval to implement the new system

10 Design Phase

➢ The project team has to consider the overall architecture based on:

  ➢ Level of automation

  ➢ Processing methodology

    ➢ Centralized processing

    ➢ Distributed processing

  ➢ Network technology

FIGURE 10-31

Automation alternatives can affect many aspects of an information system. A credit card number can be stored using a few bytes. Storing a digitized signature, however, might require far more disk space, a special type of database software, and specialized input devices. The project team should consider the pros and cons of different levels of automation because they affect all aspects of the planned information system.

© Ronald Karpilo/Alamy

10 Design Phase

➤ Software alternatives
  ➤ Programming tools
  ➤ Application development tools
  ➤ Application software
  ➤ Turnkey systems

10 Evaluation and Selection

A *request for proposal* (RFP) describes

➤ The problem and the requirements for the solution

A *request for quotation* (RFQ)

➤ Request for a formal price quotation on a list of hardware and software

FIGURE 10-35
RFQ Excerpt

City Hall Information System RFQ

The Information Technology Office is seeking qualified vendors for the quotation of network equipment required for the expansion of the city hall facility. A list of hardware and software is provided below. Prospective vendors MUST provide the total price including shipping charges and the applicable sales tax. Any deviation from the specifications MUST be noted on the quotation and a written explanation is strongly encouraged to support the substitutions. Bids submitted with equipment other than those stated in the specifications may be rejected.

Part Description	Part Number	Quantity	Price
1. Cisco Catalyst 3750 24 10/100/1000T + 4 SFP Enhanced Multilayer Switch	WS-C3750G-24TS-E	1	
2. Cisco Catalyst 3750 24 10/100/1000T + 4 SFP Standard Multilayer Switch	WS-C3750G-24TS-S	2	

10 **Application Specifications**

Describe the way the information system's software

➢ should interact with users,

➢ store data,

➢ process data,

➢ and format reports

Feature creep refers to the failure to constrain change

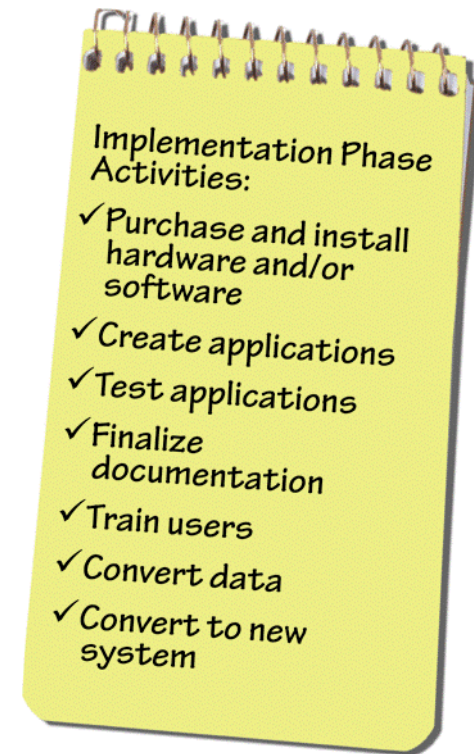➢ Changes should be managed formally, including written change requests

10 Section D: Implementation and Maintenance

- ➢ Implementation Phase
- ➢ Development and Testing
- ➢ Documentation and Training
- ➢ Conversion and Cutover
- ➢ Maintenance Phase

10 Implementation Phase

➢ Construct the new information system

FIGURE 10-37

Implementation Phase Activities:
✓ Purchase and install hardware and/or software
✓ Create applications
✓ Test applications
✓ Finalize documentation
✓ Train users
✓ Convert data
✓ Convert to new system

10 Development and Testing

Software customization

➢ process of modifying a commercial application to reflect an organization's needs

Application testing is performed in three ways:

➢ Unit testing

➢ Integration testing

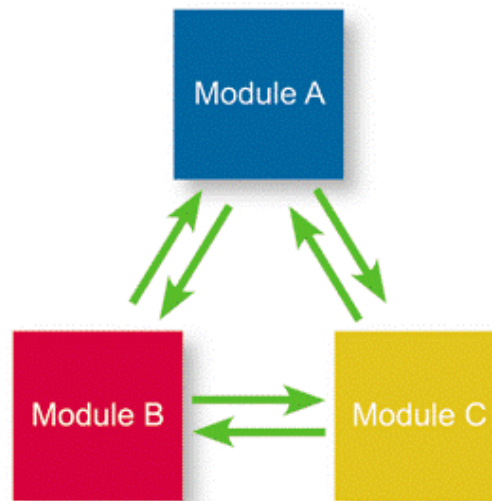➢ Test area

➢ System testing

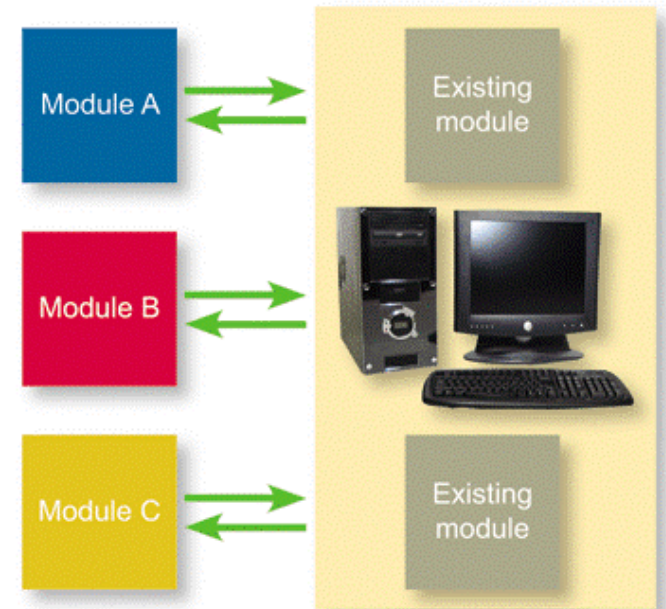# Development and Testing

FIGURE 10-38

Unit, integration, and system testing ensure that applications work.

Unit testing ensures that each module of the application software works correctly.

Integration testing ensures that all the modules work together correctly.

System testing ensures that new modules work with the rest of the system hardware and software.

© MediaTechnics

10 Documentation and Training

➢ System documentation

  ➢ Describes a system's features, hardware architecture, and programming

➢ User documentation

  ➢ Describes how to interact with the system to accomplish specific tasks

  ➢ Procedure handbook

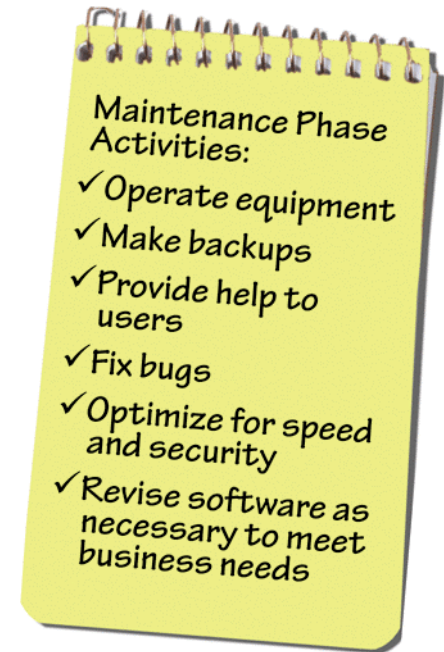   ➢ Contains step-by-step instructions for performing specific tasks

10 | Conversion and Cutover

- ➢ System conversion
  - ➢ Deactivating an old information system and activating a new one
  - ➢ Several conversion strategies:
    - ➢ Direct conversion
    - ➢ Parallel conversion
    - ➢ Phased conversion
    - ➢ Pilot conversion
- ➢ Acceptance testing is designed to verify that the new information system works as required

10 Maintenance Phase

➢ Involves day-to-day operation of the system, making modifications to improve performance, and correcting problems

➢ The term **quality of service** (**QoS**) refers to the level of performance a computer system provides

FIGURE 10-41

Maintenance Phase Activities:
✓ Operate equipment
✓ Make backups
✓ Provide help to users
✓ Fix bugs
✓ Optimize for speed and security
✓ Revise software as necessary to meet business needs

