Software Engineering Institute

Introduction to the Architecture of the CMMI® Framework

CMMI Architecture Team

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Abstract

This document is an introduction to the CMMI® (Capability Maturity Model® Integration) Framework architecture, which guides how CMMI products are developed and integrated. The architecture describes the structure, terminology, and required content of every CMMI model.

1 The CMMI Framework

Identification

This document introduces the architecture of the CMMI Framework, which is used to create CMMI models and their associated training and appraisal materials for CMMI version 1.2 and beyond.

Framework Overview

The CMMI Framework is a collection of components used to construct CMMI models, CMMI training materials, and CMMI appraisal materials:

- The model components include process areas, goals, practices, and informative material about the use of the model and its components.

- The training components include guidebooks on implementing the model and audio-visuals to support teaching how to use the model.

- The appraisal components describe the process of appraising the organization's processes against the goals and practices described in the model. They also include training for performing the appraisal process.

A purpose of the CMMI Framework Architecture is to control the selection and use of model components to construct CMMI models for various *areas of interest*. When building a new CMMI model, developers use existing well-proven components that fit the needs of the new area of interest. Using these existing components reduces the amount of training needed and the adjustment of existing processes required. The framework also enables newly developed models to retain the common terminology and structure of other CMMI models in the framework so that learning the new model will be based on familiar model concepts.

The CMMI Framework is a collection of all model components, training material components, and appraisal components. These components are organized into groups called *constellations*, which facilitate construction of approved models and preserve the legacy of existing CMM and CMMI models.

In the framework, there are constellations of components that are used to construct models, training, and appraisal materials in an area of interest (e.g., acquisition, development, or services):

- The *Acquisition* constellation supports an organization (or project) in procuring products or services from suppliers outside of the organization (or project).

- The *Development* constellation supports an organization (or project) that develops products or services.

- The *Services* constellation supports an organization (or project) that delivers services.

Also in the framework is a *CMMI model foundation* (CMF), a skeleton model that contains each of the components that must be included in every CMMI model. A CMMI model for a constellation is constructed by inserting additional model components into the CMF.

A constellation may share some components, in addition to the CMF components, with other constellations. It also may have some unique components that are different from those in any other constellation. The components included in a constellation depend on the purpose of the constellation.

2 The CMMI Model Foundation

The CMF exists within the CMMI Framework. The CMF contains sections for each of the following:

- front matter
- generic goals and generic practices
- process areas
- glossary.

The CMF is designed to provide an internally consistent set of components that must be included in every CMMI model. The content of the CMF is appropriate to the areas of interest addressed by all constellations. The process areas in the CMF have no additions, no generic practice elaborations, and no amplifications. Certain other components may be absent because they are not appropriate for all constellations. To achieve maximum reasonable commonality, the CMF process areas include introductory notes and other informative material that appropriately applies to all constellations. The CMF glossary includes the definitions of terms used in the CMF components.

In other words, constellations and models must use the CMF without deleting or changing any of its content. Adding process areas, specific goals, specific practices, specific subpractices, typical work products, generic practice elaborations, glossary entries, and front matter is permitted.

Suitable additions and amplifications may already exist in other models and may be reused in the models of a constellation when appropriate. Preserving commonality by reusing existing and proven model components saves time and reduces confusion when training people on new material.

To make changes to the CMF, change requests shall be submitted to the CMMI Architecture team. The CMMI Architecture team will invite constellation teams to participate in the evaluation of change requests and the design of change proposals so that adverse effects on the constellations' models are minimized. Once changes are approved by the CMMI Architecture team, the changes are subject to the configuration control processes of the CMMI Configuration Control Board (CCB). The CCB ensures that the implementation of the change proposals is consistent with the CMMI Framework architecture.

The process areas in the CMF are as follows:

Causal Analysis and Resolution (CAR)

Configuration Management (CM)

Decision Analysis and Resolution (DAR)

Integrated Project Management (IPM)

Measurement and Analysis (MA)

Organizational Innovation and Deployment (OID)

Organizational Process Definition (OPD)

Organizational Process Focus (OPF)

Organizational Process Performance (OPP)

Organizational Training (OT)

Project Monitoring and Control (PMC)

Project Planning (PP)

Process and Product Quality Assurance (PPQA)

Quantitative Project Management (QPM)

Requirements Management (REQM)

Risk Management (RSKM)

Constellations

Each constellation is comprised of the following elements:

- the CMF

- named groups of additions used to create CMMI models within that constellation

  Two examples are the Engineering group of additions used to insert the Engineering process areas not included in the CMF and the IPPD group of additions consisting of specific goals inserted into IPM and OPF to create the CMMI-DEV +IPPD model.

- generic practice elaborations for the process areas in the constellation (optional)

- appropriate training and appraisal materials

Change requests for a model in a constellation must be submitted to the SEI for delivery to the appropriate constellation team. The constellation team evaluates the change requests and designs a change proposal so that none of the constellations and their models are adversely affected. If the change proposal will change the CMF, the change proposal must be referred to the CMMI Architecture Team. Once changes are approved by the constellation teams and the CMMI Architecture Team, the change proposal is subject to the configuration control processes of the CMMI CCB, which ensures that the implementation of the change proposal is consistent with the CMMI Framework architecture.

CMMI Models

The models of a constellation are constructed by inserting selected groups of additions and selected groups of amplifications into the CMF. Generic practice elaborations for the process areas can also be optionally inserted into the model.

- Each addition contains a reference, glossary entry, note, subpractice, typical work product, practice, goal, or process area that is inserted into the CMF to extend its scope or emphasize a particular aspect of the model's use. The addition must preserve the CMMI model structure. For example, a practice can only be inserted into a list of practices within a goal.

