Software Measurement Process Capability Maturity Model

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Abstract—**Both software organizations and the academic community are aware that the software measurement process is in need of future support. Academic community has a lot of research in the software measurement theory, methods, tools, etc. Software organizations are also implement measurement activity with various ways. However, there is a problem: how about their measurement process in the end? It addresses this problem by creating a specialized Software Measurement Process Capability Maturity Model (SMP-CMM). SMP-CMM including five maturity levels: initial, tentatively, defined, compesive and optimized. The model focus on the basic practice areas which should be implementing of every level, it helps the originations to assess their measurement process and provides guidance for them to a higher maturity level.**

Keywords- software measurement; capability maturity model; basic practice area

I. INTRODUCTION

At present, computers play a primary role in almost every area of people's lives. The increased importance of software also places more requirements on it. Thus, it is necessary to have precise, predictable, and repeatable control over the software development process and product. So many methods, technology and strategies have been performing in software development process and software measurement is one of them. Tom DeMarco advocated that "you cannot control what you cannot measure" [1], however it is just as impossible to measure every factor in an IT project as it is to control every factor in such an IT project. The primary purpose of measurement is to provide insight into software processes and products so that an organization is better able to make decisions and manage the achievement of goals. Metrics provide the following three basic functions: (1) Control: Metrics enable managers and workers to evaluate and control the performance of the resources for which they are responsible; (2) Communication: Metrics communicate performance not only to internal workers and managers for purposes of control, but to external stakeholders for other purposes as well; (3) Improvement: Metrics identify gaps (between performance and expectation) that ideally point the way for intervention and improvement[2].

Software measurement is also a process which needs to be evaluated and the concept of process capability maturity can help organization to describe process capability. The U.S. Department of Defence Software Engineering Institute (SEI) at Carnegie Mellon University is sponsor at this area. The Capability Maturity Model (CMM) was originally developed in the 1980s by SEI as a method for objective evaluation of contractors for military software projects. It has been continuously revised since then. In 1997 development of CMM was halted in favour of its successor, Capability Maturity Model Integration (CMMI)[3][4]. As the CMM and CMMI have been widely adopted, a serious of capability maturity model been proposed, such as Testing Maturity Model (TMM)[5][6], Project Management Process Maturity Model[7][8], Maturity Model of Knowledge Management Technology[9], Software Maintenance Maturity Model[10], Requirements Process Improvement Model[11], etc. In this paper, we proposed the SMP-CMM to evaluate software measurement process maturity.

II. SOFTWARE MEASUREMENT PROCESS CAPABILITY MATURITY

Software measurement process is the portion of the software process that provides for the identification, definition, collection, and analysis of measures that are used to understand, evaluate, predict, or control software processes or products [2]. Basic activity in the software measurement process including identify scope/define procedures, collect data, analyze data and evolve process.

Software measurement process capability Maturity is defines as the ripeness and readiness of the organization to define, perform, manage, and control its software measurement process. Maturity means the ability of the growth potential, but also shows the richness of the software measurement process. Maturity helps the organization to (1) identified the state of software measurement process; (2) develop and sustain a measurement capability that is used to support management information needs; (3) consistently apply the corrective measurement process within the organization; (4)utilize corrective measurement process as a learning vehicle for improving development and measurement processes.

Of course, the organization requires a good model framework for succeed realization of the above functions, for how to upgrade to a higher level also need to provide some guidance. Because of the software CMMI has been more mature, and received widespread recognition, this article will establish the software measurement Capability Maturity Model based on CMMI, organizations use it to determine the various levels of the implementation of software measurement needed resources and the corresponding abilities.

Software measurement has been gradually carried out in software development process. The concept, method and technology about measure are slowly be accept and widespread used. Software measurement lessons and assets been accumulated slowly. So in this paper, software measurement process capability maturity includes five maturity levels: initial, tentatively, defined, compesive and optimized, each a layer in the foundation for ongoing process improvement. Fig 1 is the software measurement process capability maturity model; rectangle refers to basic practice area at the maturity level.

