SYSTEMS ANALYSIS AND DESIGN

Systems Analysis

- Systems development is systematic process which includes phases such as planning, analysis, design, implementation, and maintenance.
- It focusses on:
  - System Analysis
  - System Design
- **System Analysis:** Process of collecting and interpreting facts, identifying the problems, and decomposition of a system into its components.
- System analysis is conducted for the purpose of studying a system or its parts in order to identify its objectives. It is a problem solving technique that improves the system and ensures that all the components of the system work efficiently to accomplish their purpose.

System Design

- **System Design:** Process of planning a new business system or replacing an existing system by defining its components or modules to satisfy the specific requirements.
- Before planning, you need to understand the old system thoroughly and determine how computers can best be used in order to operate efficiently.
- System Design focuses on **how to accomplish the objective of the system**.
- System Analysis and Design (SAD) mainly focuses on –
  - Systems
  - Processes
  - Technology

- What is a System?
- The word System is derived from Greek word Systema, which means an organized relationship between any set of components to achieve some common cause or objective.
- *A system is "an orderly grouping of interdependent components linked together according to a plan to achieve a specific goal."*
- Constraints of a System
- A system must have three basic constraints −
  - A system must have some **structure and behavior** which is designed to achieve a predefined objective.
  - **Interconnectivity** and **interdependence** must exist among the system components.

Properties of a system

A system has the following properties −

Organization

- Organization implies structure and order. It is the arrangement of components that helps to achieve predetermined objectives.

Interaction

- It is defined by the manner in which the components operate with each other.
- For example, in an organization, purchasing department must interact with production department and payroll with personnel department.

Interdependence

- Interdependence means how the components of a system depend on one another. For proper functioning, the components are coordinated and linked

Properties of a system

Integration

- Integration is concerned with how a system components are connected together. It means that the parts of the system work together within the system even if each part performs a unique function.

Central Objective

- The objective of system must be central. It may be real or stated. It is not uncommon for an organization to state an objective and operate to achieve another.
- The users must know the main objective of a computer application early in the analysis for a successful design and conversion.

Elements of a Systems

Outputs and Inputs

- The main aim of a system is to produce an output which is useful for its user.
- Inputs are the information that enters into the system for processing.
- Output is the outcome of processing.

Processor(s)

- The processor is the element of a system that involves the actual transformation of input into output.
- It is the operational component of a system. Processors may modify the input either totally or partially, depending on the output specification.
- As the output specifications change, so does the processing. In some cases, input is

Elements of a System

Environment

- The environment is the "supersystem" within which an organization operates.
- It is the source of external elements that strike on the system.
- It determines how a system must function. For example, vendors and competitors of organization's environment, may provide constraints that affect the actual performance of the business.

Boundaries and Interface

- A system should be defined by its boundaries. Boundaries are the limits that identify its components, processes, and interrelationship when it interfaces with another system.
- Each system has boundaries that determine its sphere of influence and control.
- The knowledge of the boundaries of a given system is crucial in determining the nature of its interface with other systems for successful design.

Elements of a System

Control

- The control element guides the system.
- It is the decision–making subsystem that controls the pattern of activities governing input, processing, and output.
- The behavior of a computer System is controlled by the Operating System and software. In order to keep system in balance, what and how much input is needed is determined by Output Specifications.

Feedback

- Feedback provides the control in a dynamic system.
- Positive feedback is routine in nature that encourages the performance of the system.

Types of Systems

The systems can be divided into the following types –

Physical or Abstract Systems

- Physical systems are tangible entities. We can touch and feel them.
- Physical System may be static or dynamic in nature. For example, desks and chairs are the physical parts of computer center which are static. A programmed computer is a dynamic system in which programs, data, and applications can change according to the user's needs.
- Abstract systems are non-physical entities or conceptual that may be formulas, representation or model of a real system.

Open or Closed Systems

- An open system must interact with its environment. It receives inputs from and delivers outputs to the outside of the system. For example, an information system which must adapt to the changing environmental conditions.

Types of Systems

Adaptive and Non Adaptive System

- Adaptive System responds to the change in the environment in a way to improve their performance and to survive. For example, human beings, animals.
- Non Adaptive System is the system which does not respond to the environment. For example, machines.

Permanent or Temporary System

- Permanent System persists for long time. For example, business policies.
- Temporary System is made for specified time and after that they are demolished. For example, A DJ system is set up for a program and it is dissembled after the program.

Natural and Manufactured System

- Natural systems are created by the nature. For example, Solar system, seasonal system

Types of Systems

Deterministic or Probabilistic System

- Deterministic system operates in a predictable manner and the interaction between system components is known with certainty. For example, two molecules of hydrogen and one molecule of oxygen makes water.
- Probabilistic System shows uncertain behavior. The exact output is not known. For example, Weather forecasting, mail delivery.