- Each generic practice elaboration consists of informative material that explains how the generic practice affects a particular process area and a model location where it is to be inserted. The elaborations pertinent to a process area are placed in a named group.

- The elaborations and additions created by constellation teams are subject to the configuration control processes of the CMMI CCB.

Naming Rules for Selection Within a Constellation

The name of each produced model in a constellation consists of the letters *CMMI* followed by an abbreviation of the constellation name, followed by the names of the addition groups included. If an addition group is common to all of the models in the constellation, its name is not included. For example, a model in the Development constellation would, because the Engineering process area addition group is common to all of the models of the constellation, be named the *CMMI for Development (CMMI-DEV)* model. After the IPPD addition group is inserted into the model, the name becomes the *CMMI for Development plus IPPD (CMMI–DEV +IPPD)* model.

When an addition not common to all of the models of the constellation is inserted into a component of a model, the components that enclose the addition have the name of the addition group in their names, or a different style of marking (e.g., grayed in a box) to emphasize that the component was altered. The process area names are unique within a constellation, but each one has a designator for the constellation in which it resides.

For example, if an IPPD addition is a specific practice, either the specific practice title must include "+IPPD" or the material must be highlighted and labeled clearly as an "IPPD Addition." If the naming option is used, the specific goal that contains the added specific practice must also have "+IPPD" in its name. Further, the process area that contains this goal must have "+IPPD" in its name.

Rules for Marking Paragraphs in Models

The paragraphs that comprise the CMF are marked at the end of the each paragraph with a superscript of " CMF."

The paragraphs that comprise the additions are marked at the end of each paragraph with a superscript of its acronym (e.g. " DEV"). If these paragraphs are shared among two or more constellations, both acronyms are listed in superscript (e.g. " DEV ACQ"). These markings must be in the database of the CMMI Framework; they may or may not be in a printed version of a model.

Complete Insertion

A group of additions is completely inserted in their prescribed locations in the model being constructed. There are no partial insertions. This approach ensures that every model is the same every time it is generated. So, CMMI-DEV+IPPD is the same every time, with the entire IPPD addition group inserted.

Maturity Level Satisfaction

For each releasable model that is constructed using the CMMI Framework, each process area is assigned to a maturity level and there is an approved target staging that describes the process areas and capability levels that are necessary for each of the maturity levels. The process areas in the CMF are permanently assigned to maturity levels that must be the same in every constellation.

The following list summarizes the rules for approved target staging:

- To achieve maturity level 2, all process areas assigned to maturity level 2 must achieve capability level 2 or higher.

- To achieve maturity level 3, all process areas assigned to maturity levels 2 and 3 must achieve capability level 3 or higher.

- To achieve maturity level 4, all process areas assigned to maturity levels 2, 3, and 4 must achieve capability level 3 or higher.

- To achieve maturity level 5, all process areas must achieve capability level 3 or higher.

Shared process areas are staged at the same level in all constellations. If a shared process area is moved to a different level, its name will be different.

3 The Structure of CMMI Models

CMMI models have a defined structure. This structure is designed to provide familiar placement of model components regardless of constellation or version.

Model Structure

Table 1 illustrates the structure of all CMMI models. If a component name in the *Structure of the Component* columns of the table is singular, then there is only one component of that name; if it is plural, then the number of components of that name is unspecified. If a component name has quotes around it, it appears in the model exactly as the text in the quotes. The components that contain normative items are in **Bold Font.**

Table 1:   Model Structure

Component		Structure of the Component					
CMMI Model	=	Model Name	Front Matter	**Generic Goals and Practices Section**	**Process Area Sections**	Glossary	
Front Matter	=	Preface	Table of contents	*Chapters*			
Preface	=	"Preface"	Notes				
Chapter	=	Chapter Name	Notes				
Generic Goals and Practices Section	=	"GENERIC GOALS AND GENERIC PRACTICES"	Notes	**Generic Goals and Practices List**	"Applying Generic Practices"	Notes	Enabling Process Areas
Enabling Process Areas	=	"Process Areas that Support Generic Practices"	Notes	Table of Generic Practice and Process Area Relationships	Notes		

Component		Structure of the Component					
Generic Goals and Practices List	=	"Generic Goals and Generic Practices"	Notes	**Generic Goals**			
Generic Goal	=	Generic Goal Name	**Generic Goal Statement**	**Generic Practices**			
Generic Practice	=	Generic Practice Name	**Generic Practice Statement**	Purpose	Generic Subpractices		
Purpose	=	Purpose Statement	Notes				
Generic Subpractice	=	Generic Subpractice Statement	Notes				
Process Area Section	=	Process Area Heading	**Process Area Body**				
Process Area Heading	=	Process Area Name	Associated Category	Associated Maturity Level	Associated Constellation	"Purpose"	Purpose
Process Area Body	=	"Introductory Notes"	Notes	References	"Specific Practices by Goal"	**Specific Goals**	Elaborations
Specific Goal	=	Specific Goal Name	**Specific Goal Statement**	Notes	**Specific Practices**		
Specific Practice	=	Specific Practice Name	**Specific Practice Statement**	References	Notes	References	Specific Practice Body
Specific Practice Body	=	"Typical Work Products"	Typical Work Products	"Subpractices"	Subpractices		
Subpractice	=	Subpractice Statement	Notes	References			

Component		Structure of the Component					
Note	=	Text, list, table, graph, diagram. A note is informative.					
Elaboration	=	Generic Practice Name	Generic Practice Statement (with Process Area Name inserted before "process")	"Elaboration"	Notes		

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