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
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.)
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)

**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.

<table>
<thead>
<tr>
<th>CONDITIONS</th>
<th>POSSIBLE ORDER SCENARIOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>New customer?</td>
<td>Y</td>
</tr>
<tr>
<td>New customer information complete?</td>
<td>N</td>
</tr>
<tr>
<td>30+ day balance&gt;0?</td>
<td>-</td>
</tr>
<tr>
<td>Valid quantity and product number?</td>
<td>-</td>
</tr>
<tr>
<td>Quantity in stock?</td>
<td>-</td>
</tr>
<tr>
<td>Valid order—proceed to assembly stage</td>
<td>X</td>
</tr>
<tr>
<td>Valid backorder—send backorder notices to customer and assembly stage</td>
<td>X</td>
</tr>
<tr>
<td>Invalid order</td>
<td>X</td>
</tr>
</tbody>
</table>

**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.

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.

**SYMBOL GUIDE**
- Source or destination
- Process flow of data
- Data storage
- Flow of data

**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.
Unified Modeling Language (UML) & Use Case Diagrams

**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**

**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
• 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
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
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.)
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