



CMMI

CMMI

business process improvement

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About the Tutorial

SEI CMMI is a process improvement approach that provides organizations with the essential elements of effective processes. CMMI can help you make decisions about your process improvement plans.

This tutorial will give you a very good understanding on SEI CMMI.

NOTE: CMMI and CMM are registered in the U.S. Patent and Trademark office by Carnegie Mellon University.

Audience

This tutorial has been prepared for the beginners to help them understand basic functionality CMMI approach which is being adopted by various industries to create great quality products at reduced cost.

Prerequisites

It will help if you are familiar with the concepts of Quality Control and Quality Assurance and associated terminologies; however it is not a limiting factor.

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1. SEI CMMI – Overview

Process improvement is continuous improvement. We can never reach perfection. In this tutorial, we will learn CMM that is a continuously evolving and improving model where the focus is always on doing better. Our reach should always exceed our grasp.

What is CMM?

- CMM stands for **C**apability **M**aturity **M**odel.
- Focuses on elements of essential practices and processes from various bodies of knowledge.
- Describes common sense, efficient, proven ways of doing business (which you should already be doing) - not a radical new approach.
- CMM is a method to evaluate and measure the maturity of the software development process of an organization.
- CMM measures the maturity of the software development process on a scale of 1 to 5.
- CMM v1.0 was developed by the Software Engineering Institute (SEI) at Carnegie Mellon University in Pittsburgh, USA.
- CMM was originally developed for Software Development and Maintenance but later it was developed for :
 - Systems Engineering
 - Supplier Sourcing
 - Integrated Product and Process Development
 - People CMM
 - Software Acquisition

CMM Examples

- People CMM: Develop, motivate and retain project talent.
- Software CMM: Enhance a software focused development and maintenance capability.

What is Maturity?

Definitions vary but mature processes are generally thought to be:

- Well-defined,
- Repeatable,
- Measured,
- Analyzed,

- Improved, and
- Effective.

Poor but mature processes are just as bad as no maturity at all!

CMM helps to solve the maturity problem by defining a set of practices and providing a general framework for improving them. The focus of CMM is on identifying key process areas and the exemplary practices that may comprise a disciplined software process.

Immature vs Mature Organization

An immature organization would have the following characteristics:

- Process improvised during project
- Approved processes being ignored
- Reactive, not proactive
- Unrealistic budget and schedule
- Quality sacrificed for schedule
- No objective measure of quality

In contrast, the characteristics of a mature organization are as follows:

- 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

What is CMMI?

CMM Integration project was formed to sort out the problem of using multiple CMMs. CMMI product team's mission was to combine three **Source Models** into a single improvement framework for the organizations pursuing enterprise-wide process improvement. These three Source Models are:

- Capability Maturity Model for Software (SW-CMM) - v2.0 Draft C.
- Electronic Industries Alliance Interim Standard (EIA/IS) - 731 Systems Engineering.
- Integrated Product Development Capability Maturity Model (IPD-CMM) v0.98 .

CMM Integration

- Builds an initial set of integrated models.
- Improves best practices from source models based on lessons learned.
- Establishes a framework to enable integration of future models.

Difference between CMM and CMMI

CMM is a reference model of matured practices in a specified discipline like Systems Engineering CMM, Software CMM, People CMM, Software Acquisition CMM etc., but they were difficult to integrate as and when needed.

CMMI is the successor of the CMM and evolved as a more matured set of guidelines and was built combining the best components of individual disciplines of CMM (Software CMM, People CMM, etc.). It can be applied to product manufacturing, people management, software development, etc.

CMM describes about the software engineering alone where as CMM Integrated describes both software and system engineering. CMMI also incorporates the Integrated Process and Product Development and the supplier sourcing.

CMMI and Business Objectives

The objectives of CMMI are very obvious. They are as follows:

- **Produce quality products or services:** The process-improvement concept in CMMI models evolved out of the Deming, Juran, and Crosby quality paradigm: Quality products are a result of quality processes. CMMI has a strong focus on quality-related activities including requirements management, quality assurance, verification, and validation.
- **Create value for the stockholders:** Mature organizations are more likely to make better cost and revenue estimates than those with less maturity, and then perform in line with those estimates. CMMI supports quality products, predictable schedules, and effective measurement to support the management in making accurate and defensible forecasts. This process maturity can guard against project performance problems that could weaken the value of the organization in the eyes of investors.
- **Enhance customer satisfaction:** Meeting cost and schedule targets with high-quality products that are validated against customer needs is a good formula for customer satisfaction. CMMI addresses all of these ingredients through its emphasis on planning, monitoring, and measuring, and the improved predictability that comes with more capable processes.
- **Increase market share:** Market share is a result of many factors, including quality products and services, name identification, pricing, and image. Customers like to deal with suppliers who have a reputation for meeting their commitments.
- **Gain an industry-wide recognition for excellence:** The best way to develop a reputation for excellence is to consistently perform well on projects, delivering quality products and services within cost and schedule parameters. Having processes that conform to CMMI requirements can enhance that reputation.

