Learning Objectives

• Understand what information systems are and why they are needed.
• Discuss who uses information systems in a typical organization.
• Identify several types of information systems commonly found in organizations and describe the purpose of each.
• Explain the individuals responsible for system development.
• Identify and describe the different steps of the system development life cycle (SDLC).
• Discuss several approaches used to develop systems.
Overview

• This chapter covers:
  – How information systems are used by different levels of employees
  – Common types of information systems
  – The various types of computer professionals who develop systems and their primary responsibilities
  – The system development life cycle (SDLC)
  – The major approaches to system development
What Is an Information System?

- A **system** is a collection of elements and procedures that interact to accomplish a goal
- An **information System (IS)** is a system used to generate the information needed to support the users in an organization
- A **digital ecosystem** is the collection of people, products, services, and business processes related to a digital element
  - Apple digital ecosystem = Apple hardware, software, and online services
Components of an Information System

**FIGURE 10-1**
Components of an information system.
The Need for System Development

- **Systems development** is the process of designing and implementing a new or modified system.
- System development may be required because of:
  - New laws (Sarbanes-Oxley Act, HIPAA etc.)
  - Changes to the legal requirements for retaining business data (e-disclosure, etc.)
  - Introduction of new technology
    - RFID, NFC, EMV cars, smartphones, etc.
- Systems have evolved from performing just routine process tasks to provide a variety of information to assist with decision making.
Enterprise Architecture

- **Enterprise architecture** 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
Business Intelligence (BI)

- **Business intelligence (BI)** is the process of gathering, storing, accessing, and analyzing data in order to make better business decisions
  - **Business analytics (BA)** is the process of analyzing data to evaluate a company’s operations

![Figure 10-2](image)

**Business analytics (BA).**

© 2017 Cengage Learning. All Rights Reserved. May not be copied, scanned, or duplicated, in whole or in part, except for use as permitted in a license distributed with a certain product or service or otherwise on a password-protected website for classroom use.
A data warehouse is the comprehensive collection of data about a company and its customers

- A data mart is smaller and typically stores data related to a particular subject or department

Data mining involves the use of intelligent software to find subtle patterns that may not be otherwise evident

- Web mining: Data mining used in conjunction with Web data
- Text mining: Analysis of text-based data (online forms, emails, call-center notes)
- Social media analytics: Analysis of data from blogs and social media
- Often used with the massive amounts of data generated today – called big data
How It Works

Big Data ... For Everything

• Sports teams, casinos, airlines, museums, and more are gathering and analyzing big data
• Point Defiance Zoo & Aquarium uses big data analytics to help drive ticket sales, enhance visitor experiences, and raising awareness of wildlife conservation
• Successful analytics requires both quality data and the proper system to analyze it

Point Defiance Zoo & Aquarium in Washington State is using an IBM Big Data analytics system.
Users of Information Systems

• Information systems can be used by one person or by all employees
  – **Enterprise system** are used throughout an entire enterprise
  – Inter-enterprise systems are used by multiple enterprises
    • Such as a business and its suppliers and other business partners
  – Some information systems are designed for management decision making
    • Can provide managers with efficient access to the information they need to make good decisions
Managers typically manage the employees one level below them on the pyramid

- Executive managers
- Middle managers
- Operational managers
- Nonmanagement workers

External users also use information systems
Types of Information Systems

While some information systems are unique, most fall into these six basic categories.

<table>
<thead>
<tr>
<th>TYPE OF SYSTEM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office and user productivity systems</td>
<td>Facilitate communications and enhance productivity in office tasks</td>
</tr>
<tr>
<td>Transaction processing systems</td>
<td>Process and record business transactions</td>
</tr>
<tr>
<td>Decision making support systems</td>
<td>Provide needed information to decision makers</td>
</tr>
<tr>
<td>Integrated enterprise systems</td>
<td>Integrate activities throughout an entire enterprise</td>
</tr>
<tr>
<td>Design and manufacturing systems</td>
<td>Help with the design and/or manufacturing of products</td>
</tr>
<tr>
<td>Artificial intelligence systems</td>
<td>Perform actions based on characteristics of human intelligence</td>
</tr>
</tbody>
</table>
Office and User Productivity Support Systems

• An **office system** facilitates communications and enhance productivity

• **Document processing systems** consist of hardware and software used to create electronic documents

• **Document management systems (DMSs)** store, organize, and retrieve electronic documents
  – **Content management systems (CMSs)** are DMSs that also include multimedia files, images, and other content

• **Communication systems** allow employees to communicate with each other, with business partners, and with customers
Digital data. Many types of medical data are now being created and stored in digital form.

