



Capability Maturity Model

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[Process Capability Maturity]

- Software Engineering Institute (SEI) proposed a model of process capability maturity in the late 80's
 - Software Capability Maturity Model (CMM)
- Maturity of a process reflects on
 - Process management
 - Measurement
 - Adoption of good practices

[The Origin]

- U.S. Department of Defense has to assess capability of contractors
- Software CMM was followed by a range of other capability maturity models
 - People CMM
 - System Engineering Capability Model
 - SPICE, etc.

[CMM Integrated (CMMI)]

- In an attempt to integrate the capability models, SEI proposed CMMI
 - It addresses weaknesses of Software CMM
- CMMI has three main components
 - A set of process areas
 - For each area, a number of goals
 - Good practices to achieve each goal

[Process Area]

- CMMI defines 22 process areas in four categories
 - Process management (5 areas)
 - Project Management (6 areas)
 - Engineering (6 areas)
 - Support (5 areas)
- Each process area can be rated in a scale from 0 to 5

[Process Management]

- Organizational process definition (OPD)
- Organizational process focus (OPF)
- Organizational training (OT)
- Organizational process performance (OPP)
- Organizational innovation and deployment (OID)

[Project Management]

- Project planning (PP)
- Project monitoring and control (PMC)
- Supplier agreement management (SAM)
- Integrated project management (IPM)
- Risk management (RSKM)
- Quantitative project management (QPM)

[Engineering]

- Requirements management (REQM)
- Requirements development (RD)
- Technical solution (TS)
- Product integration (PI)
- Verification (VER)
- Validation (VAL)

[Support]

- Configuration management (CM)
- Process and product quality management (PPQA)
- Measurement and analysis (MA)
- Decision analysis and resolution (DAR)
- Causal analysis and resolution (CAR)

[Goals]

- Abstract description of a desirable state of an organization
- Examples of CMMI goals
 - The requirements are analyzed and validated, and a definition of the required functionality is developed.
 - Root causes of defects and other problems are systematically determined.

[Practices]

- Descriptions of ways of achieving a goal
 - Goal is more important than practices

- Examples of CMMI Practices
(The requirements are analyzed...)
 - Analyze derived requirements systematically 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.

[CMMI Models]

- CMMI assessment involves examining and rating the processes and process areas
 - Rating relates to the level of maturity
- CMMI has two instantiations
 - Staged Model
 - Continuous Model

