An Efficient Method for Verifying Contractor Capability Maturity Model (CMM) Level

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American Society for Quality (ASQ)
Software SIG
August 22, 2006

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Introduction to the Software CMM (1 of 2)

- **Initial**: Performed informally
- **Repeatable**: Disciplined process
- **Defined**: Standard, consistent process
- **Managed Quantitative**: Predictable process
- **Optimizing**: Optimized process

See [www.sei.cmu.edu](http://www.sei.cmu.edu) for more information on the CMM, CMMI®, SCE, CBA-IPI, and SCAMPI®SM.
## Introduction to the Software CMM (2 of 2)

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GAO Recommendation to a large government agency in June 1995

- “To oversee its contractors effectively, the agency’s contract managers must understand the practices used to develop software at [Software] CMM Level 2”
- “… immediately require the agency’s future software development contractors to have at least Capability Maturity Model (CMM) Level 2”.
The agency needed to determine the CMM Level of over 20 contractors
  - Twenty Software Capability Evaluations (SCEs) seemed impractical
  - Should we just ask the contractors?

Appraisal methods thought to be consistent and objective

The CMM Verification Method was established by the agency in 1996 to validate maturity of software developers in the context of Software CMM
  - Under the right conditions, reuse appraisal results
  - Supplement appraisal data with data on the contractor’s process improvement infrastructure
The agency’s procurement policy was revised effective Dec. 1, 1998 for all software development contracts

- Requires existing software development contractors to comply with Software CMM Level 2 requirements
- For new solicitations, potential developer must have achieved Software CMM Level 2 or higher as a condition for award
- Section H CMM Level 2 clause required in all software contracts
- Requires contractor’s post-award yearly participation in the CMM Verification process
What is the CMM Verification Method?

Background (4 of 4)

- MITRE has been providing Software CMM, Software Acquisition CMM and Capability Maturity Model Integration (CMMI®) expertise to the agency for performing and evolving this method since September 1999

- Most agency contractors are required to be Software CMM Level 2
  - Some contractors are required to be Software CMM Level 3 and/or Software Acquisition CMM Level 3

- The agency’s procurement policy has recently been updated to require contractors to be CMMI® Level 2
The goal of the CMM Verification Method is to allow the agency to efficiently monitor contractor CMM Level by:

- Minimizing resource needs on both agency and contractor organizations
- Supporting re-use of contractors’ objective appraisal data (SCEs, SCAMPIs<sup>SM</sup> and CBA-IPIs)
- Conducting SCEs only when required

“On an annual basis, the contractor shall validate its current software capability rating by submitting documentation to substantiate its current CMM Level. A review will be performed annually by the agency in order to confirm the Contractor’s validation.”

A team of government personnel supported by MITRE conducts the CMM Verification activities annually on all agency software development contractors
The CMM Verification Method is an annual, cyclic methodology composed of four phases:

- Phase I – All contractors submit data that include appraisal history and results for the past 18 months and process improvement plans. Verification Team evaluates contractors’ appraisal details and results.
- Phase II – Contractors provide project-specific process documentation and evidence of process performance, as requested by the Verification Team. Verification Team reviews documents and data.
- Phase III – Contractors provide on-site detailed briefings on CMM topics to the Verification Team (topics determined by the Verification Team). The Verification Team may also conduct structured technical interview.
- Phase IV – A Software Capability Evaluation is conducted on the contractors by the Verification Team.
What is CMM Verification Method?
Methodology (2 of 3)

- Each year all contractors initially start in Phase I and may be moved to any other phase, if required

- After any phase a contractor may be
  - Released for that year, if the Verification Team has verified that the contractor is compliant with the contractual CMM level
  - Referred to a Contracting Officer if the Verification Team has verified that the contractor is not compliant with the contractual CMM level
  - Sent to a subsequent phase (Phase II, III, or IV)

- The CMM Verification Method only verifies contractor process maturity – impacts to contracts decided at the executive level of the agency

- The agency retains the right to perform a SCE at any time
What is CMM Verification Method? Methodology (3 of 3)

Planning

Phase I

Phase II

Phase III

Phase IV

Not CMM Compliant

CMM Compliant Verified
CMM Verification Method Details
General Details

- Annual cycle starts with the “invitation” letter
  - Enclosures detail the materials to be submitted
- Annual conference to explain the CMM Verification process
- Staggered submittal dates to form groups of 8 – 12 contractors
  - Distributes workload
  - Consider freshness of findings from the last CMM Verification cycle
CMM Verification Method Details
Phase I Review

- A Verification Team individual is assigned responsibility for Phase I documentation for each contractor

- A team of 7 – 10 staff (including MITRE) conduct the reviews
  - Initial impressions (~10 minutes per contractor)
  - Second impressions (~30 minutes per contractor)
  - Individual review (~2 hours per contractor)

