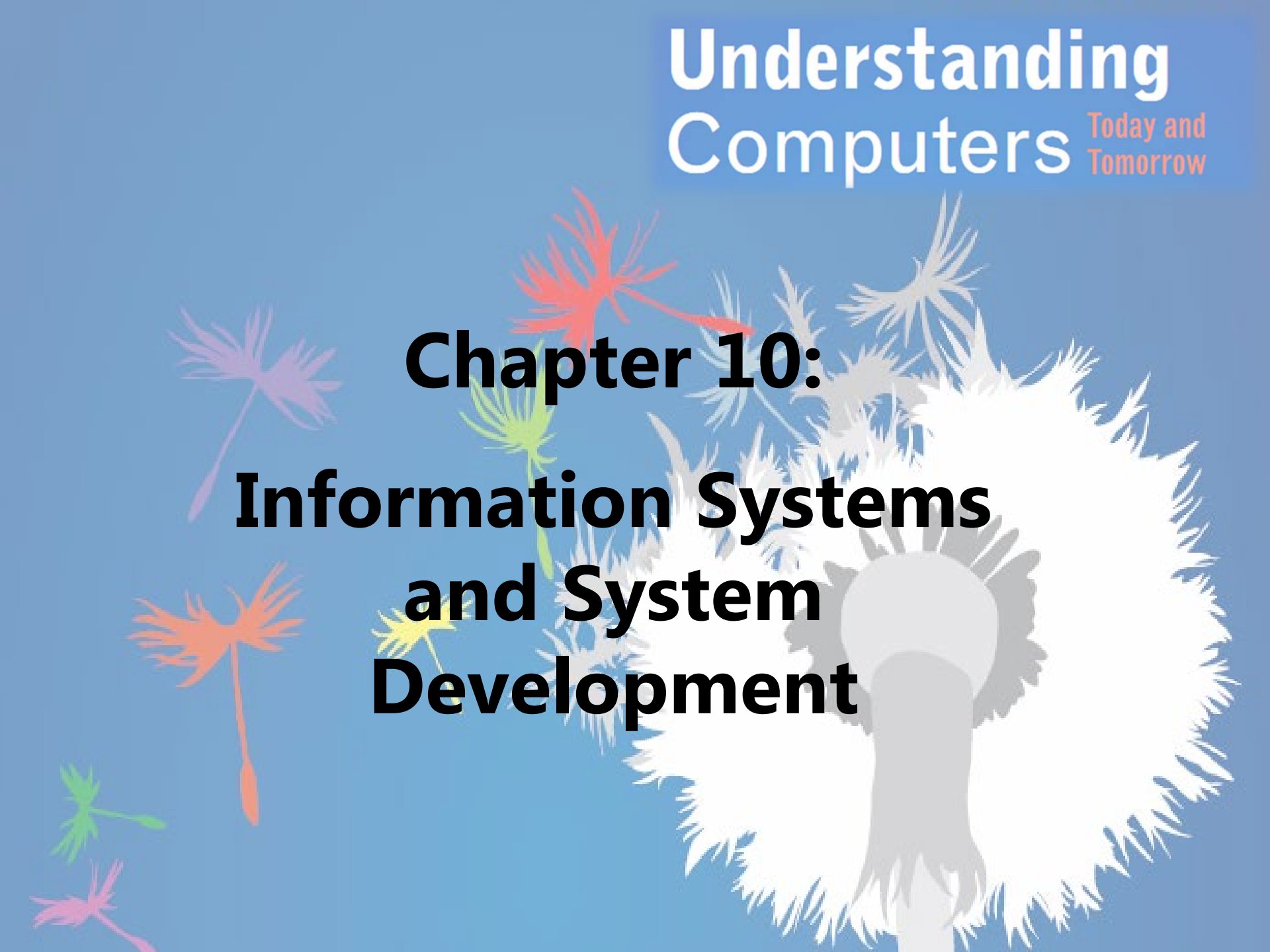


Chapter 10:

