Chapter one
Introduction to Software Requirements Engineering

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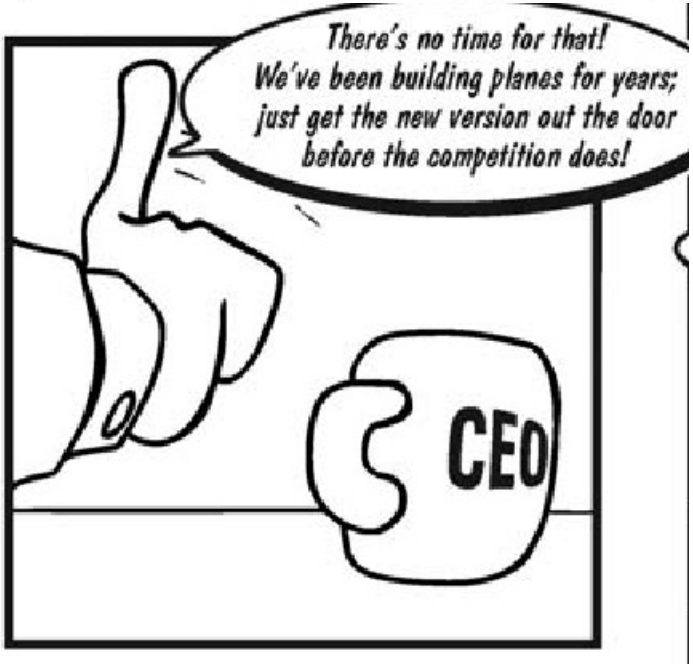

Overview of requirements
System Requirements

- **System requirements** are "what the system is required to do and the circumstances under which it is required to operate".

- **In other words**, **the requirements** are "the services that the system should provide and they set out constraints on the system's operation".
- **Examples** of **requirements** for a **library system**:

1.The system shall maintain records of all library materials including books, serials, newspapers and magazines, video and audio tapes, reports, collections of transparencies, computer disks and CD-ROMs.

System Requirements

2.The system shall allow users to search for an item by title, author.

3.The system's user interface shall be implemented using a World-Wide-Web browser.

4.The system shall support at least 20 transactions per second.

5.The system facilities which are available to public users shall be demonstrable in 10 minutes or less.

Different Types of Requirements

- **These examples that requirements** are of different types.

- 1.Very general requirements, which set out in broad terms what the system should do.
- 2.Functional requirements, which define part of the system's functionality.
- 3.Implementation requirements, which state how the system must be implemented.
- 4.Performance requirements, which specify a minimum acceptable performance for the system.
- 5.Usability requirements, which specify the maximum acceptable time to demonstrate the use of the system.

Common Requirements problems

- The requirements don't reflect the real needs of the customer for the system.
- Requirements are inconsistent and/or incomplete.
- It is expensive to make changes to requirements after they have been agreed.
- There may be misunderstandings between customers, persons developing the system requirements and software engineers developing or maintaining the system.

2. FAQS about requirements

- Before you start to understand

requirements engineering, you need some basic information and definitions in the form of frequently asked questions(FAQs).

1.What are requirements?

- (Statements of a system service).
- Requirements are defined as during the early stages of a system development as a specification of what should be implemented.
- **Description**: how the system should behave, application domain information, limitations on the system's operation, or specifications of a system property or attribute.

FAQS about requirements

2.What is requirements engineering?

- (The processes involved in developing system requirements).
- **Description**: it is new term which has been invented to cover all of the activities involved in learning, documenting, and maintaining a set of requirements for a computer-based system.
- 'Engineering' term implies that systematic and repeatable techniques should be used to guarantee that system requirements are complete, consistent, relevant, etc.

3.How much does requirements engineering cost?

- **(15% of system development costs).**
- **For smaller**, around **10%** of the total budget of the system.
- This depends on the type and size of system being developed and exactly what activities are included under the heading of requirements engineering.

FAQS about requirements

4.What happens when the requirements are wrong?

- There are number of penalties which arise when the system requirements are wrong.
- 1. the system may be delivered late and costs more than originally expected.
- 2. the customer and end-user are not satisfied with the system. They may not use its facilities or may even decide to scrap it altogether.
- 3. the system may be unreliable in use, with regular system errors and crashes disrupting normal operation.
- 4. if the system continuous in use, the costs of maintaining and evolving the system are usually very high.

