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INTRODUCTION TO CMMI

In response to the growing demand for software quality and productivity, various initiatives, models and approaches have been presented in the software industry since 1980s. A leading example for software process improvements is the Capability Maturity Model Integration (CMMI) model. The CMMI was first released in 2000 and has since been used by a large number of software development companies. Due to changes in the organization environment and community needs, the CMMI Institute launched a project to restructure the CMMI model. The main goal was to help improve business performance of the companies using it, and to adapt the software process improvement process of these companies to the changing business needs. As a result of the project CMMI V2 for development was released.

Information made publicly available indicate that CMMI V2 is already being accepted by the software development community. At the time of writing this paper already many appraisals have been conducted using CMMI V2. This fact makes this new version of the CMMI even more interesting for the testing community, since TMMI - the by far most used test process improvement model - is positioned as a complementary model to the CMMI (while TMMI can indeed also be used independent of the CMMI). The current version of TMMI re-uses structural elements of the “old” CMMI V1.3, while it elaborates on the testing-related activities executed in a software or system development company in much more detail than CMMI does.

MAJOR CHANGES IN CMMI V2

CMMI V2 is defined as “an integrated product suite consisting of 5 components that, when used together, provide a clear and proven path to achieving a company’s business objectives.”
ELEMENTS OF CMMI V2

The elements of CMMI V2 are (see figure 1): model, appraisal method, training and certifications, system and tools, adoption guidelines. It is a change in viewpoint to consider CMMI as an integrated product suite, in which the process improvement model, appraisal method, training and certification, as well as the adoption guidelines are all components, complementing each other and facilitating each other's usage.

Figure 1: Elements of CMMI V2

The model description, its elements and structure are basic for all those using CMMI V1.3 in the context of process improvement, as well as in using the model as an input for TMMI. Therefore, we focus in this paper on the elements of the CMMI V2 model.

CMMI V2 ARCHITECTURE

The basic components of the CMMI 2.0 model are: Views (containing Capability Areas, Categories for Capability Areas), Practice Areas, Practice Groups, Practices and Informative Materials. Short descriptions and explanations of these are provided hereafter (see also figure 2 for an example).

● View is a selection of a set of model components, important to and selected by an end user or predefined by the CMMI Institute. Predefined views are: CMMI Development, CMMI Services, CMMI Supplier Management. View means from the end-customer perspective means a set of important practice areas, selected by the customer based on its business needs or objectives.

● Capability Area: A group of related practice areas (previously called process areas) that can provide improved performance in the skills and activities of an organization or project.

● Categories for Capability Areas: are logical groups of related capability areas that address common problems encountered by business when producing or delivering solutions. The 4 Categories are: doing, managing, enabling and improving. As these categories emphasize some of the key relationships that exist among the practice areas, they could be regarded as a grouping similar to the engineering, support, project management and organizational process area categories in CMMI V1.3. The categories which include several capability areas, and each capability area in turn includes several practice areas, show a clearer path to capability building and improvement. The name of a capability area generally stresses solving a certain type of problem. An organization can as a result easier identify where they have performance gaps, and identify the practice areas under that capability area that they need to improve. Category and capability allow companies to fully understand their capabilities and problems, and to make choices in 10 different capability areas, to identify the scope and content of improvements.

● Practice Area: a collection of similar practices that together achieve the defined intent, value and required information described in that practice area. The name process area might have caused the misunderstanding that there was a sequential relationship between process areas, but in fact this is not true. The business value here is that this change emphasizes that CMMI V2 is a collection of best (or good) practices rather than a collection of processes to be implemented. Also, it can be mentioned as an added value of the change that the term "process" is less popular in the Agile community.

● Practice: the practices consist of required practice information and explanatory practice Information. Note that CMMI V2 explicitly mentions that the informative explanatory material of the model cannot be ignored, it is needed to understand the meaning of the required information of the model.

● Practice Group: within each practice areas, the practices are organized into a set of evolutionary levels, labeled level 1, level 2, etc. (up to Level 5), which provide a path for performance improvement. Each evolutionary level builds on previous levels by adding new functionality or sophistication resulting in increased capability.