Social, Human-Machine, Machine System

- Social System is made up of people. For example, social clubs, societies.
- In Human-Machine System, both human and machines are involved to perform a particular task. For example, Computer programming.
- Machine System is where human interference is neglected. All the tasks are

Types of Systems

Man–Made Information Systems

- It is an interconnected set of information resources to manage data for particular organization, under Direct Management Control (DMC).
- This system includes hardware, software, communication, data, and application for producing information according to the need of an organization.
  - **Formal Information System** – It is based on the flow of information in the form of memos, instructions, etc., from top level to lower levels of management.
  - **Informal Information System** – This is employee based system which solves the day to day work related problems.
  - **Computer Based System** – This system is directly dependent on the computer for managing business applications. For example, automatic library system, railway

System Models

Schematic Models

- A schematic model is a 2-D chart that shows system elements and their linkages.
- Different arrows are used to show information flow, material flow, and information feedback.

Flow System Models

- A flow system model shows the orderly flow of the material, energy, and information that hold the system together.
- Program Evaluation and Review Technique (PERT), for example, is used to abstract a real world system in model form.

System Models

Static System Models

- They represent one pair of relationships such as *activity–time* or *cost–quantity*.
- The Gantt chart, for example, gives a static picture of an activity-time relationship.

Dynamic System Models

- Business organizations are dynamic systems. A dynamic model approximates the type of organization or application that analysts deal with.
- It shows an ongoing, constantly changing status of the system. It consists of –
  - Inputs that enter the system
  - The processor through which transformation takes place
  - The program(s) required for processing

Categories of Information

Strategic Information

- This information is required by topmost management for long range planning policies for next few years. For example, trends in revenues, financial investment, and human resources, and population growth.
- This type of information is achieved with the aid of Decision Support System (DSS).

Managerial Information

- This type of Information is required by middle management for short and intermediate range planning which is in terms of months. For example, sales analysis, cash flow projection, and annual financial statements.
- It is achieved with the aid of Management Information Systems (MIS).

Operational information

Systems Analysis

- System Analysis
- System analysis is the initial phase of a software development project where the requirements of the system are gathered, analyzed, and documented. It involves understanding the problem domain, identifying the stakeholders, and defining the scope and objectives of the system.
- Key Activities in System Analysis
- **Requirement Gathering**– Identifying the needs and expectations of the users and stakeholders.
- **Requirement Analysis**– Analyzing the gathered requirements to ensure consistency, feasibility, and completeness.
- **Feasibility Study**– Assessing the technical, economic, and operational feasibility of the proposed system.

Systems Analysis

Techniques Used in System Analysis

- **Interviews**– Gathering information from stakeholders through face-to-face or online interviews.
- **Surveys**– Collecting data from a large number of respondents using questionnaires.
- **Observation**– Observing the current system in operation to understand its processes and workflows.
- **Document Analysis**– Examining existing documents, reports, and manuals.
- **Prototyping**– Creating simplified models or mock-up's of the system to gather feedback and refine requirements.

Systems Design

System design is the subsequent phase where the detailed specifications of the system are developed. It involves designing the architecture, components, interfaces, and data structures that will implement the requirements defined in the analysis phase.

Key Activities in System Design

- **Architectural Design**– Determining the overall structure and components of the system.
- **Component Design**– Designing individual components and their interactions.
- **Interface Design**– Specifying the interfaces between components and with external systems.
- **Data Design**– Designing the database schema and data structures.
- **Detailed Design**– Creating detailed specifications for each component, including

Systems Design

Techniques Used in System Design

- **Unified Modelling Language (UML)**– A standardized modelling language used to visualize, specify, construct, and document software systems.
- **Data Flow Diagrams (DFDs)**– Diagrams that illustrate the flow of data through a system.
- **Entity-Relationship Diagrams (ERDs)**– Diagrams that represent the entities and relationships between them in a database.
- **Decision Trees**– Diagrams that show the possible outcomes and decisions in a process.
- **State Transition Diagrams**– Diagrams that represent the different states a system can be in and the transitions between them.

