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قسم الانظمة الطبية الذكية

المحاضرة الثالثة

Software engineering

المادة : Software engineering
المرحلة : الثالثة
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What is a requirement?

- It may range from a high-level abstract statement of a service that the system should provide or a system constraint to a detailed mathematical functional specification.
- All of the process models for software development include activities aimed at capturing the requirements to understanding what the customer wants and what users expect the system will do.

- **The requirements may be developing to:**
  - Replace an existing manual system.
  - Enhance or extend an existing software system.
  - Develop a new system unrelated to existing systems.

Types of Requirements

User requirements:

1- Statements in natural language (NL) plus diagrams of the services the system provides and its operational constraints.
2- Should describe functional and non-functional requirements so that they understand by system users who do not have detailed technical knowledge.
3- User requirements are defined using NL, tables, and diagrams.
4- Written for customers.
5- ***Requirements readers*** **(*Client managers*, *System end-users* and *System Architects*).**

System requirements:

1- Structured documents setting out detailed description of the system services. Serve as a basis for designing the system.
2- May be used as part of the system contract.
3- System requirements may also be expressed using system models.
4- Written as a contract between client and contractor.
5- ***Requirements readers*** ***(System end-users, System architects and Software developers).***

What is Requirements definition ?

1-A high-level abstract description of requirements.
2-Is a statement, in a natural language (NL) plus diagrams, of what services the system is expected to provide and the constraints under which it must operate.
3-It is generated using customer-supplied information.
4-It should only specify the external behavior of the system; it should not be concerned with system design characteristics.

5- Should be written in such a way that it is understand able by customers without knowledge of specialized notations.

What is Requirements Specification ?

1- A detailed description of what the system should do.
2- It is a statement in a more formal notation which sets out the system services in more details.
3- It is a structured document which is sometimes called a ***functional specification***, should be precise. It may serve as a contract between the system buyer and software developer.
4- It is usually presented with the systems models developed during requirements analysis.
5- It should include all necessary information about what the system must do and all constraints on its operation.
6- It is restates the requirements in technical terms appropriate for the development of the system design.
7- Should be written by the requirements analysts.

Software specification: is an abstract description of the software which is a basis for design and implemented this specification may add further detail to the requirements specification. It is a document for the design team rather than the system customer.

Requirements engineering (RE)

- The process of establishing the services that the customer requires from a system and the constraints under which it operates and is developed.
- The requirements themselves are the descriptions of the system services and constraints that are generated during the requirements engineering process.

The requirements engineering Process

This process is the set of activities that lead to the production of the requirements definition and requirements specification, as shown in Figure **3.1**.

There are four principal stages in this process:

1- Feasibility study

- A feasibility study decides whether or not the proposed system is worthwhile.
- A short focused study that checks:

- If the system contributes to organisational objectives;
- If the system can be engineered using current technology and within budget;
- If the system can be integrated with other systems that are used.

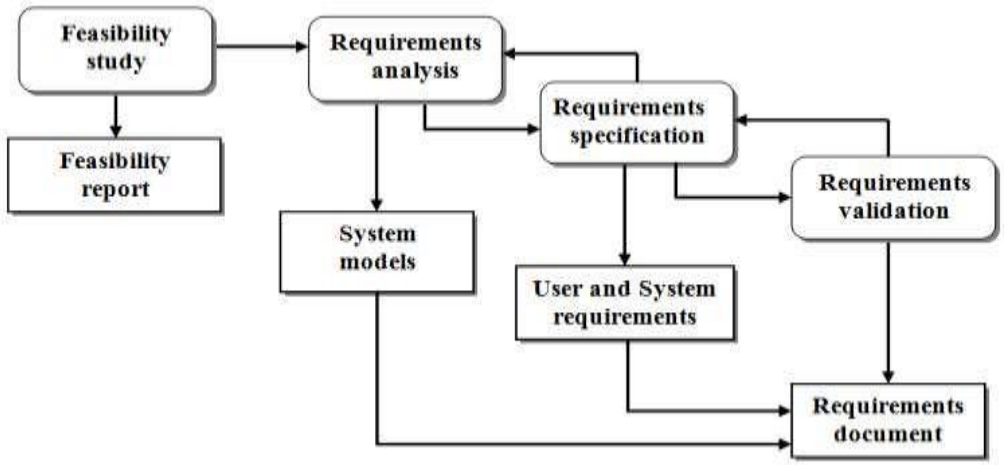

Figure 3.1: The requirements engineering process.

Feasibility study implementation

- Based on information assessment (what is required), information collection and report writing.
- Questions for people in the organisation :
  - What if the system wasn't implemented?
  - What are current process problems?
  - How will the proposed system help?
  - What will be the integration problems?
  - Is new technology needed? What skills?
  - What facilities must be supported by the proposed system?

2- Requirements analysis

- The process of deriving the system requirements through observation of existing systems, discussions with potential users and procures, task analysis and so on.
- Help the analyst understand the system to be specified.
- System prototypes may also be developed to help understand the requirements.
- Involves technical staff working (e.g. end-users, managers, engineers involved in maintenance, domain experts) with customers to find out about the application domain, the services that the system should provide and the system's operational constraints.