Source: InTouch Technologies, Inc.
Transaction Processing Systems (TPSs)

- **Transaction processing systems (TPSs)** process and record data created by an organization’s business transactions
  - Usually processed in real time
  - Contrasts with batch processing, in which a set or batch of transactions are collected over a period of time and processed together
    - Batch processing is still sometimes used for large routine tasks, such as payroll
    - Specialty TPSs used in law enforcement, the military, etc.
Types of Transaction Processing Systems

• **Order entry systems**
  – E-commerce systems
    • Financial transactions performed over the Internet
  – Point-of-sale (POS) systems
    • Used for purchases that occur in person, such as at a brick-and-mortar store

• **Payroll systems**
  – Used to compute employee taxes, deductions, and pay

• **Accounting systems**
  – Accounts receivable systems
  – Accounts payable systems
  – General ledger systems
Decision Making Support Systems: MIS

- **Management information systems (MISs)** provide 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
    - Can be provided via paper or a dashboard
  - Much of the time, the information used is generated from data obtained from transaction processing
  - Most frequently used to make moderately structured, middle-management decisions
Example of an MIS

**FIGURE 10-7**
A sales MIS.
• **Decision support systems (DSSs)** are used by middle and executive managers to make unstructured decisions
  
  – Unstructured decisions often are based on unpredictable events or incomplete knowledge, as well as qualitative data
  
  – Can incorporate data from both internal and external sources
  
  – 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
Example of a DSS

FIGURE 10-8
A car-buying DSS.
• **Geographic information systems (GISs)** combine geographical information with other types of data to provide a better understanding of relationships among the data
  
  – Commonly used to make decisions about locations (e.g. new facility locations, disaster risk, geographical crime patterns)
  
  – Also used in emergency relief and disaster relief systems to create search and rescue maps, maps of where electrical power is restored, etc.
  
  – The process of gathering, processing, and interpreting geographical information is called geomatics; an emerging major is geomatics engineering
Example of a GIS

FIGURE 10-9
Geographic information systems (GISs). This GIS illustrates the severity of the 2015 Nepal earthquake, as well as fatalities, injuries, and social media activity, by geographical region.
Integrated Enterprise Systems: EDI and ERP

• **Electronic data interchange (EDI)** refers to the transfer of data between different companies using the Internet or another network
  – Often used to automate reordering materials and products

• **Enterprise resource planning (ERP)** consists of a large integrated system that ties together all of a business’s activities
  – Data is stored in a central database and the ERP system provides access to the appropriate employees
  – Enterprise Application Integration (EAI): When the system exchanges data between different applications
Inventory and Product Management Systems

• **Inventory management systems** track and manage 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) systems limit inventory and other resources to the right amount at the right time to fill orders
  – Warehouse management systems (WMS) act as a complete distribution system

• **Product lifecycle management (PLM) systems** manage a product through its entire life cycle, from design to retirement
Example of an Inventory Management System

**FIGURE 10-10**
Inventory management systems.
Design and Manufacturing Systems

• Design and manufacturing systems are used to improve productivity at the product design stage and manufacturing stage
  – **Computer-aided design (CAD)**
    • Use of computer technology to automate design functions
    • Easier design modifications and simulations
  – **Computer-aided manufacturing (CAM)**
    • Use of computer technology to automate manufacturing functions
    • 3D printing applications
Example of a CAD Program Designing an Object to be 3D Printed

FIGURE 10-11
Computer-aided design (CAD). CAD programs can be used for a wide variety of design applications.
Artificial Intelligence Systems

• **Artificial intelligence (AI) systems** include a computer that uses AI to performs actions that are characteristic of human intelligence
  
  – Initial advances in AI made through chess-playing programs
  – IBM Watson uses cognitive learning and deep learning

