CHAPTER 1

Introduction to Systems Analysis and Design

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INFORMATION SYSTEM COMPONENTS

An information system has five key components

- **Hardware**

  Hardware consists of everything in the physical layer of the information. For example, hardware can include servers, workstations, networks, telecommunications equipment, fiber optic cables, handheld computers, scanners, digital capture devices, and other technology based infrastructure.
Software

Software refers to the programs that control the hardware and produce the desired information or results. Software consists of system software and application software.

System software manages the hardware components, which can include a single workstation or a global network which many thousands of clients.

Application software consists of programs that support day-to-day business functions and provide users with the information they require.
Data

Data is the raw material that an information system transforms into useful information.

Processes

Processes describe the tasks and business functions that users, managers, and IT staff members perform to achieve specific results.
People

User, sometimes called end users, are the people who interact with an information systems, both inside and outside the company.

The success or failure of a system usually depends on whether users are satisfied with the system’s output and operation.

To serve users, successful information systems depend on skilled professionals, such as systems analysts, programmers, network administrators, and other IT staff members.
UNDERSTANDING THE BUSINESS

- **Business Profile**
  
  A business profile is an overview that describes a company’s overall function, processes, organization, products, services, customers, suppliers, competitors, constraints, and future direction.

- **Business Models**
  
  A business model is a graphical representation of one of more business processes that a company performs, such as accepting an airline reservation, selling a ticker, or crediting a customer account. A business process describes a specific set of transaction, events, tasks, and results.
IMPACT OF THE INTERNET

- **B2C (Business-to-consumer)**

  This new shopping environment allows customers to do research, compare prices and features, check availability, arrange deliver, and choose payment methods in a single convenient session. Many companies offer incentives for online transactions because Web-based processing costs are lower than traditional methods.

  The surge in B2C marketing has created strong competition among Web designers to create attractive sites that increase online sales. The B2C trend also means more demand for systems analysts and programmers who can develop Web-based information systems and applications.
B2B (Business-to-Business)

B2B enables smaller suppliers to contact large customers, and allows purchasers to obtain instant information about market prices and availability.

Online trading marketplaces initially were developed as company-to-company data sharing arrangements called electronic data interchange (EDI).

The development of extensible markup language (XML) enabled company-to-company traffic to migrate to the Internet, which offered standard protocols, universal availability, and low communication costs. XML is a data description language that allows Web-based communication between different hardware and soft environments. XML is extremely flexible because it is concerned with the data itself rather than the output format. The unique advantage of XML is that data description is not linked to output formatting. This is just the opposite of HTML (hypertext markup language), where the language controls the way the information is displayed on a Web browser.
Web-Based System Development

Internet-based systems development is changing rapidly, as software industry giants compete in market for overall software services, rather than individual products. These services include powerful Web-development environments and software solutions.

Web services, which are Internet-based support programs that can be executed as an integral part of an information system.

Internet-based systems involve various hardware and software designs, but a simple model is a series of Web pages that provides a user interface, which communicates with one or more levels of data management software and a Web-based database server.
Enterprise Computing Systems

Enterprise computing refers to information systems that support company-wide operations and data management requirements. In many large companies, applications called enterprise resource planning (ERP) systems provide cost-effective support for users and managers throughout the company. For example, a car rental company can use ERP to forecast customer demand for rental cars at hundreds of locations.

Transaction Processing Systems

Transaction processing (TP) systems process data generated by day-to-day business operations. Examples of TP systems include customer order processing, accounts receivable, and warranty claim processing.
**Business Support Systems**

Business support systems provide job-related information support to users at all levels of a company. These systems can analyze transaction data, generate information needed to manage and control business processes, and provide information that leads to better decision-making.

Companies soon realized that computers also could produce valuable information. The new systems were called **management information systems (MIS)**. Because managers were the primary users. Today, employees at all levels need information to perform their jobs, and they rely on information systems for that support.
- **Knowledge Management Systems**
  
  Knowledge management systems are called expert systems because they simulate human reasoning by combining a knowledge base and inference rules that determine how the knowledge is applied.

- **User Productivity Systems**

  Companies provide employees at all levels with technology that improves productivity. Examples of user productivity systems include e-mail, voice mail, fax, video conferencing, word processing, automated calendars, database management, spreadsheets, desktop publishing, presentation graphics, company intranets, and high-speed Internet access. User productivity systems also include groupware. Groupware programs run on a company intranet and enable users to share data, collaborate on projects, and work in teams.
INFORMATION SYSTEM USERS AND THEIR NEEDS

- Top Managers

Top managers develop long-range plans, called strategic plans, which define the company’s overall mission and goals. To plot a future course, top managers ask questions such as “How much should the company invest in information technology” or “How much will Internet sales grow in the next five years” or “Should the company build new factories or contract out the production functions.”
- **Middle Managers and Knowledge Workers**

  Middle managers provide direction, necessary resources, and performance feedback to supervisors and team leaders.

  Middle managers need more detailed information than top managers, but somewhat less than supervisors who oversee day-to-day operations. For example, a middle manager might review a weekly sales summary for a three-state area, while a local sales team leader would need a daily report on customer sales at a single location.

  Knowledge workers include professional staff members such as systems analysts, programmers, accountants, researchers, trainers, and human resource specialists. Knowledge workers also use business support systems, knowledge management systems, and user productivity systems.
- **Supervisors and Team Leaders**

  Supervisors, often called team leaders, oversee operational employees and carry out day-to-day functions. They coordinate operational tasks and people, make necessary decisions, and ensure that the right tools materials, and training are available. Like supervisors and team leaders need decision support information, Knowledge management systems, and user productivity systems to carry out their responsibilities.