10 Maintenance Phase
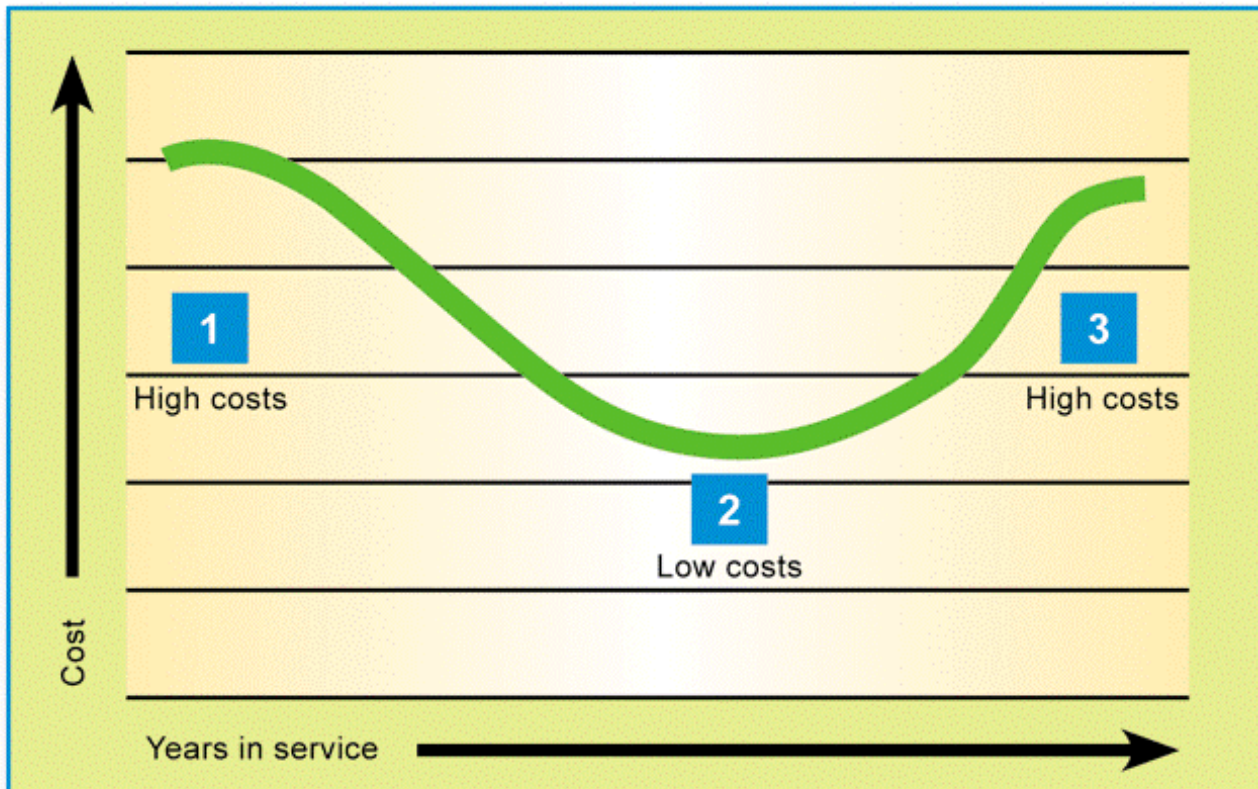
➢ Maintenance phase costs

FIGURE 10-44

Maintenance Phase Costs

1. When a new information system first goes live, maintenance costs are high while programmers work out bugs and users clamor for support.

2. After most of the bugs are fixed and users become familiar with the information system, maintenance costs decrease.

3. As an information system nears the end of its useful life span, repair costs rise, and changing business practices begin to require modifications that are time-consuming and expensive to implement.

# **10** Section E: Corporate Data Security

➢ Information System Data Vulnerabilities

➢ Information System Data Security

➢ Corporate Identity Theft

10 Information System Data Vulnerabilities

➢ Threats to a corporate information system can affect thousands of people
  - ➢ Natural disasters
  - ➢ Power outages
  - ➢ Equipment failures
  - ➢ Human errors
  - ➢ Software failures
  - ➢ Security breaches
  - ➢ Acts of war
  - ➢ Malware

FIGURE 10-45

Human error was blamed for a blackout that cascaded from the Midwestern United States, across the Northeast, and into Canada.

James Patrick Cooper/Bloomberg via Getty Images
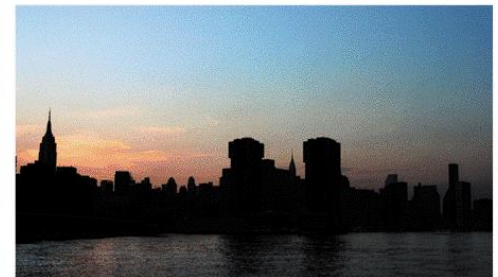
10 Information System Data Security

➢ No computer system can be completely risk-free, but several proactive measures can protect information systems from threats

  ➢ Deterrents

  ➢ Preventative countermeasures

  ➢ Corrective procedures

  ➢ Detection activities

FIGURE 10-46

Biometric identification methods, such as fingerprint and retinal scans, provide one line of defense against threats.

10 Information System Data Security

➢ A data center is a specialized facility designed to hold and protect computer systems and data

➢ A disaster recovery plan is a step-by-step plan that describes the methods used to secure data against disaster and sets guidelines for how an organization will recover lost data if and when a disaster occurs

FIGURE 10-48

Publications such as the *Disaster Recovery Journal* help risk management professionals design and update disaster recovery plans.

© Copyright Disaster Recovery Journal 2011

10 **Corporate Identity Theft**

➢ When a company's brand is used without authorization, the company has become a victim of identity theft

➢ For example, phishing scams and fake Web sites

10 Corporate Identity Theft

➢ Guidelines help corporations deal with identity theft

FIGURE 10-49

Guidelines help corporations deal with identity theft.

Help customers report scams. Provide a simple way for employees and customers to report phishing attacks that appear to originate from the company and fake versions of the corporate Web site.

Educate customers. Let customers know what kinds of legitimate communications they can expect from the company. Avoid acclimatizing customers to e-mail notifications that can make them vulnerable to future attacks. Never send customers mass mailings that contain links to the company's site or ask them to send personal data as an e-mail reply. Instead, ask customers to connect to the company's site using their browsers and provide instructions for accessing a data collection form.

Manage URLs. Make sure the company Web site is easy to find online. Keep the company URL simple so that users can access it directly, rather than through search engines or partner sites. Consider typical typographic errors that customers might make when typing the company URL. Try to reserve those URLs so that hackers can't take advantage of them. To minimize typographic errors, encourage customers to bookmark the company site by adding it to their Favorites lists.

Monitor domain name registration. Keep up to date on the corporation's domain registration and periodically check for new registrations that might make unauthorized use of the company name or trademarks.

Be prepared. Prepare for an attack before it happens by establishing relationships with law enforcement, ISPs, and others who can help locate and take down fraudulent sites.

Chapter 10 Complete

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