

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



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August 22, 2006

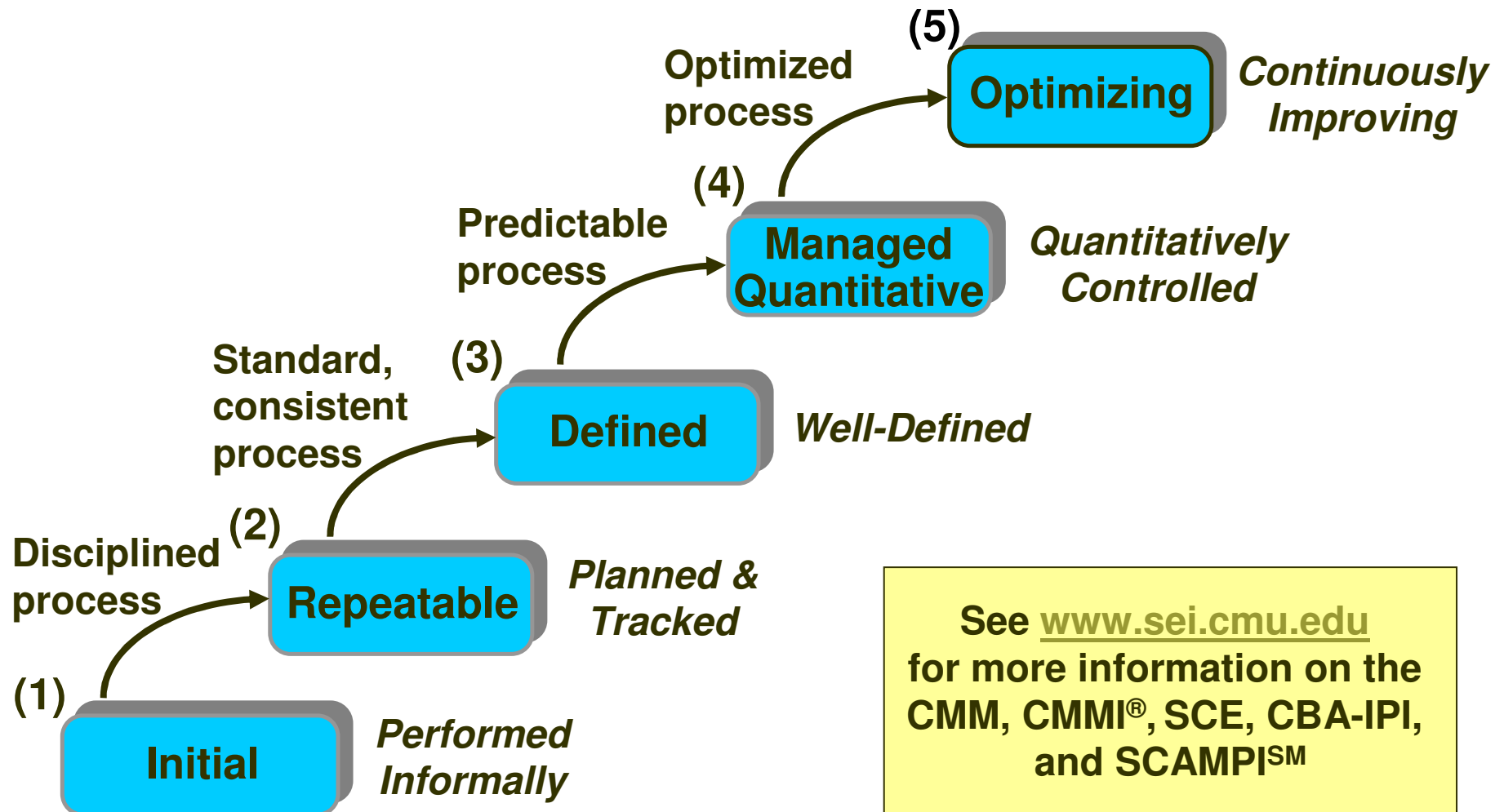
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Outline

- **Introduction to the Software CMM**
- **What is the CMM Verification Method?**
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- **Effectiveness of the CMM Verification Method and Appraisal Reuse**
- **CMM Verification Method Issues**
- **Conclusions**

Introduction to the Software CMM (1 of 2)



Introduction to the Software CMM (2 of 2)

	Focus	Key Process Areas
5 Optimizing	Continuous Process Improvement	Defect Prevention Technology Change Management
4 Managed	Quantitative Management	Quantitative Process Management Software Quality Management
3 Defined	Process Standardization	Organization Process Focus Organization Process Definition Training Program Integrated Software Management Software Product Engineering Intergroup Coordination Peer Review
2 Repeatable	Basic Project Management	Requirements Management Software Project Planning Software Project Tracking and Oversight Software Subcontract Management Software Quality Assurance Software Configuration Management
1 Initial	Competent people and heroics	

What is the CMM Verification Method? Background (1 of 4)



- **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”.**

What is the CMM Verification Method? Background (2 of 4)



