Lecture 5: Software requirements

They describe what the application must do, or the functions expected by a user
- They may be a constraint on the development process or in the application
These descriptions are subject to change as you understand better the user’s needs

Good requirements
- state a need of a user – does the user really need them?
- must be verifiable – can you tested?
- are precise – are the requirements unambiguous?
- are complete – are all needs required by the user included?
- are consistent – do you find any conflicting requirements?
- are realistic – can you really implement them given a budget, technology, staff and expected deadline?
- are traceable – which module implements each requirement?
- are grouped and prioritized – for incremental development

The description usually contains the word “shall”
Good Examples:
- The user shall be able to search for a particular book or library item from all or a selected database
- Every order shall have its own identifier
- Bad example: The system shall be easy to use (how do you test that?)

There are two types of requirements that can be identified from a use case document
- Functional and non-functional requirements

Functional requirements are those that react on some user input
- They are the features or functions implemented by the application that are expected by a user

Non-functional requirements are constraints or restrictions to the product or to developers
The various types of non-functional requirements are shown below (from Sommerville’s textbook)
Examples of non-functional requirements:
- The deliverable documents shall conform to the rules stated in XYZ-201_STD
- The system shall respond in less than 5 seconds for a search operation
- The system shall not disclose any confidential information to any non-managerial user

Problem arises when requirements are not stated precisely
- When they are ambiguous, imprecise, incomplete, contradictory

Use of natural language make cause these problems
- Some statements have different interpretations
- There are different ways to say the same thing
- We tend to mix several requirements into one leading to confusion and inconsistency
- A solution: use a formal mathematical-based language

The functional and non-functional requirements are part of the software requirements document (SRD)
There are SRD templates or forms for describing requirements
- IEEE, DoD, and other institutions
For this class, use the SRD template given in one of the team assignments

Requirements development activities (assume project scope has been defined)
1. Elicitation and analysis
2. Specification
3. Validation
4. Management

Elicitation is about discovering and gathering requirements
There are several elicitation techniques (mentioned in a reading paper assignment)
- Formal and informal interviews are useful techniques
Interviews can be closed (with pre-defined questions) or open (no predefined agenda)
Interviews supplement other information that may exist about the system
Interviews should be open-minded and with the willingness to listen to stakeholders
You should ask meaningful and thoughtful questions about their needs
- Don’t simple ask “What do you want”
Questions that you could ask (from Pressman’s textbook)
- Who will use the application?
• What is the economic benefit of a successful application?
• Can you describe the business environment in which the application will be used?
• What would you characterize “good” output that will be generated by a successful application?
• What problem(s) will this application address?
• Will special performance issues or constraints affect the way the application is approached?

Requirements can be gathered from use cases and scenarios
  - Scenarios are descriptions of how an actor interacts with the use case
  - Scenarios can be main (normal flow in use case template) and abnormal scenarios (alternate flows)
High detailed use cases may expose conflict on requirements
You must validate use cases with the stakeholders
State the status of each requirement
  TBD (to be defined), TBR (to be reviewed), Defined, Approved, Verified, Deleted

Specification consists on documenting the requirements
  - Use a requirements specification template or standard
  - You could use a tool to define, store and maintain the requirements
  - Avoid common mistakes during specification of requirements
    • such as making bad assumptions, writing implementation (specifying a solution) instead of requirements (needs)
    • Specify “good” requirements (described before)

Requirements validation consists in demonstrating that the requirements expected are met
Requirement fixes are expensive
  - It may cost 100 times the cost of fixing an implementation error
Techniques used for requirements validation:
  - Requirements review – use case reviews with users or manual analysis
    Check for the qualities described before using formal or informal reviews
  - Prototyping – check requirements with an executable model of the system
  - Test-case generation – developing test cases to check testability of the requirements
  - Automated consistency analysis – checking their consistency when formal notation is used

Requirements management is the process of managing changing requirements on any phase of software development
  - New requirements always emerge. Some due to business changes
To help the management activity, you must establish a requirements management plan
Plan includes:
  • Requirements Identification – how requirements are individually identified
  • Change management process – process for managing the changes
    Design or follow a change control procedure to guide changes
  • Traceability policies – how requirements are related to other documents
    Source traceability – trace to stakeholder who proposed a requirement
    Requirement traceability – link dependent requirements
    Design traceability – link design document subsection or module to a requirement
    Testing traceability – link test case(s) to a requirement
  • CASE (Computer-Aided Software Engineering) tool support
    Tool that helps manage requirements change