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Capability Maturity Model Integration

Sommerville, Chapter 28

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„In theory, there is no difference between theory and practice. In practice, there is.“
-- Yogi Berra (?)

Process Capability Assessment

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- To what extent do an organisation's processes follow best practice?
  - identify areas of weakness for process improvement
- various models; SEI most influential
  - Software Engineering Institute (SEI), www.sei.cmu.edu
  - SEI's mission: promote software technology transfer, particularly to US defence contractors
- CMM(I) framework measures process maturity, thereby helps with improvement
  - Capability Maturity Model (CMM) introduced in the early 1990s
  - Revised: Capability Maturity Model Integration (CMMI) introduced in 2001
  - See also: ISO/IEC 15504 (SPICE)

CMM Organisational Maturity Levels

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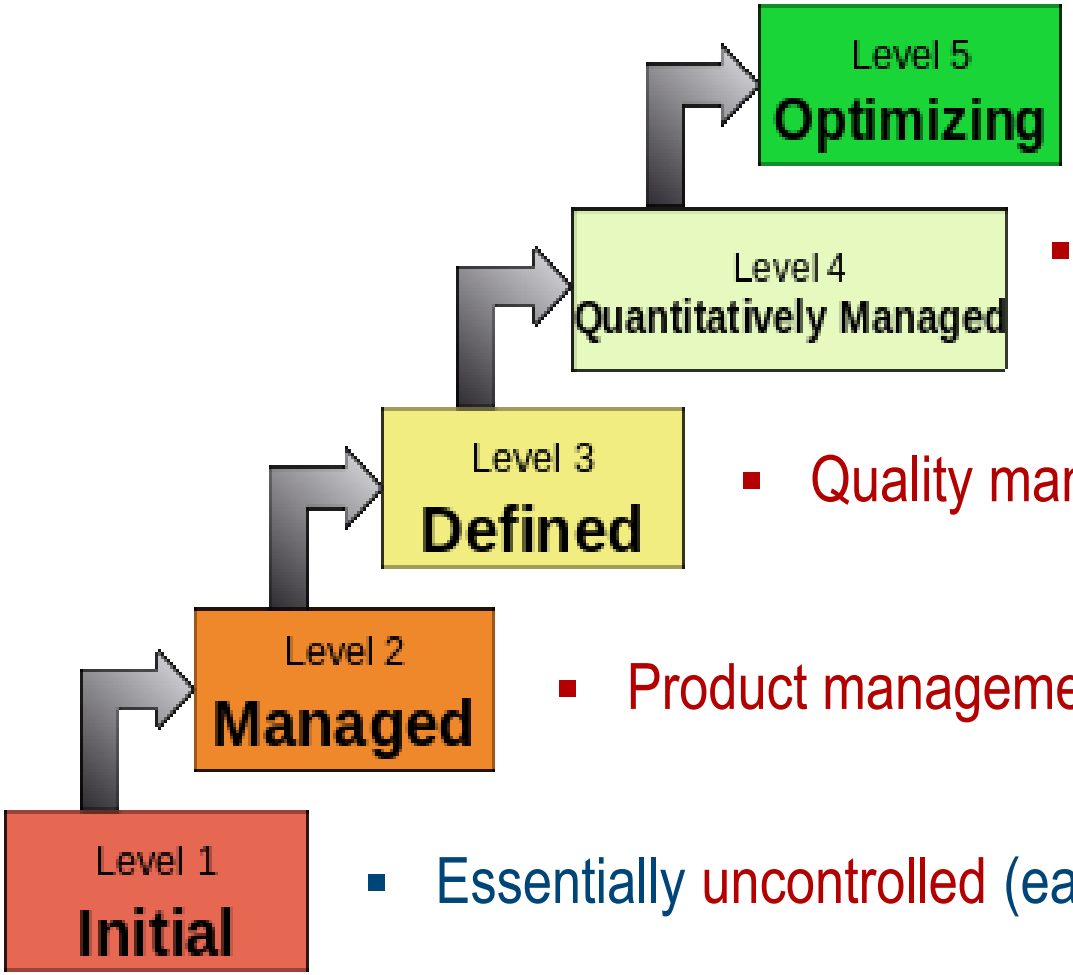