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Staged CMMI Model

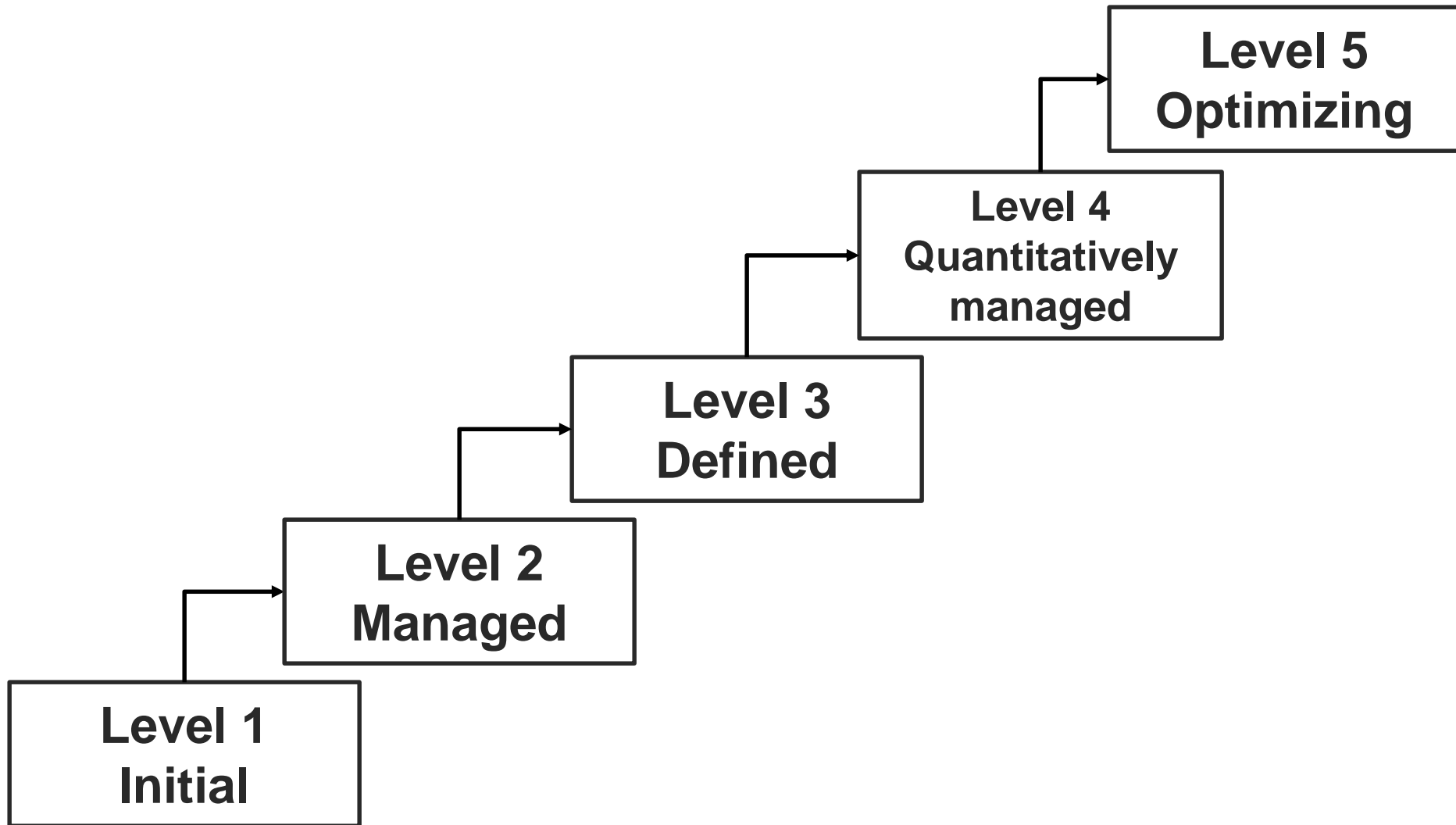
[Staged CMMI Model]

- The staged model is used to assess the capability of the organization
 - The continuous model measures specific process areas within the organization
- Staged CMMI is comparable with Software CMM

[Step-wise Improvement]

- Its goal is to assess a process capability in 5 levels of maturity
 - It describes the goals that should be achieved in each level
 - To achieve a goal, it suggests practices
- Each level is associated with a set of process areas and goals
 - Organizations move from one level to the next one by using good practices

[The CMMI Staged Model]



[Level 2: Managed]

- To achieve the 2nd level, organizations need to address 7 process areas
 - Requirements management
 - Project planning
 - Project monitoring and control
 - Supplier agreement management
 - Measurement and analysis
 - Process and product quality assurance
 - Configuration management

[Examples of Practices]

- For “Project Planning” process area:
 - Establish and maintain an organizational policy for planning and performing the project planning process.
 - Provide adequate resources for performing the project management process, developing the work products and providing the services of the process.
 - Monitor and control the project planning process against the plan and take appropriate corrective action.

[Advantages of Staged CMMI]

- Compatible with software CMM
 - It allows organizations to understand and to make a transition from one to another
- Staged CMMI defines a clear pathway for organizations
 - They can plan when and how to move from one level to another level

[Disadvantages]

- Its prescriptive nature
 - Staged CMMI assumes that all goals and practices of one level are required
- Organizations may implement some goals and practices of a higher level
 - However, these practices would not be considered for its capability



