

MGL804

Improving Software maintenance

The Generic practices of software maintenance

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TABLE OF CONTENTS

- 1. INTRODUCTION- 5 -
- 2. CMMI GENERIC PRACTICES- 8 -
- 3. APPLYING CMMI GENERIC PRACTICES ON SOFTWARE MAINTENANCE - 13 -
- 4. NEW GENERIC PRACTICES OF SOFTWARE MAINTENANCE..... - 18 -
- 5. CONCLUSION - 19 -
- 6. REFERENCES - 20 -

TABLE OF FIGURES

FIGURE 1.1 STRUCTURE OF THE CONTINUOUS AND STAGED REPRESENTATIONS	- 7 -
FIGURE 3.1 CMMI & S ^{3M} SOFTWARE MAINTENANCE PROCESSES DOMAINS.....	- 13 -
FIGURE 3.2 CMMI & S ^{3M} SOFTWARE MAINTENANCE FOR PROCESS MANAGEMENT	- 14 -
FIGURE 3.3 CMMI & S ^{3M} SOFTWARE MAINTENANCE FOR EVENT/REQUEST MANAGEMENT	- 15 -
FIGURE 3.4 CMMI & S ^{3M} SOFTWARE MAINTENANCE FOR EVOLUTION ENGINEERING MANAGEMENT	- 16 -
FIGURE 3.5 CMMI & S ^{3M} SOFTWARE MAINTENANCE FOR SUPPORT TO EVOLUTION ENGINEERING	- 17 -

TABLE OF TABLES

TABLE 2.1 GENERIC GOALS AND PROCESS NAMES - 8 -

TABLE 2.2 THE CLASSIFICATION OF GENERIC GOALS, GENERIC PRACTICES, AND THE PROCESSES - 12 -

1. Introduction

We need to understand CMMi model as we are going to identify the generic practices that apply to Software Maintenance by using the CMMi generic practices concept to help us understand what they are and how they relate to the CMMi.

We'll discover shared generic practices between the CMMi and the software maintenance maturity model; of course CMMi generic practices can't cover all processes of software maintenance, which enforces us to discover some new generic practices that are unique to this IT domain.

CMMI (Capability Maturity Model Integration) model is a collection of best practices that help organizations to improve their processes. This model is developed by product teams with members from industry, government, and the Software Engineering Institute (SEI).

Now we'll focus on generic goals, generic practices of CMMi model.

Generic Goals

Generic goals are called "generic" because the same goal statement applies to multiple process areas. A generic goal describes the characteristics that must be present to institutionalize processes that implement a process area. A generic goal is a required model component and is used in appraisals to determine whether a process area is satisfied. An example of a generic goal is "The process is institutionalized as a defined process."

Generic Practices

Generic practices are called "generic" because the same practice applies to multiple process areas. The generic practices associated with a generic goal describe the activities that are considered important in achieving the generic goal and contribute to the institutionalization of the processes associated with a process area. A generic practice is an expected model component. For example, a generic practice for the generic goal "The process is institutionalized as a managed process" is "Provide adequate resources for performing the process, developing the work products, and providing the services of the process."

Generic Practice Elaborations

Generic practice elaborations appear after generic practices to provide guidance on how the generic practices can be applied uniquely to process areas. A generic practice elaboration is an informative model component. For example, a generic practice elaboration after the generic practice “Establish and maintain an organizational policy for planning and performing the process” for the Project Planning process area is “This policy establishes organizational expectations for estimating the planning parameters, making internal and external commitments, and developing the plan for managing the project.”

Numbering Scheme

Generic goals and generic practices are numbered sequentially. Each generic goal begins with the prefix “GG” (e.g., GG 2), and each generic practice begins with the prefix “GP,” followed by a number in the form “x.y” (e.g., GP 1.1), the x corresponds to the number of the generic goal. The y is the sequence number of the generic practice under the generic goal. For example, the first generic practice associated with GG 2 is numbered GP 2.1 and the second is GP 2.2.

