Requirement Analysis

... what the customer requires from a software system ...

Contents

- Provide a justification.
- Specify requirements desired properties.
- Discuss:
  - problems
  - solutions

Requirements

- It is very difficult to formulate a complete and consistent requirements specification
- A requirements definition, a requirements specification and a software specification are ways of specifying software for different types of reader
- The requirements document is a description for customers and developers

Requirements Errors

- Requirements errors are usually very expensive to correct after system delivery
- Reviews involving client and contractor staff are used to validate the system requirements
- Stable requirements are related to core activities of the customer for the software
- Volatile requirements are dependent on the context of use of the system

A Requirement ... ?

- It may range from a high-level abstract statement of a service or of a system constraint to a detailed mathematical functional specification
- This is inevitable as requirements may serve a dual function
  - May be the basis for a bid for a contract - therefore must be open to interpretation
  - May be the basis for the contract itself - therefore must be defined in detail
  - Both these statements may be called requirements

IEEE a Requirement Definition

- A condition of capability needed by the user to solve a problem or achieve an objective
- A condition or capability that must be meet or possessed by a system ... to satisfy a contract, standard, specification, or other formally imposed document

Requirement Analysis

- For large system is the most difficult and intractable activity
- It is an error prone activity
- It is probably the software engineering weakest and critical area
- Requirements analysis produce among others the ***Software Requirements Specification (SRS)***

Requirement Engineering

- The process of establishing the services that the customer requires from a system and the constraints under which it operates and is developed
- Requirements may be functional or non-functional
  - Functional requirements describe system services or functions
  - Non-functional requirements is a constraint on the system or on the development process

Requirements analysis

- Sometimes called requirements elicitation or requirements discovery
- Involves technical staff working with customers to find out about the application domain, the services that the system should provide and the system's operational constraints
- May involve end-users, managers, engineers involved in maintenance, domain experts, trade unions, etc. These are called *stakeholders*

Why so Difficult?

- A project is initiated by clients needs !
- There is no formal document describing the clients needs !
- The document describing clients need is the result of the analysis !

  ↖ ***requirement analyst has to identify the requirements by talking to people !***

Large Systems

- Most large software systems address difficult problems
- Problems which are so complex that they can never be fully understood and where understanding develops during the system development
- Therefore, requirements are normally both incomplete and inconsistent

Why Inconsistency ?

- Large software systems must improve the current situation. It is hard to anticipate the effects that the new system will have on the organization
- Different users have different requirements and priorities. There is a constantly shifting compromise in the requirements
- System end-users and organizations who pay for the system have different requirements
- Prototyping is often required to clarify requirements

Requirement Analysis Problems

- Stakeholders don't know what they really want
- Stakeholders express requirements in their own terms
- Different stakeholders may have conflicting requirements
- Organizational and political factors may influence the system requirements
- The requirements change during the analysis process. New stakeholders may emerge

Requirement Analysis Problems

- Clients usually do not understand software or software development processes
- Developers do not understand clients' problem or application area
- SRS is a medium through which users and clients needs are specified
- A good SRS should satisfy ALL the PARTIES ... which is very hard to achieve ...

Activity

- Requirements analysis aims to specify what some people have in their minds
- The input to this activity is
  - incomplete
  - informal
  - imprecise
  - and may also inconsistent

Product

- The output of the requirement analysis is a set of requirements, hopefully:
  - complete
  - unambiguous
  - consistent
- Requirements analysis produce the ***Software Requirements Specification (SRS)***

SRS

The objective of SRS is to specify what is needed from the system not how the system will provide it!

... unfortunately, how at one level my be what at lower level ...

SRS must give enough detail to allow developers to actually build and test the system

SRS Properties

- An SRS establishes the basis for agreement between the client and the supplier on what the software product will do.
- An SRS provide reference for validation of final product.
- A high-quality SRS is a prerequisite to high quality software.
- A high-quality SRS reduce development costs.