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Inside the Industry

The Turing Test and the Loebner Prize

• AI researchers are working to create machines that think and act like people

• Alan Turing – one of the first AI researchers
  – Turing Test – if a computer could repeatedly fool a human into thinking it was human then it should be viewed as intelligent

• Loebner Prize – offered for the first computer that passes the Turing Test
Intelligent Agents

- **Intelligent agents** (virtual assistants and smart assistants) perform specific tasks to help to make a user’s work environment more efficient or entertaining
  - Typically modify their behavior based on the user’s actions
  - Application assistants
  - Chatterbots
  - Personal assistants (Google Now, Siri, Cortana)
  - Shopping bots
  - Entertainment bots

*FIGURE 10-14*
Windows 10 Cortana.
Expert Systems

• **Expert systems** provide 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 that the system uses to make decisions
  
  – 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
Example of an Expert System

**QUERY:** Should we approve a $700 purchase for Mr. Jones?

**RESPONSE:** Yes

The inference engine is the computer program that runs the expert system. It processes queries by checking rules in the knowledge base against the customer database.

**KNOWLEDGE BASE**
- Authorize purchase only if the customer has an active account.
- Authorize purchase only if the customer has not exceeded his or her credit limit.
- Authorize purchase automatically if the customer has made less than three purchases today.

**CUSTOMER DATABASE**
- Jones is customer account 0000-9999.
- Jones has a $5,000 credit limit.
- Jones has spent $1,529 in the current period.
- Jones has made two transactions today.
Neural Networks

- Neural networks are AI systems that attempt to imitate the way a human brain works.
- Used in:
  - Handwriting, speech, and image recognition
  - Medical imaging
  - Crime analysis
  - Biometric identification
  - Vision systems
- Also being applied to computer chips (neuromorphic chips).
Robotics

- **Robotics** is the study of robot technology
- A **robot** is a device, controlled by a human operator or a computer, that can move and react to sensory input
  - Used to perform high-precision but monotonous jobs
  - Used for tasks that are dangerous or impossible for humans
  - Used to perform personal tasks
  - Appearance varies widely
Military Robots

• Military robots
  – Investigate caves, buildings, trails, etc., before soldiers enter
  – Locate and defuse explosive devices
  – Provide surveillance and reconnaissance
    • Remote Piloted Aircraft (RPA)/Unmanned Aerial Systems (UASs)
  – Controlled by military personnel until autonomous robots are deployed
  – Exoskeleton suits are wearable robotic systems designed to give an individual additional physical capabilities and protection for soldiers
Examples of Military Robots

**PACKBOT ROBOT**
Designed to investigate dangerous, hostile, or inaccessible areas prior to human entry.

**REMOTE PILOTED AIRCRAFT (RPA)**
Designed to perform reconnaissance, surveillance, airstrikes, and other tasks.

**FIGURE 10-17**
Military robots.
Business Robots

• Business and industrial robots
  – Look for gas leaks, intruders, other hazards
  – Work on factory assembly lines
  – Mine coal, repair oil rigs
  – Locate survivors in collapsed mines
  – Facilitate video-conferencing and other remote presence applications

FIGURE 10-18
Business robots.
Trend

Robot Butlers and Orderlies

• A new trend in hotel guest relations
  – Fulfill guest requests, such as extra towels or room service orders
• Beginning to appear in hospitals
  – Used to transport blood samples, food, medication, linens, waste, and supplies
Personal Robots

• Personal robots (service robots)
  – Entertainment robots
  – Toy robots
  – Robots designed for household tasks
    • Mow lawns, clean floors, etc.
  – Exoskeleton suits
    • For disabled or elderly individuals

**FIGURE 10-19**
Personal robots.
Societal Implication of Robots

• Robots adds convenience to our lives
  – Replaces humans for dangerous tasks
  – Monitors and assists the disabled and elderly

• Concern exists that as true artificial intelligence becomes closer to reality, a class of robots with the potential for great harm could be created
  – South Korean government, European Robotics Research Organization (EURON), and the U.S. OSHA are developing standards for the appropriate development and use of robots
Quick Quiz (1)

1. A system containing knowledge from medical experts that is used to help diagnose patients would be a type of ____________.
   a. neural network
   b. natural language system
   c. expert system

