CS 4530: Fundamentals of Software Engineering
Lesson 3.1: Capturing User Requirements

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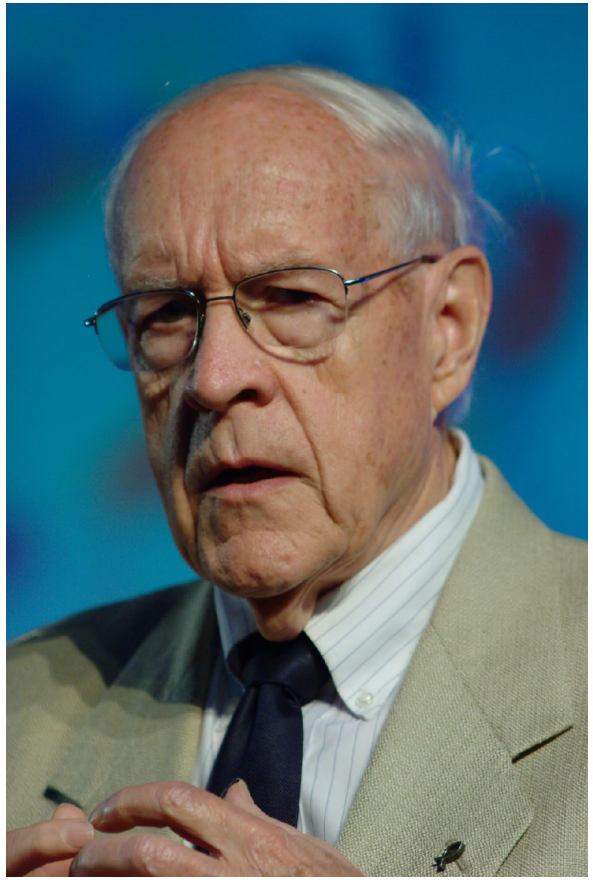
Theme for this week's lessons: No Silver Bullet

"There is no single development, in either technology or management technique, which by itself promises even one order-of-magnitude improvement within a decade in productivity, in reliability, in simplicity."

Fred Brooks, 1986



Outline of this week's lessons

Theme: Software Engineering Processes

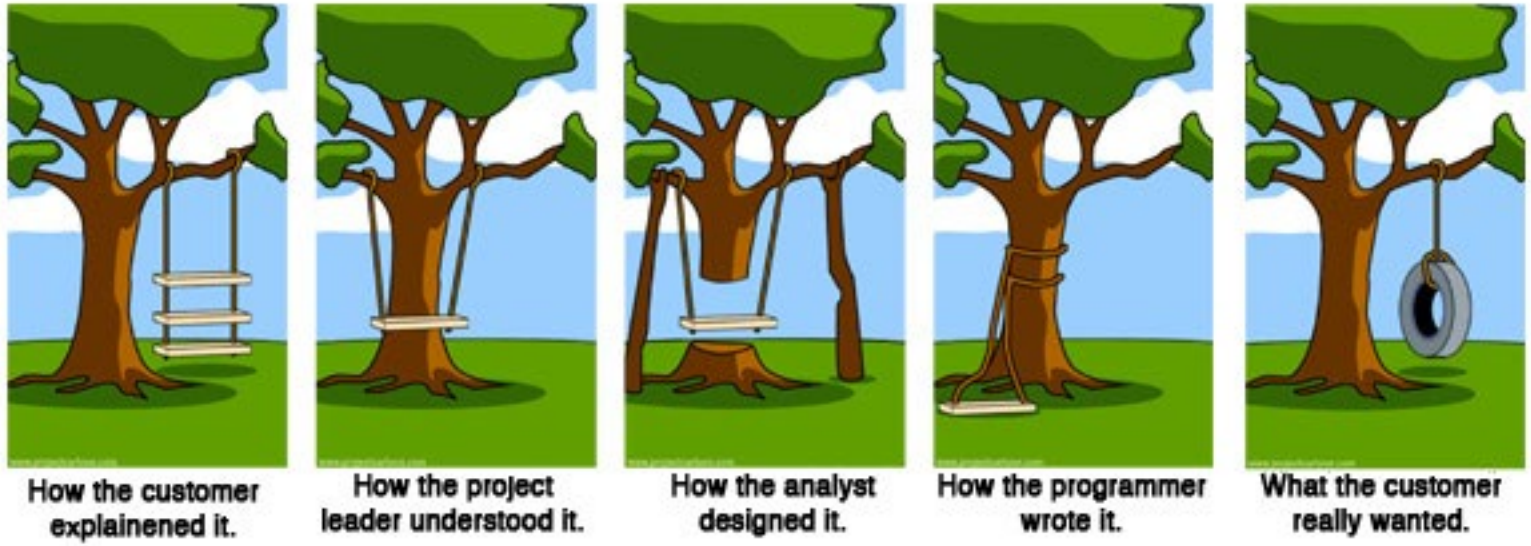
Topics:

- How do we understand what software we are supposed to build?
- How do we organize our development activities?
- How do we plan a software project?
- How do we build an effective team?