3- Requirements specification

- **Definition**
  - Is the activity of translating the information gathered during the analysis activity into a document that defines a set of requirements.
  - These should accurately reflect what the customer wants.
  - This document must be written so that it can be understood by the end-user and the system customer.

➢ Specification

- A detailed and precise description of the system requirements is set out to act as a basis for a contract between client/customer and software developer.
- The creation of this document is usually carried out in parallel with some high-level design.
- During the creation of this document, errors in the requirements definition are discovered. It must be modified to correct these problems.

Note: The requirement analysis continues during definition and specification and new requirements are change and should be placed under control of a configuration management system.

4- Requirements validation

- Concerned with demonstrating that the requirements define the system that the customer really wants.
- Requirements error costs are high so validation is very important (fixing a requirements error after delivery may cost up to 100 times the cost of fixing an implementation error).

Requirements checking

- **Validity Checks:** Does the system provide the functions which best support the customer's needs?
- **Consistency Checks:** Are there any requirements conflicts?
- **Completeness checks:** Are all functions required by the customer included?
- **Realism Checks:** Can the requirements be implemented given available budget and technology?
- **Verifiability Checks:** Can the requirements be checked?

Requirements validation techniques

1- Requirements reviews

- Systematic manual analysis of the requirements.
- Regular reviews should be held while the requirements definition is being formulated.
- Both client and contractor staff should be involved in reviews.
- Reviews may be formal (with completed documents) or informal. Good communications between developers, customers and users can resolve problems at an early stage.

2- Prototyping

- Using an executable model of the system to check requirements.

3- Test-case generation

- Requirements should be testable.

- If a test is difficult or impossible to design, this usually means that the requirement will be difficult to implement and should be reconsidered.

Requirements management

- Requirements management is the process of managing changing requirements during the requirements engineering process and system development.

- Requirements are incomplete and inconsistent:

- New requirements emerge during the process as business needs change and a better understanding of the system is developed;
- Different viewpoints have different requirements and these are often contradictory.

Stable requirements: It is derived from the core activity of the customer organisation (e.g. a hospital will always have doctors, nurses, etc), may be derived from domain models.

Volatile requirements: Requirements which change during development or when the system is in use (e.g. in a hospital, requirements derived from health-care policy).

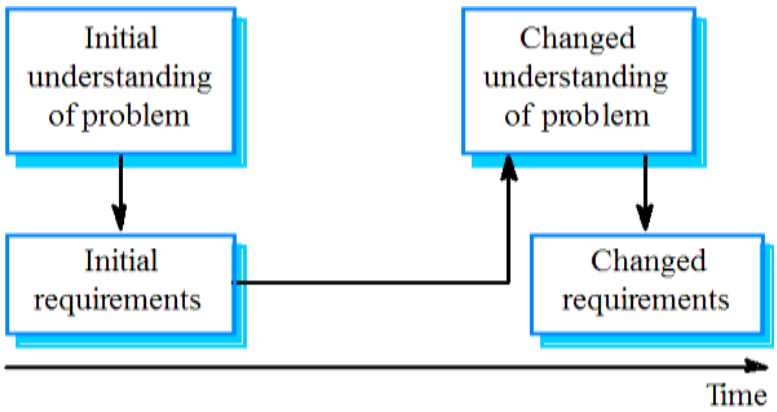

Figure 3.2: The requirements evolution process.

Requirements management planning

- During the requirements engineering process, you have to plan:

- **Requirements identification** (how requirements are individually identified);

- **A change management process** (the process followed when analysing a requirements change);

- **Traceability policies** (the amount of information about requirements relationships that is maintained);

- **CASE tool support** (the tool support required to help manage requirements change).

Requirements change management

- Should apply to all proposed changes to the requirements.

- **Principal stages:**
  1- **Problem analysis** (Discuss requirements problem and propose change);

  2- **Change analysis and costing** (Assess effects of change on otherrequirements);

  3- **Change implementation** (Modify requirements document and otherdocuments to reflect change).

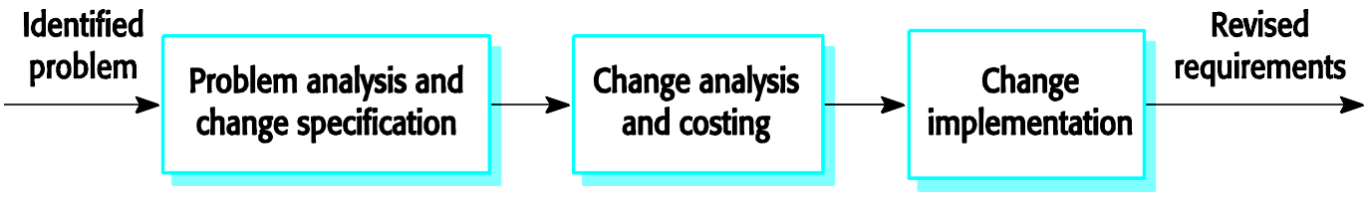

Figure 3.3: The requirements change management.