Understanding Levels

Levels are used in CMMI-DEV to describe an evolutionary path recommended for an organization that wants to improve the processes it uses to develop products or services. Levels can also be the outcome of the rating activity in appraisals. 7 Appraisals can apply to entire organizations or to smaller groups such as a group of projects or a division.

CMMI supports two improvement paths using levels. One path enables organizations to incrementally improve processes corresponding to an individual process area (or group of process areas) selected by the organization. The other path enables organizations to improve a set of related processes by incrementally addressing successive sets of process areas.

These two improvement paths are associated with the two types of levels: capability levels and maturity levels. These levels correspond to two approaches to process improvement called “representations.” The two representations are called “continuous” and “staged.” Using the continuous representation enables you to achieve “capability levels.” Using the staged representation enables you to achieve “maturity levels.”

Tying It All Together

To reach a particular level, an organization must satisfy all of the goals of the process area or set of process areas that are targeted for improvement, regardless of whether it is a capability or a maturity level.

Both representations provide ways to improve your processes to achieve business objectives, and both provide the same essential content and use the same model components.

Structures of the Continuous and Staged Representations

Figure 1.1 illustrates the structures of the continuous and staged representations. The differences between the structures are subtle but significant. The staged representation uses maturity levels to characterize the overall state of the organization's processes relative to the model as a whole, whereas the continuous representation uses capability levels to characterize the state of the organization's processes relative to an individual process area.

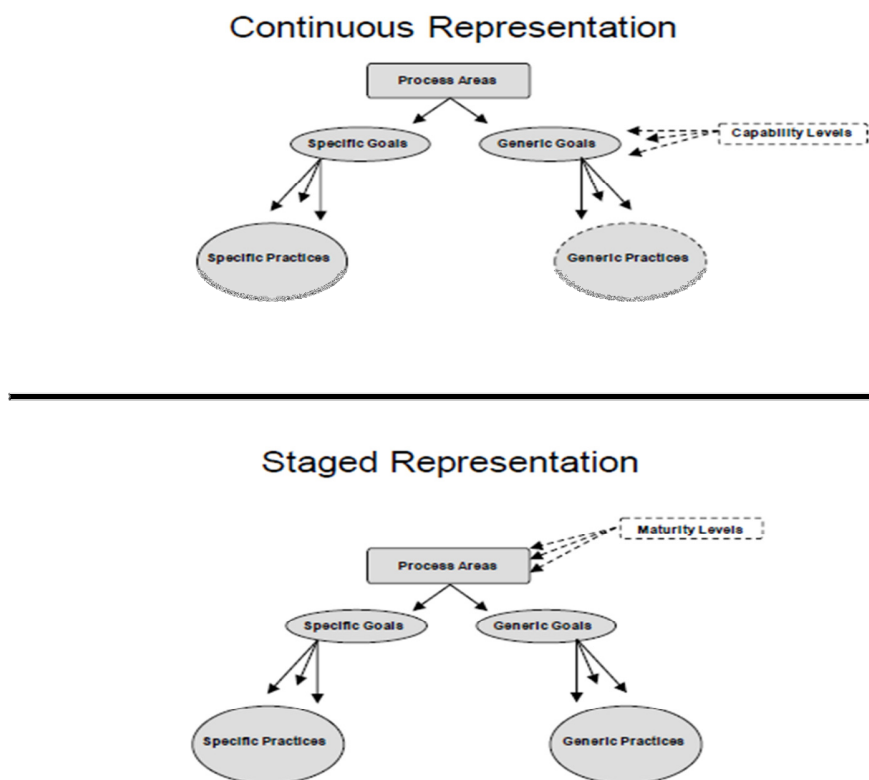


Figure 1.1 Structure of the Continuous and Staged Representations

2. CMMi generic practices

Now we'll try to go deeply into generic practices of CMMi.

