The hardest single part of building a software system is deciding precisely what to build. No other part of the conceptual work is as difficult as establishing the detailed technical requirements, including all the interfaces to people, to machines, and to other software systems. No part of the work so cripples the resulting system if done wrong. No other part is more difficult to rectify later. (Brooks, 1987)

Requirements Engineering 2009

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Introduction

• What we should learn in this course about RE
  – The role of requirements in software development
  – The system – development view and the user view, and their intersection
  – How to collect, report and manage requirements
  – What is the state-of-art of RE research
  – Users’ point of view and developers’ pov
Organization

• The course contains
  – Working in group of 3 – 4 people
  – Reviewing the work of others and giving feedback
  – Surveying literature
  – Presenting in seminars
  – Becoming an RE expert
  – Understanding that there is no single right way
Contents

• 2 projects 50%
  – A - Literature survey on a given RE topic
  – B - Requirements specification for a given system
• Presentation of A, compulsory, 10%
• Home weekly X tasks, 24%
  – Incl. feedback on B of some other group, 5%
• Final exam – very hard!, but only 16%! 
Lectures

• Not really lectures as you know
• Seminars with presentations and discussion
• Schedule will be available soon online:
  – Subscribe to the RSS feed
Demos

- Tuesday and Thursday, 10-12, B181
- Demo teacher: Minnamari Naumanen
- Home tasks need to be delivered BEFORE the demo, in order to get points
- X task are compulsory
Key aspects of successful sw development

• What are they?
Key aspects of successful sw development

• What are they?

• Resources

• User input and involvement

• Effective management and support

• **Clearly defined, complete requirements**
  – Numerous sw engineering studies show this repeatedly
Project Success Factors

1. User Involvement 15.9%
2. Executive Management Support 13.9%
3. Clear Statement of Requirements 13.0%
4. Proper Planning 9.6%
5. Realistic Expectations 8.2%
6. Smaller Project Milestones 7.7%
7. Competent Staff 7.2%
8. Ownership 5.3%
9. Clear Vision & Objectives 2.9%
10. Hard-Working, Focused Staff 2.4%
11. Other 13.9%
Other factors and risks

- Lack of commitment – management and user
- Misunderstanding requirements
- End user expectations
- Scope change, new technology
- Expertise
- Requirements froze/change
- Low method use
How Projects Really Work (version 1.5)

How the customer explained it
How the project leader understood it
How the analyst designed it
How the programmer wrote it
What the beta testers received
How the business consultant described it
How the project was documented
What operations installed
How the customer was billed
How it was supported
What marketing advertised
What the customer really needed
How Projects Really Work (version 2.0)

1. How the customer explained it
2. How the project leader understood it
3. How the analyst designed it
4. How the programmer wrote it
5. What the beta testers received
6. How the business consultant described it
7. How the project was documented
8. What operations installed
9. How the customer was billed
10. How it was supported
11. What marketing advertised
12. When it was delivered
13. What the customer really needed
14. What the digg effect can do to your site
15. The disaster recover plan

Create your own cartoon at www.projectcartoon.com
Requirements engineering

• Is one of the toughest parts in development
  – Everybody knows requirements are important
  – Few know how to do it right – 75% of companies surveyed in 1996 had some problems related to RE

• If we do not agree what to build, how do we build?
  – Analogy with building a house
Why to RE

- We try to separate problem from the design and from the solution
- We need to establish benchmarks, metrics, and views about the problem to select the right approach

- But if we desing something, that something will affect us => and maybe the problem too
So let’s ask again, why RE?

• To minimize costs
  – Software is everywhere, a major part of many small (microwave) and big (airliner) systems
  – Serious consequences of failures
  – Rework/fixing costs – 50 x the price of fix during the requirements specification
  – Costs, costs, costs...

• To build systems that have purpose, value
What are they then?

• Requirements are some simplification and approximation of the problem
  – The solution, if matching the requirements, then fullfills the problem to a certain degree

• Engineering of requirements
  – Systematic transformation of customers needs into complete, consistent, precise, verifiable, formal, ...., ...., specifications
The Standard definition IEEE 610:1990

• (1) A condition or capacity needed by a user to solve a problem or achieve an objective.

• (2) A condition or capability that must be met or possessed by a system or system component to satisfy a contract, standard, specification, or other formally imposed documents.

• (3) A documented representation of a condition or capability as in (1) or (2).
Types of requirements

• User-requirements
  – What services will be provided? What goals can be solved? What are the limitations?

• System requirements
  – Detailed, specific requirements on functions, services, limitations of the implementation
Example: IEEE 830:1993

• Introduction (Section 1 of the SRS)
  – Purpose (1.1 of the SRS)
  – Scope (1.2 of the SRS)
  – Definitions, acronyms, and abbreviations (1.3 of the SRS)
  – References (1.4 of the SRS)
  – Overview (1.5 of the SRS)

• Overall description (Section 2 of the SRS)
  – Product perspective (2.1 of the SRS)
  – Product functions (2.2 of the SRS)
  – User characteristics (2.3 of the SRS)
  – Constraints (2.4 of the SRS)
  – Assumptions and dependencies (2.5 of the SRS)
  – Apportioning of requirements (2.6 of the SRS)

• Specific requirements (Section 3 of the SRS)
  – External interfaces
  – Functions
  – Performance requirements
  – Logical database requirements
  – Design constraints
  – Software system attributes
  – Organizing the specific requirements
  – Additional comments

IEEE Recommended Practice for Software Requirements Specifications
Requirements should be:

- Written in way that whole development can be based on them – developers understand. “Could I design and implement the system based on this document?”
- Customers and users understand
  - But what do these mean in practice?
- IEEE: Correct, Unambiguous (Specific), Complete, Consistent, Verifiable, Modifiable, Traceable
<table>
<thead>
<tr>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>The system should be fast and easy-to-use.</td>
</tr>
<tr>
<td>There should be no more than 2 bugs in each unit.</td>
</tr>
<tr>
<td>User should be able to complete the transaction in less than 20 seconds.</td>
</tr>
<tr>
<td>At least 80% of users complete 95% of transactions in less than 20 seconds</td>
</tr>
<tr>
<td>First time users and users with low experience complete ... without an error and their user experience will be ...</td>
</tr>
</tbody>
</table>
Existing system knowledge
Stakeholders, users
Organization(s)
Regulation & Law
Application domain knowledge

Requirements Engineering Process

Requirements
Specifications
Models

Kotonya and Sommerville, 2002
Examples of inputs

The systems works with MySQL v. abc – xyz and all browsers supporting JavaScript.

The user can view all previous orders.

The organization is using Windows Exchange and the new system will be compatible with it.

The materials will be processed in a way compatible with the Environmental Protection Act (86/2000)

Each item will have a unique id, books will have a 10 digit ISBN.

- Existing system knowledge
- Stakeholders, users
- Organization(s)
- Regulation & Law
- Application domain knowledge
Requirements Engineering

- Requirements Development
  - Elicitation
  - Analysis
  - Documentation
- Requirements Management
  - Validation

Nikula, 2004, p. 28