Chapter I

Overview of Systems Analysis and Design

1.1 Introduction to system analysis and design

A **system** is a group of interrelated components that function together to achieve a desired result.

- A system exists within an environment
- A boundary separates a system from its environment

A system has nine characteristics

1. Components: An irreducible part or aggregation of parts that makes up a system; also called a subsystem.

2. Interrelated components: Dependence of one part of the system on one or more other system parts.

3. Boundary: The line that marks the inside and outside of a system and that sets off one system from other systems in the organization.

4. Purpose: The overall goal or function of a system.

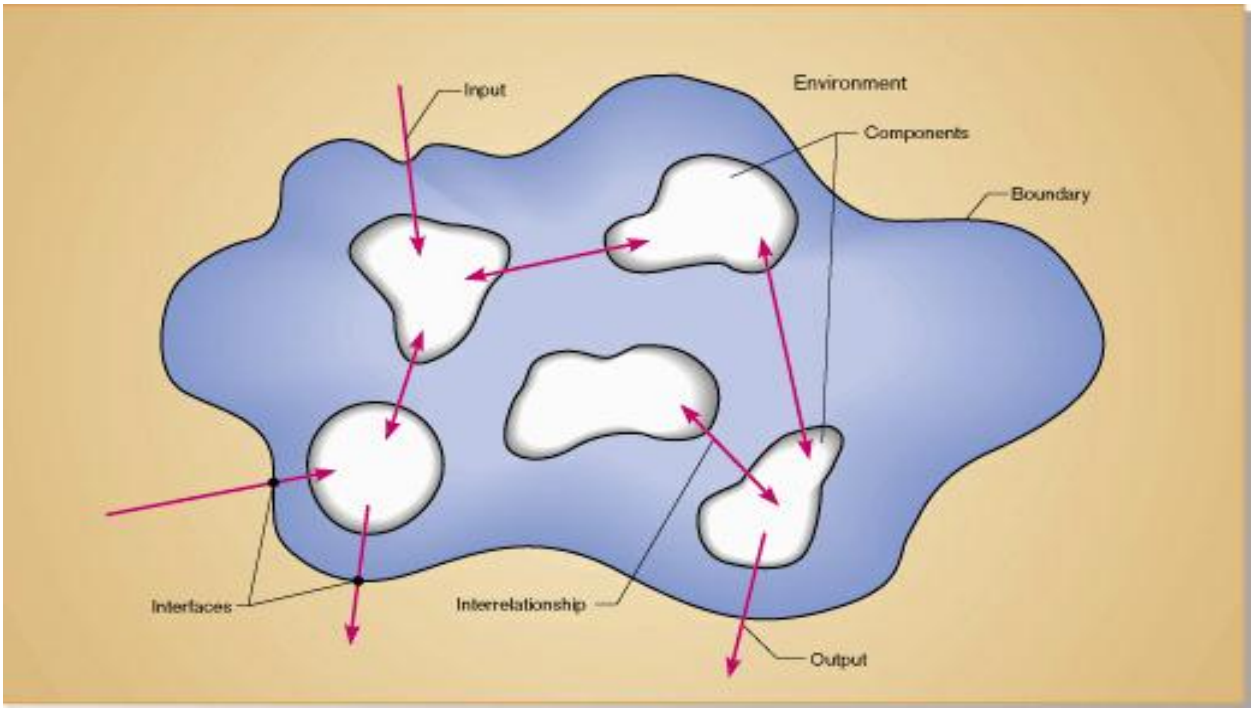
5. Environment: Everything external to a system that interacts with the system

6. Interfaces : Point of contact where a system meets its environment or where subsystems meet each other

7. Constraints: Limits to what it can do and how it can achieve its purpose within an environment (capacity, speed or capabilities)

8. Input : Whatever a system *takes* from its environment in order to fulfill its purpose

9. Output: Whatever a system *returns* to its environment in order to fulfill its purpose



An MP3 player is a system, with power supply, storage, and control subsystems

Important System Concepts

- Decomposition
  - The process of breaking down a system into smaller components
  - Allows the systems analyst to:
    - Break a system into small, manageable and understandable subsystems
    - Focus on one area at a time, without interference from other areas
    - Concentrate on component pertinent to one group of users without confusing users with unnecessary details
    - Build different components at independent times and have the help of different analysts
- Modularity
  - Process of dividing a system into modules of a relatively uniform size
  - Modules simplify system design
- Coupling
  - Subsystems that are dependent upon each other are coupled
  - Desired: loose coupling
- Cohesion
  - Extent to which a subsystem performs a single function
  - Desired: high cohesion

An **information system** (IS) is an arrangement of people, data, processes, and information technology that interact to collect, process, store, and provide as output the information needed to support an organization.