Generic practices address the aspects of process implementation and institutionalization. Where institutionalization implies that the process is rooted in the way the work is performed and there is commitment and consistency for performing the process.

The word "generic" convey the idea that these practices are applicable to any process, with the goal of enhancing the capability to perform that process. For example, "planning" is a feature common to improved management of any process.

The degree of institutionalization is embodied in the generic goals and expressed in the names of the processes associated with each goal as indicated in Table 2.1.

Table 2.1 Generic Goals and Process Names

Generic Goal	Progression of Processes
GG1	Performed process
GG2	Managed process
GG3	Defined process

Now, we need to define the three different process types:

➤ **Performed Process :**

A process that accomplishes the work necessary to satisfy the specific goals of a process area.

➤ **Managed Process**

A performed process that is planned and executed in accordance with policy; employs skilled people having adequate resources to produce controlled outputs; involves relevant stakeholders; is monitored, controlled, and reviewed; and is evaluated for adherence to its process description.

➤ **Defined Process**

A *defined process* is a *managed process* that is tailored from the organization's set of standard processes according to the organization's tailoring guidelines; has a maintained process description; and contributes process related experiences to the organizational process assets.

A defined process clearly states the following:

- Purpose
- Inputs
- Entry criteria
- Activities
- Roles
- Measures
- Verification steps
- Outputs
- Exit criteria

A critical distinction between a managed process and a defined process is the scope of application of the process descriptions, standards, and procedures. For a managed process, the process descriptions, standards, and procedures are applicable to a particular project, group, or organizational function. As a result, the managed processes of two projects in one organization can be different. Another critical distinction is that a defined process is described in more detail and is performed more rigorously than a managed process.

This distinction means that improvement information is easier to understand, analyze, and use. Finally, management of the defined process is based on the additional insight provided by an understanding of the interrelationships of the process activities and detailed measures of the process, its work products, and its services.

Relationships among processes

The generic goals evolve so that each goal provides a foundation for the next. Therefore, the following conclusions can be made:

A managed process is a performed process.

A defined process is a managed process.

Now we'll list all the generic practices of CMMi:

GP 1.1 Perform Specific Practices

Perform the specific practices of the process area to develop work products and provide services to achieve the specific goals of the process area. The purpose of this generic practice is to produce the work products and deliver the services that are expected by performing (i.e., executing) the process. These practices can be done informally without following a documented process description or plan. The rigor with which these practices are performed depends on the individuals managing and performing the work and can vary considerably.

GP 2.1 Establish an Organizational Policy

Establish and maintain an organizational policy for planning and performing the process. The purpose of this generic practice is to define the organizational expectations for the process and make these expectations visible to those members of the organization who are affected. In general, senior management is responsible for establishing and communicating guiding principles, direction, and expectations for the organization.

GP 2.2 Plan the Process

Establish and maintain the plan for performing the process. The purpose of this generic practice is to determine what is needed to perform the process and to achieve the established objectives, to prepare a plan for performing the process, to prepare a process description, and to get agreement on the plan from relevant stakeholders.

GP 2.3 Provide Resources

Provide adequate resources for performing the process, developing the work products, and providing the services of the process. The purpose of this generic practice is to ensure that the resources necessary to perform the process as defined by the plan are available when they are needed. Resources include adequate funding, appropriate physical facilities, skilled people, and appropriate tools.

GP 2.4 Assign Responsibility

Assign responsibility and authority for performing the process, developing the work products, and providing the services of the process. The purpose of this generic practice is to ensure that there is accountability for performing the process and achieving the specified results throughout the life of the process. The people assigned must have the appropriate authority to perform the assigned responsibilities.

GP 2.5 Train People

Train the people performing or supporting the process as needed. The purpose of this generic practice is to ensure that people have the necessary skills and expertise to perform or support the process. Appropriate training is provided to those who will be performing the work. Overview training is provided to orient people who interact with those who perform the work.