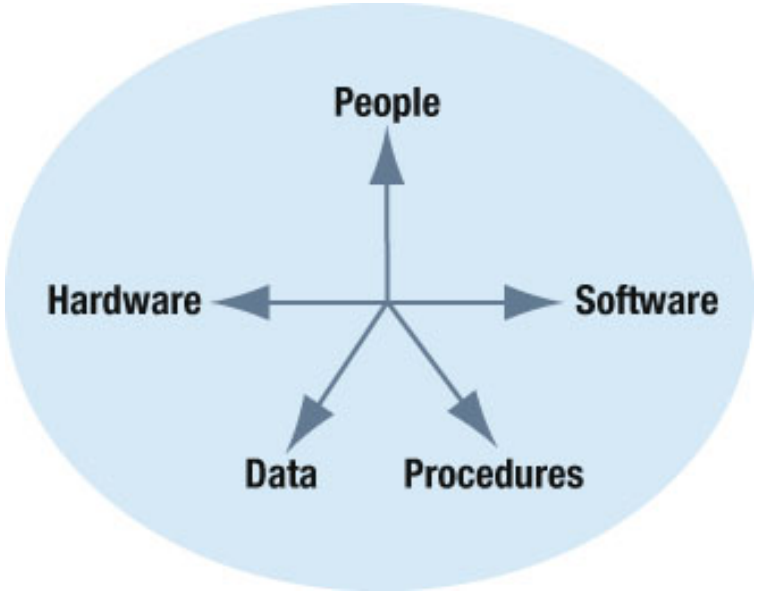
Information Systems and System Development

What Is an Information System?

- System
  - Collection of elements and procedures that interact to accomplish a goal
    - Football game, transit systems, etc.

- Information System
  - A system used to generate the information needed to support the users in an organization

FIGURE 12-1
Components of an information system.



What Is an Information System?

- Enterprise Architecture/Enterprise Resource Planning (ERP)
  - Provides a detailed picture of an organization, its function, its systems, and the relationship among them
  - Allows managers to organize and maximize the use of IT resources and make better decisions
  - Not easy to develop and requires time and effort, but once in place, it is an invaluable decision support tool

Information System Users

- Other Groups
  - Non-management workers
  - External users (customers, suppliers, other partners, etc.)

