Requirements Engineering

Software Requirements and Design
CITS4401

Week 2 -- Part 1

Key ideas covered last week

- **Stakeholders** are all people and systems that have an interest in a software project.

- A **user story** captures a specific business need of a user

  [role]
  [requirement]
  [business goal] **at least should be related to the project**

Lecture Overview

- What is Requirements Engineering
- Why is it hard ?
- 4 stages in RE
- Functional vs Non-functional requirements

Requirements Engineering

- **Requirements Engineering** is an activity that starts with planning, which involves identifying the project goals, constraints, and stakeholders. This step is crucial as it sets the direction for the entire project.

Requirements Example 1

Write a program that will read in a list of 100 positive integers, sort them into ascending order, display the sorted list and display the average of those values

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```python
def main():
    # Read in a list of 100 positive integers
    numbers = []
    for i in range(100):
        while True:
            try:
                num = int(input("Enter a positive integer: "))
                if num > 0:
                    numbers.append(num)
                    break
                else:
                    print("Please enter a positive integer.")
            except ValueError:
                print("Invalid input. Please enter a positive integer.")

    # Sort the list into ascending order
    numbers.sort()

    # Display the sorted list
    print("Sorted list of numbers:", numbers)

    # Calculate the average of the values
    average = sum(numbers) / len(numbers)
    print("Average of the values:", average)

