If software is simply for automation, what would a washing machine be like?
RE Process

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RE Process:
What is a Process?

- Given input, transforms it into output
- Consist of a set of activities
- Process descriptions are also specifications
  - Often produced by Requirements Engineers
  - Should be as complete, consistent and clear
RE Process:

Why?

Quality of product  ←  Quality of Process

- Garbage in garbage out, so get the right requirements

It is more important to understand the problem than the solution. [Albert Einstein]
RE Process: The Basic RE Evolutionary Process

Evolution is inevitable – traceability is more than a virtue

Old Reality → Old Model → Reverse Engineering → Old Implementation

Change in Reality

Change Definition

New Reality → New Model → Change Incorporation → New Implementation

Legacy Integration
RE Process: A Basic Framework [Loucopolos]

Many variations and extensions

- 3 fundamental activities:
  - understand, (formally) describe, attain an agreement on, the problem

User

Elicitation

- User reqs
- knowledge
- For more knowledge
- Domain knowledge

Specification

- User feedback
- Req. models
- Val. result
- Domain knowledge

Validation

Problem Domain

Knowledge (domain experts, laws, standards, policies, documents, etc.)

- Elicitation: determine what’s really needed, why needed, whom to talk to
- Specification: produce a (formal) RS model: translate "vague" into "concrete", etc. make various decisions on what & how
- Validation: assure that the RS model satisfies the users’ needs
RE Process:
Spiral Model [KotonyaSummerville98]

How many cycles? When to analyze and negotiate? Risk analysis?

- Requirements elicitation: Requirements discovered through consultation with stakeholders
- Requirements analysis and negotiation: Requirements are analysed and conflicts resolved through negotiation
- Requirements documentation: A requirements document is produced
- Requirements validation: The requirements document is checked for consistency and completeness
An RE Process is dominated by human, social and organisational factors

RE Processes: RAD (Role Actor Diagram)

**Stakeholders/Actors/Agents**

<table>
<thead>
<tr>
<th>ACTIONS</th>
<th>ROLES</th>
</tr>
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</table>
| Understand problem | Req. engineer  
Domain expert  
End-user |
| Establish outline requirements | Req. engineer  
End-user |
| Select prototyping system | Software engineer  
Project manager |
| Develop prototype | Req. engineer  
Software engineer |
| Evaluate prototype | End-user  
Domain expert  
Req. engineer  
Software engineer |

_for prototyping_ [Kotonya&Sommerville98]
RE Process:
A RE Process Maturity Model
Based on CMM

Level 1 - Initial
Ad-hoc requirements engineering; requirements problems are common

Level 2 - Repeatable
Standardised requirements engineering; fewer requirements problems

Level 3 - Defined
Defined process based on best practice; process improvement in place
IEEE Standard for SRS

1 Introduction
   Purpose
   Scope
   Definitions, acronyms, abbreviations
   Reference documents
   Overview

2 Overall Description
   Product perspective
   Product functions
   User characteristics
   Constraints
   Assumptions and Dependencies

3 Specific Requirements

Appendices
Index

Identifies the product, & application domain
Describes contents and structure of the remainder of the SRS
Describes all external interfaces: system, user, hardware, software; also operations and site adaptation, and hardware constraints
Summary of major functions
Anything that will limit the developer’s options (e.g. regulations, reliability, criticality, hardware limitations, parallelism, etc)
All the requirements go in here (i.e. this is the body of the document).
IEEE STD provides 8 different templates for this section
3.1 External Interface Requirements
   3.1.1 User Interfaces
   3.1.2 Hardware Interfaces
   3.1.3 Software Interfaces
   3.1.4 Communication Interfaces

3.2 Functional Requirements
   *this section organized by mode, user class, feature, etc.*
   *For example:*
     3.2.1 Mode 1
       3.2.1.1 Functional Requirement 1.1
       ...
     3.2.2 Mode 2
       3.2.1.1 Functional Requirement 1.1
       ...
     3.2.n Mode n
       ...

3.3 Performance Requirements
   *Remember to state this in measurable terms!*

3.4 Design Constraints
   3.4.1 Standards compliance
   3.4.2 Hardware limitations etc.

3.5 Software System Attributes
   3.5.1 Reliability
   3.5.2 Availability
   3.5.3 Security
   3.5.4 Maintainability
   3.5.5 Portability

3.6 Other Requirements
RE in Agile Methods

Basic Philosophy

- Reduce communication barriers
  Programmer interacts with customer
- Reduce document-heavy approach
  Documentation is expensive and of limited use
- Have faith in the people
  Don’t need fancy process models to tell them what to do!
- Respond to the customer
  Rather than focusing on the contract

Weaknesses

- Relies on programmer’s memory
  Code can be hard to maintain
- Relies on oral communication
  Mis-interpretation possible
- Assumes single customer representative
  Multiple viewpoints not possible
- Only short term planning
  No longer term vision

E.g. Extreme Programming

- Instead of a requirements spec, use:
  User story cards
  On-site customer representative
- Pair Programming
- Small releases
  E.g. every three weeks
- Planning game
  Select and estimate user story cards at the beginning of each release
- Write test cases before code
- The program code is the design doc
  Can also use CRC cards (Class-Responsibility-Collaboration)
- Continuous Integration
  Integrate and test several times a day
RE in V Model

- System requirements
- Software requirements
- Preliminary design
- Detailed design
- Code & debug
- Component test
- Unit test
- Acceptance test
- Software integration
- System integration

Level of abstraction

Time

Test and interface

Analyze and design
RE Processes: Volere Requirements Process

How many cycles? When to analyze and negotiate?
RE Processes: RE Process Variability

Many Variety …and Evolution is inevitable

- RE processes vary radically from one organisation to another
- Factors contributing to this variability include
  - Technical maturity
  - Disciplinary involvement
  - Organisational culture
  - Application domain
  - …

- There is therefore no ‘ideal’ requirements engineering process [KotonyaSummerville98]
NFRs & RE Process: A Requirements Management System

Many variations and extensions
Prototyping is used for:
- understanding the requirements for the user interface
- examining feasibility of a proposed design approach
- exploring system performance issues

Problems:
- users treat the prototype as the solution
- a prototype is only a partial specification

[Dorfman, 1997, p9]