

12-17-2004

## **A Personnel-Driven Mini Assessment Approach for Supporting Continuous System and Software Process Improvement**

Lee McKinney  
*University of New Orleans*

Follow this and additional works at: <https://scholarworks.uno.edu/td>

---

### **Recommended Citation**

McKinney, Lee, "A Personnel-Driven Mini Assessment Approach for Supporting Continuous System and Software Process Improvement" (2004). *University of New Orleans Theses and Dissertations*. 191.  
<https://scholarworks.uno.edu/td/191>

This Thesis is protected by copyright and/or related rights. It has been brought to you by ScholarWorks@UNO with permission from the rights-holder(s). You are free to use this Thesis in any way that is permitted by the copyright and related rights legislation that applies to your use. For other uses you need to obtain permission from the rights-holder(s) directly, unless additional rights are indicated by a Creative Commons license in the record and/or on the work itself.

This Thesis has been accepted for inclusion in University of New Orleans Theses and Dissertations by an authorized administrator of ScholarWorks@UNO. For more information, please contact [scholarworks@uno.edu](mailto:scholarworks@uno.edu).

A PERSONNEL-DRIVEN MINI ASSESSMENT APPROACH FOR SUPPORTING  
CONTINUOUS SYSTEM AND SOFTWARE PROCESS IMPROVEMENT

A Thesis

Submitted to the Graduate Faculty of the  
University of New Orleans  
in partial fulfillment of the  
requirements for the degree of

Master of Science  
in  
The Department of Computer Science

by

Lee McKinney

B.Sc. Texas A&M University, 1995

December 2004

© 2004, Lee McKinney

## **Dedication**

In loving memory of

Gregory Lee Wamsley

March 19, 1951 – April 25, 2004

Husband, father, and friend.

You were the true measure of a man.  
Your thoughtfulness, kindness, and selflessness will stand as a model for us all.

Good-bye, Dad.  
I love you.

## Acknowledgments

Thank you to my thesis examination committee.  
Your questions and comments helped to strengthen my understanding of this thesis.

The development of key concepts in this research would not have been possible without my advisor Dr. Shengru Tu. His curiosity and direction were a constant inspiration.

My baby boy served as a reminder to keep things in perspective during the time I had to spend away from him. Thank you for your hugs and kisses, son.

Most importantly, I wish to thank my loving wife Gretchen.  
Her support for our home, our son, my work, my studies, my potential, and me  
while pursuing her own professional and academic goals  
made my graduate experience possible.  
She is love in every way.  
I love you, Gretchen.

**Table of Contents**

List of Figures ..... vi

List of Tables ..... vii

Abstract ..... viii

Chapter 1: Introduction ..... 1

    1.1 Process Models..... 1

    1.2 Formal Assessments ..... 1

    1.3 An Example: SCAMPI ..... 2

    1.4 Process Improvement ..... 3

    1.5 Persistence of Formal Assessment Records..... 3

    1.6 A Personnel-driven Mini Assessment (PMA) Approach ..... 4

Chapter 2: Background: The Anatomy of Formal Assessments ..... 5

Chapter 3: PMA ..... 11

    3.1 Anatomy of PMA ..... 11

        3.1.1 Phase 1: Planning and Preparation..... 11

        3.1.2 Phase 2: Assessment Conduct ..... 13

        3.1.3 Phase 3: Results Reporting..... 14

        3.1.4 PMA Process Flow ..... 15

    3.2 Potential PMA Pitfalls ..... 16

Chapter 4: Continuous Process Improvement ..... 18

    4.1 A Continuous Process Improvement Process ..... 19

    4.2 The PMA Contribution ..... 20

Chapter 5: Related Works ..... 21

    5.1 PMA and Formal Assessments: A Comparison..... 21

    5.2 Other Mini Assessment Approaches ..... 22

Chapter 6: PMA Implementation Experiment ..... 24

    6.1 Persistence of PMA Records..... 24

    6.2 Assessment Session ..... 25

    6.3 Assessment Results Reporting ..... 27

    6.4 Adding Support for ISO/IEC 15504 Gauging..... 32

Chapter 7: Conclusion..... 33

References ..... 34

Vita ..... 36

## List of Figures

Figure 3.1.4-1 PMA Process Flow.....	16
Figure 3.2-1 August 2004 SEI Organization Size vs. Maturity Profile .....	17
Figure 4-1 SEI August 2004 International CMMI Maturity Profile.....	18
Figure 4.1-1 FA and PMA: Continuous Process Improvement Process.....	19
Figure 6.1-1 PMA Entity Enterprise JavaBeans.....	24
Figure 6.3-1 CMMI-SE/SW (staged) Maturity Level Process Areas .....	31

