Software Engineering

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System Engineering

- A system is a set of inter-related components, with an identifiable boundary, working together for some purpose
- Properties of a system:
  - a system may include software, mechanical, electrical and electronics components
  - System components are dependent on each other for functioning properly
  - All system exhibit predictable behavior
- Types:
  - Open: interacts freely with its environment (Ex: Weather forecasting system)
  - Closed: it is cut-off from its environment (Ex: Embedded system inside washing machine)

Characteristics of system:

- Consists of components and sub-components
- Inter-related components
- Boundary
- Purpose
- Environment (external/internal entities that interacts with the system)
- Input
- Output
- Constraints (limitations of system)

- Components of Computer-based systems
  - Software
  - Hardware
  - People
  - Database
  - Documentation
  - Procedures
- **Emergent System:**
  - A system where all sub-systems work together to form a complete system and failure of any component may give rise to unusable system
- Types of emergent property:
  - Functional properties (appears when all parts of a system work together to achieve some objective)
  - Non-functional properties (reliability, performance and safety)

Examples of Emergent properties:

- Volume of system (actual space occupied by the system)
- Reliability of system (depends on reliability of system components, but unexpected interactions can cause new types of failures)
- Security of system
- Reparability of system
- Usability of system (hardware, software, system operators and the environment where it is used)

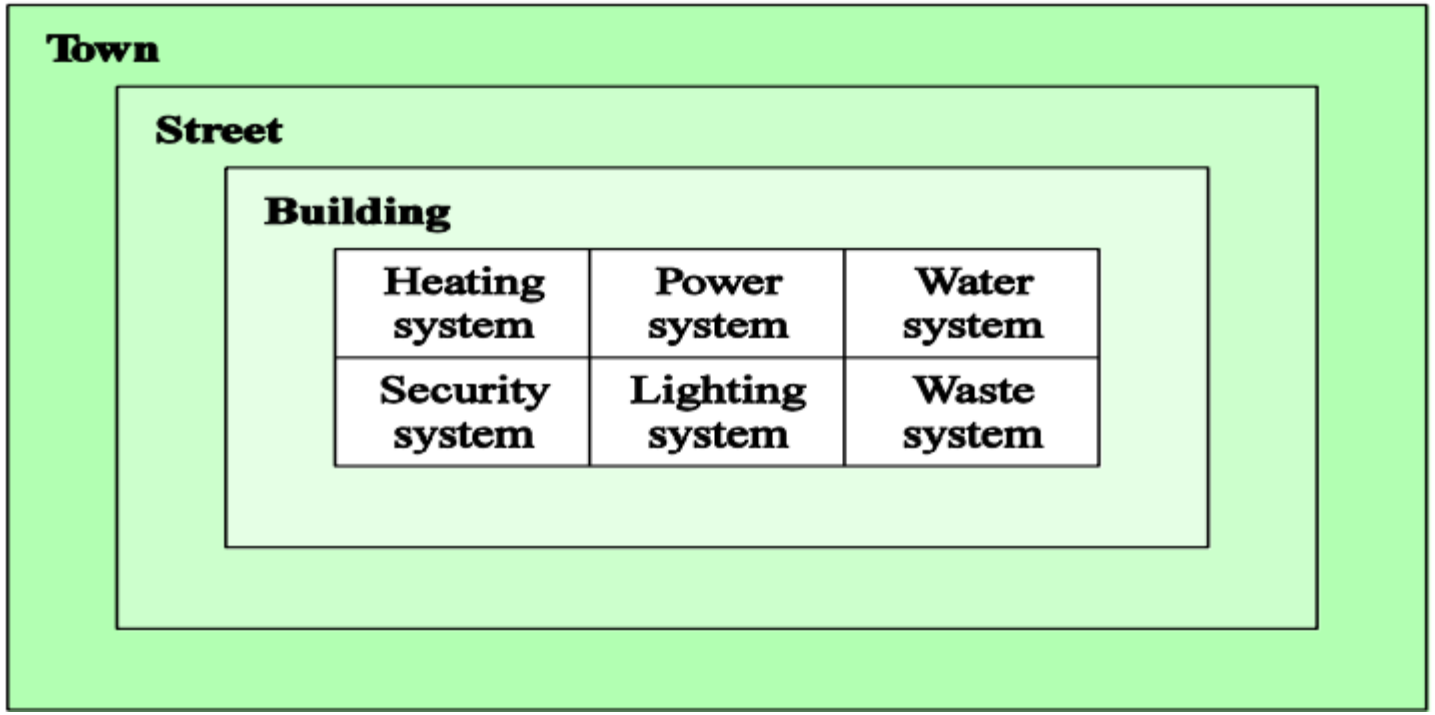
Influences on reliability

- Hardware
- Software
- Operator

System and its environment

- System are not independent and exists in its environment
- Environment affects the functioning of the system