GP 2.6 Control Work Products

Place selected work products of the process under appropriate levels of control. The purpose of this generic practice is to establish and maintain the integrity of the selected work products of the process (or their descriptions) throughout their useful life.

GP 2.7 Identify and Involve Relevant Stakeholders

Identify and involve the relevant stakeholders of the process as planned. The purpose of this generic practice is to establish and maintain the expected involvement of relevant stakeholders during the execution of the process.

GP 2.8 Monitor and Control the Process

Monitor and control the process against the plan for performing the process and take appropriate corrective action. The purpose of this generic practice is to perform the direct day-to-day monitoring and controlling of the process. Appropriate visibility into the process is maintained so that appropriate corrective action can be taken when necessary. Monitoring and controlling the process can involve measuring appropriate attributes of the process or work products produced by the process.

GP 2.9 Objectively Evaluate Adherence

Objectively evaluate adherence of the process and selected work products against the process description, standards, and procedures, and address noncompliance. The purpose of this generic practice is to provide credible assurance that the process and selected work products are implemented as planned and adhere to the process description, standards, and procedures.

GP 2.10 Review Status with Higher Level Management

Review the activities, status, and results of the process with higher level management and resolve issues. The purpose of this generic practice is to provide higher level management with the appropriate visibility into the process.

GP 3.1 Establish a Defined Process

Establish and maintain the description of a defined process. The purpose of this generic practice is to establish and maintain a description of the process that is tailored from the organization's set of standard processes to address the needs of a specific instantiation. The organization should have standard processes that cover the process area, as well as have guidelines for tailoring these standard processes to meet the needs of a project or organizational function. With a defined process, variability in how the processes are performed across the organization is reduced and process assets, data, and learning can be effectively shared.

The following table 2.2 summarizes all CMMi generic practice, relates them to generic goals and processes.

Table 2.2 The classification of generic goals, generic practices, and the processes

Generic Goal	Progression of Process	Generic Practice
GG 1	Performed process	GP 1.1 Perform Specific Practices
GG 2	Managed process	GP 2.1 Establish an Organizational Policy
		GP 2.2 Plan the Process
		GP 2.3 Provide Resources
		GP 2.4 Assign Responsibility
		GP 2.5 Train People
		GP 2.6 Control Work Products
		GP 2.7 Identify and Involve Relevant Stakeholders
		GP 2.8 Monitor and Control the Process
		GP 2.9 Objectively Evaluate Adherence
		GP 2.10 Review Status with Higher Level Management
GG 3	Defined process	GP 3.1 Establish a Defined Process
		GP 3.2 Collect Process Related Experiences

3. Applying CMMi Generic practices on software maintenance

In order to understand what generic practices are for software maintenance, the CMMi generic practices concept will be used, so we need first to make a similarity between the processes domains of CMMi, and S3m, the following figure 3.1 demonstrates these process domains