SDLC

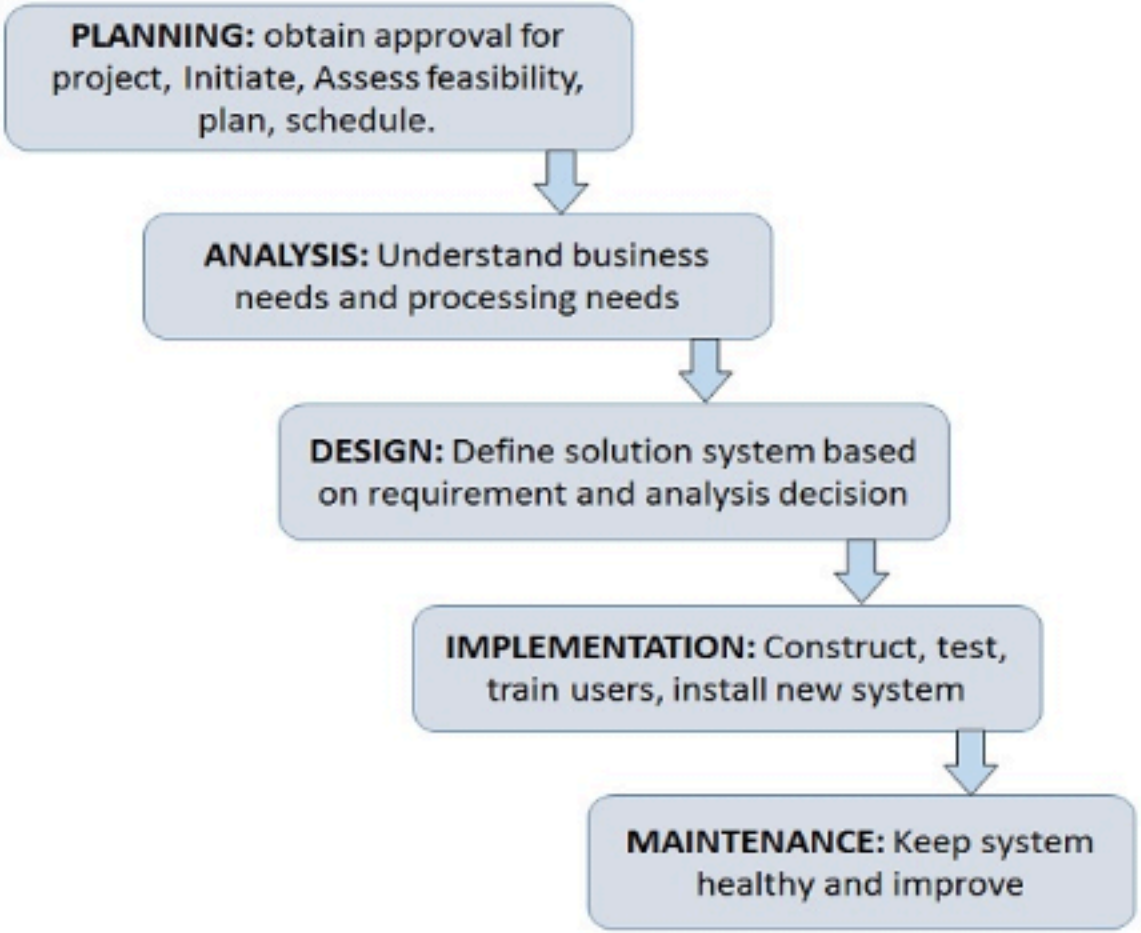
- An effective System Development Life Cycle (SDLC) should result in a high quality system that meets customer expectations, reaches completion within time and cost evaluations, and works effectively and efficiently in the current and planned Information Technology infrastructure.
- System Development Life Cycle (SDLC) is a conceptual model which includes policies and procedures for developing or altering systems throughout their life cycles.

SDLC

- SDLC is used by analysts to develop an information system. SDLC includes the following activities –
- requirements
- design
- implementation
- testing
- deployment
- operations
- maintenance

Phases of SDLC

- Systems Development Life Cycle is a systematic approach which explicitly breaks down the work into phases that are required to implement either new or modified Information System.


PLANNING: obtain approval for project, Initiate, Assess feasibility, plan, schedule.
ANALYSIS: Understand business needs and processing needs
DESIGN: Define solution system based on requirement and analysis decision
IMPLEMENTATION: Construct, test, train users, install new system
MAINTENANCE: Keep system healthy and improve

Feasibility Study or Planning

- Define the problem and scope of existing system.
- Overview the new system and determine its objectives.
- Confirm project feasibility and produce the project Schedule.
- During this phase, threats, constraints, integration and security of system are also considered.
- A feasibility report for the entire project is created at the end of this phase.

Analysis and Specification

- Gather, analyze, and validate the information.
- Define the requirements and prototypes for new system.
- Evaluate the alternatives and prioritize the requirements.
- Examine the information needs of end-user and enhances the system goal.
- A Software Requirement Specification (SRS) document, which specifies the software, hardware, functional, and network requirements of the system is prepared at the end of this phase.

- System Design
- Includes the design of application, network, databases, user interfaces, and system interfaces.
- Transform the SRS document into logical structure, which contains detailed and complete set of specifications that can be implemented in a programming language.
- Create a contingency, training, maintenance, and operation plan.
- Review the proposed design. Ensure that the final design must meet the requirements stated in SRS document.
- Finally, prepare a design document which will be used during next phases.

- Implementation
- Implement the design into source code through coding.
- Combine all the modules together into training environment that detects errors and defects.
- A test report which contains errors is prepared through test plan that includes test related tasks such as test case generation, testing criteria, and resource allocation for testing.
- Integrate the information system into its environment and install the new system.

- Maintenance/Support
- Include all the activities such as phone support or physical on-site support for users that is required once the system is installing.
- Implement the changes that software might undergo over a period of time, or implement any new requirements after the software is deployed at the customer location.
- It also includes handling the residual errors and resolve any issues that may exist in the system even after the testing phase.
- Maintenance and support may be needed for a longer time for large systems and for a short time for smaller systems.