System hierarchies



System Engineering

- Activity of specifying, designing, implementing, validating, deploying and maintaining systems.
- Problems of system engineering is similar to that of software engineering.
- Software has become a crucial part of most of the systems and the delay in software causes the delay in system

Problems in system engineering

- Requires great deals of coordination across multiple disciplines
- System must be designed to last many years in a changing environment
- Time estimation and missed schedules
- Maintenance problems
- Unmanaged systems and improper integration of sub-systems

System Engineering Process

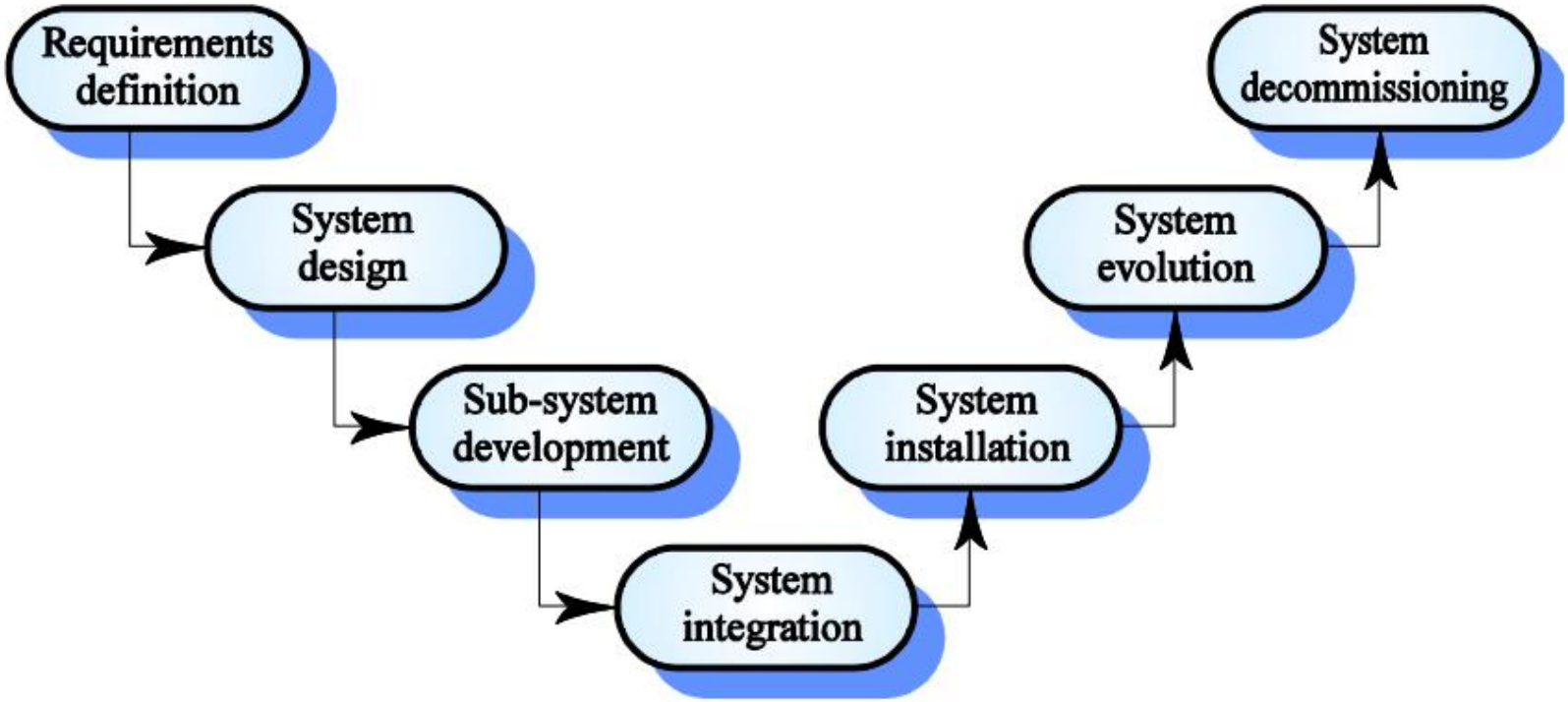


Fig: Phases of the system engineering process

- Requirements
  - Abstract functional requirements
  - System properties (non-functional requirements)
  - Characteristics that the system must exhibit (detailed functionalities)
- System Design Process
  - Partition requirements
  - Identify sub-systems
  - Assign requirements to sub-systems
  - Specify sub-system functionality
  - Define subsystem interface
- Sub system development
  - Parallel projects developing the hardware, software and communications
  - May have lack of communication across implementing teams

