Lecture 7

Requirement Engineering

Outline

- Why requirements analysis?
- Requirements engineering processes
- Requirements engineering processes
  - Requirements elicitation
  - Requirements analysis
  - Requirements specification
- Requirements change

The Requirement

Software system requirements consist of 3 types:
- Functional requirements
  - Describe what the system should do.
  - These requirements depend on the **software purpose**.
- Non-functional requirements
  - Describe how well the system should do.
  - These requirements are imposed on the system as a constraint.
- Domain requirements
  - Come from the application domain of the system and describe characteristics and constraints of the system.
  - These requirements are imposed on the system as a constraint.

Constraints are limitations on the system, time, money, etc.

Non-functional requirements are often more critical than individual functional requirements.

Non-functional Requirement

The non-functional requirements may come from:
- Required characteristics of the software (product requirements).
  - These requirements specify that the delivered product must behave properly in its environment.
- The organization developing the software (organizational requirements).
  - These requirements are a consequence of the customer's and developer's organizations.
- External factors (external requirements).
  - These requirements are from regulatory standards, general public, or laws.

Non-functional Requirement

Non-functional Requirements

You should avoid writing non-functional requirements quantitatively so that they can be objectively tested.

Property	Measure
Speed	Processed transactions/second User/event response time Screen refresh time
Size	Megabytes/number of ROM chips
Ease of use	Training time Number of help frames
Reliability	Mean time between failure, probability of unavailability Rate of failure occurrence Time to restart after failure
Robustness	Time to restart after failure Percentage of events causing failure Probability of data corruption on failure
Portability	Percentage of target dependent statements Number of target systems

Example Search Engine

User requirements definition:
The IR system shall provide monthly management reports showing the cost of goods sold by each store during that month.

Non-functional requirements definition:
The IR system shall process monthly management reports showing the cost of goods sold by each store during that month.

Example

User requirements definition:
The IR system shall provide monthly management reports showing the cost of goods sold by each store during that month.

Non-functional requirements definition:
The IR system shall process monthly management reports showing the cost of goods sold by each store during that month. Management reports shall be produced in a standard format that is compatible with the company's standard office software and should be available on-line or on printed paper. The reports shall be produced on the company's local area network and should be available to anyone with a valid password.

Requirements Engineering Processes

It is practice, requirements engineering is an iterative process in which the activities are interleaved.

Requirements Elicitation

Requirements elicitation process:
- It combines elements of design and architectural issues but they can be ignored or left open at this stage.
- Eliciting requirements is a difficult process for several reasons:
  - Requirements may be implicit or hidden.
  - Requirements may conflict, without experience in the domain, it is difficult to see how requirements will affect the system.
  - Different stakeholders, with diverse requirements, may express requirements in different ways.
  - Political factors may influence the requirements of a system.
  - The requirements change for business and technical reasons while the system is developed. It inevitably changes during the analysis process.

Requirements Elicitation

- Requirements elicitation process:
  - It involves technical staff working with customers to find out how the system that will meet their requirements should be.
- Eliciting requirements is a difficult process for several reasons:
  - Requirements may be implicit or hidden.
  - Requirements may conflict, without experience in the domain, it is difficult to see how requirements will affect the system.
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Requirements Elicitation

The elicitation and analysis process:

Requirements Elicitation

Two fundamental approaches:
- Traditional approach: Ask people what they do.
- Ethnomethodology approach: Observe people at work and infer what they do from their interactions with the system and each other.

Interviews can be difficult, for two reasons:
- Interviewees may be reluctant to share information with the interviewer, or may be reluctant to participate in the process.
- It is a fundamental trait of work behavior.

Ethnography is a technique that can be used to find effective requirements. Ethnography:
- Observing work participants.
- Observing work participants.
- Relationship: Association, aimed, include and generalization.

Requirements Specification

Requirements specification is the process of writing down the user and system requirements in a standard specification document. User requirements are written using:
- Natural language sentences.
- Forms.
- Tables.
- Mathematical notations, structured notations, or formal specifications.

System requirements are written using:
- Natural language sentences.
- Structured natural language.
- Tables.
- Mathematical specifications (an notations, finite notations, or formal specifications).
- Graphical notations (such as UML or other specifications).

Structured natural language

- Write define one or more standard templates for expressing requirements, with specified fields for different types of information. Information included in a template:
  - The function or entity to which the requirement applies.
  - A description of its inputs and the origin of these inputs.
  - A description of its outputs and the destination of these outputs.
  - Information about the information needed for the computation or other processes that are used in the function or entity.
  - A description of the action to be taken.
  - A description of the pre-condition or the system setting (or what must be true before the function is performed), and post-condition specifying the system state after the function.
  - A description of the side effects, if any of the function.

Example Usecase Template

Name	Name of the use case.
Actors	Actors in the use case.
Description	A description of the use case.
Preconditions	Conditions that must be satisfied before the use case can be initiated.
Postconditions	Conditions that must be satisfied after the use case has been completed.
Flow	Flow of events in the use case.
Exceptions	Exceptional events that may occur during the use case and how they are handled.
Extensions	Other use cases that may be added to this one.
Relationships	Other use cases with which this one interacts.
Activity diagram	Graphical representation of the use case.

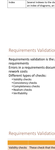
Use Case Diagram

- Show relationships in a use case diagram.
- Show actors and the use cases.
- Show the boundary of the system. They are displayed as ovals.
- Associate actors and use cases in a rectangle. Actors are outside of the system boundary.
- Relationship: Association, aimed, include and generalization.

Use Case Diagram

- Association: Association.
- To communicate or interaction between an actor and a use case.
- Include: Include.
- Indicates that one use case is included in another use case.
- Extend: Extend.
- Indicates that a use case is extended by another use case under specified conditions.
- Generalization: Generalization.
- Indicates an "is a" relationship between two use cases or two actors.

Example Use Case Diagram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