## List of Tables

Table 2-1 SCAMPI Planning & Preparation Processes .....	6
Table 2-2 SCAMPI Appraisal Conduct Processes.....	8
Table 2-3 SCAMPI Results Reporting Processes.....	9
Table 5.1-1 PMA and SCAMPI: A Comparison .....	21



## **Abstract**

Assessments are fundamental to the process improvement program of any organization in the software industry. Assessments provide a view of the state, capability, and maturity of processes in an organization relative to a reference model. Formal assessments are the most recognized, and are comprehensive in nature. Although the depth of their evaluation often results in significant process improvement opportunities, formal assessments are too costly for frequent use by many organizations. The interim between assessments typically leaves these organizations without the currency of process state information necessary to effectively drive continuous process improvement. Mini-assessments have emerged as a solution. This paper presents a mini-assessment approach that offers a substantial cost reduction compared to formal assessments and satisfies the process state currency requirement. A specification of the approach is given, followed by discussions on the process improvement possible with its use, comparisons to other assessment methods, and an example implementation.

## **Chapter 1: Introduction**

Assessments are fundamental to the systems and software process improvement programs of any organization in the software industry. An assessment is a sampling of process state across an organization. An assessment provides an organization with a view of its capability or maturity with respect to one or more processes defined in a process model. The view depends on the type of assessment chosen, the scope of the assessment, and the process model(s) used. Organizations use this information to plan for, conduct, and track process improvement efforts. Regular use of assessment tools is therefore a requirement for effective process improvement programs. This thesis proposes a personnel-driven mini assessment approach (PMA) to assist software organizations in addressing this requirement.

### **1.1 Process Models**

In general terms, a process is a series of actions that have a useful result. Unless the process is well defined, its repeatability and consistency are not assumed. Repeatability refers to the ability of the process to produce a specific output based on one or more instances of identical or similar inputs. Consistency refers to the semantics of the process definition.

A process model is a framework of actions regarded as best practices for a given domain. The model serves as a specification for designing a repeatable and consistent process within the domain. As an example, the CMMI-SE/SW [2] models systems and software engineering best practices. A model is used as a reference during the assessment of an implementing process.

### **1.2 Formal Assessments**

For the purposes of this thesis, assessments conducted to assign capability or maturity ratings to organizational processes are regarded as formal. Although they provide a detailed analysis of processes relative to a given reference model, formal assessments are often regarded as prohibitive due to the costs involved with sponsoring and supporting them. For this reason, their use is an infrequent but crucial component of continuous process improvement efforts.

Formal assessments consist of many activities that are commonly organized at a high-level into planning, preparation, conduct, and findings presentation phases. The planning phase includes provisions for the other three phases, and is largely performed before any activity begins on-site at the organization.

An investigation of several formal approaches [10,11,12,15] reveals the need to use a team. Team conduct of an assessment provides for consensus-based decisions during all assessment phases. A team typically consists of 5-10 members, each contributing specific experience and knowledge to the conduct of an assessment. The members may be personnel from the organization being assessed, assessment professionals (preferably external to the organization), and anyone else the assessment sponsor requires. For all members, travel expenses can be

involved in the preparation for, and conduct of, the assessment. For those members internal to the organization, time away from regular duties can cause productivity interruptions.

Some organizational personnel not on an assessment team may serve as participants in the assessment process. For each, time is needed for various activities, including completing process capability questionnaires and/or attending interviews conducted by the team or a sub team. Participants are thus important process data sources. As with team members, participants may have travel expenses.

The availability of information technology support is essential. Formal assessments have several phases that require planning, scheduling, data management, and presentations. Conferencing with geographically distributed parties is often necessary, and can provide vital input to assessment data collection. Software tools [7] are becoming a popular and efficient mechanism for steering assessment activities.

