Requirements Analysis (Week 4)

Some content adapted from Rajib Mall’s book and Craig Larman’s book.

Requirements Phase

- Many projects fail:
  - Because they start implementing the system.
  - Without determining whether they are building what the customer really wants.

Why Requirements analysis and specification?

- Factors that cause projects to fail:
  - Lack of User Input 12.8%
  - Incomplete Requirements & Specifications 12.3%
  - Changing Requirements & Specifications 11.8%
  - Lack of Executive Support 7.5%
  - Technology Incompetence 7.0%
  - Lack of Resources 6.4%
  - Unrealistic Expectations 5.9%
  - Unclear Objectives 5.3%
  - Unrealistic Time Frames 4.3%
  - New Technology 3.7%
  - Other 23.0%

- Standish Group, *The Standish Group Report: Chaos*, 1995, http://www.scs.carleton.ca/~beau/PM/Standish-Report.html

Domain Analysis

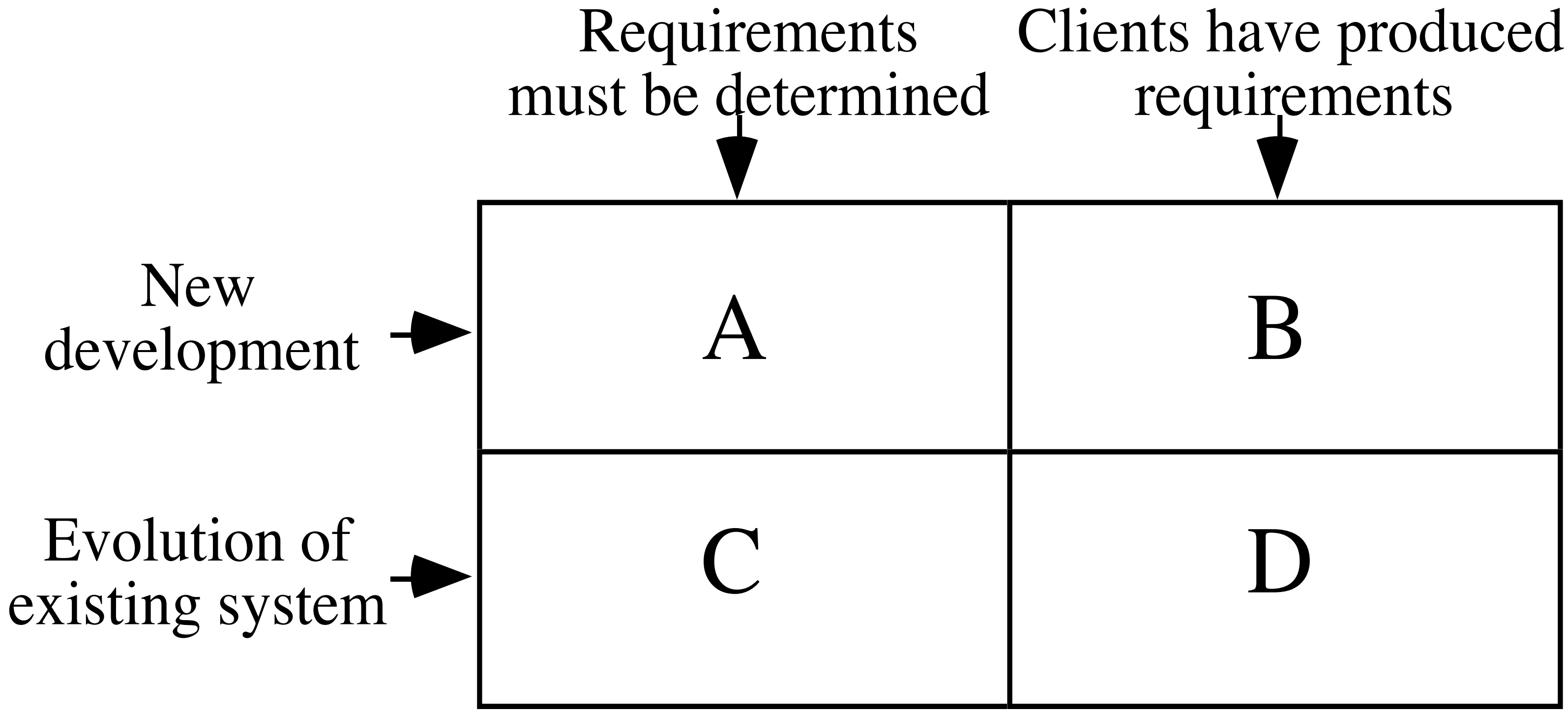
- With in the context of SDLC
  - Feasibility Study
  - Requirements
  - Design
  - Implementation
  - Testing
  - Maintenance