- System Integration
  - Direct (switching off old system and turning on new system)
  - Parallel (running both old and new systems parallel until the management decides to turn off old system)
  - Single location installation (installing new system at one site, experimenting with it until the management decides to install new system throughout the organization)
  - Phased installation (installing parts of the system until all the parts of old system is replaced by new system)
- System Evolution
  - Evolving system with new requirements
  - Legacy system must be maintained

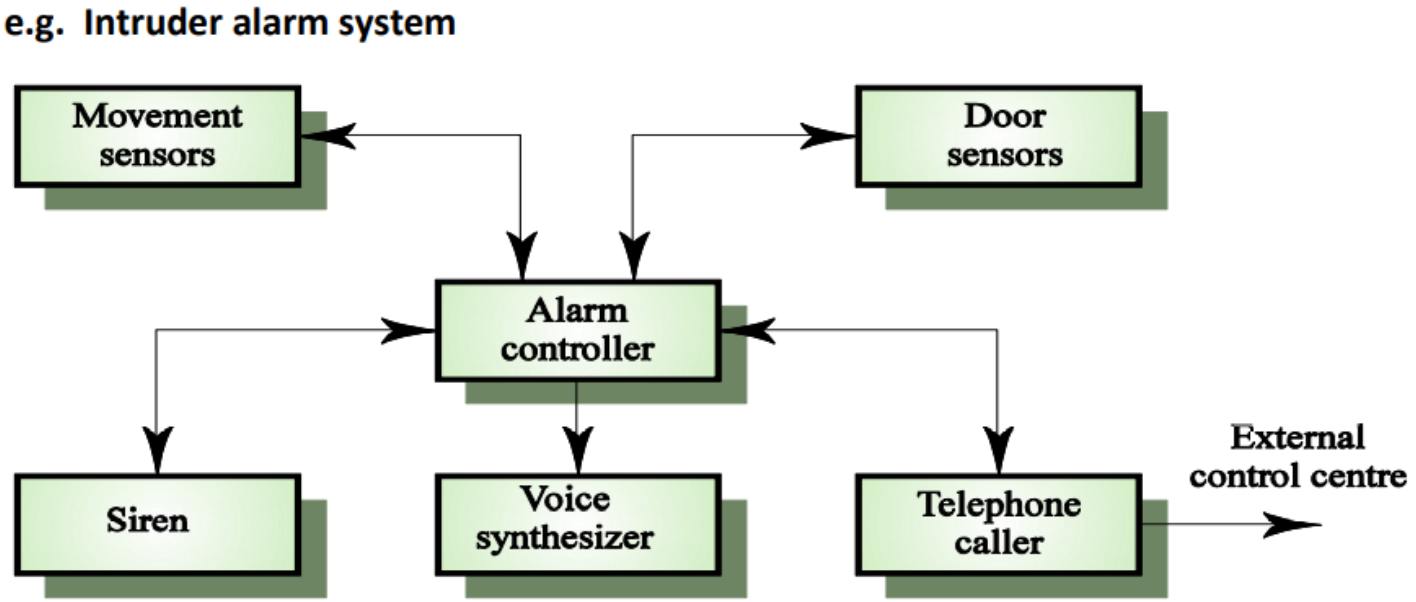
  Problems:

  - Environmental assumption may be incorrect
  - Human resistance to new system
  - Physical installation problems
  - Operator training has to be identified

- System Decommissioning
  - Taking system out of service after its lifetime
  - May require data to be restructured and converted to be used in other systems

System Modeling

- Creating an architectural model that presents an abstract view of the sub-systems making up that system



Information System

- integrated set of components for collecting, storing, and processing data and for providing information, knowledge

Classes of information System

- Transaction Processing System
- Management Information System
- Decision Support System
- Expert System

System Analyst

- Someone who does the analysis of a complete system
- Responsibilities:
  - Efficient capture of data from its business source
  - Flow of useful and timely information back to the business and its people

To Be Continued…