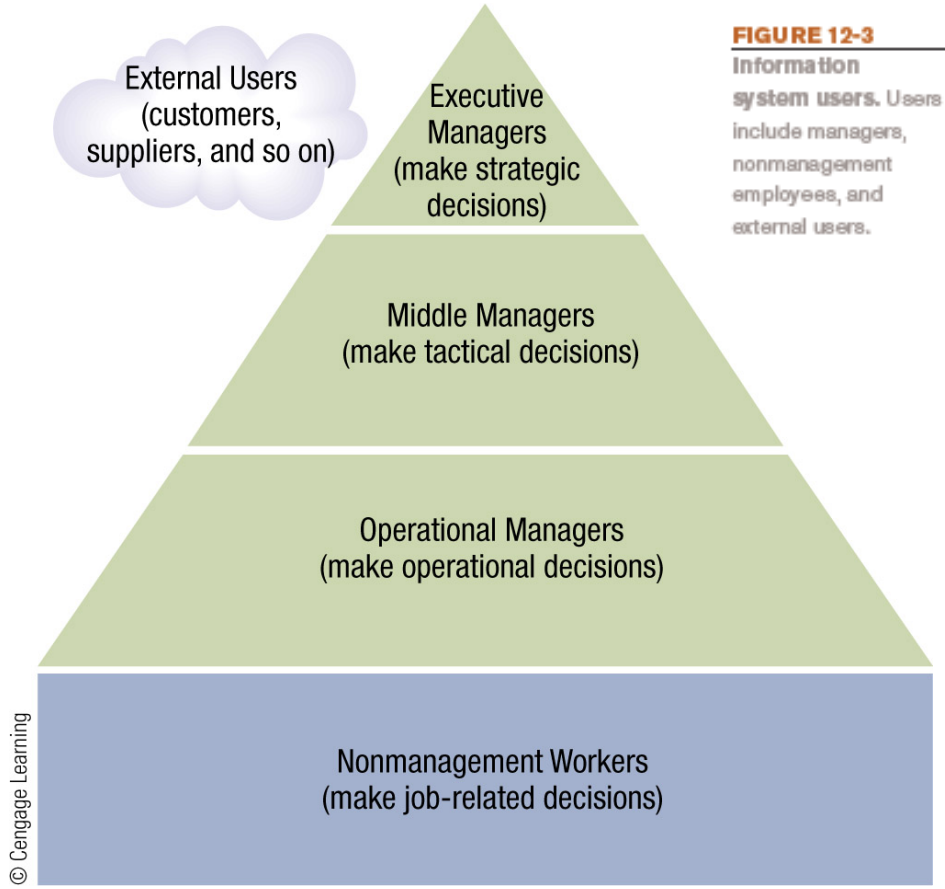


FIGURE 12-3
Information system users. Users include managers, nonmanagement employees, and external users.

System Development Life Cycle (SDLC)

- Planning/Problem Identification
- Analysis
- Design
  - Acquisition (text includes as separate phase)
- Implementation
- Maintenance

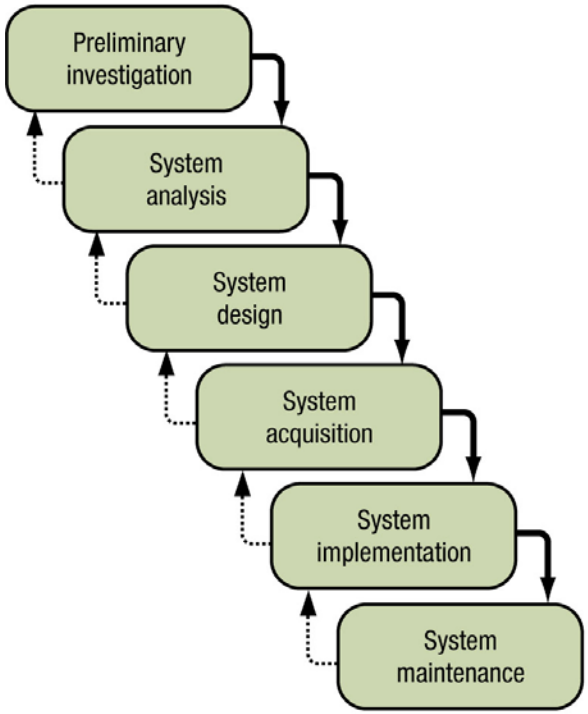
Responsibility for System Development

- Internal
- Outsourced
  - Hiring outside vendors to perform specific business tasks
  - Offshore
    - Outsourced to another country
  - Nearshoring
    - Outsourcing to nearby countries
  - Homesourcing (homeshoring)
    - Outsourcing to home-based workers

