Embedded Systems Software Engineering

Jarosław Kuchta

Requirements Engineering
Main objectives of requirements engineering

• Determination of project goals:
  – Business goals define the benefits that the customers will reach through project implementation
  – Purpose define the main functions to serve business goals

• Requirements extracting:
  – functional requirements
  – non-functional requirements (data requirements, quality requirements etc.)

• Agreement on rules for product acceptance
Requirements source

• Stakeholders:
  – Customers / management (business goals)
  – End users (functional requirements)
  – Other people (stuff, community)

• Non personal sources:
  – Legislation
  – Formal and informal standards
Main problem - understanding

I know you think you understand what you think I said, but I’m not sure you realize that what you heard is not what I thought...
Requirements extraction

• The realization by shareholders of their needs
• Needs statement
• Transformation of the needs to system requirements.
• Gaining information needed to understand the requirements.
Requirements description

- Text description
- Diagrams
- Mathematical / physical formulas
- Combined description (consistency problem)
- The need for logical organization and relationships requirements - reveals gaps, redundancies and inconsistencies in the requirements
- The requirements of different stakeholders are recorded separately and then merged together
- Requirements must be numbered so that in later phases be able to refer to them.
Auxiliary means

- Prototyping
- Modeling
- Iterative approach
Results

- Valid requirements
- Invalid requirements
- Project scope
Three categories of requirements

• Requirements known and explicitly specified (for a specific project)
• Requirements known by stakeholders, but not specified explicitly (regarded as obvious)
• Requirements not known by stakeholders, but mandatory or desired (by legislation or standards)
System Requirements Specification

1. Introduction
2. Basic Info
3. Functional Requirements
4. Non-functional Requirements
5. Acceptation Criteria
6. References
7. Appendices
Introduction

- Project identification
- Short project description
- Main project goal
- Foundation

*It may be described in a separate document “System Vision”*
Basic Info (1)

• Requirements Sources (stakeholders and other)

• Project Objectives (determined by customers)
  – Business goals (determined by management)
  – Purpose (determined by end users)

Note: Sources and objectives are prioritized
Basic Info(2)

• System Context
  – Users (roles)
  – External Systems

• Infrastructure conception (for complex systems)
  – Subsystems
  – Components
Functional Requirements

• System function detailed description
• Requirements organization (by users / by components)
• Requirement properties:
  – text description
  – applies to (which user / external system)
  – source of the requirement
  – priority
Non-functional Requirements

• Data Requirements
• Quality Requirements
• Other Requirements
Data Requirements

• Main data concepts
• Data terms explanation
• Source of explanation
• Priority
Quality Requirements

• Reliability (safety, security, error tolerance)
• Performance (execution efficiency, interaction efficiency)
• Flexibility (portability, stability, scalability)
• Usability (learnability, understandability, operability)

Note: Quality requirements should be precisely determined (quantified)
Other Requirements

• Extraordinary situations (exceptional situations, critical situations, failover situations)
• Hardware configuration requirements
• Software configuration requirements
• Extra requirements
Acceptation criteria

• Tests
• Trial time
• Maintenance
• Specific constraints
References

- “System Vision” document
- Technical documentation
- Articles
- Standards
- Existing source code
- ...

References
Appendices

• Glossary (may be in separate document)
• Tabular data
• Diagrams
• ...
SRS purpose

- Basis for estimating and planning
- Functional requirements ➔ use cases modeling
- Data requirement + glossary ➔ class modeling
- Quality requirements, hardware/software configuration ➔ design decisions
- Acceptance criteria ➔ test design
Bibliography

• Roger S. Pressman: Software Engineering. A Practitioner's Approach (book, PDF)
• USA Department of Defense: Systems Engineering Fundamentals (PDF)
• Klaus Pohl, Chris Rupp: Requirements Engineering Fundamentals (book)
• IREB (International Requirements Engineering Board) Downloads