- Team drives towards consensus findings on each submittal

- Verification criteria applied to all submissions
  - Results (proof of level rating)
  - Relevancy (work similar to that performed for the agency)
  - Objectivity (rating independently verified)
  - Timeliness (<18 months)
  - Consistency (with SEI CMM Appraisal Framework (CAF))
CMM Verification Method Details
Verification Criteria – Relevancy

- Most troublesome criterion – resists algorithmic definition
- Appraisals of agency projects are clearly relevant
- In larger companies, the appraised organization may not be the organization performing on the agency contract
- Appraisal data from other customers and projects *may* be relevant
  - Same people? Process? Product?
  - Even if the projects are co-located the CMM level may not match
  - Even if some agency work was evaluated, all agency work may not be at the same CMM level
CMM Verification Method Details
Verification Criteria – Objectivity

- Did the assessment team include evaluators independent of the appraised organization to avoid a potential conflict of interest in the findings?

- Look at the degree of independence of the appraisal team and especially the assessment team lead
  - Organization staff, and potentially agency project staff, are part of assessment team for CBA-IPIs and SCAMPIsSM
  - Even staff outside the organization (and outside the company) can feel pressured to produce favorable results
The agency requires contractors to submit current and last year’s Process Improvement Plans as part of their submission data

- Can provide clues about the company’s commitment to CMM
- Useful in cases where appraisal data may only weakly meet criteria
CMM Verification Method Details
Qualified Staff

- The CMM Verification Process is guided by a process improvement expert with qualifications equal to those of a Lead Evaluator
- Verification team staff have qualifications similar to those of SCE team members
- Trained in Software CMM, Software Acquisition CMM, CMMI®, and SCE methodologies
- Have extensive software engineering and management experience (as a team)
- Facilitated consensus building techniques
- Subjective judgments require consensus of experienced and knowledgeable individuals
Continuous marketing and outreach to affected parties
- Sell the benefits of Software CMM
- Educate those receiving software development products (program managers, Contracting Officers Technical Representatives (COTRs), Contracting Officers (COs))
  - How to recognize Software CMM Level 2 behavior and artifacts
  - How to ask appropriate questions
- Educate the contractors/potential contractors on the CMM Verification process
  - Data that must be provided
  - Examples of good and bad submissions
- Explain what activities are considered software development
Benefits of CMM Verification Method and Appraisal Reuse

- Minimizes time and cost for contractors and the agency, related to ensuring compliance with required CMM Level
  - New appraisal not always required
  - Data submission often demonstrates compliance

- Maintains a level playing field during the CMM Verification cycle through adherence to CMM Verification procedures and evaluation criteria

- Builds a repository of data that justifies agency decisions and actions

- Gives the agency additional insight into contractor performance activities
Over the years, more contractors are passing Phase I without having to progress to other phases
  - One exception is contractor reorganizations and mergers

Contractor feedback has been increasingly positive regarding the CMM Verification Process

Grandfathered contracts have graduated to Level 2

Even very small contractors have been able to meet Level 2 requirements

SCEs have tended to support contractor assertions
CMM Verification Method Issues
General Issues

- Difficult to determine the relevancy of an assessment to agency work if agency projects were not evaluated
  - Even if the projects are co-located the CMM level may not match
  - Even if some agency work was evaluated, all agency work may not be at the same CMM level

- Objectivity can also be difficult to determine
  - Organization staff, and potentially agency project staff, are part of assessment team for CBA-IPIs and SCAMPIs\textsuperscript{SM}
  - Even staff outside the organization (and outside the company) can feel pressured to produce favorable results

- It is expensive for contractors to perform a SCE, SCAMPI\textsuperscript{SM}, or CBA-IPI every 18 months

- For many contractor organizations it would be more economical to ensure CMM level by performing SCEs/SCAMPIs\textsuperscript{SM}/CBA-IPIs less frequently with frequent spot checks or smaller assessments
CMM Verification Method Issues
Small Business Issues

- For our discussion, small business = 25 or fewer developers
- Small businesses tend to be given small contracts that do not cover the full software lifecycle – difficult to provide coverage for CMM
- Small businesses frequently are not funded to provide project management expertise – difficult to provide evidence of CMM Level 2
- Internal and external CMM appraisals are too expensive for small businesses
- Small businesses are more subject to potential conflicts of interest during internal assessments
Conclusions

- The CMM Verification process provides a way to efficiently and effectively monitor contractor and potential contractor compliance with a CMM Level by reusing appraisal data. Effective implementation requires
  - Procedures for implementation
  - Evaluation criteria
  - Skilled, trained staff

- There are indications that benefits have been obtained, including increasing contractor CMM Level, through use of the CMM Verification Process

- However, no one cannot absolutely ascertain a CMM/CMMI® Level without performing a SCE or SCAMPI℠ on the specific projects