2. SEI CMMI – Disciplines

The CMM Integration is a model that has integrated several disciplines/bodies of knowledge. Currently there are four bodies of knowledge available to you when selecting a CMMI model.

Systems Engineering

Systems engineering covers the development of complete systems, which may or may not include software. Systems engineers focus on transforming customer needs, expectations, and constraints into product solutions and supporting these product solutions throughout the entire lifecycle of the product.

Software Engineering

Software engineering covers the development of software systems. Software engineers focus on the application of systematic, disciplined, and quantifiable approaches to the development, operation, and maintenance of software.

Integrated Product and Process Development

Integrated Product and Process Development (IPPD) is a systematic approach that achieves a timely collaboration of relevant stakeholders throughout the life of the product to better satisfy customer needs, expectations, and requirements. The processes to support an IPPD approach are integrated with the other processes in the organization.

If a project or organization chooses IPPD, it performs the IPPD best practices concurrently with other best practices used to produce products (e.g., those related to systems engineering). That is, if an organization or project wishes to use IPPD, it must select one or more disciplines in addition to IPPD.

Supplier Sourcing

As work efforts become more complex, project managers may use suppliers to perform functions or add modifications to products that are specifically needed by the project. When those activities are critical, the project benefits from enhanced source analysis and from monitoring supplier activities before product delivery. Under these circumstances, the supplier sourcing discipline covers the acquisition of products from suppliers.

Similar to IPPD best practices, supplier sourcing best practices must be selected in conjunction with best practices used to produce products.

CMMI Discipline Selection

Selecting a discipline may be a difficult step and depends on what an organization wants to improve.

- If you are improving your systems engineering processes, like Configuration Management, Measurement and Analysis, Organizational Process Focus, Project

Monitoring and Control, Process and Product Quality Assurance, Risk Management, Supplier Agreement Management etc., then you should select Systems engineering (SE) discipline. The discipline amplifications for systems engineering receive special emphasis.

- If you are improving your integrated product and process development processes like Integrated Teaming, Organizational Environment for Integration, then you should select IPPD. The discipline amplifications for IPPD receive special emphasis.
- If you are improving your source selection processes like Integrated Supplier Management then you should select Supplier sourcing (SS). The discipline amplifications for supplier sourcing receive special emphasis.
- If you are improving multiple disciplines, then you need to work on all the areas related to those disciplines and pay attention to all of the discipline amplifications for those disciplines.

We will discuss different areas related to CMMI implementation in subsequent chapters.

3. SEI CMMI – Representations

The CMMI is structured as follows:

- Maturity Levels (staged representation) or Capability Levels (continuous representation)
- Process Areas
- Goals: Generic and Specific
- Common Features
- Practices: Generic and Specific

This chapter will discuss about two CMMI representations and rest of the subjects will be covered in subsequent chapters.

A representation allows an organization to pursue different improvement objectives. An organization can go for one of the following two improvement paths.

Staged Representation

The staged representation is the approach used in the Software CMM. It is an approach that uses predefined sets of process areas to define an improvement path for an organization. This improvement path is described by a model component called a Maturity Level. A maturity level is a well-defined evolutionary plateau towards achieving improved organizational processes.