- **Operational Employees**

  Operational Employees include users who rely on TP systems to enter and receive data they need to perform their jobs. Many companies find that empowerment improves employee motivation and increases customer satisfaction.
Figure 1  A typical organizational model identifies business functions and organizational levels.
SYSTEMS DEVELOPMENT METHODS

- Structured Analysis

  Structured analysis is a traditional systems development technique that is time-tested and easy to understand. Structured analysis uses a series of phases, called the systems development life cycle (SDLC), to plan, analyze, design, implement, and support an information system.

  Structured analysis uses a set of process models to describe a system graphically. Because it focuses on processes that transform data into useful information, structured analysis is called a process-centered technique.

  Process modeling identifies the data flowing into a process, the business rules that transform the data, and the resulting output data flow.
SCHOOL RESORSTRATION SYSTEM

**Figure 2** The REGISTER STUDENTS process accepts input data from two sources and transforms it into output data.
Object-Oriented Analysis

Whereas structured analysis treats processes and data as separate components, object-oriented analysis (O-O) combines data and the processes that act on the data into things called objects. The result is a set of software objects that represent actual people, things, transactions, and events.

An object is a member of a class, which is a collection of similar objects. Objects possess characteristics called properties, which the object inherits from its class or possesses on its own.

In O-O design, built-in processes called methods can change an object’s properties.

One object can send information to another object by using a message. A message requests specific behavior or information from another object.
Joint Application Development and Rapid Application Development

Users often were unhappy with the finished product. Systems development teams could complete their work more rapidly and produce better results. Two methodologies became popular: joint application development (JAD) and rapid application development (RAD). Both JAD and RAD use teams composed of users, managers, and IT staff. The difference is that JAD focuses on team-based fact-finding, which is only one phase of the development process, while RAD is more like a compressed version of the entire process.
THE SYSTEMS DEVELOPMENT LIFE CYCLE

The SDLC model includes the following steps:

1. Systems planning
2. Systems analysis
3. Systems design
4. Systems implementation
5. Systems operation, support, and security

Traditionally, the SDLC is pictured as a waterfall model
Figure 3 The phases and deliverables of the SDLC phases.
- **Systems Planning**

  The systems planning phase usually begins with a formal request to the IT department, called a systems request.

  The purpose of this phase is to perform a preliminary investigation to identify the nature and scope of the business opportunity or problem. A key part of the preliminary investigation is a feasibility study that reviews anticipated costs and benefits and recommends a course of action based on operational, technical, economic, and time factors.

  Often you will need to learn more about business operations before you can reach a conclusion.

  In some situations, you might recommend a business process review, rather than an IT solution.
- **Systems Analysis**
  
  The purpose of the systems analysis phase is to build a logical model of the new system. To understand the system, you perform fact-finding using techniques such as interviews, surveys, document review, observation, and sampling.

  The system requirements document describes management and user requirement, costs and benefits, and outlines alternative development strategies.

- **Systems Design**
  
  At this stage, you design the user interface and identify all necessary outputs, inputs, and processes. In addition, you design internal and external controls, including computer-based and manual features to guarantee that the system will be reliable, accurate, maintainable, and secure.

  The result of this phase is documented in the *system design specification*
- **Systems Implementation**

  The new system is constructed. Programs are written, tested, and documented, and the system is installed.

  At the conclusion of this phase, the system is ready for use.

- **Systems Operation, Support, and Security**

  A well-designed system will be secure, reliable, maintainable, and scalable.
SYSTEMS DEVELOPMENT GUIDELINES

- **Planning**
  
  Stick to an overall development plan.

- **Involve the Users Throughout the Development Process**
  
  Modeling and prototyping can help you understand user needs and develop a better system.

- **Listening Is Very Important**
  
  Listen carefully! The best system is the one that meets user needs most effectively.
- **Create a Timetable with Major Milestones**
  
  Identify major milestones for project review and assessment.

- **Identify Interim Checkpoints**
  
  Establish interim checkpoints between major milestones to ensure that the project remains on schedule.

- **Remain Flexible**
  
  Systems development is a dynamic process, and overlap often exists between the phases of systems planning, analysis, design, and implementation.

- **Develop Accurate Cost and Benefit Information**
  
  Managers need to know the cost of developing and operating a system. At the start of each, you must provide specific estimates.
**Figure 4** A typical IT department organization chart shows the major functions.
- **Application Development**
  Traditionally, IT departments had an application development group composed of systems analysts and programmers who handled information system design, development, and implementation.

- **Systems Support and Security**
  The systems support and security group implements and monitors physical and electronic security hardware, software, and procedures.

- **User Support**
  User support provides users with technical information, training, and productivity support. The user support function usually is called a help desk or information center (IC).
- **Database Administration**
  
  Database administration involves database design, management, security, backup, and user access.

- **Network Administration**
  
  Network Administration includes hardware and software maintenance, support, and security. In addition to controlling user access, network administrators install, configure, manage, monitor, and maintain network applications.

- **Web Support**
  
  Web support involves design and construction of Web pages, monitoring traffic, managing hardware and software, and linking Web-based applications to the company’s existing information systems.
Exercises 1

1. Identify the main components of an information system
2. How do companies use EDI? What are some advantages of using XML?
3. Describe five types of information systems, and give an example of each.
4. Describe four organization levels of a typical business and their information requirements.
5. Describe the phases of the systems development life cycle.

Reference