Based on the use of teams in the formal approaches studied, and from professional experience on an assessment team, it is clear that the ratings determination process of formal assessments requires team consensus. In other words, the mere existence of process execution artifacts is not regarded as sufficient evidence for determining process capability ratings. Team consideration of participant knowledge of assessed processes is a factor as well.

As a final point on formal assessments, the utility of assessment output is likely to be limited outside of the assessment context. The context includes the organization, the process reference model, and assessment method. A number of software engineering process reference models and associated assessment methods exist. Unless an assessment can be conducted in accordance with defined international standards, this diversity in software process improvement contexts will inhibit international capability comparability [6,9]. ISO/IEC 15504 [8] is a pending international standard for Software Process Assessment that provides the common ground needed.

### **1.3 An Example: SCAMPI [1]**

To illustrate the details of section 1.1, the Standard CMMI<sup>SM</sup> Appraisal Method for Process Improvement (SCAMPI<sup>SM</sup>) [12] can be considered. The SCAMPI provides a complete, in-depth assessment of organizational and selected project level processes of an organization relative to some or all Process Areas (PAs) in a specific Capability Maturity Model Integration (CMMI<sup>SM</sup>) [2] model. The Software Engineering Institute (SEI) at Carnegie Mellon University develops and maintains CMMI models and the SCAMPI. An SEI-authorized lead assessor is a required member of any SCAMPI team, and is responsible for ensuring that assessment conduct complies with SCAMPI processes.

Given the in-depth and comprehensive nature of a SCAMPI assessment, each one is typically very expensive. The cost is three-dimensional: personnel, resources, and business interruption. With the exception of the lead assessor, the personnel involved are normally from the assessed organization, and include both assessment team members and participants. When an organization is geographically dispersed, the sponsor sometimes prefers to have the team co-located. Achieving this co-location normally incurs personnel travel costs. Assessment

participants may also be expected to travel. The resources involved in a SCAMPI assessment include various types of information technology. Team Internet access, PC projectors, projector screens, and removable storage media are typical needs. Professional experience on a SCAMPI team revealed that spreadsheets are a good tool for tracking and verifying the Practice Implementation Indicators (PIIs) required by the SCAMPI Method Definition Document [12]. These PIIs are intended to provide the assessment team with rapid access to PA implementation artifacts such as documents, presentations, and meeting minutes. The same experience also revealed the utility of teleconferencing during various SCAMPI sessions. Finally, an organization can expect notable losses in productivity during a SCAMPI assessment. Activities can last for at least several weeks. During this time, some organizational personnel may have to work full time on the assessment team, and some may make themselves available as needed for participation (interviews, process implementation evidence verification and validation, etc.).

A SCAMPI team communicates throughout an appraisal. This facilitates process data verification, corroboration, consolidation, and ratings generation. Any of a number of support tools can be used, including spreadsheets and databases [13].

The SCAMPI MDD [12] includes support for generating ISO/IEC 15504 process profiles if a sponsor desires standard capability comparability in the international software community.

#### **1.4 Process Improvement**

Business processes are seldom static over time. They must evolve in response to an ever-changing global marketplace in order for an organization to remain efficient and competitive.

Process improvement consists of objectives and a plan for meeting them. Objectives could include process efficiency, satisfaction of a customer requirement, or compliance with standards or process models. Objectives should be aligned with business goals such as CMMI-SE/SW level 3 or business growth. Effective process improvement requires the availability of process state data before, during, and after improvement efforts. Without this data, progress tracking is not possible.

#### **1.5 Persistence of Formal Assessment Records**

A formal assessment is a sampling of process state across an organization. This is true regardless of the process reference model; the model simply dictates what the state data should consist of. From the perspectives of process improvement and process capability or maturity claims, the value of the sampled state will decay with time [4]. Unless state data can be generated at a meaningful frequency, an organization is likely to experience a reduction of internal compliance with established processes, failed process improvement attempts due to the inability to track and report progress vertically, and a reluctance from the software community to hold any regard for process capability claims.

## 1.6 A Personnel-driven Mini Assessment (PMA) Approach

This thesis proposes a cost-effective personnel-driven systems and software engineering process mini-assessment approach. The primary goal is to support continuous process improvement efforts within an organization by significantly increasing the frequency of process state sampling. Indirect benefits include process reference model education for personnel, and the identification of the strengths and weaknesses of organizational and project process institutionalization efforts.