Learning Goals for this Lesson

- At the end of this lesson, you should be able to
  - Explain the overall purposes of requirements analysis
  - Enumerate and explain 3 major dimensions of risk in Requirements Analysis
  - Explain the difference between functional and non-functional requirements, and give examples of each
  - Explain the notion of a user story, with examples. (including conditions of satisfaction)

Overall question:
How to make sure we are building the right thing



Requirements Analysis

Planning & Design

Implementation

Why is requirements analysis hard?

Problems of understanding

Do users know what they want?

Do users know what we don't know?

Do we know who are users even are?

Problems of scope

What are we building?

What non-functional quality attributes are included?

Problems of variability

Changing requirements over time

Soliciting Requirements

Option 1: Users tell developers what they want

- Client determines the problem and the solution
- Requirements might be formally provided in the form of a contract or statement of work
- Client might provide all requirements, or just some subset (e.g. “must be HIPPA compliant”)

Soliciting Requirements

Option 2: Direct research

- Interview users, ask questions about their problems, propose potential solutions, examine those solutions
- Embed your client in your design team, or better yet, become an anthropologist in your client's environment
- Build requirements documents that demonstrate your understanding of the requirements, iterate
- Empowers your team with credibility and authority

Documentation can help us address problems of understanding

- Documentation helps our whole team make sure they are building the right thing
- Documentation can help specify implicit requirements
- Documentation can also serve as an artifact to iterate on with a client

Documentation should also capture non-functional requirements

- Qualities that reflect the execution of the system
  - Accessibility
  - Availability
  - Capacity
  - Efficiency
  - Performance
  - Privacy
  - Response Time
  - Security
  - Supportability
  - Usability
- Example: “A 4-core server with 16 GB RAM should be able to service at least 200 simultaneous clients with less than 300ms latency”

Documentation should also capture non-functional requirements

- Qualities that reflect the evolution of the system
  - Testability
  - Maintainability
  - Extensibility
  - Scalability
- Example: “A 3rd party component built conforming to the API defined in the Canvas LMS specification can create, modify, and delete assignments on behalf of an authenticated user”

Formal Specifications can be used to document requirements

- Define all expected behaviors under all expected conditions
- Works best when domain is well-understood

[Search] [txt|html|pdf|ps|with errata|bibtex] [Tracker] [WG] [Email] [Diff1]

From: draft-ietf-http-v11-spec-rev-06 Draft Standard
Obsoleted by: 7230, 7231, 7232, 7233, 7234, 7235 Errata exist
Updated by: 2817, 5785, 6266, 6585
Network Working Group R. Fielding
Request for Comments: 2616 UC Irvine
Obsoletes: 2068 J. Gettys
Category: Standards Track Compaq/W3C
J. Mogul
Compaq
H. Frystyk
W3C/MIT
L. Masinter
Xerox
P. Leach
Microsoft
T. Berners-Lee
W3C/MIT
June 1999

Hypertext Transfer Protocol -- HTTP/1.1

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

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Abstract

The Hypertext Transfer Protocol (HTTP) is an application-level protocol for distributed, collaborative, hypermedia information systems. It is a generic, stateless, protocol which can be used for many tasks beyond its use for hypertext, such as name servers and distributed object management systems, through extension of its request methods, error codes and headers [47]. A feature of HTTP is the typing and negotiation of data representation, allowing systems to be built independently of the data being transferred.

HTTP has been in use by the World-Wide Web global information initiative since 1990. This specification defines the protocol referred to as "HTTP/1.1", and is an update to RFC 2068 [33].

1.2 Requirements

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [34].

An implementation is not compliant if it fails to satisfy one or more of the MUST or REQUIRED level requirements for the protocols it implements. An implementation that satisfies all the MUST or REQUIRED level and all the SHOULD level requirements for its protocols is said to be "unconditionally compliant"; one that satisfies all the MUST level requirements but not all the SHOULD level requirements for its protocols is said to be "conditionally compliant."

1.3 Terminology

This specification uses a number of terms to refer to the roles played by participants in, and objects of, the HTTP communication.

connection
A transport layer virtual circuit established between two programs for the purpose of communication.

message
The basic unit of HTTP communication, consisting of a structured sequence of octets matching the syntax defined in section 4 and transmitted via the connection.

request
An HTTP request message, as defined in section 5.

