A Software Life-cycle Model
Which part will we talk about today?

- Requirements
- Module Design (Program Design, Detailed Design)
- System Design (Architecture, High-level Design)
- Implementation of Units (classes, procedures, functions)
- Unit testing
- Module Testing (Integration testing of units)
- System Testing (Integration testing of modules)
- Acceptance Test (Release testing)
- Maintenance

Validate Requirements, Verify Specification
Verify System Design
Verify Module Design
Verify Implementation

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

Part I: Capability Maturity Model
Part II: Quality Management
Agenda - What will you learn today?

Part I
Capability Maturity Model

Part II
Quality Management
Part I
Capability Maturity Model
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

A mature organisation do things well, which does not necessarily mean doing something good.

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

Criticality for user

Product complexity
CMMI for development, staged representation

CMMI = Capability Maturity Model Integration

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

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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
How do you determine the maturity level?

Staged Representation

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

Maturity Levels
How are the Process Areas documented?

- **Process Area**
  - **Specific Goals**
    - Specific Practices
      - Example Work Products
      - Subpractices
  - **Generic Goals**
    - Generic Practices
      - Subpractices
      - Generic Practice Elaborations
  - **Purpose Statement**
  - **Introductory Notes**
  - Related Process Areas

**KEY:**
- Required
- Expected
- Informative
Example: Requirements Management (REQM)

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

```
- Resolve issues
- Requirements in plan
- Obtain commitment
- Manage changes

- Requirements rationale
- Customer wish
- CEO wish

- Requirements document
- R1: ...

- Design
- Function 1
- Property 3

- Traceability eases maintenance
```
REQM Specific goal

- SG1 Manage Requirements

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

- 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

Map this to your way of working

Use these to fulfill the goal
More Mature Requirements Engineering

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

REQM
RD (Requirements Definition)
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

- **validate requirements, verify specification**
  - **REQM**
  - **RD**

- **verify system design**
  - **System Design**
    - **Architecture**, **High-level Design**
  - **TS**

- **verify module design**
  - **Module Design**
    - **Program Design**, **Detailed Design**
  - **VER**

- **verify implementation**
  - **Implementation of Units**
    - **classes**, **procedures**, **functions**
  - **OPD**

- **unit testing**
  - **Unit testing**
  - **CM**

- **module testing**
  - **Module Testing**
    - **Integration testing of units**
  - **PPQA**

- **system testing**
  - **System Testing**
    - **Integration testing of modules**
  - **VAL**

- **acceptance test**
  - **Acceptance Test**
    - **Release testing**
  - **PP**

- **maintenance**
  - **Maintenance**
  - **RSKM**

- **project management**
  - **Project Management**
  - **Supporting Tools**, **Education**

- **software quality assurance**
  - **Software Quality Assurance (SQA)**

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**Part I**
- **Capability Maturity Model**

**Part II**
- **Quality Management**

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Part II
Quality Management
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
TickIT

- An interpretation of ISO 9001 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.tickit.org/
### Quality Function Deployment

#### Part I
**Capability Maturity Model**

#### Part II
**Quality Management**

![Diagram with Quality Function Deployment matrix and organizational difficulty scale]

**Organizational Difficulty** (Criticality Range):
- **Strong - 9**
- **Medium - 4**
- **Weak - 1**

**How Much**:
- 100%
- 50%
- 25%
- 10%

**Engineering Assumptions**:
- Our Company
- Company A
- Company B

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<th>Component</th>
<th>Performance</th>
<th>Size of Range</th>
<th>Technical Details</th>
<th>Customer Rating</th>
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<td>Easy to put on</td>
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<td>Comfortable when hanging</td>
<td>5</td>
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<tr>
<td>Fits over different clothes</td>
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<td>Assemble gear loops</td>
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<td>Does not restrict movement</td>
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<td>Strong - 9</td>
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<th>Relative Importance (%)</th>
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<th>Absolute Importance</th>
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<td>46 97 57 10 62 109 72 30</td>
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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