2. True or False: An order-entry system would be classified as a management information system.

3. A(n) _________ is a device, controlled by a human, that can move and react to sensory input.

Answers:
1) c; 2) False; 3) robot
Responsibility for System Development

• The **information systems (IS) department** is responsible for an organization’s computers, systems, and other technology
  – Also called the **information technology (IT) department**
  – The **systems analyst** studies systems in order to determine what work needs to be done, and how this work may best be achieved
  – Other IT personnel:
    • Business analysts, application programmers, operations personnel, and security specialists
    • New positions include cybersecurity specialists and Chief Data Officer
Examples of IS/IT Jobs

<table>
<thead>
<tr>
<th>Application programmer/software developer</th>
<th>Multimedia developer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codes application software; often identified by the language or platform being used, such as C# developer, JavaScript developer, or .NET developer.</td>
<td>Develops multimedia content for Web sites and applications.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business analyst</th>
<th>Network/computer systems administrator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifies the business needs of a system and makes sure systems meet those needs.</td>
<td>Responsible for planning and implementing the networks and/or computers within an organization.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chief information officer (CIO)</th>
<th>Network engineer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oversees routine transaction processing and information systems activities, as well as other computer-related areas. Also known as the vice president of information systems.</td>
<td>Responsible for the overall implementation, maintenance, and optimization of network hardware, software, and communications; called a cloud network engineer when the infrastructure is cloud based.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cloud architect</th>
<th>Network operator/troubleshooter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluates a company's computing needs and deploys appropriate cloud solutions to meet them.</td>
<td>Responsible for overseeing the day-to-day activities for a network and performing necessary duties to keep the network operating smoothly.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cloud engineer</th>
<th>Network systems and data communications analyst</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plans and conducts technical tasks associated with the implementation and maintenance of virtualized or cloud systems.</td>
<td>Manages the networks in an organization and determines what changes, if any, are needed. Also known as a network architect.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cloud product manager</th>
<th>Network technician</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plans the concepts, strategies, positions, and sales used with cloud-based products.</td>
<td>Installs, maintains, and upgrades networking hardware and software.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cloud services developer</th>
<th>Security specialist/information systems security manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designs and builds the end-user interfaces and tools used with cloud services.</td>
<td>Responsible for seeing that an organization's hardware, software, and data are protected from hackers, malware, natural disasters, accidents, and the like. Also known as the chief security officer (CSO).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communications analyst</th>
<th>Software/application software/systems software engineer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyzes, maintains, and troubleshoots data communications networks and assists with connectivity.</td>
<td>Designs and builds complex software applications; called a cloud software engineer when the software is cloud based.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Computer operations manager</th>
<th>Systems administrator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oversees the computer operations staff and facility.</td>
<td>Responsible for maintaining a large, multiuser system; called a cloud systems administrator when the system is cloud based.</td>
</tr>
</tbody>
</table>
Examples of IS/IT Jobs (cont’d)

<table>
<thead>
<tr>
<th>Database administrator</th>
<th>Systems analyst</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsible for setting up and managing large databases within an organization.</td>
<td>Studies systems in an organization to determine what changes need to be made and how to best accomplish these changes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Database analyst</th>
<th>Systems engineer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsible for designing and developing an organization's data flow models and database architecture.</td>
<td>Oversees and coordinates the various engineering tasks performed during systems development.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data center architect</th>
<th>Systems programmer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manages the whole data center environment, including servers, virtualization, power, cooling, security, and so on.</td>
<td>Codes system software, fine-tunes operating system performance, and performs other system software-related tasks.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data entry operator</th>
<th>Trainer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsible for keying data into a computer system.</td>
<td>Trains users about a particular program, system, or technology.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Digital marketing manager/social media manager</th>
<th>Web analytics developer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promotes a company and attracts customers via digital platforms, such as social media, e-mail, and blogs.</td>
<td>Measures user interactions with company Web sites and uses that data to optimize the sites.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Help desk technician/specialist</th>
<th>Web designer/developer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assists users in solving software and hardware problems.</td>
<td>Designs and develops Web sites.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Information engineer</th>
<th>Web programmer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyzes an organization’s data to locate trends, problems, and other useful information for management.</td>
<td>Writes the program code necessary for a Web site, such as to provide animation and database connectivity.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge engineer</th>
<th>Webmaster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsible for setting up and maintaining the expert knowledge base used in expert system applications.</td>
<td>Responsible for all technical aspects of a Web site.</td>
</tr>
</tbody>
</table>
Outsourcing