Information technology is a contemporary term that describes the combination of computer technology (hardware and software) with telecommunications technology (data, image, and voice networks).

1.2. Types of Information Systems and Systems Development

1.2.1. Office Information Systems

An **office information system**, or **OIS** is an information system that uses hardware, software and networks to enhance work flow and facilitate communications among employees. Employees perform tasks electronically using computers and other electronic devices, instead of manually. With an office information system, for example, a registration department might post the class schedule on the Internet and e-mail students when the schedule is updated. In a manual system, the registration department would photocopy the schedule and mail it to each student's house.

The software an office information system uses to support these activities include word processing, spreadsheets, databases, presentation graphics, e-mail, Web browsers, Web page authoring, personal information management, and groupware. Office information systems use communications technology such as voice mail, facsimile (fax), videoconferencing, and electronic data interchange (EDI) for the electronic exchange of text, graphics, audio, and video. An office information system also uses a variety of hardware, including computers equipped with modems, video cameras, speakers, and microphones; scanners; and fax machines.

1.2.2 Transaction Processing System

A transaction, in the context of a database, is a logical unit that is independently executed for data retrieval or updates.

In computer science, transaction processing is information processing that is divided into individual, indivisible operations, called *transactions.* Each transaction must succeed or fail as a complete unit; it cannot be only partially complete.

A transaction processing system (TPS) is an information system that captures and processes data about business transactions.

Types of Transaction Processing Systems

A. Batch Transaction Processing

BTP collects the transaction data as a group and processes it later after time delay as batches of identical data. Processed when convenient or economical to do so. Large volumes have lower processing costs

Examples of BTP systems include:

- CHEQUE CLEARANCE- A cheque is a written order asking the bank to pay an amount of money to a particular person. When one is issued to a person they deposit it into a bank account yet the money cannot be withdrawn until the cheque is cleared. This involves checking the that the cheque writer has enough money in their account to cover it usually taking 3 working days in which cheques are cleared in a group during a quiet period of the day.

- BILL GENERATION- Organizations develop a bill or invoice of services or products supplied to a customer. Usually generate a group of bills at a scheduled time as this enables the user to effectively manage time and results in less disruption to main database.

B. Real-Time Transaction Processing

RTTP is the immediate processing of data. Provides instant confirmation yet requires access to online database. Involves using terminal or workstation to enter data and display results and a large number of users to simultaneously perform transactions.

Examples of RTTP systems include:

- RESERVATION SYSTEMS- involve setting aside a service or product for the customer to use at a future time. Commonly used for travelling such as in flight or train bookings and motel reservations. Require an acceptable response time because transactions are made in presence of customers.

1.2.3 Management Information System

A **management information system,** or **MIS** is an information system that generates accurate, timely and organized information so managers and other users can make decisions, solve problems, supervise activities, and track progress. Because it generates reports on a regular basis, a management information system sometimes is called a management reporting system (MRS).

Management information systems often are integrated with transaction processing systems. To process a sales order, for example, the transaction processing system records the sale, updates the customer's account balance, and makes a deduction from inventory. Using this information, the related management information system can produce reports that recap daily sales activities; list customers with past due account balances; graph slow or fast selling products; and highlight inventory items that need reordering. A management information system focuses on generating information that management and other users need to perform their jobs.

An MIS generates three basic types of information: detailed, summary and exception. Detailed information typically confirms transaction processing activities. A Detailed Order Report is an example of a detail report. Summary information consolidates data into a format that an individual can review quickly and easily. To help synopsize information, a summary report typically contains totals, tables, or graphs. An Inventory Summary Report is an example of a summary report.

Exception information filters data to report information that is outside of a normal condition. These conditions, called the exception criteria, define the range of what is considered normal activity or status. An example of an exception report is an Inventory Exception Report is an Inventory Exception Report that notifies the purchasing department of items it needs to reorder. Exception reports help managers save time because they do not have to search through a detailed report for exceptions.