- Process improvement strategies defined & used
- Process management procedures & strategies defined & used
- Quality management strategies defined & used
- Product management procedures defined & used
- Essentially uncontrolled (each project a "one-time heroic act")

[Wikipedia]

Problems with the CMM

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- Model levels
  - Companies could be using practices from different levels at the same time but if all practices from a lower level were not used, it was not possible to move beyond that level
- Discrete rather than continuous
  - Did not recognise distinctions between the top and the bottom of levels
- Practices oriented
  - Concerned with how things were done (the practices) rather than the goals to be achieved

CMMI

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- CMMI = Capability Maturity Model Integration
  - integrated capability model
    that includes software and systems engineering capability assessment
- Components:
  - Process areas – 24 process areas that are relevant to process capability and improvement are identified. These are organised into 4 groups.
  - Goals – Goals are descriptions of desirable organisational states. Each process area has associated goals.
  - Practices – Practices are ways of achieving a goal;
    however, they are advisory and other approaches to achieve the goal may be used.

CMMI Process Areas

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Process areas – Goals – Practices

Process management	Organisational process definition; Organisational process focus; Organisational training; Organisational process performance; Organisational innovation and deployment
Project management	Project planning; Project monitoring and control; Supplier agreement management; Integrated project management; Risk management; Integrated teaming; Quantitative project management
Engineering	Requirements management; Requirements development; Technical solution; Product integration; Verification; Validation
Support	Configuration management; Process and product quality management; Measurement and analysis; Decision analysis and resolution; Organisational environment for integration; Causal analysis and resolution

CMMI Goals

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Process areas – Goals – Practices

- Goal:
  - Corrective actions are managed to closure when the project's performance or results deviate significantly from the plan.
  - Actual performance and progress of the project is monitored against the project plan.
  - The requirements are analysed and validated and a definition of the required functionality is developed.
  - Root causes of defects and other problems are systematically determined.
  - The process is institutionalised as a defined process.

- Process area:
  - Specific goal in Project Monitoring and Control
  - Specific goal in project monitoring and control
  - Specific goal in requirements development
  - Specific goal in causal analysis and resolution
  - Generic goal

CMMI Practices

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Process areas – Goals – Practices

- Practice
  - Analyse derived requirements to ensure that they are necessary and sufficient
  - Validate requirements to ensure that the resulting product will perform as intended in the user's environment using multiple techniques as appropriate.
  - Select the defects and other problems for analysis.
  - Perform causal analysis of selected defects and other problems and propose actions to address them.
  - Establish and maintain an organisational policy for planning and performing the requirements development process.
  - Assign responsibility and authority for performing the process, developing the work products and providing the services of the requirements development process.
- Associated goal
  -
  - The requirements are analysed and validated and a definition of the required functionality is developed.
  - Root causes of defects and other problems are systematically determined.
  - The process is institutionalised as a defined process.
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CMMI Assessment

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- Examines processes used in an organisation and assesses maturity in each process area
- Merged into one final "grade" using a 6-point scale:
  - Not performed;
  - Performed;
  - Managed;
  - Defined;
  - Quantitatively managed;
  - Optimizing.