• **Outsourcing** involves hiring outside vendors to perform specific business tasks
  – Offshoring
    • Outsourcing to another country
  – Nearshoring
    • Outsourcing to nearby countries
  – Homesourcing (homeshoring)
    • Outsourcing to home-based workers
  – Crowdsourcing
    • Outsourcing a task to a large, undefined group of people via the Web
Outsourcing: Advantages and Disadvantages

• Advantages
  – Lower costs and staffing flexibility
  – Socially responsible outsourcing

• Disadvantages
  – Communication problems and cultural differences
  – Quality control and security

• Captive offshoring
  – U.S. companies own facilities in other countries and hire employees in that country
  – Gives company more control over employees and procedures than with conventional outsourcing
Digital Badges

• Icons that represent academic achievements or acquired skills
• Offered by educational institutions, Web sites, companies, etc.
• Can be standard or customized
• Displayed via a digital badge system
• Can be shown to potential employers and schools
Quick Quiz (2)

1. Which term refers to outsourcing work to another country?
   a. benchmarking
   b. offshoring
   c. prototyping

2. True or False: The IT worker who codes computer programs is known as the computer operator.

3. The IT employee most involved with system development is the __________.

Answers:
1) b; 2) False; 3) systems analyst
The System Development Life Cycle (SDLC)

- The **system development life cycle (SDLC)** refers to the development of a system from the time it is first studied until the time it is updated or replaced.
A preliminary investigation is a feasibility study performed to assess whether or not a full-scale project should be undertaken:

- Examines the problem, possible solutions, and the approximate costs and benefits of those solutions
- Documentation: Feasibility report
  - Contains findings on status of existing system and benefits/feasibility of changing to a new system
  - Includes system analysts’ recommendations regarding whether or not the project should move on to the next stage in the SDLC
System Analysis

- **System analysis** examines the current system and the identified problems
  - Data collection
    - Gathering information about the system
      (organizational chart, observation, interviewing users, etc.)
  - Data analysis
    - Analyzing information to determine the effectiveness and efficiency of current system and/or requirements for new or modified systems
Data Analysis Tools

• Entity-relationship diagrams (ERDs) and data flow diagrams (DFDs) are used to model the entities in a system and the flow of data within the system
  – ERD shows the logical relationships among entities
  – DFD provides a visual representation of the data movement in an organization

• Decision tables and decision trees are useful for identifying procedures and summarizing the decision making process of one step of a system
Example of a Data Flow Diagram and a Decision Table

**Figure 10-24**

Data flow diagrams and decision tables. These tools are frequently used to analyze a system during the system analysis phase of the SDLC.
Data Analysis Tools (cont’d)

• Business process modeling notation (BPMN) is a graphical, standardized notation used to model business processes
  – Used to model the business processes used within systems
  – Designed to be understood by all individuals involved in the system
  – Expresses processes graphically using diagrams similar to flowcharts

• Class diagrams and use case diagrams are used to illustrate systems that are based on the concept of objects
Example of a Class Diagram and a Use Case Diagram

**FIGURE 10-25**

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

**CUSTOMER**

- **Class name**
  - Name
  - Address
  - Telephone number
  - E-mail address
  - Password
  - Credit limit
  - Balance

- **Attributes**
  - Change telephone
  - Change address
  - Change e-mail address
  - Change password
  - Make payment
  - Place order

- **Methods**
  - Place order
  - Update information
  - Make payment

**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).
System Analysis Documentation

• Documentation:
  – Any instruments used for data gathering
    • Questionnaires
    • Interview questions
  – The diagrams and models used to summarize and analyze the data
    • Diagrams, tables, trees, models, etc.
System Design

- **System design** specifies what the new system will look like and how it will work.