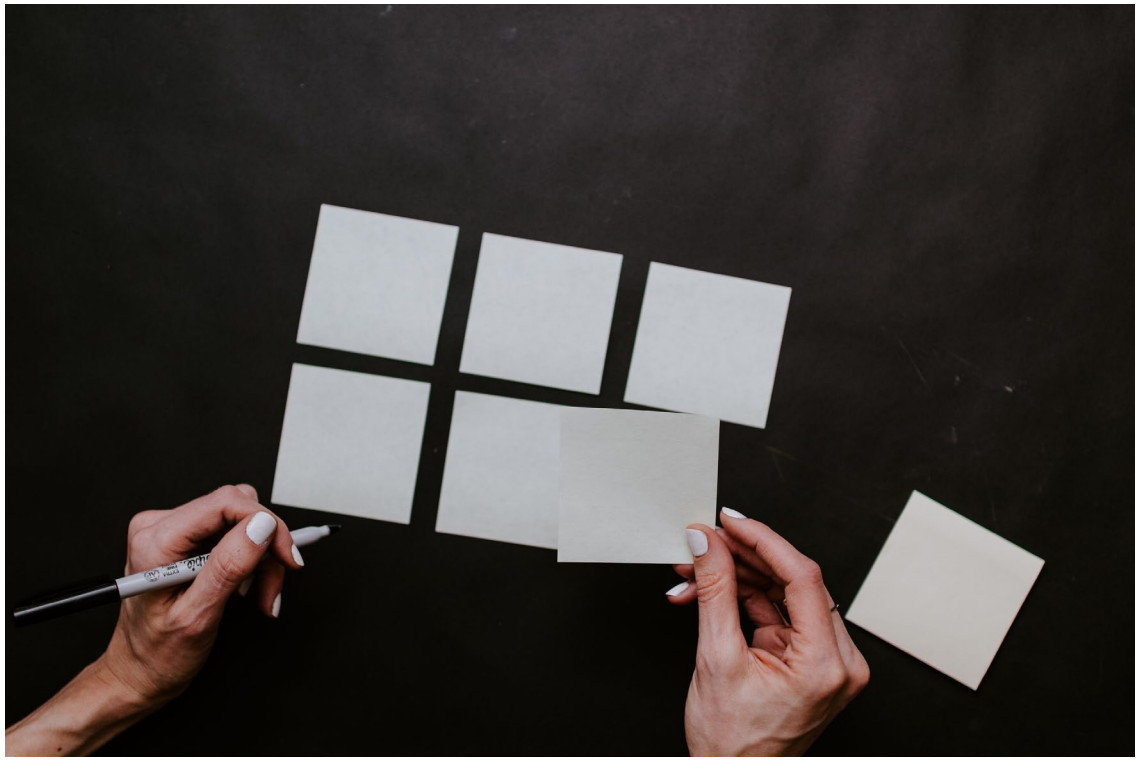
response
An HTTP response message, as defined in section 6.

User Stories can document requirements from a *user's* point of view

Specifying what should happen, for whom, and why

As a <role> I can <capability>, so that <receive benefit>

Conditions of Satisfaction:
Given <interaction with software, state of environment>, I expect <behavior and side effects>



Writing User Stories: INVEST

- Independent
- Negotiable
- Valuable
- Estimable
- Small
- Testable

As a <role> I can <capability>,
so that <receive benefit>

User Stories: Example – Backup Software

As a computer user, I want to backup my entire hard drive so that my files are safe

As a typical computer user, I want to specify folders to backup, so that my most important files are safe

As a power user, I want to specify subfolders and filetypes NOT to backup, so that my backup doesn't fill up with things that I don't need to preserve

Conditions of Satisfaction: Backup Software

- How do we know if we have satisfied the user? Lots of detail doesn't fit onto 3x5 card:
  - Where do backups get saved?
  - What if backup system is unavailable?
  - What if backup system is full?
  - Do backups ever get rotated/deleted?
- Conditions of satisfaction are a list of common cases and special cases that must work

Conditions of Satisfaction: Backup Software

- "As a typical computer user, I want to specify folders to backup, so that my most important files are safe"
- My conditions of satisfaction are:
  - If the network and remote backup service are available, and I am not over my storage quota, the backup should be successful.
  - After successfully running, an updated copy of each of the files that I have requested to be backed up are stored in a redundant, cloud filesystem
  - If a backup is not successful, an error message is prominently displayed indicating the cause of failure to be in the software, the network, the remote backup storage, or other

Non-Functional Requirements: Backup Software

- Does “After successfully running, an updated copy of each of the files that I have requested to be backed up are stored in a redundant, cloud filesystem” guarantee success?
  - What was the transfer speed? (Performance)
  - How much temporary disk space did it use to create the backup? (Performance)
  - How long did I spend on the phone with support to set up the software? (Usability)
  - Are my files encrypted, or access controlled at all? (Security)

Requirements: Which to pick?

- There are four knobs you can adjust when negotiating requirements:
  - Project scope
  - Project duration
  - Project quality
  - Project cost
- Usually cost is most constrained: you have a budget to spend, and you have a headcount of developers to pay
- Determining feasible scope, timeline and maximizing quality is the subject of much software engineering research, see next lesson

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