

SE-210

Software System Requirements

I. Introduction

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Week 2 Class 1



Course Objectives

- Introduces process, methods and tools related to the software requirements engineering area.
- Topics:
 - Requirements elicitation
 - Requirements analysis
 - Requirements specification
 - Requirements validation
 - Requirements management
 - Case studies
 - Software engineering tools, such as RequisitePro, Rational Rose and Visio.

Course Work

- Homework assignments
 - There will be at least two assignments
- Midterm
 - Two midterms
- Final exam
- Group project
 - A software requirements specification
 - Team of at least three

Grading (Tentative)

- Quiz 08%
- Assignment 08%
- Midterm 24%
- Final exam 50%
- Group project 10%

Textbook

- Gerald Kotonya and Ian Sommerville, *Requirements Engineering: Processes and Techniques*, John Wiley & Sons.
- Geri Schneider and Jason Winters, *Applying Use Cases: A Practical Guide*, Second Edition, Addison-Wesley.

Chapter 1 Overview

- To introduce the notion of system requirements and the requirements engineering process.
- To explain how requirements engineering fits into a broader system engineering process
- To explain the importance of the requirements document

System requirements

- Define what the system is required to do and the constraints under which
- Example
 - The system shall allow users to search for an item by title, author, or by ISBN.
 - The system's user interface shall be implemented using a World-Wide-Web browser.
 - The system shall support at least 20 transactions per second.
 - The system facilities which are available to public users shall be demonstrable in 10 minutes or less.

The requirements define the services that the system should provide and they set out constraints on the system's operations

Types of requirements

- Very general requirements which set out in broad terms what the system should do.
- Functional requirements which define part of the system's functionality.
- Implementation requirements which state how the system must be implemented.
- Performance requirements which specify a minimum acceptable performance for the system.
- Usability requirements which specify the maximum acceptable time to demonstrate the use of the system.

Requirements problems

- The requirements don't reflect the real needs of the customer for the system.
- Requirements are inconsistent and/or incomplete.
- It is expensive to make changes to requirements after they have been agreed.
- There are misunderstandings between customers, those developing the system requirements and software engineers developing or maintaining the system.

Example

- The system shall Allow user to search an item by title, author or ISBN
- The problems of writing Req. are universal and there will never be a complete solution to these problems.

Week 2 Class 2



FAQS about requirements

- What are requirements?
 - A statement of a system service or constraint
- What is requirements engineering?
 - The processes involved in developing system requirements
- How much does requirements engineering cost?
 - About 15% of system development costs
- What is a requirements engineering process?
 - The structured set of activities involved in developing system requirements

FAQs contd.

- What happens when the requirements are wrong?
 - Systems are late, unreliable and don't meet customers needs
- Is there an ideal requirements engineering process?
 - No - processes must be tailored to organisational needs
- What is a requirements document?
 - The formal statement of the system requirements
- What are system stakeholders?
 - Anyone affected in some way by the system

FAQs contd.

- What is the relationship between requirements and design?
 - Requirements and design are interleaved. They should, ideally, be separate processes but in practice this is impossible
- What is requirements management?
 - The processes involved in managing changes to requirements

What is RE?

- It covers the following activities:
 - Discovering
 - Documenting
 - Maintaining

Set of Req. for a CBIS.

How much it cost?

- According to surveys
 - 10 – 15% of the total development cost.

Systems engineering

- There is a close relationship between software and more general system requirements
- Computer-based systems fall into two broad categories:
 - User-configured systems where a purchaser puts together a system from existing software products
 - Custom systems where a customer produces a set of requirements for hardware/software system and a contractor develops and delivers that system

Classes of custom systems

- Information systems
 - Primarily concerned with processing information which is held in some database.
- Embedded systems
 - Systems where software is used as a controller in some broader hardware system
- Command and control systems
 - Essentially, a combination of information systems and embedded systems where special purpose computers provide information which is collected and stored and used to make decisions