Errors Cost

It had been discovered that in some project 54 % of the errors were detected after unit testing and that 45 % of this errors were actually originated during early stages i.e., 25 % of the error occurs during requirement and early design stages

Phase	*Cost(person-hours)*
Requirements	2
Design	5
Coding	15
Acceptance Test	50
Operation/Maint.	150

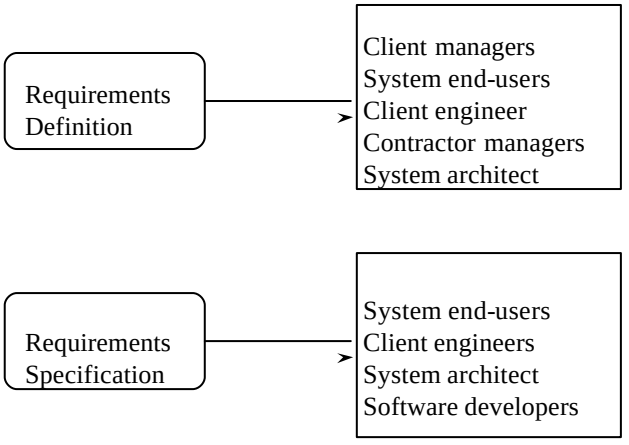
Definition/Specification

- Requirements definition
  - A statement in natural language plus diagrams of the services the system provides and its operational constraints. Written for customers
- Requirements specification
  - A structured document setting out detailed descriptions of the system services. Written as a contract between client and contractor
- Software specification
  - A detailed software description which can serve as a basis for a design or implementation. Written for developers

Definition/Specification

- Requirements definition
  - Customer-Oriented descriptions of the system's functions and constraints on its operation
- Requirements specification
  - Precise and detailed descriptions of the system's functionality and constraints. Intended to communicate what is required to system developers and serve as the basis of a contract for the system development

Requirement Reader



Definition

Definition

- *The software must provide a means of representing and accessing external files created by other tools.*

Specification

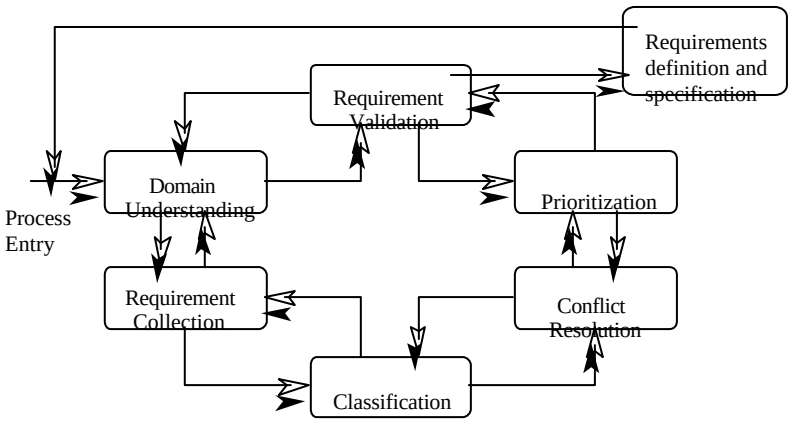
Specification

1.1 *The user should be provided with facility to define the type of external files.*
1.2 *Each external files type may have an associated tool which may be applied to the file*
1.3 *Each external files type may be represented as a specific icon on the user's display.*
1.4 *Facilities should be provided for the icon representing an external file type to be defined by the user*
1.5 *When a user selects an icon representing an external file, the effect of that selection is to apply the tool associated with the external file type to the file represented by the selected icon.*

Requirement Engineering Process

- Feasibility study
  - Find out if the current user needs be satisfied given the available technology and budget?
- Requirements analysis
  - Find out what system stakeholders require from the system
- Requirements definition
  - Define the requirements in a form understandable to the customer
- Requirements specification
  - Define the requirements in detail

Requirement Process



Process Activities

- Domain understanding
- Requirements collection
- Classification
- Conflict resolution
- Prioritization
- Requirements validation

Analysis Issues

- Obtain the needed information ...
  - may be you are not really welcome ... after all knowledge is power ...
- Organize the obtained information ...
  - a huge amount of unstructured information barely ever let you to check consistency ...

Analysis Issues

- Resolving contradictions ...
  - you probably must mediate between

    conflicting requirements or user needs or ...
- Focus on what and avoid to mix requirement and design

Analysis Partition

- Divide et impera: divide the problem into sub problems
- Partition with respect to:
  - objects
  - functions

Objects/Functions

- Objects:
  - entities in the real world with clear, defined boundaries and independent existence (sensors, bill, managers).
- Functions:
  - a task, service, process or activity that is now performed in the real world and it has to be performed by the system.