

Lesson 7: Systems Analysis & Design

1. Foundation: System Concepts

System Fundamentals

- **Definition:** Interrelated components working together according to a plan to achieve a specific objective.
- **Classifications:**
 - **Open vs. Closed:** Interacts with environment vs. isolated.
 - **Natural vs. Man-made:** Made by nature vs. made by humans.
 - **Living vs. Physical:** Composed of living vs. non-living things.

Types of Information Systems

- **TPS (Transaction Processing):** For *Operational Level* (daily routine transactions).
- **OAS (Office Automation):** Increases productivity of office workers (e.g., email).
- **MIS (Management Info. System):** For *Management Level* (routine summary reports).
- **DSS (Decision Support):** For *Management Level* (semi-structured decisions).
- **ESS (Executive Support):** For *Strategic Level* (unstructured decisions).
- **KMS (Knowledge Management):** Manages organizational knowledge & experience.
- **ERP (Enterprise Resource Planning):** Integrates all core business functions.
- **Expert System:** AI-based system that mimics a human expert.

2. The SDLC: Models & Methods

SDLC Process Models

- **Waterfall:** Sequential, linear model. *Best for stable, clear requirements.*
- **Spiral:** Combines iteration with risk analysis. *Best for large, high-risk projects.*
- **Agile:** Iterative, with rapid delivery of small features. *Best for changing requirements.*
- **Prototyping:** Building a working model to get user feedback early.
- **RAD (Rapid Application Dev.):** Develops functional modules in parallel for fast delivery.

Development Methodologies

- **Structured:** Traditional, top-down approach (e.g., SSADM).
- **Object-Oriented:** Models the system as a collection of interacting objects.

3. Planning & Analysis

Preliminary Investigation

- **Problem Identification:** A preliminary survey to understand and define the problem and scope of the system.
- **Feasibility Study (Is it possible?)**
 - **Technical:** Do we have the tech/skills?
 - **Economic:** Do benefits justify cost? (Cost-Benefit Analysis).
 - **Operational:** Will people use it? Is there resistance?
 - **Organizational:** Does it support company goals?

Requirement Analysis (What should it do?)

- **Functional:** The *activities* the system must perform.
- **Non-functional:** The *qualities* or constraints (e.g., speed, security, reliability).
- **IEEE Standard:** Essential needs use "Shall"; desirable ones use "Should".

SSADM & Modeling Tools

SSADM (Structured Systems A&D Methodology)

A structured approach covering the SDLC from feasibility to design.

- **Stages:** Feasibility Study → Requirements Analysis → Requirements Specification → Logical System Specification → Physical Design.

- **DFD (Data Flow Diagram):** Shows data movement.
 - **Components:** External Entity, Process, Data Flow, Data Store.
 - **Levels:** Context Diagram (Level 0), Level 1 DFD, Document Flow Diagram.
- **LDM (Logical Data Modeling):** Shows data structure.
 - **Components:** Entity, Attribute, Relationship.
 - **Tools:** Cardinality (1-1, 1-M) & Entity Matrix.

4. Design, Testing & Deployment

System Design

- **Logical vs. Physical Design:** What the system must do (tech-independent) vs. how it will be implemented (with specific tech).
- **Database Mapping:** Entity → Table, Attribute → Field.
- **Data Dictionary:** A repository of metadata (data about data).

System Testing

Testing Techniques & Levels

Techniques: **White-box** (tests internal code) vs. **Black-box** (tests functionality).

Levels (Bottom-up):

1. **Unit Testing** (by programmers).
2. **Integration Testing** (testing combined units).
3. **System Testing** (testing the whole system).
4. **Acceptance Testing** (by users).

Deployment & Alternatives

- **Deployment Methods:** Parallel, Direct (Big Bang), Phased, Pilot.
- **COTS vs. Custom Software:**
 - **COTS:** Buying a ready-made package. Pros: Cheaper, faster. Cons: May not fit perfectly.
 - **Custom:** Building from scratch. Pros: Perfect fit, competitive advantage. Cons: Expensive, time-consuming.
 - **Key Concepts:** Gap Analysis, Business Process Reengineering, Business Process Mapping.