



Lecture 4: Requirements Engineering

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In week 1, on the SE part of this course . . .

- Objectives, motivation and structure of the Inf2C-SE course
- Why is Software Engineering still hard?
- Software engineering activities
- Brief history of SE
- Software project vs software product engineering
- Software development processes: plan-driven and agile

This lecture

- Requirements engineering
 - What is a requirement?
 - Kinds of requirements
 - Requirements vs. design
 - The concept of a stakeholder
 - Sub-activities of requirements engineering

What is a software requirement?

A **software requirement** is “a property that must be exhibited by something in order to solve some problem in the real world” (From SWEBOOK V3, Ch1)

Requirements reflect the needs of different people at various levels of the organisation.

Requirements engineering is often used to describe the systematic handling of requirements

Kinds of requirements

Functional requirements (services): What the system should do.

Non-functional requirements (constraints or quality requirements.):
How it should be: how fast it should be; how seldom it should fail;
what standards it should conform to; how easy it is to use; etc.

Informally called '*ilities*' because may refer to efficiency, security, portability, usability etc.

Kinds of requirements

Non-functional requirements may be more important than functional requirements!

- Can be workarounds for functional requirements
- User experience often shaped by non-functional requirements

Distinction not always clear-cut

- Security might initially be a non-functional requirement, but, when requirements refined, it might result in addition of authorisation functionality

Requirements vs design

Requirements try to avoid design,

- expressing **what** is desired,
- not **how** what is desired should be realised

Stakeholders in requirements

Requirements are usually relevant to multiple **stakeholders**.

Stakeholders are “any person or group who will be affected by the system, directly or indirectly”.

(from Sommerville “Software Engineering” chapter 4).

Stakeholders in requirements

Requirements are usually relevant to multiple stakeholders:

- End users
- Customers paying for software
- Government regulators
- System architects
- Software developers
- Software testers
- ...

Exercise (1)

Go to **wooclap.com** and use the code **UFMBHT**

What kind of requirements are each of these, and why? ...

- 1) Non-functional, because it is about privacy; 2) Non-functional, because it is about security
- 1) Functional, because it is about what the system shall do; 2) Non-functional, because it is a constraint on the system
- 1) Non-functional, because it is about privacy; 2) Functional, because it is about specific functionality
- 1) Functional, because it says what the system shall do; 2) Also functional, out of the same reasons

Click on the projected screen to start the question

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Exercise (2)

Go to **wooclap.com** and use the code **UFMBHT**

Who do you think the stakeholders of an online travel booking system could

Option	Stakeholders	Percentage	Count
1	Environmental charities, road an ...	0%	0
2	Investors, the tourism board, tourism ...	0%	0
3	Travellers, travel agencies, airlines, ...	0%	0
4	The developers, testers and other ...	0%	0
5	2 and 3	0%	0

Click on the projected screen to start the question

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Requirements engineering activities

- Gathering (*elicitation*)
- Sorting out (*analysis*)
- Writing down (*specification*)
- Checking (*validation*)

Activities often overlapping, not in strict sequence, and iterated.

Several approaches possible for each activity. Choice is very dependent on nature of software developed and overall software development process.

Requirements engineering is critical

- Faulty requirement processes can have huge knock-on consequences in later software process activities.
 - It is the **major source of project failure** according to Standish CHAOS reports.
- One motivation for incremental nature of Agile processes.

Requirements elicitation sources

- **Goals:** high-level objectives of software
- **Domain Knowledge:** Essential for understanding requirements
- **Stakeholders:** Vital, but they may find expressing requirements difficult
- **Business rules:** E.g. Uni regulations for course registration
- **Operational Environment:** E.g. concerning timing and performance
- **Organisational Environment:** How does software fit with existing practices?

(From SWEBOOK V3, Ch1)

Requirements elicitation techniques

Techniques include:

- Interviews
- Scenarios
- Prototypes
- Facilitated meetings
- Observation

Requirements elicitation: interviews

Traditional method: ask them what they want, or currently do

Can be challenging:

- Jargon confusing
- Interviewees omit information obvious to them

Important to

- be open minded: requirements may differ from those pre-conceived,
- prepare starting questions, e.g. from first-cut proposal for requirements.
Helps to focus dialogue

Requirements elicitation: scenarios

Scenarios are typical possible interactions with the system

- Provide a context or framework for questions.
- Allow "what if" or "how would you do this" questions.
- Easy for stakeholders to relate to
- Can be captured as **user stories** and **use cases**

Requirements elicitation: prototypes

Can include

- screen mock-ups
- storyboards
- early versions of systems

Like scenarios, but more “real”. High quality feedback. Often help to resolve ambiguities.

Requirements elicitation: facilitated meetings

Get discussion going with multiple stakeholders in a structured manner, to refine requirements

Help with:

- Requirements that are not about individual activities
- Surfacing / resolving conflicts

Need a trained facilitator.

Requirements elicitation: observation

Suitable if replacing existing system or business process

- Nuances can make or break a software product

Immersive method. Expensive.

Helps with:

- Surfacing complex / subtle tasks and processes
- Finding the nuances that people never tell you

Not so good if innovating

- Consider 15 years ago capturing requirements for a touchscreen smartphone

Requirements analysis

Requirements elicitation often produces a set of requirements that

- contains *conflicts* (e.g., one stakeholder wants one-click access to data, another requires password protection)
- is *too large* for all requirements to be implemented.

Requirements analysis is the process of getting to a single *consistent* set of requirements, *classified* and *prioritised* usefully, that will *actually* be implemented.

Requirements specification

Requirements can be recorded in various ways, perhaps using:

- very informal means e.g. handwritten cards in user stories in agile development
- a document written in careful structured English, e.g.
 - 3.1.4.4 The system shall... *for an essential feature*
 - 3.1.4.5 The system should... *for a desirable feature*
- use case models with supporting text
- a formal specification in a mathematically-based language.

Requirements validation

Checks include:

- **Consistency checks**
- **Completeness checks**
- **Realism checks:**
 - can requirements be met using time and money budgets?
- **Verifiability:**
 - is it possible to test that each requirement is met?
 - Applies to both functional and non-functional requirements.
 - Non-functional requirements must be measurable.

*Response time must be under 1 sec,
not Performance must be good.*

Exercise (3)

Go to **wooclap.com** and use the code **UFMBHT**

Your company is tasked by a university with developing a specialised system

- 1 Interviews (also asking for scenarios), observation 0% 0
- 2 Prototypes and interviews asking for scenarios 0% 0
- 3 Observation, prototypes 0% 0
- 4 Facilitated meetings with the whole team 0% 0

Click on the projected screen to start the question

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Exercise (4)

Go to **wooclap.com** and use the code **UFMBHT**

What do you think will help her to write a more or less formal

Copy participation link

- 1 The type of software development process: plan-driven or agile 0% 0
- 2 Whether the software is high or low criticality 0% 0
- 3 The speed with which you need to release a version of the system: having a long time to deliver a large release or quick small releases. 0% 0
- 4 All of the above 0% 0

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Resources

- SWEBOOK V3, Chapter 1, Software Requirements.
- Sommerville SE, Part 1 chapter on Requirements Engineering.
- Browse for definitions of different non-functional requirements. You may want to start from Wikipedia.