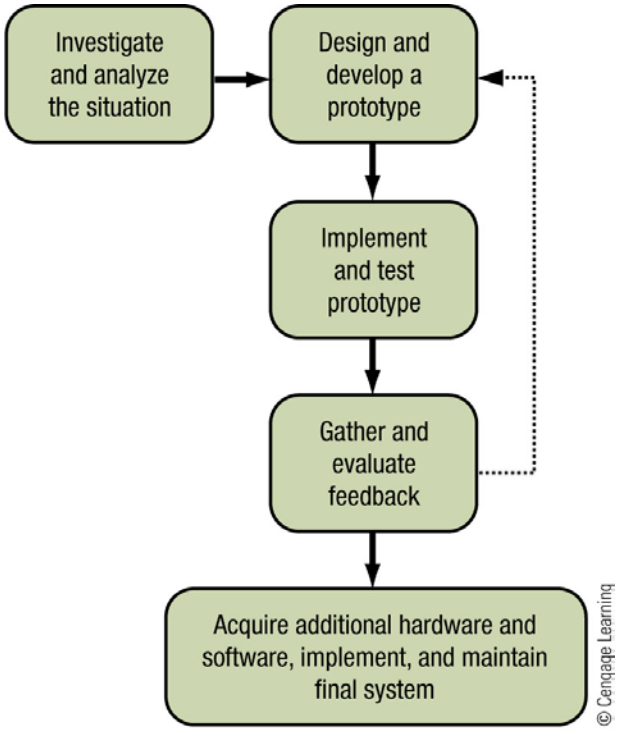
SDLC Approaches

- Waterfall model
    - Each phase begins only when previous one is completed
    - Time-consuming
- The Iterative Approach
  - System is developed incrementally
    - Steps are repeated until the system is finalized
  - Prototyping
    - Small model, or prototype, of the system is built before the full-scale development effort is undertaken

SDLC Approaches



WATERFALL METHOD (TRADITIONAL APPROACH)
Each step in the SDLC is carried out in order, although some interaction typically occurs.



PROTOTYPING (ITERATIVE APPROACH)
An iterative process in which a prototype is designed, developed, and tested, and then an improved prototype is developed and tested, and the process is repeated until the final version is reached.

FIGURE 12-28
Two different approaches to system development.

1. Planning/Problem Identification

- Phase 1
- Identify problem => is organization/operations competitive
  - New threats
  - New technologies
  - Inefficiencies
  - New laws (Sarbanes-Oxley Act, HIPAA etc.)
  - Changes to the legal requirements for retaining business data (e-disclosure, etc.)

2. Analysis

- Phase 1 planning inputs (deliverables) into phase 2
  - Again note development should be iterative
- What's out there – options?
- Cost-Benefit Analysis
  - Considers both tangible and intangible benefits to determine if the benefits of the new system outweigh the cost

SDLC Analysis

- Analysis results put into Diagrams, Tables, Trees, and Models
- Also contains instruments used for data gathering and other tools used to summarize and analyze the data
    - Questionnaires
    - Interview questions
    - Environmental analysis

➔ Capture and record everything for documentation and institutional learning and experience

SDLC Analysis Tools

- Entity-Relationship Diagrams (ERDs) and Data Flow Diagrams (DFDs)
  - Used to model the entities in a system and the flow of data within the system
  - Provides a visual representation of the data movement in an organization
- Decision Tables and Decision Trees
  - Useful for identifying procedures and summarizing the decision making process of one step of a system
- Class Diagrams and Use Case Diagrams
  - Object-oriented systems

The System Development Life Cycle (SDLC)

	RULES	POSSIBLE ORDER SCENARIOS							
CONDITIONS	New customer?	Y	Y	Y	Y	N	N	N	N
	New customer information complete?	N	Y	Y	Y	–	–	–	–
	30+ day balance>0?	–	–	–	–	N	Y	N	N
	Valid quantity and product number?	–	Y	N	Y	Y	–	N	Y
	Quantity in stock?	–	Y	–	N	Y	–	–	N
ACTIONS	Valid order—proceed to assembly stage		X			X			
	Valid backorder—send backorder notices to customer and assembly stage				X				X
	Invalid order	X		X			X	X	

