Requirements Engineering

Chapter 4.1-4.2

Based on slides from Software Engineering 9th ed, Sommerville.

Topics

1) How are requirements stated for the customer vs for the developer?

2) What is the difference between functional and non-functional requirements?

Requirements engineering

- The process of establishing:
  - the.. from a system and
  - the.. and is developed.

2 Types of requirement

- **User** requirements
  - High-level description of..
    - Uses English statements and diagrams.
    - May be basis for bidding on a project.

- **System** requirements (functional specification)
  - Document detailing precisely..
    - Often more formal and technical than the user requirements.
    - May be part of a contract for developing system.
User and system requirements

1. The MHC-PMS shall generate monthly management reports showing the cost of drugs prescribed by each clinic during that month.

Exercise: User or System Requirement?

- Classify each requirement for slide-presentation software as a (U)ser, or (S)ystem requirement:
  - As user drags a slide while reordering a slide-deck, other slides move out of way with animation effect lasting 0.25s.
  - System supports reordering slides from a thumbnail view via drag-and-drop.
  - User may animate content onto the slide where it is initially hidden and then appears.
  - Animations for current slide displayed in tree view.
  - Animations may be reordered using up and down arrows at bottom of display window.

Functional and non-functional requirements

- **Functional** requirements
  - Ex: How the system should react to particular inputs and particular situations.
  - May state what the system should not do.

- **Non-functional** requirements
  - Constraints on the system such as timing, development process, or standards compliance.
  - rather than individual features.
**Functional requirements**

- **Functional user requirements:**
  - statements of what the system should do.

- **Functional system requirements:**
  - describe the system services...

- Problems arise when..
  - Ambiguous requirements may be interpreted differently by developers and users:
    - “Police help dog bite victim”
    - “He fed her cat food”
    - “One morning I shot an elephant in my pyjamas”

**Requirements & imprecision**

- Functional requirements for the MHC-PMS
  - A user shall be able to search the appointments lists for all clinics.
  - Each staff member shall be uniquely identified by his or her 8-digit employee number.

- Consider the term ‘search’:
  - **User intention:**
    - search for a patient across all appointments in all clinics.
  - **Developer interpretation:**
    - search for a patient in any one specific clinic.

**Requirements completeness and consistency**

- In principle, requirements should be both complete and consistent.
  - **Complete:**

- **Consistent:**
  
in the requirements.

- Practically impossible to produce a complete and consistent requirements document.

**Non-functional requirements**

- Non-Functional requirements:
  - reliability, response time and storage space.
  - programming language or development method.

- Non-functional requirements may be more critical than functional requirements.
  - If they are not met, the system may be useless.
### Types of nonfunctional requirement

- **Product requirements**
- **Organizational requirements**
- **External requirements**
  - **Efficiency requirements**
  - **Dependability requirements**
  - **Security requirements**
  - **Regulatory requirements**
  - **Ethical requirements**
- **Usability requirements**
- **Performance requirements**
- **Space requirements**
- **Environmental requirements**
- **Operational requirements**
- **Development requirements**
- **Legislative requirements**
- **Accounting requirements**
- **Safety/security requirements**

### Non-functional requirements implementation

- Non-functional requirements may affect.. (rather than single components).
  - Ex: organize system to minimize communication to meet performance requirements.

- A non-functional requirement may..
  - Ex: security needs may dictate numerous features to meet those needs.

### Non-functional requirements in the MHC-PMS

- **MHC-PMS Product requirement**
  - Specify that the delivered product must..
  - e.g. execution speed, reliability, etc.

  "The MHC-PMS shall be available to all clinics during normal working hours (Mon–Fri, 0830–17.30). Downtime within normal working hours shall not exceed five seconds in any one day."

- **MHC-PMS External requirement**
  - From factors external to the system:
    - e.g. ...
      - interoperability requirements, etc.

  "The system shall implement patient privacy provisions as set out by law in HStan-03-2006-priv."
Goals and requirements

- Challenge:
  - Non-functional requirements may be...

- Write non-functional requirements quantitatively:
  - User goal:
    - "The system should be easy to use and organized such that user errors are minimized."
  - Verifiable requirement:
    - "After 4 hours of training, average user error shall be less than 2 per hour."

Domain requirements problems

- Understandability problem
  - Requirements are expressed in...
  - Often hard to understand for software engineers developing the system.

- Implicitness problem
  - Domain specialists understand the area so well that they do not think of...
  - Simplified example:
    - "Use the mouse to click on the icon."

Exercise

- Fill in the following grid with example requirements for a mine-sweeper game on the computer.

<table>
<thead>
<tr>
<th>Functional Requirement</th>
<th>Non-Functional Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Requirement</td>
<td>System Requirement</td>
</tr>
</tbody>
</table>

Metrics for specifying nonfunctional requirements

<table>
<thead>
<tr>
<th>Property</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>User response time</td>
</tr>
<tr>
<td></td>
<td>Screen refresh rate</td>
</tr>
<tr>
<td>Size</td>
<td>Megabytes</td>
</tr>
<tr>
<td>Ease of use</td>
<td></td>
</tr>
<tr>
<td>Reliability</td>
<td>Mean time between failure</td>
</tr>
<tr>
<td></td>
<td>Rate of failure occurrence</td>
</tr>
<tr>
<td>Robustness</td>
<td>Time to restart after failure</td>
</tr>
</tbody>
</table>
Summary

- Requirements define
  - what the system should do and
  - constraints on its operation and implementation.

- Functional requirements:
  - the services that the system must provide.

- Non-functional requirements:
  - constrain the system or development process.
  - Often relate to emergent properties of the system.
  - Apply to the system as a whole.