FAQS about requirements

- 5.What is a requirements engineering process?
- (The structured set of activities involved in developing system requirements).

- **Process activities** include requirements elicitation, requirements analysis and negotiation and requirements validation.
- A **complete process description** should include, what activities are carried out, the structuring or schedule of these activities, who is responsible for each activity, the inputs and outputs to/from the activity and tools used to support requirements engineering.

FAQS about requirements

- 6.Is there an ideal (perfect) requirements engineering process?
- (No - processes must be tailored to organizational needs).
- There is no single process which is right for all organizations.
- Each organization must develop its own process which is appropriate for the type of systems it develops, its organizational culture, and the level of experience and ability of the people involved in requirements engineering.
- To state a good requirements engineering process, organizations need to involve people who are actually involved in requirements engineering.
- 7. What is a requirements document?
- (The formal statement of the system requirements).

FAQS about requirements

- The requirements document is an official statement of the system requirements for customers, end-users, and software developers.
- Depending on the organization, the requirements document may have different names such as the 'functional specification', 'the requirement definition', 'the software requirements specification(SRS)', etc.

8.What are system stakeholders?

- (All people who have an interest in the system under development.).
- System stakeholders are people or organizations who will be affected by the system and who have a direct or indirect influence on the system requirements.

FAQS about requirements

- Include – end-users(final user) of the system, managers and individuals involved in the organizational processes, engineers responsible for the system development and maintenance, customers of the organization who will use the system to provide some services, external bodies such as regulators or certification authorities, etc.
- Example: Automated railway signaling system is to be developed.
- possible stakeholders are:

1. Train company operators responsible for running the signaling system.
2. Train crew (team).
3. Railway managers.

FAQS about requirements

- 4. Passengers.
- 5. Equipment installation and maintenance engineers.
- 6. Safety certification authorities.

9.What is the relationship between requirements and design?.

- Usually a complex relationship between requirements and design.
- Some people (Jackson,1995) suggest that they quite separate activities: requirements are mostly associated with the problem to be solved. Design is associated with the solution to the problem. i.e., requirements engineering is about what has to be done; design is about how it should be done.

FAQS about requirements

- 10. What is requirements management?
- Requirement management is the process of managing changes to the system requirements.
- Requirements for a system always change to reflect the changing needs of system stakeholders, changes in the environment in which the system is to be installed, changes in the business which plans to install the system, changes in laws and regulations, etc.

3.Systems Engineering

- There is a close relationship between software and more general system requirements.

Computer-based systems fall into two broad categories:

- User-configured systems where a purchaser(buyer) puts together a system from existing software products.
  - eg: word processor, a drawing package and a file exchange program are installed on Machines to create a 'writing system'.
- The majority of personal computer systems are of this type.
- Custom systems where a customer produces a set of requirements for hardware/software system and a contractor develops and delivers that system.
  - eg: very small size of embedded systems like, microwave ovens, military messaging systems.

Classes of customer systems

Information systems:

- Primarily concerned with processing information which is held in some kind of database.
- Usually implemented using standard computer hardware(e.g. mainframe computers, workstations, PCs) and are built on top of commercial operating systems.

Embedded systems:

- Systems where software is used as a controller in some broader hardware system.
- They range from simple systems(e.g. in a CD player) to very complex control systems(e.g. in a chemical plant).

Classes of customer systems

Command and control systems:

- Essentially, a combination of information systems and embedded systems where special purpose computers provide information which is collected and stored in a data base and used to help people make decisions.
- These systems usually involve a mix of different types of computer which are networked in same way.
- Within the whole system, there may be several embedded systems and information systems.
- The largest and most complex systems such as air traffic control systems, railway signaling systems, military communication systems, etc.
- Requirements engineering for these systems includes hardware and software specification and a specification of the operational procedures and processes.

Emergent properties

- Emergent properties are properties of the system as a whole and only emerge once all of the individual sub-systems have been integrated.
- Examples of emergent properties for computer-based systems are:
  - Reliability
  - Maintainability
  - Performance
  - Usability
  - Security
  - Safety