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

The Starting Point for Software Projects

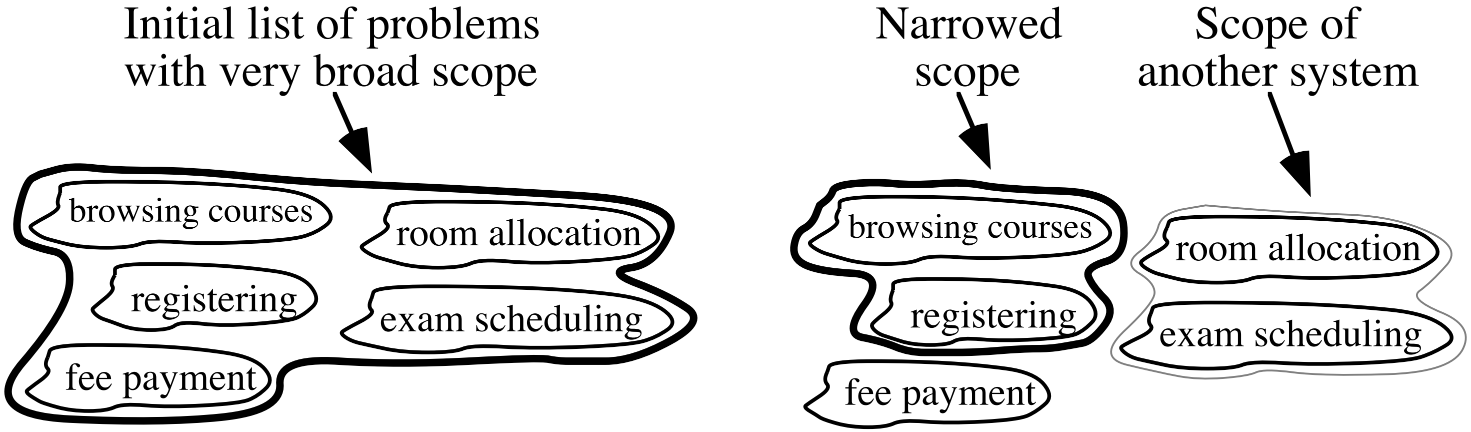


	Requirements must be determined	Clients have produced requirements
New development	A	B
Evolution of existing system	C	D

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



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*.

Types of Requirements

- Business requirements
  - High-level objectives of the organization or customer who requests the system.

- Functional requirements
  - Describe *what* the system should do

  For example, features (use cases)

- Non-functional requirements
  - *Constraints* that must be adhered to during development

  For example, quality constraints, technology constraints, process constraints, etc.

Requirements Phase

- Goals of requirements phase:
  - Fully understand the user requirements.
  - Remove inconsistencies, anomalies, etc. from requirements.
  - Document requirements properly in an SRS document.

Requirements Phase

- Consists of two distinct activities:
    - Requirements Gathering and Analysis
    - Requirements Specification

Who Carries Out Requirements Analysis and Specification?

- The person who undertakes requirements analysis and specification:
  - Known as requirements analyst or systems analyst
  - Collects data pertaining to the product
  - Analyzes collected data:
    - To understand what exactly needs to be done.
  - Writes the Software Requirements Specification (SRS) document.

