

Capability Maturity Model Process Improvement

Mark D. Schaeffer
Office of the Under Secretary of Defense

The Software Engineering Institute (SEI) is a federally funded Research and Development Center with the mission to accelerate the most effective technology and practice of modern software engineering. The SEI is funded primarily by the Department of Defense (DoD) but also accepts work from other government organizations as well as the private sector via Cooperative Research and Development Agreements.

The centerpiece product of the SEI has been the Software Capability Maturity Model (CMM) released in 1991. This model has contributed to widespread success in assisting organizations in improving their efficiency in developing quality software products. The success of the Software (SW) CMM spawned other CMMs that address a wide range of subjects.

A CMM provides an organization a conceptual framework within which specific processes, e.g., configuration management and quality, can be optimized to efficiently improve the capability of organizations. A CMM provides state-of-the-art practices to

- Determine the maturity of an organization's processes.
- Establish goals for process improvement.
- Set priorities for immediate process improvement actions.
- Plan for a culture of product or service excellence.

By focusing on specific processes, an organization can best leverage the resources for their improvement activities while rallying the organization around specific goals. A CMM can be a road map showing an organization how it can systematically move to more mature

levels of performance and do it in more effective and efficient ways. After an objective assessment, an organization can set its goals for increasing the capability of its processes. To the DoD, this translates into more affordable products and services for our war fighters.

CMMs can include processes that span the entire lifecycle. Starting with requirements management, they can span the breadth of product development, ensuring quality, lean production concepts, and support to the field. Each individual process includes elements that provide basic practices as well as additional practices that add incremental benefits and maturity. When these processes are sufficiently matured, the organization increases its performance or maturity.

Subsequent to the success of the SW-CMM, other CMMs were developed with SEI support. These CMMs included the Systems Engineering CMM and the Integrated Product Development (IPD) CMM. It became apparent in the development of these and other models that they all contained common processes, e.g., configuration management, quality, and requirements management, supporting the various functional disciplines, software engineering, and systems engineering. Improvements in these common processes could benefit other disciplines. Further, it became apparent that process improvement resources applied to one functional discipline, e.g., software engineering, could be beneficial to another functional discipline. The common elements used in a software CMM appraisal could be used for a systems engineering appraisal, and there would be no need to redo the appraisal of common elements. In addition, improvement efforts based on unique CMMs could result in suboptimization, confusion, and potentially unnecessary expenditure of process improvement resources.

Acquisition reform in the DoD created a significant paradigm shift away from a "how-to" mentality approach to an approach centered on Statements of Objectives and Performance-Based Requirements. The earlier capability models and standards were clearly used in the context of meeting contract requirements. There were even brief attempts to use them as selection criteria or as compliance benchmarks rather than frameworks to identify and define characteristics of good practices that facilitate process improvement. Remember the Requests for Proposals that required an SW-CMM Level 2 or above to propose? Although DoD Directive 5000 directs we select capable suppliers, it does not direct how it should be determined or set arbitrary levels. DoD has learned over time two important things about maturity levels:

- Many organizations have benefited from the use of CMMs as process improvement tools resulting in delivery of improved products to DoD and government.
- Many projects or products delivered by organizations, purported to be at the SEI Level II or Level III, have not met the customers' requirements.

One of the top-priority projects in the SEI is integration of the CMM products for use in single or multiple functional disciplines. Industry and government along with the SEI now have enough experience in the various functional disciplines to build this framework upon which all present and future CMMs can be based. This will greatly enhance the efforts of CMM users and protect the resources already invested. Organizations can use their previous CMM process improvement work and tailor their future efforts to their unique organization. The initial common framework effort will be based on the SW-CMM, the SE-CMM, and the IPD-CMM. Other functional disci-

Editor's note: As of press time, this article represents the most recent direction for Department of Defense CMM-related efforts. CROSSTALK will publish more information on the CMM Integration effort as it becomes available.

plines may be added later. To efficiently use the government funds allocated to CMMs, further work on CMMs that are not common framework compliant has been halted. The work accomplished to date in Software CMM, Version 2.0 and the IPD CMM have been included in the initial CMM Integration (CMMI) baseline.