The Continuous CMMI Model

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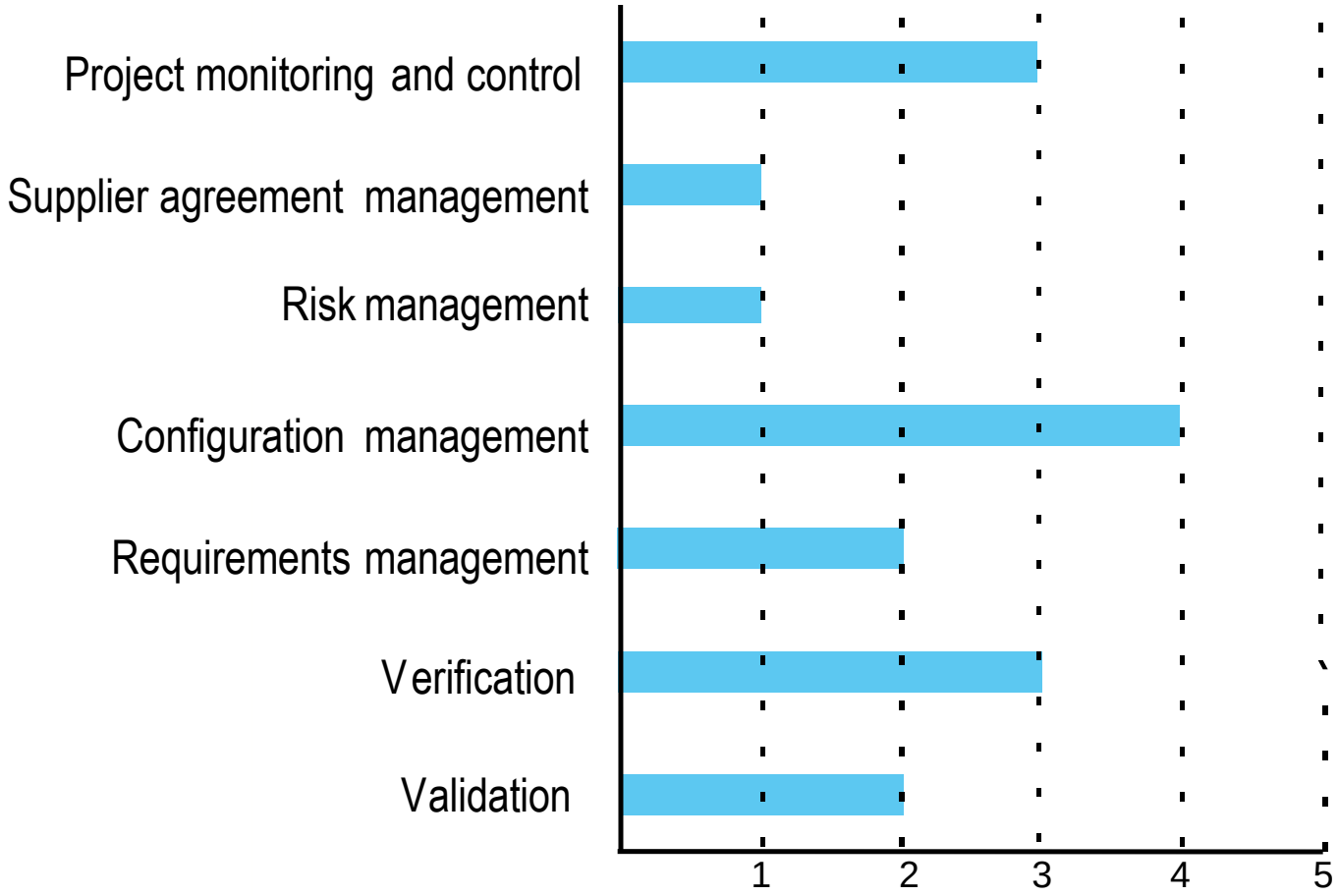
- First extension: staged CMMI model
  - Each maturity level has process areas and goals.
  - Eg, process area associated with "managed level" includes:
    Requirements management; Project planning; Project monitoring and control; Supplier agreement management; Measurement and analysis; Process and product quality assurance.
- Next extension: continuous CMMI model
  - finer-grain: considers individual or groups of practices, assesses their use
  - maturity assessment not a single value, but one maturity value per area
  - each process area: levels 1…5
  - Advantage:
    organisations can pick and choose process areas to improve according to their local needs

Sample Process Capability Profile



Wrap-Up

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- CMM(I): assess IT company on its maturity wrt. managing its own processes
- Process improvement in CMM(I) based on reaching a set of goals related to good software engineering practice
- CMMI: summary value → detailed assessment on several parameters

Real World Benefits: Lockheed Martin M&DS

SW CMM ML2 (1993) to ML 3 (1996) to CMMI ML5 (2002)

1996 - 2002
- increased software productivity by 30%
- decreased unit software cost by 20%
- decreased defect find and fix costs by 15%