Attributes of the approach are:

- ◆ Cost, resource, and business interruptions are reduced.
- ◆ Assessment conduct polls CMMI-SE/SW (staged) practices directly.
- ◆ Process data collection is based on Practice Implementation Indicators (PIIs).
- ◆ No assessment team is needed.

Before presenting PMA, the details of formal assessments are discussed in Chapter 2. This will provide an understanding of their comprehensive process coverage. PMA follows in Chapter 3. The PMA attributes presented above will be apparent as Chapter 3 is read with Chapter 2 in mind.

Chapter 4 provides a discussion on the continuous process improvement enabled by PMA. Formal assessments are an important part of this improvement cycle. The role each assessment type is clearly illustrated.

Chapter 5 offers a comparison of PMA to the SCAMPI approach, and presents several other software process mini-assessment approaches found during the literature review for PMA.

An implementation of PMA using IBM WebSphere software is discussed in Chapter 6. PMA is defined to put the process practitioner in control of assessment conduct and records generation. The WebSphere implementation demonstrates this nicely.

## **Chapter 2: Background: The Anatomy of Formal Assessments**

Formal assessments (FAs) consist of many activities that are commonly organized at a high-level into planning, preparation, conduct, and findings presentation phases. The planning phase includes provisions for the other three phases, and is largely performed before any activity begins on-site at the organization.

Several authors [8,10,12] have indicated that identification of process improvement objectives in the context of business goals is arguably the most important step in planning a FA. These objectives serve as critical input to the choice of assessment type and scope.

Selection of an assessment team, arranging for any necessary reference model and assessment method training for team members, logistics, and initial review of organizational process documentation are typical activities performed in preparation for a FA. Resources for these efforts are determined during assessment planning. The details involved with planning and preparing for a SCAMPI assessment (discussed in section 1.2) are shown in the table below.

**Table 2-1 SCAMPI Planning & Preparation Processes**

Phase	Process	Purpose	Activities
1 Plan and Prepare for Appraisal	1.1 Analyze Requirements	Understand the business needs of the organizational unit for which the appraisal is being requested. The appraisal team leader will collect information and help the appraisal sponsor match appraisal objectives with their business objectives.	1.1.1 Determine Appraisal Objectives
			1.1.2 Determine Appraisal Constraints
			1.1.3 Determine Appraisal Scope
			1.1.4 Determine Outputs
			1.1.5 Obtain Commitment to Appraisal Input
	1.2 Develop Appraisal Plan	Document requirements, agreements, estimates, risks, method tailoring, and practice considerations (e.g., schedules, logistics, and contextual information about the organization) associated with the appraisal. Obtain, record, and make visible the sponsor's approval of the appraisal plan.	1.2.1 Tailor Method
			1.2.2 Identify Needed Resources
			1.2.3 Determine Cost and Schedule
			1.2.4 Plan and Manage Logistics
			1.2.5 Document and Manage Risks
			1.2.6 Obtain Commitment to Appraisal Plan
	1.3 Select and Prepare Team	Ensure that an experienced, trained, appropriately qualified team is available and prepared to execute the appraisal process.	1.3.1 Identify Team Leader
			1.3.2 Select Team Members
			1.3.3 Prepare Team
	1.4 Obtain and Analyze Initial Objective Evidence	Obtain information that facilitates site-specific preparation. Obtain data on model practices used. Identify potential issue areas, gaps, or risks to aid in refining the plan. Get preliminary understanding of the organizational unit's operations and processes.	1.4.1 Prepare Participants
			1.4.2 Administer Instruments
			1.4.3 Obtain Initial Objective Evidence
			1.4.4 Inventory Objective Evidence
	1.5 Prepare for Collection of Objective Evidence	Plan and document specific data collection strategies including sources of data, tools and technologies to be used, and contingencies to manage risk of insufficient data.	1.5.1 Perform Readiness Review
			1.5.2 Prepare Data Collection Plan
1.5.3 Replan Data Collection (if needed)			

Training can also be provided for participants before and during an assessment [10,12]. The instruction can come from the FA team, the organization being assessed, or both. Organizations normally ensure selected participants have a basic understanding of how they will contribute process data to the assessment, and attempt to fill any knowledge gaps participants may have. The FA team provides some form of orientation to any participants during the opening minutes of any assessment phase involving them.