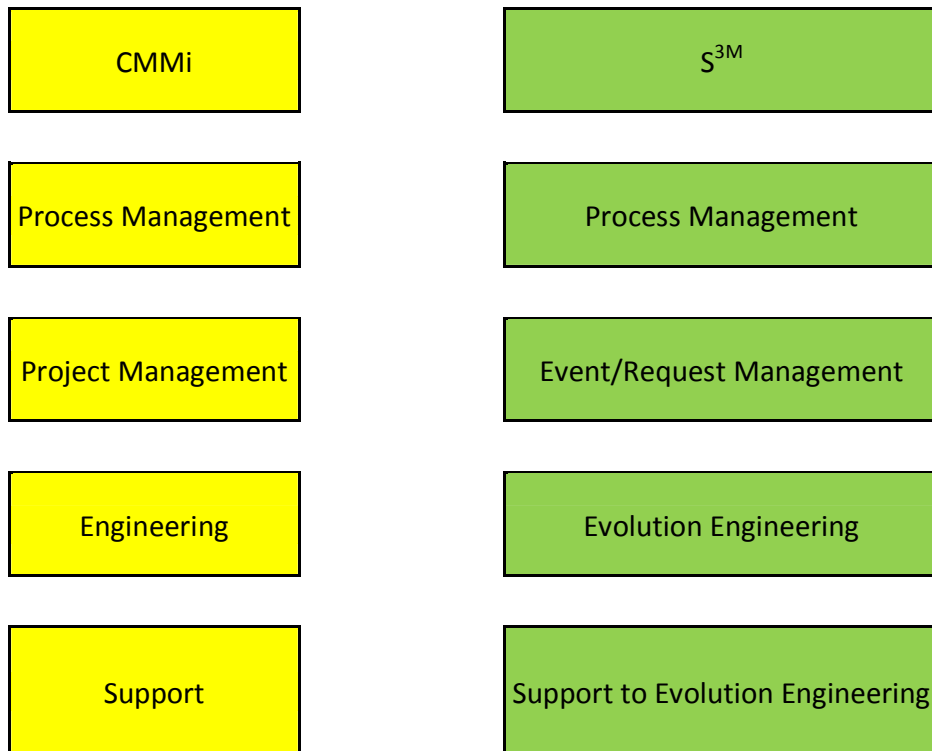


Figure Error! No text of specified style in document.1 CMMi & S^{3M} software maintenance processes domains

From this figure, we can notice that in software maintenance, engineering and support activities can be centered around software evolution and not on its initial conception, so CMMi engineering domain was renamed evolution engineering.

We go through these four processes domains trying to find if it is possible to apply CMMi generic practices on software maintenance, and determine which processes need new generic practices missed by CMMi.

Process Management

This figure 3.2 matches CMMi generic practices with S^{3M} for process management, but for the last process; “maintenance innovations and deployment”, it seems that CMMi can't suppose a generic process to be applied.