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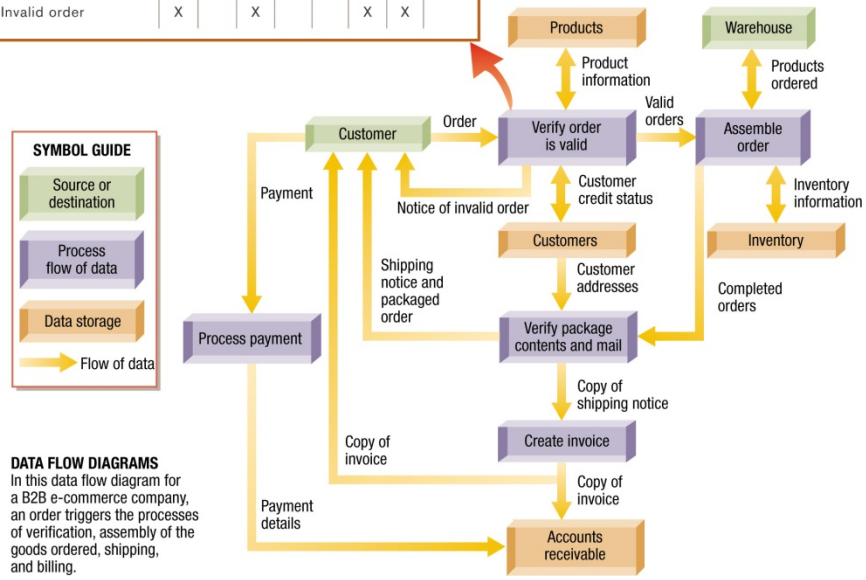
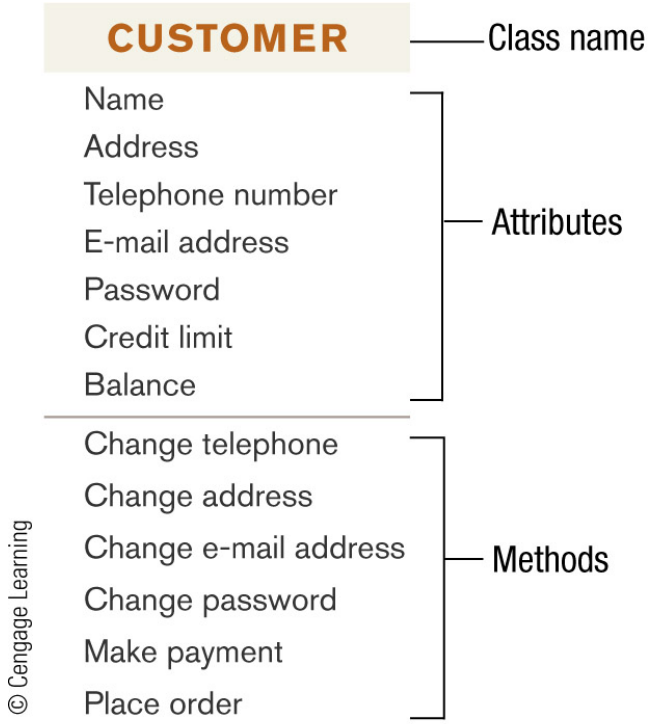
DECISION TABLES
This decision table describes the actions taking place in the "Verify order is valid" process. Each column represents one scenario; N = No, Y = Yes, and X indicates the resulting action for each scenario. The rules in this decision table determine whether or not an order moves on to the order assembly stage.



DATA FLOW DIAGRAMS
In this data flow diagram for a B2B e-commerce company, an order triggers the processes of verification, assembly of the goods ordered, shipping, and billing.

FIGURE 12-23
Data flow diagrams and decision tables. These tools are frequently used to analyze a system during the system analysis phase of the SDLC.

Unified Modeling Language (UML) & Use Case Diagrams



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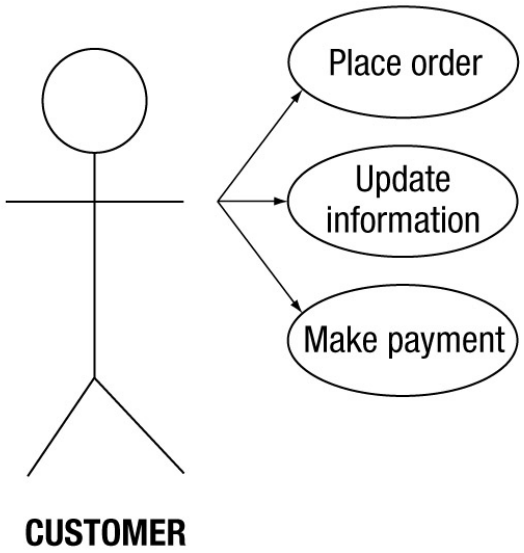
CLASS DIAGRAM
Lists the attributes and methods that all instances in the class (in this case the Customer class) possess.