Once a FA is planned and properly prepared for, a detailed review and analysis of organizational processes can be conducted at a location specified in the final FA plan. This work focuses on the consolidation of objective data in the form of process documents, process execution artifacts, interview feedback (i.e. affirmations), and any process data offered by the organization through the use of appraisal tools [13]. Interviews are normally used to align participant knowledge of organizational and project processes with the document, artifact, and tool evidence collected prior to commencing the interviews. This combined approach, interviews and artifacts, is intended to provide the FA team with a complete understanding of the institutionalization status of assessed processes. The completion of data consolidation efforts is generally followed by a team consensus approach to the generation of assessment findings. The details involved with conducting a SCAMPI assessment (discussed in section 1.2) are shown in the table below.



**Table 2-2 SCAMPI Appraisal Conduct Processes**

Phase	Process	Purpose	Activities
2 Conduct Appraisal	2.1 Examine Objective Evidence	Collect information about the practices implemented in the organizational unit and relate the resultant data to the reference model. Perform the activity in accordance with the data collection plan. Take corrective actions and revise the data collection plan as needed.	2.1.1 Examine Objective Evidence from Instruments
			2.1.2 Examine Objective Evidence from Presentations
			2.1.3 Examine Objective Evidence from Documents
			2.1.4 Examine Objective Evidence from Interviews
	2.2 Verify and Validate Objective Evidence	Verify the implementation of the organizational unit's practices for each instantiation. Validate the preliminary findings, describing gaps in the implementation of model practices. Each implementation of each practice is verified so it may be compared to CMMI practices, and the team characterizes the extent to which the practices in the model are implemented. Gaps in practice implementation are captured and validated with members of the organizational unit. Exemplary implementations of model practices may be highlighted as strengths to be included in appraisal outputs.	2.2.1 Verify Objective Evidence
			2.2.2 Characterize Implementation of Model Practices
			2.2.3 Validate Practice Implementation Gaps
	2.3 Document Objective Evidence	Create lasting records of the information gathered by identifying and then consolidating notes, transforming the data into records that document practice implementation, as well as strengths and weaknesses.	2.3.1 Take/Review/Tag Notes
			2.3.2 Record Presence/Absence of Objective Evidence
			2.3.3 Document Practice Implementation Gaps
			2.3.4 Review and Update the Data Collection Plan
	2.4 Generate Appraisal Results	Rate goal satisfaction based upon the extent of practice implementation throughout the organizational unit. The extent of practice implementation is determined/judged based on validated data (e.g., the three types of objective evidence) collected from the entire representative sample of the organizational unit. The rating of capability levels and/or maturity levels is driven algorithmically by the goal satisfaction ratings.	2.4.1 Derive Findings and Rate Goals
			2.4.2a Determine Process Area Capability Level
			2.4.2b Determine Satisfaction of Process Areas
			2.4.3a Determine Capability Profile
			2.4.3b Determine Maturity Level
2.4.4 Document Appraisal Results			

After a FA, training in the form of lessons learned, reference model coverage gaps, and a process improvement action plan is often provided by the assessed organization to select personnel (often including participants). The FA team may offer brief input to this training during the presentation of findings. The details of the findings presentation during a SCAMPI assessment are shown in the table below.

**Table 2-3 SCAMPI Results Reporting Processes**

Phase	Process	Purpose	Activities
3 Report Results	3.1 Deliver Appraisal Results	Provide credible appraisal results that can be used to guide actions. Represent the strengths and weaknesses of the processes in use at the time. Provide ratings (if planned for) that accurately reflect the capability level/maturity level of the processes in use.	3.1.1 Present Final Findings
			3.1.2 Conduct Executive Session(s)
			3.1.3 Plan for Next Steps
	3.2 Package and Archive Appraisal Assets	Preserve important data and records from the appraisal, and dispose of sensitive materials in an appropriate manner.	3.2.1 Collect Lessons Learned
			3.2.2 Generate Appraisal Record
			3.2.3 Provide Appraisal Feedback to CMMI Steward
			3.2.4 Archive and/or Dispose of Key Artifacts

A SCAMPI assessment can support an ISO/IEC 15504-conformant findings view as part of the final findings presentation. To do so, accommodations must be made in process data collection, consolidation, and findings generation planning for collecting the necessary information [12]. If supported, the 15504 view can provide the assessed organization with a process capability profile recognizable in the international software community.

