Capability Maturity Model

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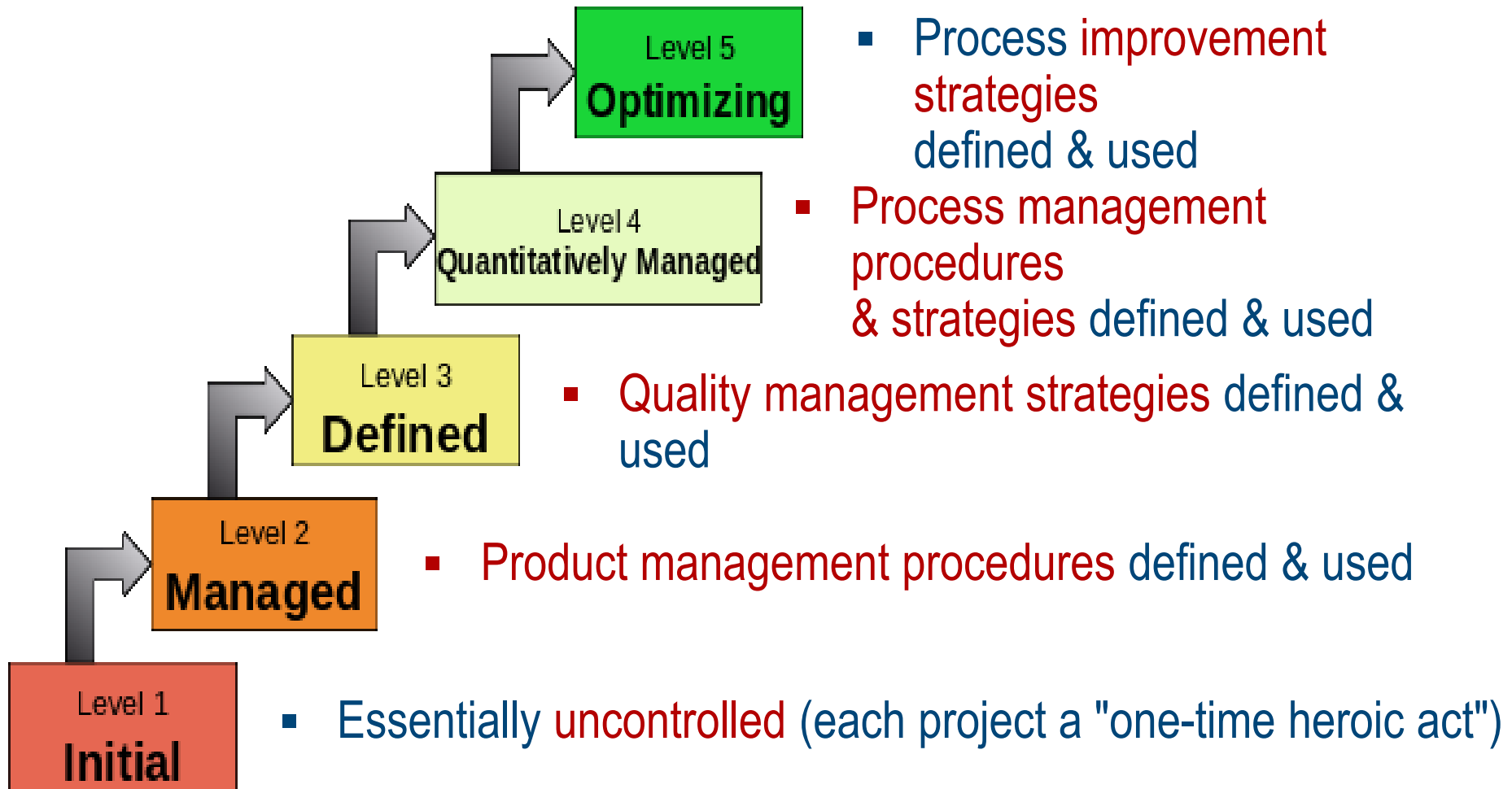
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„In theory, there is no difference between theory and practice. In practice, there is."
-- Yogi Berra (?)

Process Capability Assessment

- To what extent do organisation 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 mission: promote software technology transfer, particularly to US defence contractors

- CMM(I) framework measures process maturity, thereby helps with improvement

  - Capability Maturity Model (CMM) -- 1990s

  - Revised: Capability Maturity Model Integration (CMMI) -- 2001

  - See also: ISO/IEC 15504 (SPICE)

CMM Organisational Maturity Levels

Level 5
Optimizing

Level 4
Quantitatively Managed

Level 3
Defined

Level 2
Managed

Level 1
Initial

- 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

- 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

- 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

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

Sample CMMI Goals

- Corrective actions managed to closure when project performance or results deviate significantly from plan.