- **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**

What is the CMM Verification Method? Background (3 of 4)



- **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**

What is the CMM Verification Method? Goals and Objectives

- **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, SCAMPISSM 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**

What is CMM Verification Method? Methodology (1 of 3)



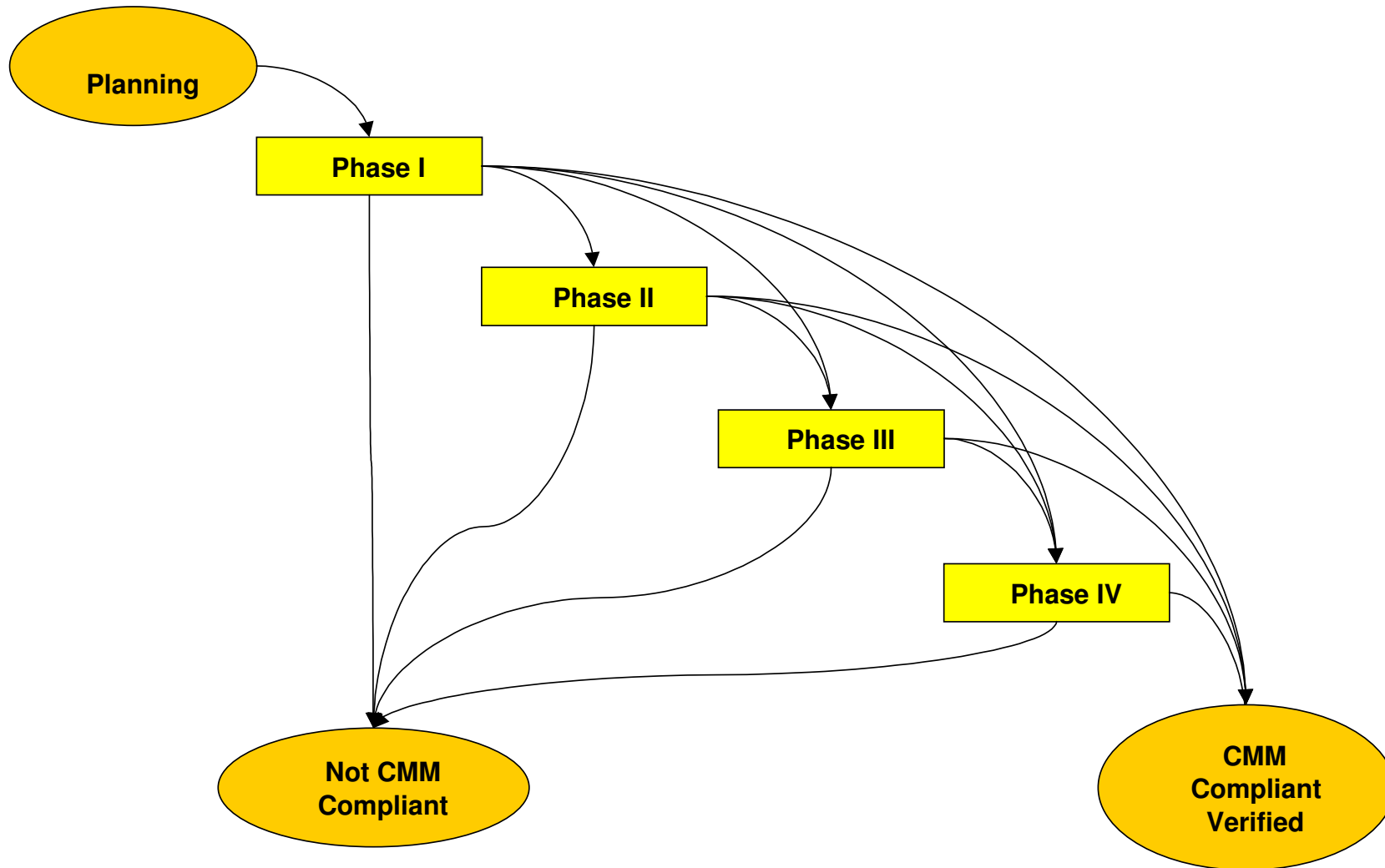
- **The CMM Verification Method is an annual, cyclic methodology composed of four phases:**
 - **Phase I – All contractors submit data that include appraisal history and results for the past 18 months and process improvement plans. Verification Team evaluates contractors’ appraisal details and results.**
 - **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)



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-IPs and SCAMPIsSM**
 - **Even staff outside the organization (and outside the company) can feel pressured to produce favorable results**

CMM Verification Method Details

Process Improvement Plans



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**

CMM Verification Method Details

Selling and Educating



- **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**

Effectiveness of CMM Verification Method and Appraisal Reuse



- **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 SCAMPIsSM**
 - **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, SCAMPISM, or CBA-IPI every 18 months**
- **For many contractor organizations it would be more economical to ensure CMM level by performing SCEs/SCAMPIsSM/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 SCAMPISM on the specific projects**