A FA can be summarized as consisting of pre-onsite, on-site, and post-onsite activities. The post-onsite phase is generally the internal process improvement response from the assessed organization.

As mentioned in section 1.1, frequency of FA use is quite low due to cost, including that of business interruption. This is unfortunate, because the software process assessment community currently appears to lack a well recognized mechanism for the convenient, inexpensive defense or check of organizational process maturity or capability claims between FAs. Output records from FAs generally serve only as supporting data or evidence during findings (view) presentation, and as a reference for future assessments. To rephrase, the records have an essentially static existence. From a currency perspective, they provide no support for process maturity or capability persistence checks between assessments (refer to section 1.3).

Despite their drawbacks, FAs are fundamental to the software process improvement community. As an example, a number of organizations are known to have achieved significant improvements

in their systems and software engineering capability through SW-CMM [17] and CMMI-based software process improvement programs. One such organization is listed in the references [14]. The capability evolution these organizations experienced required a commitment to continuous process improvement from management and engineering personnel. CBA IPI [3] and SCAMPI FAs were key to facilitating this commitment.

## **Chapter 3: PMA**

Formal assessments (FAs) provide a comprehensive view of the capability of organizational and project processes, and are fundamental to the long-term vitality of any software process improvement program. Their use would be far more frequent in the systems and software community if the cost of conducting them could be reduced. However, a careful review of the anatomy of an exemplar FA in Chapter 2 reveals that appreciable cost reduction would be somewhat difficult to achieve. Each component of the FA contributes a well-defined role to the comprehensive assessment of processes.

This thesis proposes an original personnel-driven mini-assessment (PMA) method as a cost-effective solution for gauging organizational and project process state, capability, and effectiveness between FAs. Regular use of PMA is intended to support continuous process improvement efforts within an organization, while facilitating process reference model education and identifying the strengths and weaknesses of organizational and project process institutionalization efforts. For PMA, the reference model is the CMMI-SE/SW v1.1 staged representation.

The most notable cost-reducing aspects of PMA are its completely internal composition relative to the assessed organization, and the absence of an assessment team. The personnel involved with planning, conducting, and responding to a PMA assessment are internal to the assessed organization. Responsibility for assessing processes falls squarely on the shoulders of those to whom it should matter the most: process practitioners.

### **3.1 Anatomy of PMA**

For the sake of comparison with Chapter 2, the PMA approach is presented by phase: Planning and Preparation, Assessment Conduct, and Results Reporting. The process and activity identifiers begin with the associated phase number.

#### **3.1.1 Phase 1: Planning and Preparation**

As with a FA, the decision to carry out a PMA rests with a member of management. In the case of a FA, this is likely to require senior management. For a PMA on the other hand, any member of management should be adequate. This added latitude provides authority for process gauging as frequently as feasible to arguably the most influential manager at the practitioner level: the project manager. Planning and preparation then begins, but requires far less time than in FA. The processes and activities are defined below.

##### Process 1.1

Management initiates a PMA.

### Purpose

Management identifies the need for and begins the planning of a PMA. The assessment purpose, scope, and schedule are documented. Scoping includes identifying which projects will contribute to assessment input, and therefore indirectly results in the location of candidate participants. Scoping also determines which Process Areas (PAs) from the process reference model will be assessed.

### Activities

- 1.1.1: Document the purpose and scope of the PMA, including maturity level.
- 1.1.2: Document the desired number of participants.
- 1.1.3: Document the calendar time frame of the PMA.

### Process 1.2

Management selects participants.

### Purpose

PMA participants are selected based on personnel profiles and assessment objectives. Personnel profiles are normally available within the Human Resources (HR) function of an organization.

### Activities

- 1.2.1: Document selection criteria relative to PMA purpose and scope.
- 1.2.2: Document candidate participants based on selection criteria.
- 1.2.3: Document strengths and weaknesses of candidates relative to criteria.
- 1.2.4: Select participants from the candidates (selection count must comply with PMA (1.1.2)).