- Actual performance & progress is monitored against project plan.

- Requirements are analysed & validated and a definition of the required functionality is developed.

- Root causes of defects and other problems are systematically determined.

- Process is institutionalised as defined process.

Sample CMMI Practices

Process areas – Goals – Practices

- Validate requirements to ensure that the resulting product will perform as intended in the user's environment using multiple techniques as appropriate.

- 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.
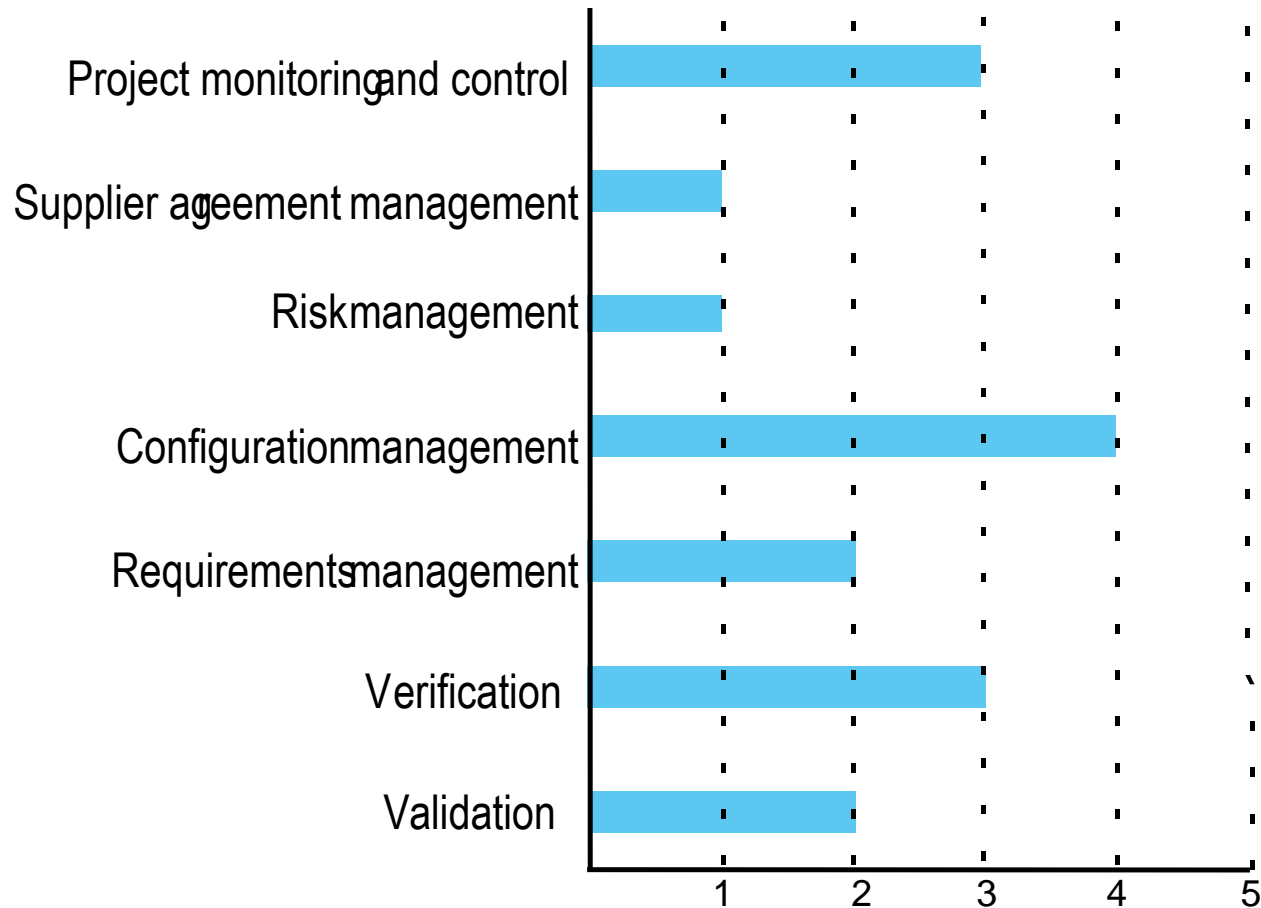
CMMI Assessment

- Examines processes in organisation, assesses maturity in process areas

- Merge into one final "grade" using a 6-point scale:

  - Not performed;

  - Performed;

  - Managed;

  - Defined;

  - Quantitatively managed;

  - Optimizing.

The Continuous CMMI Model

- 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

- CMM: assess IT company on maturity wrt. managing own processes

- Process improvement in CMM based on
  reaching 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%