if __name__ == "__main__":
    main()
```

Requirements Example 2

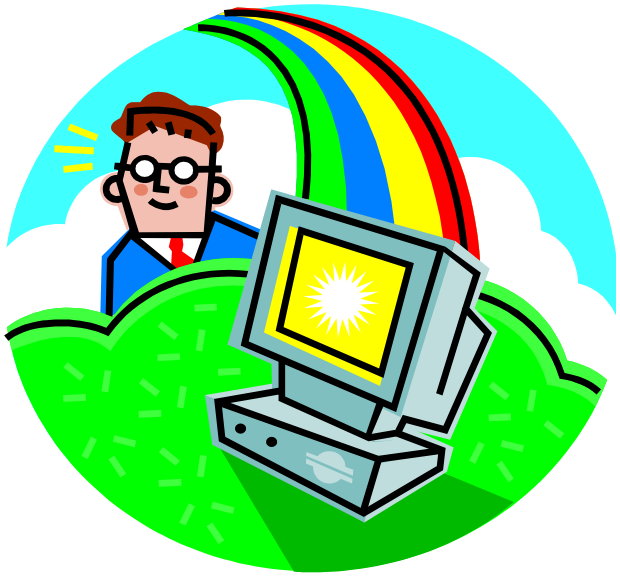
Develop an automated system that will allow us to process orders at least 24 hours sooner, on the average, and will allow us to ship our products to customers at least 3 days sooner than currently

Requirements Example 3

Develop the SW that will allow the Z-676 airliner to land itself, without pilot intervention, at major airports

Requirements Example 4

Develop a new personal productivity product for small computers that will sell at least one million copies at a retail price of at least $200



Why is RE Difficult?

- SW Engineering is a ***creative, problem solving activity***
- Real ***customers*** are not sure what they want
- Large SW systems have many different ***stakeholders*** with different needs and priorities
- Real developers are ***not*** sure how to build it
- Real requirements ***creep***

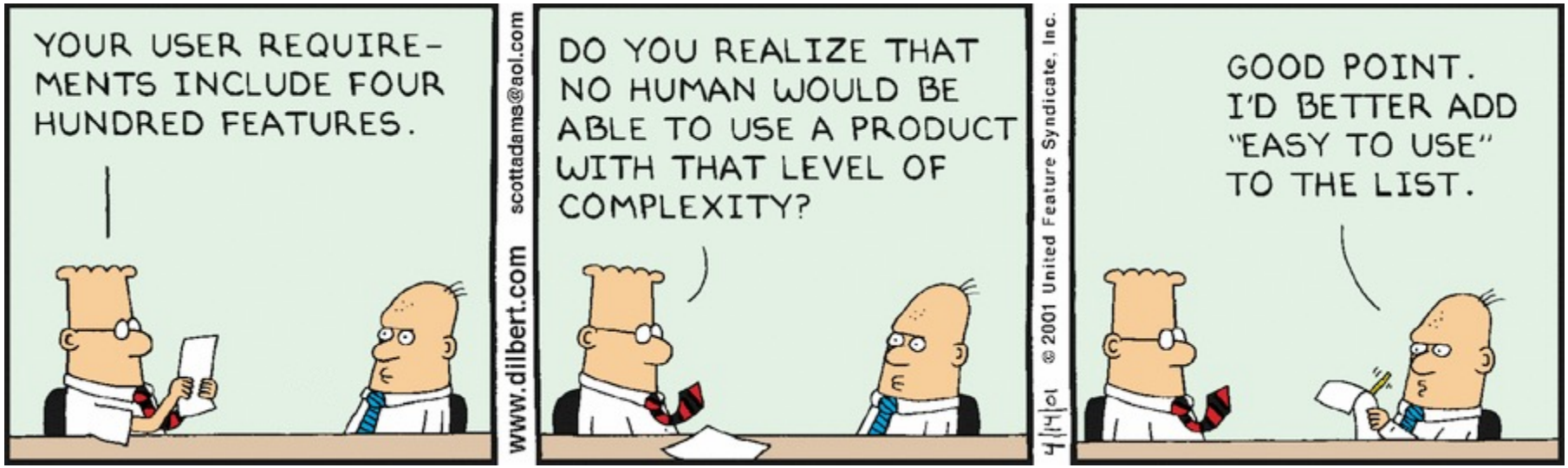
Requirements Tip

It is difficult to capture intent with only “words”

So use some diagrams/pictures

Tip: PowerPoint is a fast & cheap way to mock-up a user interface. Can be 1/10 the time to do mock-ups in code.

Complexity ?


YOUR USER REQUIREMENTS INCLUDE FOUR HUNDRED FEATURES.
DO YOU REALIZE THAT NO HUMAN WOULD BE ABLE TO USE A PRODUCT WITH THAT LEVEL OF COMPLEXITY?
GOOD POINT. I'D BETTER ADD "EASY TO USE" TO THE LIST.
www.dilbert.com scottadams@aol.com
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4/4/01

Why is Requirements Engineering Important?

- **Poor requirements capture = Big problem (=$$)**
- **Misunderstanding = Chaos (=$$)**
- **= Software project failure (=$$$$$$$!)**

* https://blog.capterra.com/agile-project-management-statistics-for-2018/

Reality is harsh…

Software Project Failures

https://en.wikipedia.org/wiki/List_of_failed_and_overbudget_custom_software_projects

2013	Queensland Health Payroll System	Payroll system	Australia	State government	The Queensland Health Payroll System was launched in 2010 in what could be considered one of the most spectacularly over budget projects in Australian history, coming in at over 200 times the original budget. In spite of promises that the new system would be fully automated, the new system required a considerable amount of manual operation.[13]	$AUD 1.2bn *($6m)*	Outsourced	

2007	2014	e-Borders	Advanced passenger information programme	United Kingdom	UK Border Agency	A series of delays.	over £412m (£742m)	Outsourced	Cancelled
2011	2014	Pust Siebel	Police case management	Sweden	Police	Poor functioning, inefficient in work environments.[9]	SEK 300m ($35m)[10]	Outsourced	Scrapped

The 4 Major Activities of Requirements Engineering

- Elicitation
- Analysis
- Specification
- Validation

The 4 Major Activities of Requirements Engineering

- Elicitation: discover the requirements
- Analysis: ensure the requirements are correct, complete, consistent and unambiguous
- Specification: document the requirements
- Validation: ensure that the system addresses the client's needs

Functional Requirement (Def)

An area of functionality the system must support.

The functional requirements describe the interactions between the actors and the system independent of the realization of the system [Bruegge & Dutoit, Glossary]

Example: The system will display a user's current bank account balance

Non-functional Requirement (Def)

A user-visible constraint on the system (restriction or limitation).

Non-functional requirements describe user-visible aspects of the system that are not directly related with the functionality of the system. [Bruegge & Dutoit, Glossary]

Example: The system will display user bank account details within 5 seconds

Quality Attributes

- A class of non-functional requirements.

- Examples:
  - usability
  - reliability
  - security
  - Safety
  - …..
  - .....

Project Requirements

- **Business Requirements** describe in business terms ***what*** must be delivered or accomplished to provide value.

- **Product Requirements** describe the system or product which is one of several possible ways to accomplish the business requirements.

- **Process Requirements** describe the processes the developing organization must follow and the constraints that they must obey.

Recommended reading

- R. S. Pressman, *Software Engineering: A Practitioner's Approach, 10th* ed., McGraw Hill 2020
  - Chapter 1, covering "**The evoluting Role of Software**", "**The Changing Nature of Software**", "**Software Myths**".
- B. Bruegge and A. H. Dutoit, *Object-Oriented Software Engineering – Using UML, Patterns, and Java,* 3rd ed., Prentice Hall, 2010
  - Section 1.1 "**Introduction: Software Engineering Failures**"
- A. Cockburn, Agile Software Development

Sample Requirements Document Structure

- 1. Introduction
  - 1.1 Purpose of the system
  - 1.2 Scope of the system
  - 1.3 Objectives and success criteria of the project
  - 1.4 Definitions, acronyms, and abbreviations
  - 1.5 References
  - 1.6 Overview
- 2. Current system
- 3. Proposed system
  - 3.1 Overview
  - 3.2 Functional requirements
  - 3.3 Nonfunctional requirements
    - 3.3.1 Usability
    - 3.3.2 Reliability
    - 3.3.3 Performance
    - 3.3.4 Supportability
    - 3.3.5 Implementation
    - 3.3.6 Interface
    - 3.3.7 Packaging
    - 3.3.8 Legal
  - 3.4 System models
    - 3.4.1 Scenarios
    - 3.4.2 Use case model
    - 3.4.3 Object model
    - 3.4.4 Dynamic model
    - 3.4.5 User interface—navigational paths and screen mock-ups
- 4. Glossary