Continuous CMMI Model

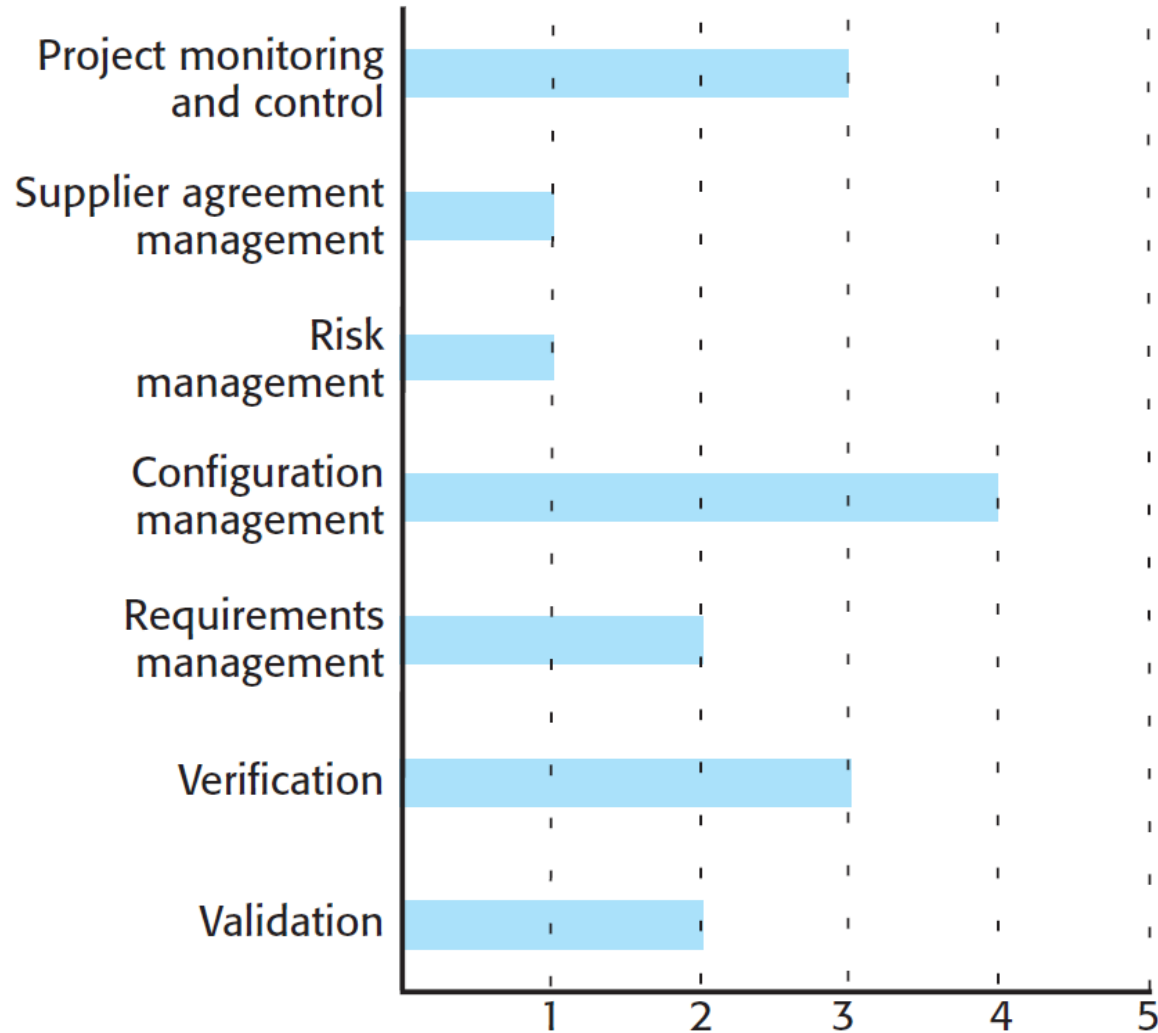
Continuous CMMI Model

- This model considers individual or groups of practices
 - It does not classify a organization in discrete levels (it is not a single value)
- Continuous CMMI considers all 22 process areas
 - Each process area has a capability assessment level from 0 to 5

[Process Area Levels]

- Each process are can be assessed in one of 6 possible levels
 - 0 Incomplete
 1. Performed
 2. Managed
 3. Defined
 4. Quantitatively managed
 5. Optimizing

[Example of Capability Profile]



[Advantage]

- Continuous CMMI permits discretion and flexibility
 - A organization can switch from continuous to stages once all process areas are addressed (e.g., in Level 2)
- Organizations can choose process for improvement according to their needs

[Bibliography]

- Ian Sommerville. **Software Engineering**, 10th Edition. Pearson Education, 2016.
 - Chapter 2: Section 2.4
 - Chapter 26 (online): Section 26.5