Requirements Phase

- Final output of this phase:
  - Software Requirements Specification (SRS) Document.
- The SRS document is reviewed by the customer.
  - Reviewed SRS document forms the basis of all future development activities.

Requirements Analysis

- Requirements analysis consists of two main activities:
  - Requirements gathering
  - Analysis of the gathered requirements

Requirements Gathering

- Also known as requirements elicitation.
- If the project is to automate some existing procedures
  - e.g., automating existing manual accounting activities,
  - The task of the system analyst is a little easier
  - Analyst can immediately obtain:
    - input and output formats
    - accurate details of the operational procedures

Requirements Gathering (CONT.)

- In the absence of a working system,
  - Lot of imagination and creativity are required.
- Interacting with the customer to gather relevant data:
  - Requires a lot of experience.

Case Study: Automation of Office Work at CSE Dept.

- The academic, inventory, and financial information at the CSE department:
  - Being carried though manual processing by two office clerks, a store keeper, and two attendants.
- Considering the low budget he had at his
- Disposal:
  - The HoD entrusted the work to a team of student volunteers.

Case Study: Automation of Office Work at CSE Dept.

- The team was first briefed by the HoD about the specific activities to be automated.
- The analyst first discussed with the two clerks:
  - Regarding their specific responsibilities (tasks) that were to be automated.
- The analyst also interviewed student and faculty representatives who would also use the software.

Case Study: Automation of Office Work at CSE Dept.

- For each task, they asked:
  - About the steps through which these are performed.
  - They also discussed various scenarios that might arise for each task.
  - The analyst collected all types of forms that were being used.

Analysis of the gathered requirements

- Main purpose of requirements analysis:
  - Clearly understand the user requirements,
  - Detect inconsistencies, ambiguities, and incompleteness.
- Incompleteness and inconsistencies:
  - Resolved through further discussions with the end-users and the customers.

Inconsistent Requirement

- Some part of the requirement:
  - contradicts with some other part.
- Example:
  - One customer says turn off heater and open water shower when temperature > 100 C
  - Another customer says turn off heater and turn ON cooler when temperature > 100 C

Incomplete Requirement

- Some requirements have been omitted:
  - Possibly due to oversight.
- <u>Example:</u>
  - The analyst has not recorded:
    when temperature falls below 90 C
    - heater should be turned ON
    - water shower turned OFF.

Analysis of the gathered requirements (contd.)

- Requirements analysis involves:
  - Obtaining a clear, in-depth understanding of the product to be developed,
  - Remove all ambiguities and inconsistencies from the initial customer perception of the problem.

Analysis of gathered requirements (contd.)

- Experienced analysts take considerable time:
  - To understand the exact requirements the customer has in his mind.
- Experienced systems analysts know - often as a result of past (painful) experiences

Analysis of gathered requirements (contd.)

- Several things about the project should be clearly understood by the analyst:
  - What is the problem?
  - Why is it important to solve the problem?
  - What are the possible solutions to the problem?
  - What complexities might arise while solving the problem?

Analysis of gathered requirements (contd.)

- Some anomalies and inconsistencies can be very subtle:
  - Escape even most experienced eyes.
  - If a **formal model** of the system is constructed,
    - Many of the subtle anomalies and inconsistencies get detected.

Analysis of gathered requirements (contd.)

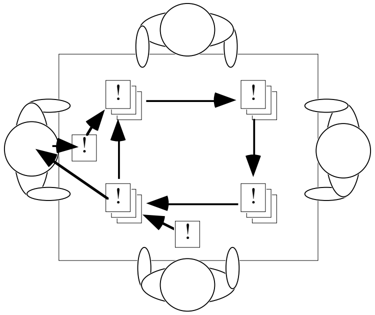
- After collecting all data regarding the system to be developed,
  - Remove all inconsistencies and anomalies from the requirements,
  - Systematically organize requirements into a Software Requirements Specification (SRS) document.

Techniques - Gathering and Analyzing 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 Analyzing 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 Analyzing 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

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*