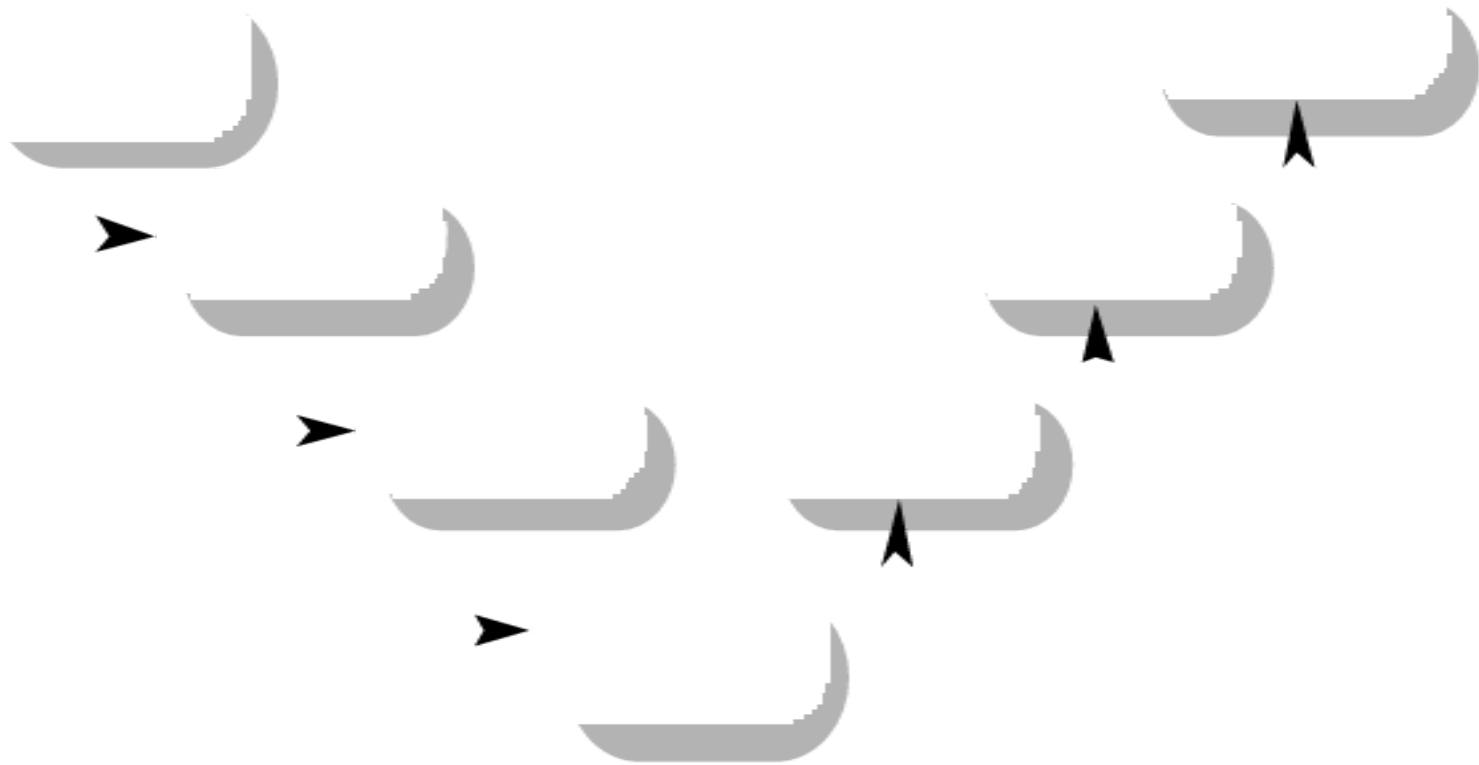
Emergent properties

- Emergent properties are properties of the system as a whole and only emerge once all of its individual sub-systems have been integrated
- Examples of emergent properties
 - Reliability
 - Maintainability
 - Performance
 - Usability
 - Security
 - Safety

Week 2 Class 3



The systems engineering process



System engineering activities

- System requirements engineering
 - The requirements for the system as a whole are established and written to be understandable to all stakeholders
- Architectural design
 - The system is decomposed into sub-systems
- Requirements partitioning
 - Requirements are allocated to these sub-systems
- Software requirements engineering
 - More detailed system requirements are derived for the system software

System engineering activities

- Sub-system development
 - The hardware and software sub-systems are designed and implemented in parallel.
- System integration
 - The hardware and software sub-systems are put together to make up the system.
- System validation
 - The system is validated against its requirements.

Requirements document

- The requirements document is a formal document used to communicate the requirements to customers, engineers and managers.
- The requirements document describes:
 - The services and functions which the system should provide
 - The constraints under which the system must operate
 - Overall properties of the system i.e.. constraints on the system's emergent properties
 - Definitions of other systems which the system must integrate with.
 - Info. about the application domain (How to carry out specific task/computation).
 - Constraints on the process.

Users of requirements documents

- System customers
 - specify the requirements and read them to check they meet their needs
- Project managers
 - Use the requirements document to plan a bid for system and to plan the system development process
- System engineers
 - Use the requirements to understand the system being developed
- System test engineers
 - Use the requirements to develop validation tests for the system
- System maintenance engineers
 - Use the requirements to help understand the system

Requirements document structure

- IEEE/ANSI 830-1993 standard proposes a structure for software requirements documents

1. Introduction

1.1 Purpose of requirements document

1.2 Scope of the product

1.3 Definitions, acronyms and abbreviations

1.4 References

1.5 Overview of the remainder of the document

Requirements document structure

2. General description

2.1 Product perspective

2.2 Product functions

2.3 User characteristics

2.4 General constraints

2.5 Assumptions and dependencies

3. Specific requirements

Covering functional, non-functional and interface requirements.

4. Appendices

5. Index

Adapting the standard

- The IEEE standard is a generic standard which is intended apply to a wide range of requirements documents.
- In general, not all parts of the standard are required for all requirements documents
- Each organisation should adapt the standard depending on the type of systems it develops

Adapting the standard (cont...)

- The following appendices may be included where appropriate:
 - Hardware interface specification
 - Software components which must be reused in the system implementation
 - Data structure specification
 - Data-flow models of the software system
 - Detailed object models of the software system
- Index

Writing essentials

- Requirements are read more often than they are written. You should invest time to write readable and understandable requirements
- Do not assume that all readers of the requirements have the same background and use the same terminology as you
- Allow time for review, revision and re-drafting of the requirements document

Writing guidelines

- Define standard templates for describing requirements
- Use language simply consistently and concisely
- Use diagrams appropriately
- Supplement natural language with other description of requirements
- Specify requirements quantitatively