In building these CMMI products, the needs of industry and government partners must be understood and met. We have had extensive participation in our reviews of the CMMI requirements, and broad collaborative efforts are underway developing the products. We are depending on the functional discipline

experts from industry and government to assist in building the products.

In summary, the CMMI project requires a broad collaborative effort to ensure that the best practices are included and process improvement resources are optimized. Industry along with government and the SEI are participating on a team to build the CMMI products. Since many organizations have already made considerable investments in CMM-oriented process improvement efforts, it is important that the products of this project efficiently integrate into these efforts, and that resources are not wasted on a new approach. ♦

About the Author



Mark D. Schaeffer has over 20 years experience in weapons systems acquisition and program management in the Office of the Secretary of Defense, Naval Sea Systems Command, and as congressional staff. He has been the deputy director for systems engineering since November 1994 and is responsible for policy and implementation of systems engineering, technical risk management, design for manufacturing quality, reliability and maintainability, manufacturing, and acquisition logistics.

Coming Events

Software Quality Through Robust Testing

Dates: May 21, 1998

Location: Eatontown, N.J.

Subject: Gain confidence in year 2000 fixes, reduce testing time and cost, improve coverage, and find defects early.

Contact: Madhav Phadke, Voice: 732-577-2878; Fax: 732-577-2879; E-mail: Madhav_Phadke@compuserve.com

7th IEEE North Atlantic Test Workshop

Dates: May 28-29, 1998

Location: West Greenwich, R.I.

Subject: Issues for the 21st Century: higher quality, more economical, and more efficient testing methodologies and designs.

Sponsor: IEEE Computer Society, Test Technology Technical Committee, University of Rhode Island

Contact: Jim Monzel, Voice: 802-769-6428; Fax: 802-769-7509, E-mail: jmonzel@vnet.ibm.com

Effective Methods of Defect Detection and Defect Prevention

Dates: June 2-4, 1998

Location: Seattle, Wash.

Subject: "Software Quality," decomposed into defect detection and defect prevention.

Sponsor: Quality Assurance Institute
Contact: Voice: 407-363-1111; Fax: 407-363-1112; Internet: <http://www.qaiusa.com>

5th International Conference on Software Reuse

Dates: June 2-5, 1998

Location: Victoria, British Columbia
Sponsor: IEEE Computer Society in cooperation with Association for Computing Machinery

Contact: Dr. Jeffrey S. Poulin, program co-chairman; Voice: 607-751-6899; Fax: 607-751-6025; E-mail: Jeffrey.Poulin@lmco.com

Second Workshop on Software Architectures in Product Line Acquisitions

Dates: June 8-10, 1998

Location: Hawthorne Hotel, Salem, Mass.

Subject: Applying software architecture technology to acquisition of all or parts of a line of software-intensive systems. Based on government and industry experiences, working groups will make recommendations for moving to an architecture-based acquisition approach for a product line.

Contact: Lt. Col. Gene Glasser, E-mail: glassere@issc.belvoir.army.mil

15th International Conference on Testing Computer Software

Dates: June 8-12, 1998

Location: Washington, D.C.

Subject: "Testing Under Pressure," with emphasis on management strategies.

Sponsor: U.S. Professional Development Institute

Contact: Voice: 301-270-1033; Fax: 301-270-1040; E-mail: admin@uspdi.org; Internet: <http://www.uspdi.org>

Software Cost and Schedule Estimation Course

Dates: July 13-15, 1998

Location: University of California at Los Angeles

Subject: Many issues associated with project cost and schedule estimation, why projects succeed or fail, advantages and disadvantages of widely used models, year 2000 challenge, emerging issues, and reference sources.

Sponsor: UCLA Extension Short Course Program

Contact: Marcus Hennessy, Voice: 310-825-1047; Fax: 310-206-2815; E-mail: mhenness@unex.ucla.edu