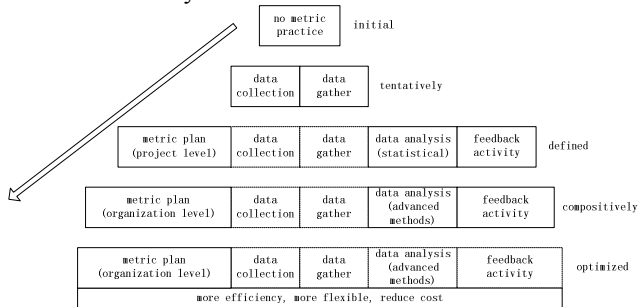|					
no metric practice					initial
data collection	data gather				tentatively
metric plan (project level)	data collection	data gather	data analysis (statistical)	feedback activity	defined
metric plan (organization level)	data collection	data gather	data analysis (advanced methods)	feedback activity	compositively
metric plan (organization level)	data collection	data gather	data analysis (advanced methods)	feedback activity	optimized
more efficiency, more flexible, reduce cost					

Figure 1: software measurement process capability maturity model

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A. Maturity level 1: Initial

At maturity level 1, the organization usually does not provide an environment to support measurement. This level is the lowest possible and tragically the level most software developing companies fall into when they deploy measurement activities. There are many reasons lead to this phenomenon. For example, company is new-established and small scale, product is simple. Anyway, there are no any measurement traces in organization at this level.

B. Maturity level 2: tentatively

At maturity level 2, the need for measurement has been recognized and some tentatively metric practice has been deploying in origination although metric processes are usually ad hoc and chaotic. Metric goal is to exist but not been clearly defined and documented. Metric activity is been development in arbitrary way.

At this level, in software organizations, measurement is often equated with collecting and reporting data and focuses on presenting the numbers. There are two basic practice areas in measurement process: data collection and data gather. Data collection is refers to somebody can get some data at specific state, such as project manager can get his staffer's week report about effort. Data gather is refers to manage data that been collected, such as manager need gather all data about his staffer's effort for estimated schedule of project.

C. Maturity level 3: Defined

At maturity level 3, defining measures and procedures for data collection, storage, and analysis, the projects of the organization have ensured that metric processes are planned and executed in accordance with policy. Metric process is intactness, including five basic practice areas: metric plan, data collect, data gather and feedback activities.

Details of five basic practice areas are well described. In metric plan, metrics are got by scientific methods, such as goal-question-metric method, data collect ways, table format, data supplier, data accepter and data report time are all defined. Reporting results of measurement and analysis activities to appropriate end users in a timely and usable fashion, it is important to do data analysis in level 3. Statistical process control (SPC) is used in organization, it consists of some techniques used to help individuals understand, analyze, and interpret numerical information. SPC is used to identify and track variation in processes. All kinds of control chart are widely applying techniques in SPC. Feedback activities carry into execution according to variation in process, such as schedule delay, costs overspend.

D. Maturity level 4: compositiveDefined

At maturity level 4, measurement processes are well characterized and understood, and are described in standards, procedures, tools, and methods. The five basic practice areas are same as in level 4, but these measurement activities are compositive with software development as close as possible. The special characteristic of level 4 is that measurement activity is no longer additional burden, data collection and data gather is a part of project management, data analysis tool been used in management system.

A critical distinction between maturity levels 3 and 4 is the scope of measurement standards, measurement process descriptions, and measurement procedures. At maturity level 3, the measurement standards, measurement process descriptions, and measurement procedures are project level, may be quite different in each specific instance of the measurement process. At maturity level 4, the standards, process descriptions, and procedures about measurement for a project are tailored from the organization's set of measurement standard processes to suit a particular project or organizational unit

Another critical distinction is that at maturity level 3, data analysis be inclined to SPC technique. But at maturity level 4, the use of data mining has become possible because metric data was collected from different project. Organizations try to use rough sets, neural networks, Bayesian network technology to find the relationship between data, provide information for decision-making.

E. Maturity level 5: Optimized

At maturity level 5, the main purpose is to improve the measurement efficiency, reduce costs, and optimize the

measurement process. Organization has identified the most appropriate measure of processes, measurement methods and measurement tools.

Software measurement process assets library already has a wealth of assets, such as process standards, measurement plan, and metric indicator model etc. Software measurement process assets library provide measurement service for organization and it becomes valuable treasure of software organization, so keep the library upgrade, provide continues service and improved measurement process is a major work in maturity level 5.

IV.   CONCLUSION

It described a compatibility maturity model for software measurement process that is based on the well-known CMMI created by SEI. SMP-CMM including five maturity levels: initial, tentatively, defined, compesive and optimized. Every level has its basic practice areas and responsibility. According to SMP-CMM, organization can inspect their measurement process situation, control process improvement orientation, etc. If want SMP-CMM become more favorable, we need for continuous improvement in practice and perfect the details, providing operational methods, which are the direction of our next step.

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