Software Quality Management

Software Engineering Theory

Kristian Sandahl
Department of Computer and Information Science
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Requirements

System Design
(Architecture, High-level Design)

Module Design
(Program Design, Detailed Design)

Implementation of Units (classes, procedures, functions)

Unit testing

Acceptance Test
(Release testing)

System Testing
(Integration testing of modules)

Module Testing
(Integration testing of units)

Maintenance

Validate Requirements, Verify Specification

Verify System Design

Verify Module Design

Verify Implementation

Project Management, Software Quality Assurance (SQA), Supporting Tools, Education
Views on quality

- Transcendent – something we learn to recognize
- Product-based – measurable variable
- Usage-based – in the eyes of the beholder
- Manufacturing-based – conformance to requirements
- Value-based – market sets the value
The Shewhart cycle

Evaluate process
(Change the process)
Evaluate PDCA

Decide goal (the right quality)
Select process (activities)
Determine present state

Formulate facts about goal fulfilment

Run the process (project)
Levels of quality assurance

- Appraisal – eg. defect detection
- Assurance – eg. prediction of defects
- Control – adjust the process
- Improvement: reduce variation, increase precision
Remember Usability Engineering?

Evaluate goals of
- Relevance
- Efficiency
- Attitude
- Learnability
A mature organisation has:
- Inter-group communication and coordination
- Work accomplished according to plan
- Practices consistent with processes
- Processes updated as necessary
- Well defined roles/responsibilities
- Management formally commits

If you want to expand here, you need to increase maturity.

A mature organisation do things well, which does not necessarily mean doing something good.
CMMI for development, staged representation

1: Initial

2: Repeatable

3: Defined

4: Managed

5: Optimising

CMMI = Capability Maturity Model Integration
Life at level 1

The organisation is over-committed, processes are abandoned in crisis, and no repetition of success.

Success is totally dependent on heroes
Life at level 2

- Fewer surprises
- Processes are based on organizational policies
- **Process adherence** is evaluated
- Processes are established and followed even in crisis
- Projects ensure adequate competence and resources
- We know stakeholders’ needs
- We can control changes
- The project is visible to managers and other stakeholders at mile-stones and toll-gates
- We can **repeat** a previous success
- Works well for individual projects
Life at level 3

- Tailoring processes from your own standard definitions
- Standard processes are improved
- Process descriptions are more complete, detailed and rigorous
- Opens for development (and creativity) of alternatives
- Works for a range of projects
- Originally the minimum level
Life at level 4

- Quantitative analysis (statistics) of goals, products, processes
- Higher predictive capability
- Deviations are subject for Root Cause Analysis (RCA, 5Whys)
- Frequent measures
Life of level 5

• Everyone is committed to the continuous improvement of processes
• Innovation climate paired with an ability to evaluate new technology
• The outcome of improvements are evaluated at all relevant levels in the organisation
• You know your gaps in performance
• Challenge: Company culture, new markets
• Used by many sub-contractors for marketing purposes
Staged Representation

- Process Areas
  - Specific Goals
    - Specific Practices
  - Generic Goals
    - Generic Practices

Maturity Levels
How are the Process Areas documented?
Example: Requirements Management (REQM)

- A Maturity Level 2 Process Area
- Purpose: Manage requirements, ensure alignment to project plan and work products.
- Introductory notes contain:
REQM Specific goal

Map this to your way of working

• SG1 Manage Requirements

  Requirements are managed and inconsistencies with project plans and work products are identified

Use these to fulfill the goal

• SP 1.1 Understand Requirements
• SP 1.2 Obtain Commitment to Requirements
• SP 1.3 Manage Requirements Changes
• SP 1.4 Manage Bidirectional Traceability of Requirements
• SP 1.5 Ensure Alignment Between Project Work and Requirements
More Mature Requirements Engineering

1: Initial
2: Repeatable
3: Defined
4: Managed
5: Optimising

RD (Requirements Definition)

REQM
Requirements Definition

- A Maturity level 3 Process Area
- Purpose: Elicit, analyze, and establish customer, product, and product components requirements
- This means:
  - Investigate the true needs of the customer
  - Formulate functional and non-functional requirements, on relevant product levels
  - Validate requirements
Lvl 2 and 3 PA’s relevant for the course

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LiU EXPANDING REALITY
ISO 9000-3

- ISO 9000-3 is guideline to apply ISO 9001 to software industry, which is built on the principles:
  - *Principle 1* Customer focus
  - *Principle 2* Leadership
  - *Principle 3* Involvement of people
  - *Principle 4* Process approach
  - *Principle 5* System approach to management
  - *Principle 6* Continual improvement
  - *Principle 7* Factual approach to decision making
  - *Principle 8* Mutually beneficial supplier relationships

- ISO = International Organization for Standardization
- The Swedish member: SIS = Swedish Standards Institute (sic!)
Total Quality Management

- What’s get measured gets done
- Importance of feedback
- Non-personal software
- Creating a passion for quality
- Live as you learn
- Incentive system
- Involve customers
- Set prioritized goals
- Quality is everybody’s responsibility
- Document how you will work with quality
- Improve continuously

= Some Guidelines to TQM

Short intro: http://managementhelp.org/quality/tqm/tqm.htm
TickITplus

- An interpretation of ISO 9001 and other standards for software,
- a standard set of requirements on the competence and behavior of certification auditors,
- a standardized training course for certification auditors,
- a registration scheme for approved certification auditors,
- a system for accrediting certification bodies for conducting TickIT certifications,
- a logotype to be used on certificates to show TickIT certification.

http://www.tickitplus.org/default.aspx
## Quality Function Deployment

### Direction of Improvement

<table>
<thead>
<tr>
<th>WHATS</th>
<th>HOWS</th>
<th>Performance Measures</th>
<th>Size of Range</th>
<th>Technical Details</th>
<th>Customer Rating</th>
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<tr>
<td></td>
<td>Easy to put on</td>
<td>2</td>
<td></td>
<td></td>
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<td></td>
<td>Comfortable when hanging</td>
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<td>Fits over different clothes</td>
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<td>Accessible gear loops</td>
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<td>Does not restrict movement</td>
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<tr>
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<td>Lightweight</td>
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### Organisational Difficulty

| | | | | | | |
|---|---|---|---|---|---|
| 5 | 4 | 3 | 2 | 1 | 0 |

### Engineering Assessment

<table>
<thead>
<tr>
<th></th>
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### Absolute Importance

| | | | | | |
|---|---|---|---|---|
| 48 | 87 | 67 | 10 | 52 |

### Relative Importance (%)

<p>| | | | | |</p>
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**LiU Expanding Reality**

24
Six sigma

Goal: Reduce waste
Origin and application in production industry. Applicability in software is debated.

My view:
Requires repetition
Requires sampling

http://www.itil-itsm-world.com/sigma.htm
Wisdom

communication

infrastructure

performance