Object-Oriented Software Engineering

Practical Software Development using UML and Java

T. Lethbridge and R. Laganière

Chapter 4:

Developing Requirements

4.1 Domain Analysis

The process by which a software engineer learns about the domain to better understand the problem:

- The *domain* is the general field of business or technology in which the clients will use the software
- A *domain expert* is a person who has a deep knowledge of the domain

Benefits of performing domain analysis:

- Faster development
- Better system
- Anticipation of extensions

Typical Domain Analysis document

A. Introduction
B. Glossary
C. General knowledge about the domain
D. Customers and users
E. The environment
F. Tasks and procedures currently performed
G. Competing software
H. Similarities to other domains

4.3 Defining the Problem and the Scope

A problem can be expressed as:

- A *difficulty* the users or customers are facing,
- Or as an *opportunity* (e.g., new functionality) that will result in some benefit such as improved productivity or sales.

The solution to the problem normally will entail developing software

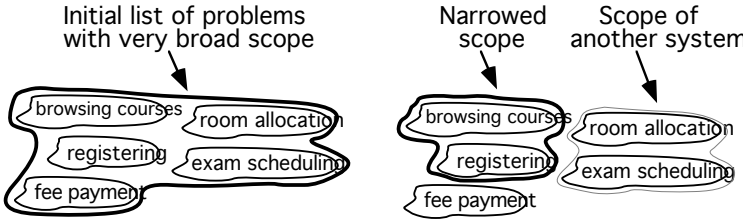
A good problem statement is short and succinct

Defining the Scope

Narrow the *scope* by defining a more precise problem

- List all the things you might imagine the system doing
  - —Exclude some of these things if too broad
  - —Determine high-level goals if too narrow

Example: A university registration system



4.4 What is a Requirement

Requirement: A statement about the proposed system that all stakeholders agree must be made true in order for the customer's problem to be adequately solved.

- Short and concise piece of information
- Says something about the system
- All the stakeholders have agreed that it is valid
- It helps solve the customer's problem

A collection of requirements is a *requirements document*.

4.5 Types of Requirements

Functional requirements

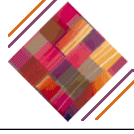
- Describe *what* the system should do

Non-functional requirements

- C*onstraints* that must be adhered to during development

Functional requirements

- What *inputs* the system should accept
- What *outputs* the system should produce
- What data the system should *store* that other systems might use
- What *computations* the system should perform
- The *timing and synchronization* of the above



Non-functional requirements

All must be verifiable

Three main types

1. Categories reflecting: usability, efficiency, reliability, maintainability and reusability
   - —Response time
   - —Throughput
   - —Resource usage
   - —Reliability
   - —Availability
   - —Recovery from failure
   - —Allowances for maintainability and enhancement
   - —Allowances for reusability

Non-functional requirements

2. Categories constraining the *environment and technology* of the system.
   - —Platform
   - —Technology to be used

3. Categories constraining the *project plan and development methods*
   - —Development process (methodology) to be used
   - —Cost and delivery date
     - Often put in contract or project plan instead

4.7 Types of Requirements Document

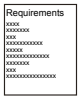
Two extremes:

An informal outline of the requirements using a few paragraphs or simple diagrams

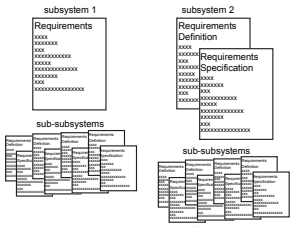
requirements *definition*

A long list of specifications that contain thousands of pages of intricate detail

requirements *specification*



- Requirements documents for large systems are normally arranged in a hierarchy



Level of detail required in a requirements document

- How much detail should be provided depends on:
  - —The size of the system
  - —The need to interface to other systems
  - —The readership
  - —The stage in requirements gathering
  - —The level of experience with the domain and the technology
  - —The cost that would be incurred if the requirements were faulty

