System Engineering and Analysis

“What is the role of the software product?”

Lecture Objectives

To examine the elements of a computer-based system
To understand the development process of a system
To illustrate the representations of a business information system

Definition of System

“A collection of interrelated components that work together to achieve some objective”

Objective: to develop a product, to support business functions…etc

Information system types

Manual (read a text by your eyes then summarize using your pen)
Automated (get the information through a computerized system)

System elements

Software: computer programs, data structures, and related documents.
Hardware: electronic computing devices and connectivity devices.
People: users and operators.
Database: large and organized collection of information that is accessed via the software.
Documentation: descriptive information for user and operator (e.g. hardcopy manuals, on-line help files)
Procedures: steps that define the specific use of each system element.

System environments

Internal, like users, organization structure and procedures
External, consists of all factors outside the organization that affect the system

To illustrate the representations of a system
System Life Cycle

System Life Cycle Phases (Continued)

• Feasibility Study
  - Economic, technical, legal feasibility (can be done or not).
  - Cost-benefit analysis, risk assessment
  - "Go / no-go" decision

• Analysis
  - Requirements definition & specification
  - there are some special tools and techniques that help the analyst as DFD, Data Dictionary

System Life Cycle Phases

• Initial Strategy
  - Identification of needs, problems, opportunities, goal objectives and scope.
  - Critical to the success of the project.
  - The analyst must be honest.
  - The analyst must discover what the business is trying to do.

• Design
  - Logical & Physical Design (Design the interface, input/output, file or database)
  - System specifications

• Implementation
  - Installation
  - Training
  - File conversion
  - Systems testing, security

System Life Cycle Phases (Continued)

• Determining the Requirements (Information and Tools)
  - Several tools are used to define IR in the business, sampling, investigating of hard data, interviewing, questionnaires, observing, prototyping.
  - The analyst is striving to understand what information users need to perform their job

• Maintenance, Review and Test
  - Amendments (fix) by the programmers
  - System audit, by the programmers and analyst
System Engineering Hierarchy

- Domain of interest
- System element
- Business or product domain
- World view
- Domain view
- Element view
- Detailed view

System Engineering Hierarchy continue

- World view: the entire business or technology is examined.
- Domain view: specific domain of interest.
- Element view: the need for targeted system element (e.g., data, software, hardware, people) is analyzed.
- Detailed view: analysis, design, and construction of a targeted system element.

Exogenous & Endogenous Inputs

- Exogenous inputs link one constituent of a view with other constituents (at the same or other levels)
- Endogenous inputs link individual components of a constituent at a particular view

Restraining Factors of System Model

- Assumptions
- Simplifications
- Limitations
- Constraints
- Preferences

System Modeling

The engineer creates models that:
- Define processes for the view under consideration.
- Represent behaviour of the processes.
- Explicitly define *exogenous* and *endogenous* input to the model.
- Represent all linkages (including output) to better understand the view.

Enterprise Modeling

- Organizational structure
- Business-level data modeling
- Process modeling
- Information flow modeling
Organizational Structure

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XYZ Company

Corporate Support          Sales & Marketing    Engineering    Manufacturing

Finance                  Planning
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Business-level Data Modeling

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Product A                 Salesperson

Describes                  Sells

Purchases                  Evaluates

Customer                   Contacts

Inquires about             Assists
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Information Flow Modeling

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Contact record

Establish customer contact

Product description

Provide product info

Product info

Provide evaluation product

Address: questions/concerns

Accept sales order

Check availability

Prepare delivery order
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Summary

- System analysis provides the ‘big’ picture of the computer-based system where software is to be used
- By understanding the system, a better software product can be produced
- Identification of elements of the system provides the framework for software requirements

Software Requirements Specifications

- Problem Statement
  - System reference, problem areas
- Data model
  - Entity Relationship Diagram
- Functional requirements
  - List of functions, Context diagram, DFD
- Behaviour model
  - State Transition Diagram
- Glossary of Terms
References


“Software Engineering” by Ian Sommerville, Addison-Wesley, 2001