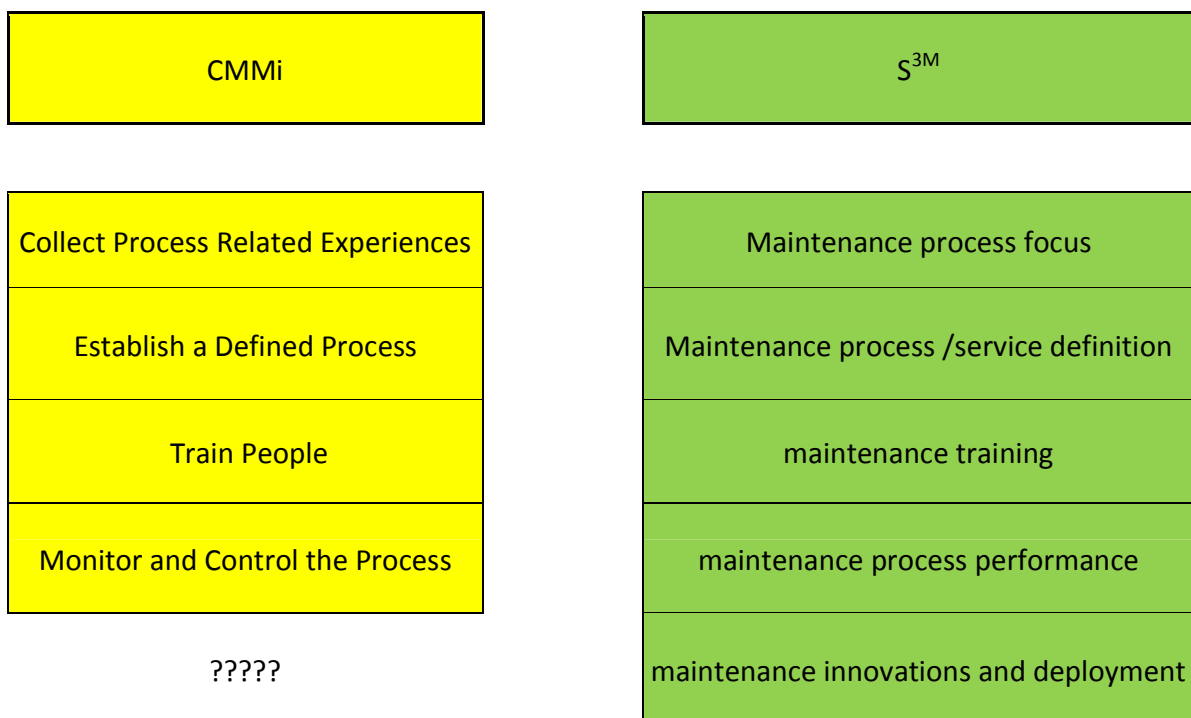


Figure 3.2 CMMi & S^{3M} software maintenance for process management

Event/Request Management

This figure 3.3 matches CMMi generic practices with S^{3M} for even/request management, for “SLA and supplier agreements management”, we can’t make a match between CMMi generic practices and S3M, so we need new generic practices for such process.