USE CASE DIAGRAM
Lists a user of the system (in this case a real customer) and its use cases (the actions the user may take).

FIGURE 12-24
Class and use case diagrams. These tools are frequently used to model object-oriented systems.

3. SDLC Design

- System Design
  - Specifies what the new system will look like and how it will work (input from phase 2 analysis)
  - Developing the Design and Specifications for the New System
    - Model of new system is developed; diagrams can include:
      - Data dictionary
        - » Describes all data in a system
      - Data flow and/or class diagrams of the new system
      - Input/output designs

Rapid Application Development & Joint Application Development RAD & JAD

- The End-User Development Approach
  - User is primarily responsible for the development of the system
  - Most feasible when system being developed is small and inexpensive
  - Measures must be taken to ensure that the system is compatible with existing systems and no new problems are introduced

SDLC Design

- RFPs and RFQs
  - RFP is a Request for Proposal
    - Contains list of technical specifications for equipment, software, and services needed
  - RFQ is a Request for Quotation
    - Names desired items needed and asks for a quote
- Evaluating Bids
  - Most companies have procedures for evaluating bids
    - Benchmark test
    - Evaluation tables

SDLC Design

- Design Deliverables => Output
  - Prototypes
  - RFPs, RFQs, and Vendor Evaluation Materials
  - Includes RFP or RFQ sent to potential vendors
  - Proposals received
  - Documentation produced during the evaluation of bids

SDLC Acquisition

- System Acquisition *(note many authors include this in implementation)*
- System analysts determine where to obtain the necessary hardware, software, and other system components
- The Make-or-Buy Decision
  - Determining if the software needed will be purchased from a vendor or developed in-house
    - If developed in-house, software to be developed moves into the program development process (Chapter 11)

4. SDLC Implementation

- System Implementation
  - The new system is installed, tested, and made operational
    - Data migration
  - System must be thoroughly tested
    - Test data should be realistic and include incorrect data

Implementation Conversion

- System Conversion done when testing phase is completed, system is installed
  - Direct conversion
    - » Old system deactivated and new system is immediately implemented
  - Parallel conversion
    - » Both systems are operated simultaneously until it is determined that the new system works properly
  - Phased conversion
    - » System is implemented by module
  - Pilot conversion
    - » New system used at just one location within the organization

The System Development Life Cycle (SDLC)

- Implementation schedule, test data, test results, training materials should be saved for future reference
- User Training
  - All training manuals should be developed and given to users
  - Training takes place on the actual system
  - Can occur one-on-one or in groups
- Documentation: Implementation Schedule, Test Data and Results, and Training Materials

5. SDLC Maintenance

- System Maintenance
  - Most expensive phase
  - Maintenance is an ongoing process
  - Minor adjustments are made to the finished system to keep it operational until the end of the system's life or until the time that the system needs to be redesigned
  - Post-Implementation Review
    - Identifies any glitches in the new system that need to be fixed
  - When a major change is needed, the project goes through the SDLC again

SDLC Maintenance

- Documentation => Completed Project Folder
  - Results of the post-implementation review are added to the accumulated documentation
  - Information can be useful to auditors who may check to see that proper procedures were followed

Types of Information Systems Office & User Productivity

- Office and User Productivity Support Systems
  - A system used to facilitate communications and enhance productivity
  - Used by virtually all employees
  - Document Processing Systems
    - Hardware and software used to create electronic documents
  - Document Management Systems (DMSs) and Content Management Systems (CMSs)
    - Document Management System
      - Stores, organizes, and retrieves electronic documents

Types: Communication Systems

- Communication Systems
  - Allow employees to communicate with each other, with business partners, and with customers
    - E-mail
    - Messaging
    - Videoconferencing
    - Collaborative (workgroup) computing
    - Telecommuting