1.2.4 Decision Support System

Transaction processing and management information systems provide information on a regular basis. Frequently, however, users need information not provided in these reports to help them make decisions. A sales manager, for example, might need to determine how high to set yearly sales quotas based on increased sales and lowered product costs. Decision support systems help provide information to support such decisions.

A **decision support system (DSS)** is an information system designed to help users reach a decision when a decision-making situation arises. A variety of DSSs exist to help with a range of decisions.
A decision support system uses data from internal and/or external sources.
Internal sources of data might include sales, manufacturing, inventory, or financial data from an organization's database. Data from **external sources** could include interest rates, population trends, and costs of new housing construction or raw material pricing. Users of a DSS, often managers, can manipulate the data used in the DSS to help with decisions.

Some decision support systems include query language, statistical analysis capabilities, spreadsheets, and graphics that help you extract data and evaluate the results. Some decision support systems also include capabilities that allow you to create a model of the factors affecting a decision.

1.2.5 Expert Systems

An **expert system** is an information system that captures and stores the knowledge of human experts and then imitates human reasoning and decision-making processes for those who have less expertise. Expert systems are composed of two main components: a knowledge base and inference rules. A **knowledge base** is the combined subject knowledge and experiences of the human experts. The **inference rules** are a set of logical judgments applied to the knowledge base each time a user describes a situation to the expert system.

Integrated Information Systems

With today's sophisticated hardware, software and communications technologies, it often is difficult to classify a system as belonging uniquely to one of the five information system types discussed. Much of today's application software supports transaction processing and generates management information. Other applications provide transaction processing, management information, and decision support. Although expert systems still operate primarily as separate systems, organizations increasingly are consolidating their information needs into a single, integrated information system.

IS Type	IS Characteristics	Systems Development Methods
Transaction processing system	High-volume, data capture focus; goal is efficiency of data movement and processing and interfacing different TPSs	Process orientation; concern with capturing, validating, and storing data and with moving data between each required step
Management information system	Draws on diverse yet predictable data resources to aggregate and summarize data; may involve forecasting future data from historical trends and business knowledge	Data orientation; concern with understanding relationships among data so data can be accessed and summarized in a variety of ways; builds a model of data that supports a variety of uses
Decision support system	Provides guidance in identifying problems, finding and evaluating alternative solutions, and selecting or comparing alternatives; potentially involves groups of decision makers; often involves semi-structured problems and the need to access data at different levels of detail	Data and decision logic orientations; design of user dialogue; group communication may also be key, and access to unpredictable data may be necessary; nature of systems requires iterative development and almost constant updating

1.3 Developing Information Systems and the Systems Development Life cycle

System Development Methodology

A standard process followed in an organization to conduct all the steps necessary to analyze, design, implement and maintain information systems.

Systems Development Life Cycle (SDLC)

Traditional methodology used to develop, maintain, and replace information systems

Consists of five phases:

1. Planning
   - Two Main Activities
     - Identification of need
     - Investigation and determination of scope
2. Systems Analysis
   - Study of current procedures and information systems
     - Determine requirements
     - Generate alternative designs
     - Compare alternatives
     - Recommend best alternative
3. Design
   - Convert recommended solution to system specifications

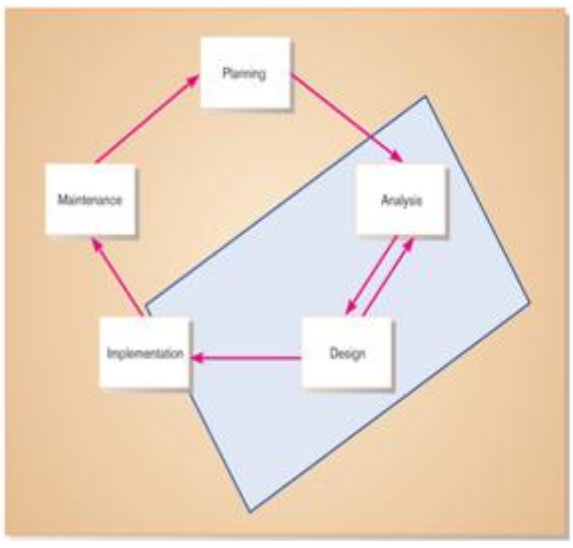
- Logical design: functional features described independently of computer platform
- Physical design: logical specifications transformed to technology-specific details

4. Implementation
   Information system is coded, tested, installed, and supported in the organization.
5. Maintenance
   Systematically repair and improve the information system