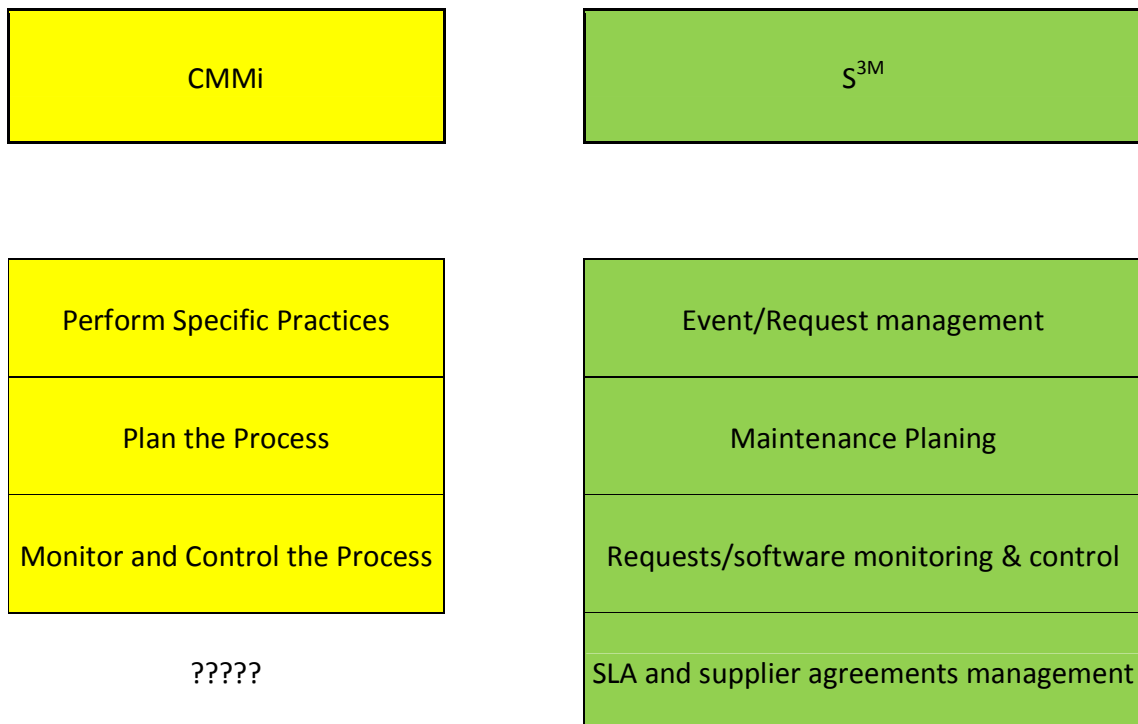


Figure 3.3 CMMi & S^{3M} software maintenance for Event/Request Management

Evolution Engineering Management

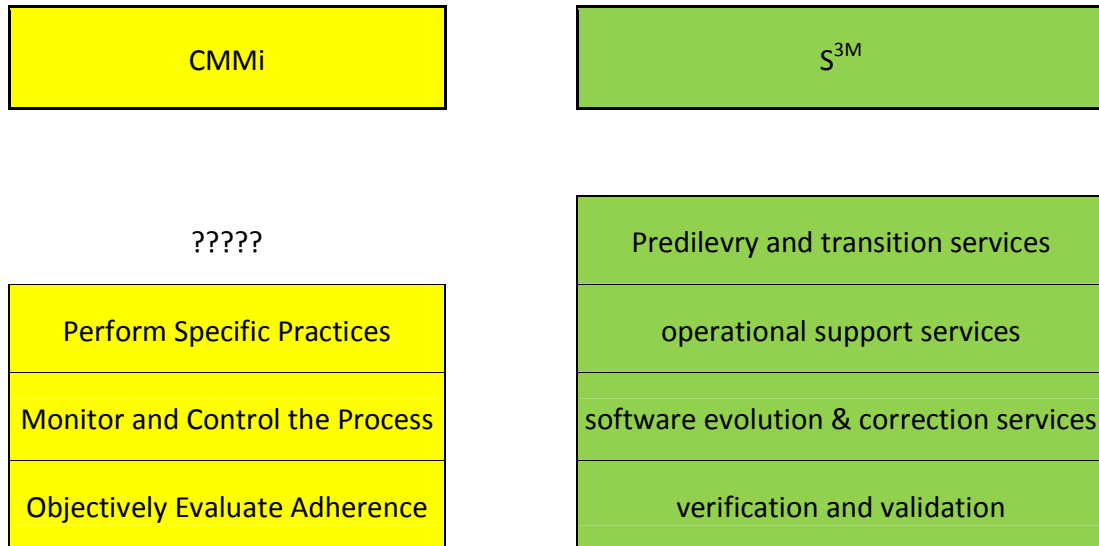


Figure 3.4 CMMi & S^{3M} software maintenance for Evolution Engineering Management

When we try to use CMMi generic practices on S^{3M} for Evolution Engineering Management, we succeed doing it but not for “Predelivery and transition services” processes.