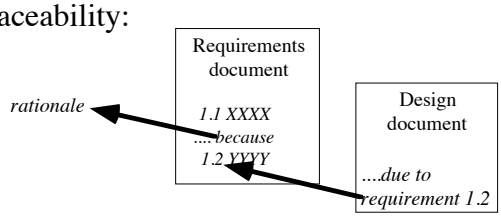
4.8 Reviewing Requirements

- **Each individual requirement should**
  - —Have **benefits that outweigh the costs** of development
  - —Be **important** for the solution of the current problem
  - —Be expressed using a **clear and consistent notation**
  - —Be **unambiguous**
  - —Be **logically consistent**
  - —Lead to a system of **sufficient quality**
  - —Be **realistic** with available resources
  - —Be **verifiable**
  - —Be uniquely **identifiable**
  - —**Does not over-constrain the design** of the system

Requirements documents...

- The document should be:
  - —sufficiently complete
  - —well organized
  - —clear
  - —agreed to by all the stakeholders

- Traceability:



Typical Requirements document...

A. Problem
B. Background information
C. Environment and system models
D. Functional Requirements
E. Non-functional requirements

4.9 Managing Changing Requirements

Requirements change because:
- Business process changes
- Technology changes
- The problem becomes better understood

Requirements analysis never stops
- Continue to interact with the clients and users
- The benefits of changes must outweigh the costs.
  - —Certain small changes (e.g. look and feel of the UI) are usually quick and easy to make at relatively little cost.
  - —Larger-scale changes have to be carefully assessed
    - Forcing unexpected changes into a partially built system will probably result in a poor design and late delivery
- Some changes are enhancements in disguise
  - —Avoid making the system *bigger*, only make it *better*

4.13 Difficulties and Risks in Domain and Requirements Analysis

- Lack of understanding of the domain or the real problem
  - —*Do domain analysis and prototyping*
- Requirements change rapidly
  - —*Perform incremental development, build flexibility into the design, do regular reviews*
- Attempting to do too much
  - —*Document the problem boundaries at an early stage, carefully estimate the time*
- It may be hard to reconcile conflicting sets of requirements
  - —*Brainstorming, JAD sessions, competing prototypes*
- It is hard to state requirements precisely
  - —*Break requirements down into simple sentences and review them carefully, look for potential ambiguity, make early prototypes*

Extra material from Chapter 4:
Developing Requirements

4.6 Some Techniques for Gathering and Analysing Requirements

Observation

- Read documents and discuss requirements with users
- Shadowing important potential users as they do their work
  - —ask the user to explain everything he or she is doing
- Session videotaping

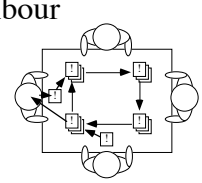
Interviewing

- Conduct a series of interviews
  - —Ask about specific details
  - —Ask about the stakeholder's vision for the future
  - —Ask if they have alternative ideas
  - —Ask for other sources of information
  - —Ask them to draw diagrams

Gathering and Analysing Requirements...

Brainstorming

- Appoint an experienced moderator
- Arrange the attendees around a table
- Decide on a 'trigger question'
- Ask each participant to write an answer and pass the paper to its neighbour



Joint Application Development (JAD) is a technique based on intensive brainstorming sessions

Gathering and Analysing Requirements...

Prototyping

- The simplest kind: *paper prototype*.
  - —a set of pictures of the system that are shown to users in sequence to explain what would happen
- The most common: a mock-up of the system's UI
  - —Written in a rapid prototyping language
  - —Does *not* normally perform any computations, access any databases or interact with any other systems
  - —May prototype a particular aspect of the system

Gathering and Analysing Requirements...

Informal use case analysis

- Determine the classes of users that will use the facilities of this system (actors)
- Determine the tasks that each actor will need to do with the system

More on use cases in the next lectures!