Types: Transaction Processing

- Transaction Processing Systems (TPSs)
  - Processes and records data created by an organization's business transactions
  - Usually processed in real time
  - Order Entry Systems
    - E-commerce systems
      - Financial transactions performed over the Internet
    - Point-of-sale (POS) systems
      - Records purchases at the place where the customer physically purchases a product or service
  - Payroll Systems
    - Used to compute employee taxes, deductions, and pay
  - Accounting Systems
    - Accounts receivable systems
    - Accounts payable systems
    - General ledger systems

FIGURE 12-6
Electronic citation systems. This type of transaction processing system allows officers to issue citations electronically.

Types: MIS & DSS

- Management Information Systems
- Decision Support Systems
- Operational, Tactical and Strategic Decision making
- Uncertainty/Unstructured data increase higher in pyramid
- Timeframes lengthen higher in the period

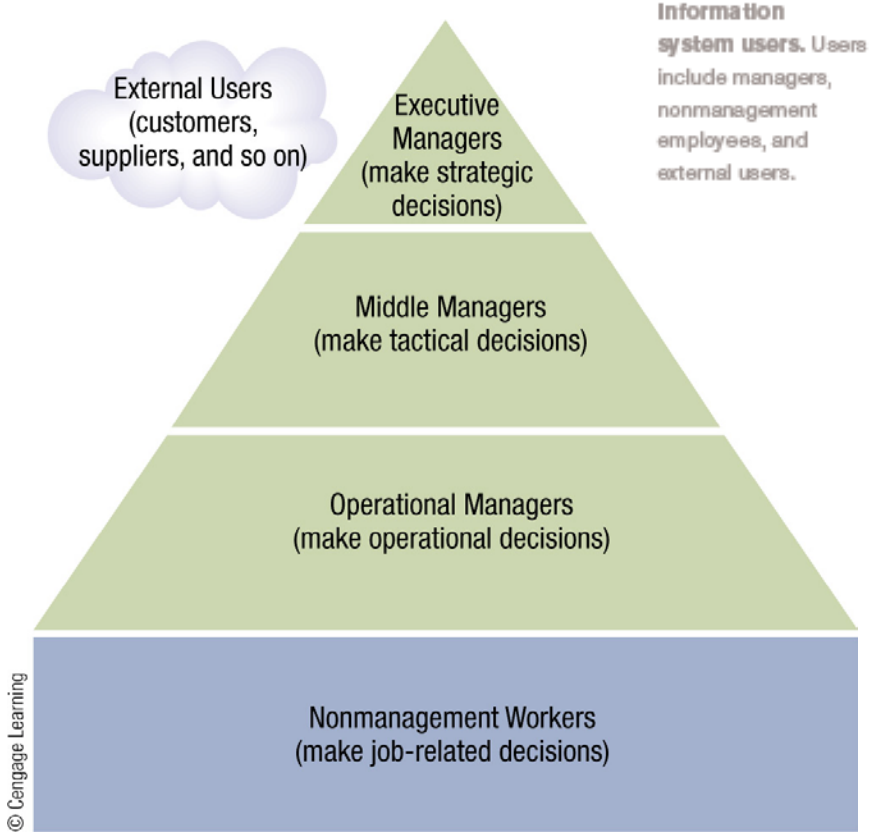


FIGURE 12-3
Information system users. Users include managers, nonmanagement employees, and external users.