Support to Evolution Engineering

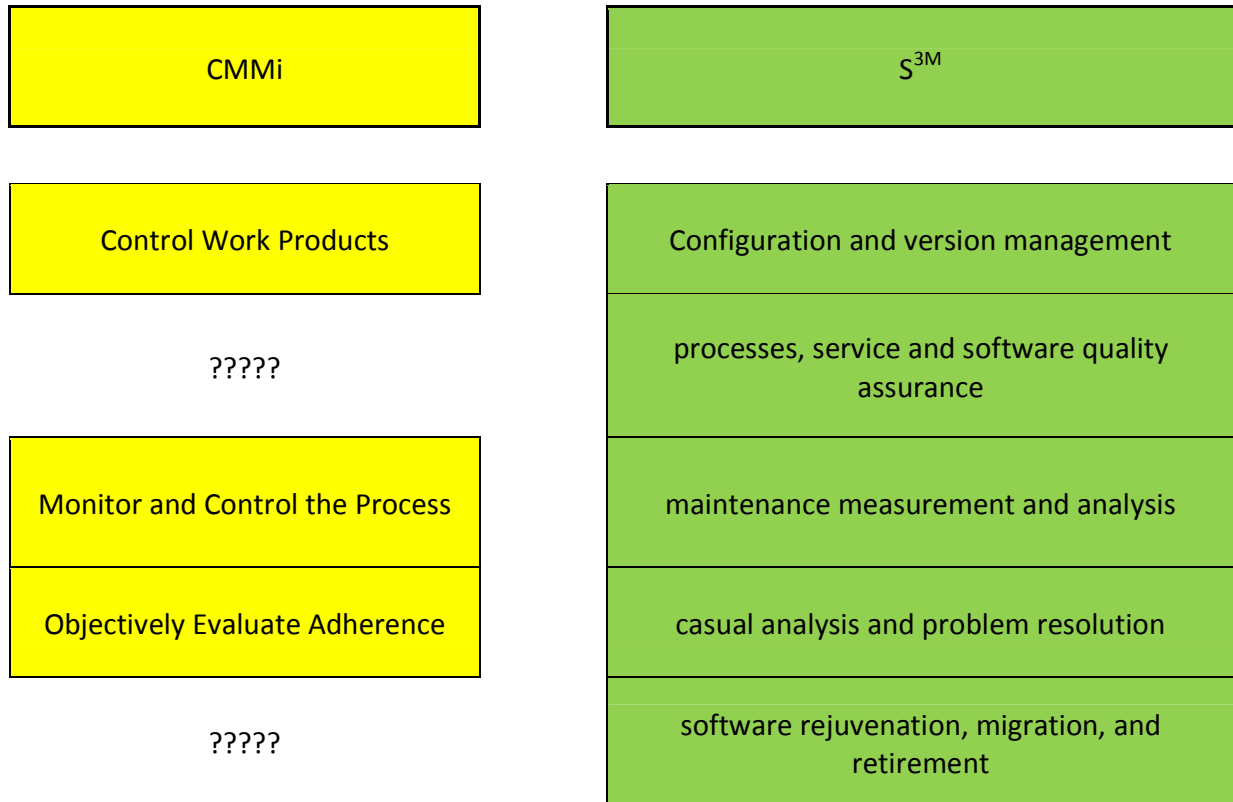


Figure 3.5 CMMi & S^{3M} software maintenance for Support to Evolution Engineering

When we try to use CMMi generic practices on S^{3M}, we succeed doing it but not for “processes, service and software quality assurance”, and “software rejuvenation, migration, and retirement” processes.

4. New generic practices of software maintenance

Here, we should ask an important question, why CMMi doesn't adequately cover software maintenance?

The answer is that CMMi is customized or more suitable for large projects, while S^{3M} deals with relatively small projects, consequently CMMi couldn't cover some issues needed in software maintenance such as:

- Concept of maintenance maturity
- Rejuvenation-related plans as the need for redocumentation, reengineering, reverse engineering, software migration, and retirement.

After similarity between CMMi and S^{3M} for generic practices, for the four main processes domains, the following new generic practices are suggested:

- ✓ Establish transition phase between different processes
This new suggested generic practice could be helpful in Evolution Engineering Management, to address "Predevry and transition services" process.
- ✓ Establish quality assurance system applicable for all software maintenance processes
As the Support to Evolution Engineering main process needs a new generic practice for "processes, service and software quality assurance", this suggested generic practice could define, specify the way to such process.
- ✓ Define criteria for software rejuvenation, migration, and retirement

Also through the Support to Evolution Engineering main process, "software rejuvenation, migration, and retirement" processes requires a new generic practice, so defining a criteria for software rejuvenation, migration, and retirement would be so useful when working on these important processes.

5. Conclusion

The S3M model is appropriate for small-scope software maintenance projects that imply unique maintenance processes compared to CMMi, as a consequence, CMMi doesn't address these processes and practices.

New generic practices are required for software maintenance such as:

Establish transition phase between different processes.

Establish quality assurance system applicable for all software maintenance processes

Define criteria for software rejuvenation, migration, and retirement

6. References

1- Software Maintenance Management:

Evaluation and Continuous Improvement; April, Alain; Alain, Abran; 2008.

2- CMMI® for Development, Version 1.3

Improving processes for developing better products and services, November 2010, TECHNICAL REPORT.

3- http://en.wikipedia.org/wiki/Service-level_agreement

4- <http://www.software-quality-assurance.org/cmmi-technical-solution.html>