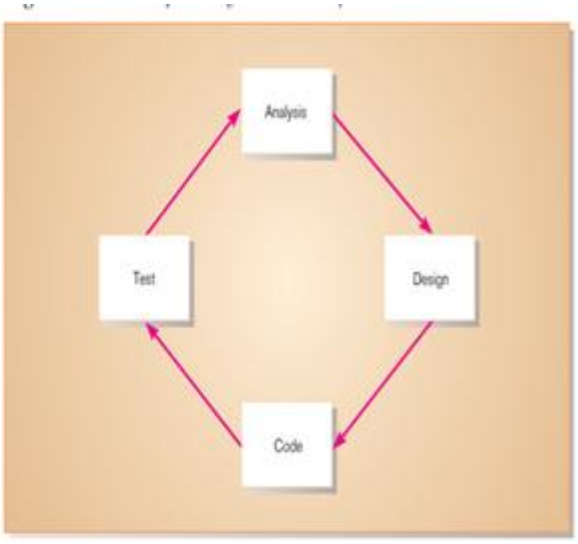
Phase	*Products, Outputs, or Deliverables*
Planning	Priorities for systems and projects; an architecture for data, networks, and selection hardware, and IS management are the result of associated systems;
	Detailed steps, or work plan, for project;
	Specification of system scope and planning and high-level system requirements or features;
	Assignment of team members and other resources;
	System justification or business case
Analysis	Description of current system and where problems or opportunities are with a general recommendation on how to fix, enhance, or replace current system;
	Explanation of alternative systems and justification for chosen alternative
Design	Functional, detailed specifications of all system elements (data, processes, inputs, and outputs);
	Technical, detailed specifications of all system elements (programs, files, network, system software, etc.);
	Acquisition plan for new technology
Implementation	Code, documentation, training procedures, and support capabilities
Maintenance	New versions or releases of software with associated updates to documentation, training, and support

The Heart of the Systems Development Process

The heart of the System Development

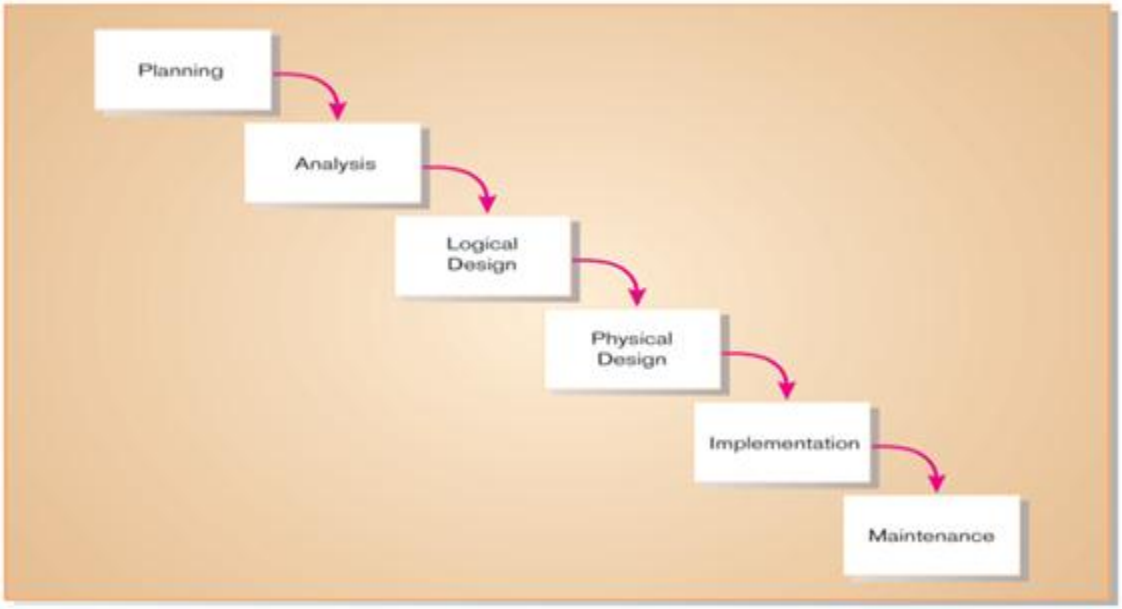


The System Development Life Cycle



Current practice combines analysis, design, and implementation into a single iterative and parallel process of activities