Figure 2: Example CMMI V2 architecture and practice area organization

CAPABILITY AND MATURITY LEVELS

In CMMI V2 the concept of capability and maturity level is implemented via the so-called "evolutionary level". Evolutionary level is a characteristic within one practice area. For a practice area, the practices are organized into a set of evolutionary levels. Different levels contain different maturity of the practices’ sets.

According to this, at level 1 of a practice area has practices in place that ensure a simple approach to meeting intent of practice area. This is not a complete set of practices to achieve the full intent of the practice area. At level 2 is simple, but complete set of practices are in place that address the full intent of the practice area. At level 3 the practice set of a practice area is characterized by the fact that it uses organizational standards & tailoring to address work characteristics, uses organizational assets and a focus on achieving performance objectives. Etc. for levels 4 and 5. One can note that "Evolutionary level" is very similar to the CMMI V1.3 concept of capability level, that was initially associated to process areas by the continuous approach of CMMI.
Maturity levels refer to the evolutionary levels within the organization. There are practice areas associated with each maturity level (see figure 3 for an example). An important change is that already at level 1 all practice areas are present. The difference among the different levels (of maturity) is not any more in the practice areas required on that level, but in the practices of each practice area needed at that level. Thinking of CMMI V1.3, this would be somewhat similar to the idea that a process area has different specific practices associated to different maturity levels, while all process areas would have a set of practices required already in the beginning. For example, Risk Management (a level 3 process area of CMMI V1.3) would already be required already at maturity level 2 having some basic practices already in place, while more sophisticated practices would be added at higher maturity level. Business value of this change lies in bringing clearer and a more methodical path for building capability and improving. Although it is not explicitly stated, CMMI V2 is much more a continuous model than a staged one. In summary, with CMMI V1.3 the maturity level was defined by compliance with a limited set of process areas, with CMMI V2, the maturity level is defined by compliance with the level specific practices of all practice areas.

<table>
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<tr>
<th>Category</th>
<th>Capability Area</th>
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<th>L2</th>
<th>L3</th>
<th>L4</th>
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<td>Configuration Management</td>
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</tbody>
</table>

Figure 3: Example practices areas and their associated levels to which they have practices.

As a result of the above a maturity level 0 (see figure 4) named Incomplete has been introduced, where the company is characterized by an unknown and ad-hoc way of doing things, where the work may or may not get done. Note that while all practice areas have practices associated to level 1 and level 2, only some practice areas have practices associated to level 3, level 4 and level 5.

Figure 4: CMMI V2 Maturity Levels

There is no more concern for generic goals and generic practices any more, made it useless to keep the notions on specific goals and specific practices. Therefore in CMMI V2 only the notion of practices exists. This change reduces the complexity of the model and make CMMI V2 easier to understand and implement.

When thinking about the business value of having Sustaining Habit & Persistence versus generic goals and generic practices, one must understand that generic goals and generic practices in CMMI V1.3 were necessary but were often not given sufficient attention in implementation. Generic goals and specific practices in CMMI V2.0 become Practice areas, which avoids duplication and emphasizes the meaning of the processes in the organization. This has a huge impact on the evaluation scores of the organization being appraised, so its importance is enhanced. Generic goals and generic practices were the basis for an organization to implement CMMI, and now their importance increases, having two new practice areas replacing them. This will force the organizations to re-examine their infrastructures, which can help CMMI to be better integrated into the organization.

OBTAINED VALUE STRONGLY EMPHASIZED

In CMMI V1.3, only on higher maturity levels process improvement is explicitly driven by business objectives. In CMMI V2.0 in each practice area a new element is added, called "value", which describes the value of that practice. This change reflects the business objective driven improvements. For example, in capability area ensuring quality, the Peer Review there is the statement of Value: "To identify problems or defects as earlier as possible, reducing cost and re-work."

Although "value" was mentioned in CMMI V1.3, it was largely submerged in the hundreds of pages of model description. This change is a landmark improvement of CMMI V2.0, as it not only enables enterprises to understand the practical value of the model, but also makes it clear that this is the goal that the organization should pursue. It comprehensively emphasizes the intent and value of the model content at all levels.
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