Types: MIS

- Management Information Systems (MIS)
  - Provides decision makers with regular, routine, and timely information that is used to make decisions
  - Usually provides information in the form of computer-generated reports
    - Detailed, summary, exception
  - Much of the time, this information is generated from data obtained from transaction processing
  - Most frequently used to make moderately structured, middle-management decisions

Types: DSS

- Decision Support Systems (DSSs)
  - Provides people with the tools and capabilities to organize and analyze their decision making information
  - Typically are interactive and provide information on demand
  - Most often used by middle and executive managers who require unstructured, unpredictable on-demand information
  - Incorporates internal and external data
  - Usually tailored to help with specific types of decisions such as sales and transportation
  - Executive Information system (EIS)
    - A DSS targeted directly to upper management

Types: Enterprise Systems

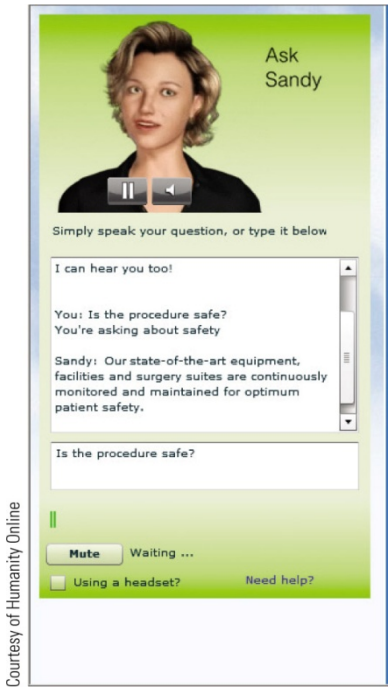
- Integrated Enterprise System
  - Designed to work together throughout an enterprise
  - Electronic Data Interchange (EDI)
    - Transfers data between different companies using the Internet or another network
    - Often used to automate reordering materials and products
  - Enterprise Resource Planning (ERP)
    - Large integrated system that ties together all of a business's activities
    - Enterprise Application Integration (EAI)
      - Exchanging information from an ERP or other internal system among different applications and organizations

Types: Inventory, Supply, Value Chain

- Inventory and Product Management Systems
  - Tracks and manages inventory
  - Can help optimize ordering
- Supply Chain Management (SCM)
  - Oversees materials, information, and finances as they move from the original supplier to the consumer
- Just-in-time (JIT)
  - Resources are limited to the right amount at the right time to fill orders
- Warehouse Management Systems (WMS)
  - Acts as a complete distribution system

Types: Intelligent Agents

- Intelligent Agents
  - Programs that perform specific tasks to help to make a user's work environment more efficient or entertaining and that typically modifies its behavior based on the user's actions
  - Application assistants
  - Shopping bots
  - Entertainment bots
  - Chatterbots
  - May be part of Semantic Web
    - Predicted evolution of the current Web



Courtesy of Humanity Online

FIGURE 12-13
A Web page chatterbot.

Types: Expert Systems

- Expert Systems (AI)
  - Provides the type of advice that would be expected from a human expert and has two main components
  - Knowledge Base
    - Database containing facts provided by human experts and rules the system should use to make decisions based on those facts
  - Inference Engine
    - Program that applies the rules to the data stored in the knowledge base, in order to reach decisions
  - Is only as good as the knowledge base and inference engine; also needs honest, correct information from the user in order to work correctly

Types: Neural Networks

- Neural Networks (AI)
  - A system in which the human brain's pattern-recognition process is emulated by the computer
  - Used in:
    - Handwriting, speech, and image recognition
    - Medical imaging
    - Crime analysis
    - Biometric identification
    - Vision systems (quality checks in manufacturing, recognizing postage stamps, etc.)

FIGURE 12-15
Neural network systems. Neural networks are often used in biometric identification systems, such as to analyze fingerprints.

Courtesy of Crossmatch

Types: Robotics

- Robotics
  - The study of robot technology
  - Robot
    - A device, controlled by a human operator or a computer, that can move and react to sensory input
  - Military Robots
    - Investigate caves, buildings, trails, etc., before soldiers enter
    - Locate and defuse explosive devices
    - Provide surveillance
    - Exoskeleton Suit
      - » Wearable robotic systems designed to give an individual additional physical capabilities and protection

Summary

- What Is an Information System?
- Types of Information Systems
- Responsibility for System Development
- The System Development Life Cycle (SDLC)
- Approaches to System Development