Capability Maturity Model (CMM)

a software maturity model
developed by the Software Engineering
Institute at Carnegie Mellon Univ (Pittsburgh)

Why?

- CMM can be used to assess maturity of an organization and implement an improvement strategy
- can also be used for assessment as part of a software acquisition policy
  - to qualify contractors, by requiring them to be certified according to CMM maturity levels

Immature organization

- Processes improvised during the course of the project
- Process is a sequence of steps that focus on solving unanticipated crisis situations
  - products → often delivered late
  - quality is questionable. Conversely, a mature organization has an organization-wide standard approach to software processes

Mature organization

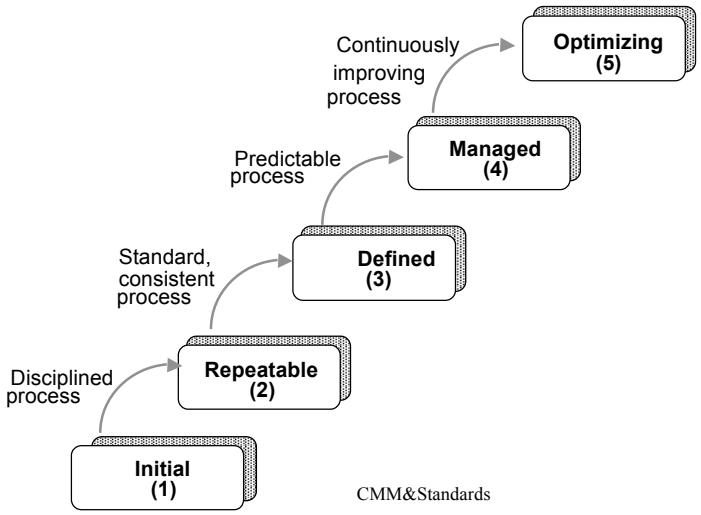
- Organization-wide standard approach to software processes, which is known and accepted by all engineers
- Focus on continuous improvement of both its *performance* and *product quality*

"Software process maturity is the extent to which a specific process is explicitly defined, managed, measured, controlled, and effective. Maturity implies a potential for gowth in capability and indicates both the richness of an organization's software process and the consistency with which it is applied in projects throughout the organization. As a software organization gains in software maturity, it institutionalizes its software process via policies, standards, and organizational structures. Institutionalization entails building an infrastructure and a corporate culture that supports the methods, practices, and procedures of the business, so that they endure after those who originally defined them have gone." (Paulk et al. [1993])

Glossary

- Software process
- Software process capability: what you can expect from a given process
- Software process performance: results obtained from a given process
- Software process maturity: the level at which is defined, managed, measured, controlled and executed
  - capabilities can be predicted for a mature process
  - performances can improve for a mature process

Maturity levels



Level 1: initial

- Ad-hoc, chaotic. Success only depends on personal skills and efforts of individuals.
- Lack of "stable" environment. No "good practices" applied.
- If a "crisis" arises (deadline likely to be missed, budget overflow) established procedures and quality control eliminated
- Software process capability impredictable
- Hard to estimate duration and cost and predict quality

Level 2: repeteable
Goal: project management

- Basic project management techniques are in place: costs, schedule and functionalities are under control
- Success of a process can be repeated if context is similar
- Configuration management in place to control consistence and integrity of artifacts

Level 3: defined
Goal: define process

- There is a documented organization's standard software process
- Someone is responsible for managing the standard process
- All projects follow a process that derives from the standard (project's defined software process)
- Such process includes criteria for completing a phase, verification techniques to adopt, …
- Managers have a god visibility of process for all projects
- A training program is in place for all roles in the organization

Level 4: managed
Goal: control the process

- Quality measures for process and product are collected, to support quantitative analysis
- Data collected, maintained and analyzed company-wide in a software process database
- It is possible to set quantitative goals for process and product quality
- Results of the process are predictable
- Product quality is also predictable

Level 5: optimizing
Goal: continuous improvement

- Quantitative data gathered as process is active support continuous process improvement
- Strenghts and weaknesses can be identified
- Main effort is on preventing defects rather than eliminating them
- Defects are analyzed to identify and remove their sopurce
- Continuous process improvement:
  - incremental, improving existing process
  - incorporating innovations, new methods and technology in a controlled way

How to improve in level?

- Move gradually from one level to the next
- Don't jump through levels

How to use CMM?

- Software capability evaluation
  - evaluate maturity of a contractor
- Software process assessment
  - try to improve status

Standards

Internal standards

- Enterprises adopt internal standards
- Often based on the use of certain tools which may enforce the standard
  - management (PERT and Gantt charts)
  - documentation (UML)

ISO-9000 series of quality standards

- Describe the requirements of a quality system; defines minimum attributes that an organization must possess to satisfy certain contractual commitments
- Existing standards as of 2000:
  - ISO 9000:2000: Fundamentals and vocabulary
  - ISO 9001:2000: Requirements
  - ISO 9004:2000: Guidelines for performance improvements
- Asctions to perform to obtain a certification
  - Define, document, and maintain procedures and operating instructions
  - Verify that procedures and instructions are executed and keep trace

Other standard

- MIL-STD 2167A
- IEEE Standards
  http://standards.ieee.org/
- ESA standards