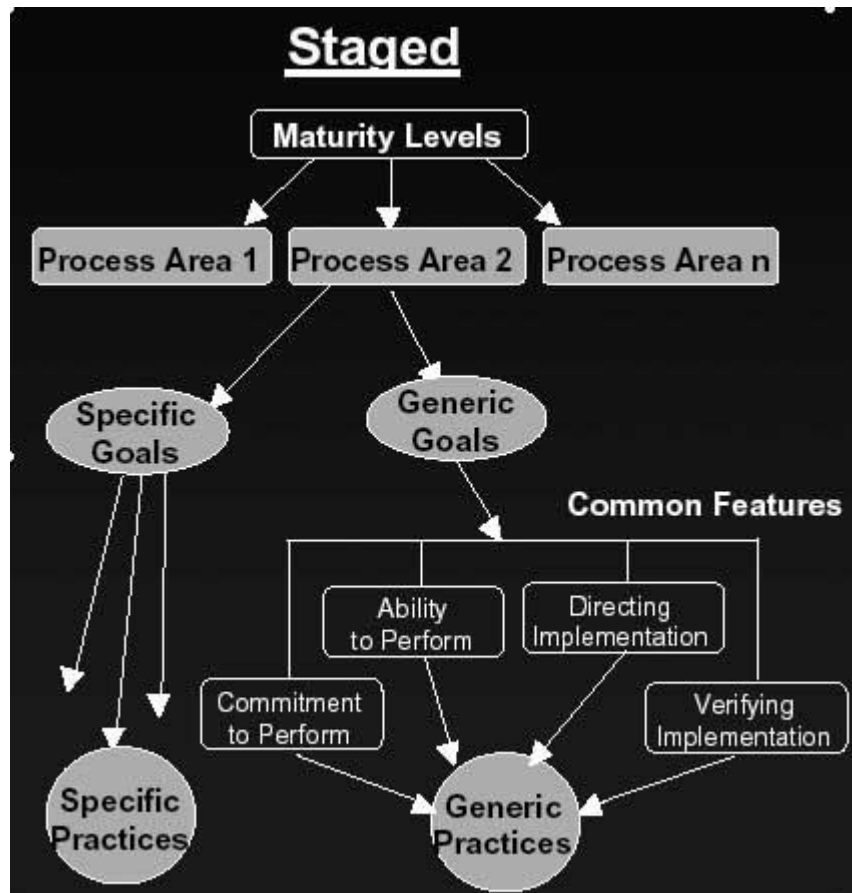
CMMI Staged Representation

- Provides a proven sequence of improvements, each serving as a foundation for the next.
- Permits comparisons across and among organizations by the use of maturity levels.
- Provides an easy migration from the SW-CMM to CMMI.
- Provides a single rating that summarizes appraisal results and allows comparisons among organizations.

Thus Staged Representation provides a pre-defined roadmap for organizational improvement based on proven grouping and ordering of processes and associated organizational relationships. You cannot divert from the sequence of steps.

CMMI Staged Structure

Following picture illustrates CMMI Staged Model Structure.



Continuous Representation

Continuous representation is the approach used in the SECM and the IPD-CMM. This approach allows an organization to select a specific process area and make improvements based on it. The continuous representation uses Capability Levels to characterize improvement relative to an individual process area.

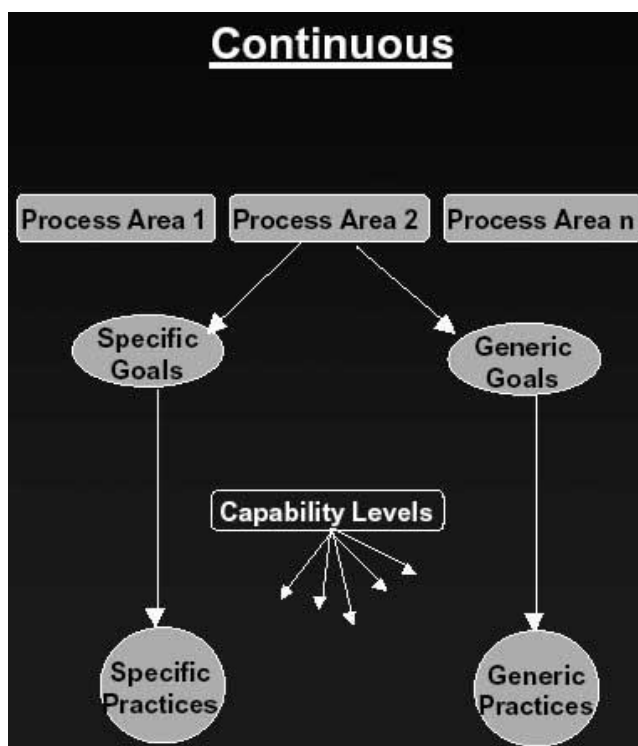
CMMI Continuous Representation

- Allows you to select the order of improvement that best meets your organization's business objectives and mitigates your organization's areas of risk.
- Enables comparisons across and among organizations on a process-area-by-process-area basis.
- Provides an easy migration from EIA 731 (and other models with a continuous representation) to CMMI.

Thus Continuous Representation provides flexibility to organizations to choose the processes for improvement, as well as the amount of improvement required.

CMMI Continuous Structure

The following picture illustrates the CMMI Continuous Model Structure.



Continuous vs. Staged Representations

Continuous Representation	Staged Representation
Process areas are organized by process area categories.	Process areas are organized by maturity levels.
Improvement is measured using capability levels. Capability levels measure the maturity of a particular process across an organization; it ranges from 0 through 5.	Improvement is measured using maturity levels. Maturity levels measure the maturity of a set of processes across an organization; it ranges from 1 through 5.
There are two types of specific practices: base and advanced. All specific practices appear in the continuous representation.	There is only one type of specific practice. The concepts of base and advanced practices are not used. All specific practices appear in the staged representation except when a related base-advanced pair of practices appears in the continuous representation, in which case only the advanced practice appears in the staged representation.

Capability levels are used to organize the generic practices.	Common features are used to organize generic practices.
All generic practices are included in each process area.	Only the level 2 and level 3 generic practices are included.
Equivalent staging allows determination of a maturity level from an organization's achievement profile.	There is no need for an equivalence mechanism to back the continuous representation because each organization can choose what to improve and how much to improve using the staged representation.

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