Lecture 4: Requirements Engineering

COSI 120b, Principles of Software Engineering
All Software Starts With Requirements

• What should this application do?
• How should it react?
• What should it accomplish?
• Who should it be targeted to?
• What are the priorities?
• What defines success?
Good Software Starts With Good Requirements

• Underspecified requirements can result in a poorly defined application
  – If the priorities are unclear, the application may appear incomplete to the customer
  – If interactions are ambiguous, the application may not respond correctly
  – If the application functionality is underspecified, features may not be implemented correctly
  – If success is undefined, how do you know what you are trying to do?
Bad Software Starts With Bad Requirements

- 40 - 60 percent of all defects can be traced to bad requirements (Davis, 1993, Leffingwell, 1997)
- Defects in the requirements stage may be the most expensive to fix later on (Brooks, 1995)
- Two most frequently reported problems in industry are specifying and managing requirements (ESPITI, 1995)
“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 technique requirements, including all the interfaces to people, to machines, and to other software systems. No other part of the work so cripples the resulting system if done wrong. No other part is more difficult to rectify later”

- No Silver Bullet: Essence and Accidents of Software Engineering (Brooks, 1987)
Cost of Change

- Requirements
- Design
- Code
- Test
- Deployment
Overview

- Stakeholders
- What is a requirement?
  - Parts of a requirement
- Requirements Process
- Establishing Scope
- Functional Requirements
- Prototyping and XP
- Conclusions
Stakeholders

• Requirements come from somewhere
  – If they only came from one source, that would be easy
  – Requirements may come from multiple sources, and may be altered by still more
  – These people are stakeholders
Stakeholders

• Customers who fund the project
  – Direct funding, acquisition funding, etc
• Users who interact with the product
  – UI designers
• Requirements analyst
  – Someone in your organization that interfaces with the customer
• Fellow Developers
  – Especially if the application has multiple stages of development
Stakeholders

- Testers
  - Determine correctness
- Documentation writers
- Project Managers
- Legal Staff
  - Intellectual property
  - Legal guidance
- Manufacturing
- Sales, marketing, field support, help desk
Stakeholders

• Dealing with the stakeholders
  – Is a given stakeholder authorized to give you a new requirement?
    • A sales person who promises a new feature
  – How does the requirement interface with existing requirements?
    • Does it conflict with existing requirements?
  – How does the requirement effect the success metric?
    • If it increases the work, what happens to your promised delivery date?
  – Is it possible?
    • “perpetual energy”
What is a requirement?

• A capability or condition needed by a user to solve a problem or achieve an objective

• 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 document
What are requirements?

• What is the problem?
  – Project’s scope may not defined
  – Customers are too busy with the design
  – Project managers or sales people give conflicting requirements
  – Authoritative requirements exist in the head of the project manager alone
  – Lack of prioritization
  – Ambiguous requirements
What are requirements

• More problems
  – Focus on UI, not the functionality
  – Requirements are signed-off, yet continue to change
  – Project scope increases, yet resources do not
  – Lost requirements
  – Unknown status
  – Unused functionality
  – Completed to specification, but the customer is still not happy
What are requirements

• How do we avoid these problems?
  – Well specified requirements
  – Techniques to manage requirements
  – Understanding of how requirements can hurt and help the project
  – Techniques to elicit reasonable requirements out of stakeholders
  – Techniques to reconcile requirements
Types of Requirements

Functional

- Business Requirements
  - Vision and Scope Document
  - User Requirements
  - Use-Case Document
  - System Requirements
  - Functional Requirements

Nonfunctional

- Business Rules
- Quality Attributes
- External Interfaces
- Constraints
- Software Requirements Specification
Requirements Process

• Elicitation
  – Defining the stakeholders
  – Getting the needs for stakeholder representatives

• Analysis
  – Taking the elicited requirements and turning them into useful objects
    • Tasks
    • Business rules
    • Functional requirements
    • Nonfunctional requirements
Requirements Process

• Specification
  – Requirements to system components and system architecture
  – Negotiation of implementation priorities
  – Translation into written requirements, specifications and models

• Validation
  – Reviewing the documented requirements with the customer
  – Correct any problems before design starts
Requirements Management

• Requirements baseline
• Evaluating changes before approving
  – Change Control Board
• Incorporating approved changes in a controlled fashion
• Keeping deadlines and timelines in sync
• Negotiating new commitments
• Incorporating new requirements into the baseline
Requirements Management
Good Requirements

• The characteristics of good requirement statements
  – Complete
  – Correct
  – Feasible
  – Necessary
  – Prioritized
  – Unambiguous
  – Verifiable
Good Requirements

- The characteristics of good requirement specifications
  - Complete
  - Consistent
  - Modifiable
  - Traceable
Conclusions

• Requirements are important
  – Cost of change

• Next class we will talk about
  – Gathering requirements
  – Formalizing requirements

• Requirements are hard to get right
  – As you are about to find out
Assignment 1a

• Think about building a new Word Processor
• Everyone will be assigned a stakeholder
• For the class one week from today, come up with a set of requirements that you, in the role of a stakeholder, would request
• Be prepared to present these requirements
• Work ALONE
• Send me (seth@cs.brandeis.edu) your requirements by 5pm on Sunday (2/6/2005)
Stakeholder Roles for Assignment 1a

- Customer
- UI Designer
- Tester
- Sales
- End User