Traditional Waterfall SDLC



One phase begins when another completes, little backtracking and looping
What are the problems with the Waterfall Approach

- System requirements "locked in" after being determined (can't change)
- Limited user involvement (only in requirements phase)
- Too much focus on milestone deadlines of SDLC phases to the detriment of sound development practices

1.4 System Analysis and Design Tools

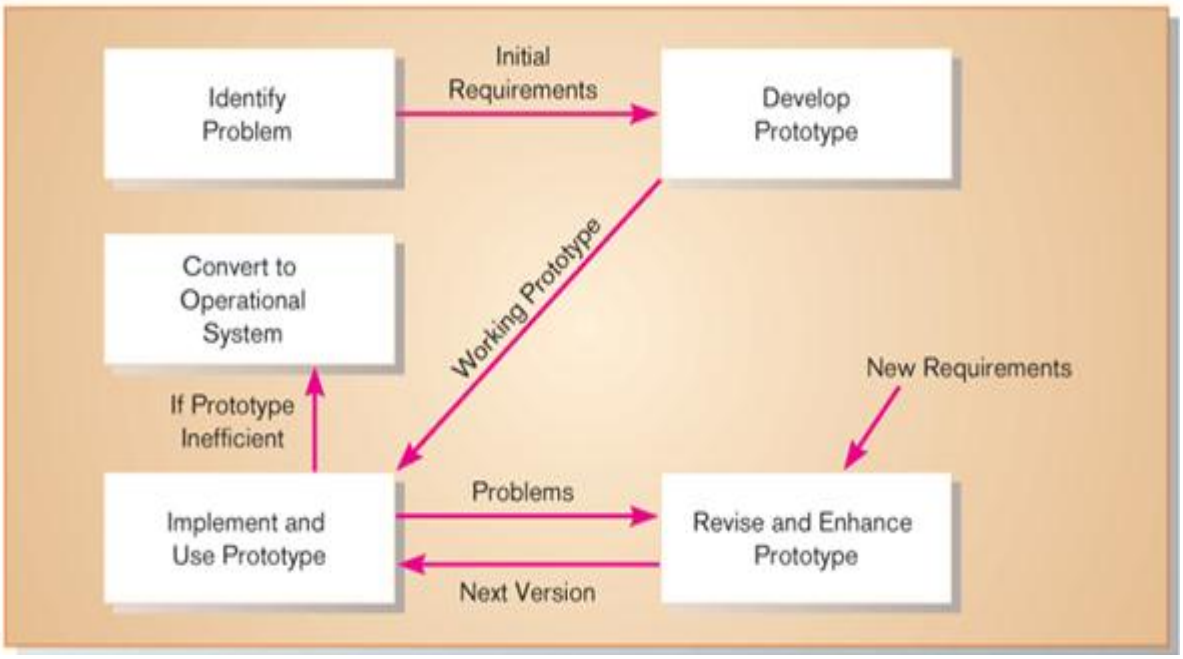
A prototype is an early sample, model, or release of a product built to test a concept .

Creating a demo of a new system.

Software prototyping, refers to the activity of creating prototypes of software applications, i.e., incomplete versions of the software programs being developed.

Iterative development process:

- Requirements quickly converted to a working system
- System is continually revised
- Close collaboration between users and analysts



- **Joint Application Design (JAD)**
  A structured process in which users, managers, and analysts work together for several days in a series of intensive meetings to specify or review system requirements.

  - The Joint Application Development (JAD) technique is an extended, facilitated workshop.
  - It involves collaboration between stakeholders and systems analysts to identify needs or requirements in a concentrated and focused effort.
  - The outcome of a series of JAD sessions is a precise statement of user requirements.
  - A prototype may also be developed.

Assignment No: 1

1. What do you mean by system and system analysis? Explain the system development life cycle with example.
2. Explain the steps in the maintenance process and contrast them with the phase of the systems development life cycle.
3. Mention the key concepts of system development life cycle and explain each steps with example.
4. What are types of information system?
5. Differentiate between transaction processing systems (TPS) and management information system (MIS).
6. Explain the types of information with example and compare each of them.
7. Differentiate between decision support system and management information system.
8. List and explain some of the problems with traditional waterfall SDLC?
9. What do you mean by prototyping? List the advantages and disadvantages of using prototyping.
10. What do you mean by JAD? List the advantages and disadvantages of using JAD.