# REQUIREMENTS ANALYSIS AND SPECIFICATION

## Definitions

**Requirement**  is a condition or a capability needed by the user to solve a problem and to achieve an objective.

**Analysis**  is studying the customer’s and user’s requirements to arrive at a definition of software requirements. The analyst has to understand the problem and its context ie thorough understanding of existing system

**Specification** is the description of each of the essential requirements of the software and the external interface

Requirements analysis is done in order to understand the problem the software system is to solve. The problem could be automating an existing manual process, developing a new automated system, or a combination of the two.

The emphasis in requirements analysis is on identifying *what* is needed from the system, not *how* the system will achieve its goals.

The task is complicated by the fact that they are often atleast two parties involved in software development-a client and a developer. The developer usually do not understand the client’s problem domain, and the client often does not understand the issues involved in software systems. This causes a communication gap which has to be adequately bridged during requirements analysis.

## Types of Requirements

Functional requirement --- A system/software requirement that specifies a function that a system/software system or system/software component must be capable of performing. These are software requirements that define behavior of the system, that is, the fundamental process or transformation that software and hardware components of the system perform on inputs to produce outputs.

For example “*The system must process withdrawals and dispense cash*”

Nonfunctional requirement --- It is a software requirement that describes not what the software will do, but how the software will do it, for example, software performance requirements, software external interface requirements, software design constraints, and software quality attributes.

For example “*The system should be fast and efficient*”

Nonfunctional requirements are difficult to test; therefore, they are usually evaluated subjectively.

## Requirements engineering

The task of capturing, structuring, and accurately representing the user's requirements so that they can be correctly embodied in systems which meet those requirements (i.e. are of good quality).

It focuses on assessing if the system is useful to the business (feasibility study), discovering requirements (elicitation and analysis), converting these requirements into some standard format (specification), and checking that the requirements define the system that the customer wants (validation).

In practice, requirements engineering isn’t sequential process, it’s an iterative process in which activities are interleaved.

Requirements engineering helps software engineers to better understand the problem they will work to solve. It encompasses the set of tasks that lead to an understanding of what the business impact of the software will be, what the customer wants and how end-users will interact with the software.

Requirements engineering is composed of four key activities – feasibility study, requirements elicitation, requirements analysis and negotiation, requirements specification or documentation and requirements validation.

### Requirement engineering Processes

**Feasiblity 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.

It is based on information assessment(what is required), information collection and report writing.

**Requirement elicitation** is the action of discovering system requirements through consultation with stakeholders. Some of the sources of this discovery could be system documents, domain knowledge, and market studies.

Different methods of elicititation are used which include interviews, brainstorming session, Facilitated Application Specification Technique(FAST), Quality Function Deployment(QFD), etc.

*Interviews:* A typical conversational method is interviews. It is most commonly used method in requirements elicitation. An Interview is generally conducted by an experienced analyst, who has some generic knowledge about the application domain as well. In an interview, Analyst discusses the desired product with different stakeholders and develops an understanding of their requirements. Generally Interviews are divided in two groups. [2]

1.       Closed Interview: In this interview the requirements, we have to prepare some predefined questions and try to get the answers for these questions for the stakeholder.

2.       Open-ended Interview: In this interview, we do not need to prepare any predefined questions, and the information from the stakeholders in open discussions.

*Brainstorming sessions:* Futrell et al. (2002, pg. 523) describes brainstorming as “a group technique that may be used during the requirements-gathering process to promote creative thinking. It facilitates defining the problem to be solved by the life cycle activities to follow”.

It has some similarities with workshops and focus groups as in Brainstorming stakeholders are gather together for a short time period but in this short time period they develop a large and broad list of ideas. In this meeting “out -of-the-box” thinking approach is encouraged. The brainstorming involves both idea generation and idea reduction.

Brainstorming for requirements is useful as it generates a large amount of them, even if they are not true or possible to implement. Each generated requirement is recorded and explored, to see if it is actually important. Requirements that are not deemed essential are postponed for a later release or are dropped entirely. Brainstorming can save time by documenting requirements that may be required at a later stage. It also generates requirements that even the stakeholders may not come up with.

*Facilitated Application Specific Techniques (FAST):*

The objective of this method is to bridge the gap between the customer and the developer.

Fast is similar to brainstorming and contains the following tasks:

* Conduct a meeting at a neutral site with developers and stakeholders present
* Ensure adequate preparation of the attendees and encourage participation
* Generate an informal agenda
* Require a facilitator to enable the meeting to run smoothly(The facilitator can either be a customer or a developer)
* Define a method of documentation
* Guarantee attendees will not critique or debate the proposals

At the end of FAST meeting both the customer and the developer will have understood the system well.

### *Quality Function Deployment (QFD):* QFD emphasizes the understanding of what is valuable to the customer and then deploy these values throughout the development process

QFD is “an overall concept that provides a means of translating customer requirements into the appropriate technical requirements for each stage of product development and production”. The distinguishing attribute of QFD is the focus on customer needs throughout all product development activities. By using QFD, organizations can promote teamwork, prioritize action items, define clear objectives, and reduce development time.

Although QFD covers a broad portion of the product development life cycle, the earlier stages of the process are applicable to requirements elicitation for software engineering. These stages include

1. identifying the customer (stakeholders)
2. gathering high-level customer requirements
3. constructing a set of system features that can satisfy customer needs
4. creating a scale to evaluate system features against satisfaction of customer needs(e.g. a 5 point scale 1. V. important 2.Important 3. Less Important 4. Not important 5. Unrealistic )

Note that the evaluation of features and needs could also be used for prioritization of requirements, in the context of a QFD requirements elicitation activity.

**Requirement analysis** is scrutinizing the gathered requirements in order to make consistent and unambiguous requirements. It also involves providing the graphical view of the system using the requirements. This is done by the use of context diagram and Data Flow Diagram(DFD)

**Requirement validation** is the process of reviewing requirements for clarity, consistency and completeness.

Requirements validation is concerned with showing that the requirements actually define the system that the customer 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.

R**equirements management:** Requirements management is the process of managing changing requirements during the requirements engineering process and system development.

Requirements are inevitably 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.