- The design and specifications for the new system should include:
  - Data dictionary: Describes all data in the new system
  - Diagrams of the new system
    - Data flow diagrams, class diagrams, BPDs, etc.
    - User interface (UI) designs
      - The input and output screens to be used for all device types
      - Layouts of Web pages to be used
    - Security features needed
Examples of User Interface (UI) Designs

**NEW STUDENT ENTRY FORM**

- **Name**: David
- **Address**: 123 Elm Street
- **City**: Visalia
- **Phone**: (555) 555-1111
- **On Financial Aid**
- **Major**

**INPUT SCREEN DESIGNS**
Show the screens users will use to input data into a system.

**WEB PAGE LAYOUTS**
Show the overall design of a Web page and how users will interact with that page.

**My Web Store**

- **Special Offer**
- **Other Items On Sale**

**FIGURE 10-26**
User interface (UI) designs are created during the system design phase.
• Cost-benefit analysis is used to determine if benefits of the new system outweigh the cost
  – Includes both tangible and intangible benefits
• Documentation: System design/specifications
  – All designs and specs developed during the system design phase to illustrate the new system
System Acquisition

• During **system acquisition**, the system analyst determines where to obtain the necessary hardware, software, and other system components
  – First, determine if the needed software will be purchased from a vendor or developed in-house
    • Commercial is often the fastest and least expensive
    • Custom is usually more expensive but can fit the requirements more easily
      – Can be developed by an outside vendor or in house
      – If developed in house, software to be developed moves into the program development process (Chapter 11)
System Acquisition (cont’d)

• RFPs and RFQs – can be used to request bids from outside vendors
  – RFP (request for proposal)
    • Contains list of technical specifications for equipment, software, and services needed
  – RFQ (request for quotation)
    • Names desired items needed and asks for a quote
• Bids are then evaluated to select the vendor to be used
  – Benchmark tests can help evaluate and compare proposed solutions
• Documentation: RFPs, RFQs, bids received, and vendor evaluation materials
System Implementation

• During **system implementation**, the new system is installed, tested, and made operational
  – Getting existing data ready to move to the new system (data migration)
  – Testing the new system
    • Test data should be realistic and include incorrect data
  – Once the system passes the testing stage, system conversion can begin
System Conversion

• Direct conversion
  – Old system is 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
System Conversion Approaches

**FIGURE 10-28**
System conversion. Converting from an old system to the new one often follows one of these four approaches.

- **DIRECT CONVERSION**
  - The old system is replaced by the new system all at once.

- **PARALLEL CONVERSION**
  - The old system and new system are both operated until it is determined that the new system is working properly.

- **PHASED CONVERSION**
  - The system is implemented by module (each module can be implemented using either direct or parallel conversion).

- **PILOT CONVERSION**
  - The new system is used at only one location within the organization. After it is determined that the new system is working correctly, it is installed at the other locations.
User Training and System Implementation Documentation

• User training
  – Users’ manuals and other support 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 test results
  – Training materials and users’ manuals
System Maintenance

• **System maintenance** is an ongoing process
  – The post-implementation review identifies any glitches in the new system that need to be fixed
  – Ongoing adjustments as needed to update it or add new features
  – When a major change is needed, the system goes through the SDLC again to determine if a new system is needed

• Documentation: Completed project folder
  – All documentation gathered from all stages of the SDLC including the post-implementation review
Approaches to System Development

- **Traditional system development:** SDLC phases are carried out in the traditional order
  - Referred to as the waterfall model
  - Each phase begins only when previous one is completed

- **Iterative approach:** The system is developed incrementally
  - Steps are repeated until the system is finalized
  - **Prototyping**
    - A small model, or *prototype*, of the system is built before the full-scale development effort is undertaken
Approaches to System Development (cont’d)

• **End-user development approach**: The 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
Examples of System Development Approaches

**FIGURE 10-29**
Two different approaches to system development.

**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.
Quick Quiz (3)

1. The first step of the system development life cycle is to __________.
   a. design the system
   b. perform a preliminary investigation
   c. implement the system

2. True or False: The traditional approach to systems development also is referred to as the waterfall model.

3. A test used to evaluate or measure a systems performance is called a(n) __________.

Answers:
1) b; 2) True; 3) benchmark test
Summary

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