### Process 1.3

Management assigns PAs to each participant.

### Purpose

CMMI-SE/SW Process Areas are assigned to participants in a manner that most effectively aligns participant profiles with assessment objectives.

### Activities

- 1.3.1: Assign PAs to each participant so as to align strengths and weaknesses with the PMA purpose and scope.
- 1.3.2: Record the PA assignments.
- 1.3.3: Construct and record a mapping of the strengths and weaknesses of each participant to the PMA purpose and scope.
- 1.3.4: Archive all planning data and records.

### Process 1.4

Prepare participants.

### Purpose

Make the participants aware of the assessment, their responsibilities, and the assessment time frame. Arrange for participant access to the assessment environment.

### Activities

- 1.4.1: Inform participants of their involvement in a PMA.
- 1.4.2: Inform participants of their assigned PAs.
- 1.4.3: Inform participants of the assessment deadline. (Comply with PMA 1.1.3.).
- 1.4.4: Enable participant access to the assessment environment.

Planning and preparing for a PMA is intended to require no more than one week. This is an estimate, but is based on realistic assumptions about the time management needs to interface with HR to gather personnel profiles related to process improvement experience, to identify candidate participants, to select participants based on candidate availability, and to formally assign Process Areas and complete the planning documentation. Participant preparation can be handled in one day, depending on the mechanics of configuring the assessment environment.

Promptness in planning enables overhead costs associated with assessment initiation to be kept low. Three primary parties interact: management, HR, and candidate participants. This is the extent of the interaction necessary to meaningfully plan for PMA. No team formation is involved. When compared to the interactions and time necessary to plan and prepare for a FA, the cost savings of just this phase of PMA can be regarded as a reason for accepting PMA as a viable solution for an inexpensive catalyst to process improvement between FAs.

### **3.1.2 Phase 2: Assessment Conduct**

The activity involved with assessment conduct represents the most significant difference between PMA and a FA. To illustrate this point, review the exemplar conduct of a SCAMPI assessment in table 2-2, and then consider the conduct of PMA as defined below.

#### Process 2.1

Participants are assessed in their assigned PAs.

#### Purpose

PMA participants are polled directly for their knowledge of CMMI-SE/SW practice implementation evidence.

Assessment can be facilitated with any tool (paper, IT, etc), but must consist of output records capable of supporting CMMI-SE/SW Process Area capability and organizational maturity level gauging as defined in the PMA Results Reporting processes (see section 3.1.3). Additionally, the records must be in a format suitable for archiving.

### Activities

- 2.1.1: Poll participants on the implementation of practices based on the identification of appropriate artifacts for each practice.
- 2.1.2: Poll participants on their level of confidence with each artifact per practice.
- 2.1.3: Archive identified practice implementation evidence and artifact confidence indicators.

Table 2-2 displays processes requiring a team to examine collected CMMI practice implementation evidence, validate examination results with participants, and identify implementation gaps. As process 2.4 in table 2-2 points out, ultimate findings decisions based

on this approach involve “judgment” by the team. In PMA, practice implementation evidence collection is restricted to polling participants on their knowledge of practice artifacts. The team judgment found in a SCAMPI assessment, and common to FAs in general, is replaced with allowing participants to do their own judging of practice satisfaction. This is accomplished by having participants indicate their level of confidence that identified artifacts cover the intent of a given practice during polling.

The sole use of process practitioners in process assessment has a number of benefits. In the absence of a team, participants are likely to be more at ease. This can lead to the assessment being viewed as a simple query about how a given project or organization performs key activities. Using participant confidence to judge practice satisfaction enables each practitioner to convey their sense of certainty about the execution of processes. This can provide management with an awareness of process training issues not otherwise revealed through a team-based assessment, where practice implementation validation is typically performed with one or more participant groups. Group responses can be influenced by social or event pressure. As a result, significant process training or institutionalization issues can be obscured.

### **3.1.3 Phase 3: Results Reporting**

Reporting assessment results in PMA differs from a FA, such as a SCAMPI assessment, in that findings are not based on team examination of process definition and execution evidence. Instead, results are a gauge of this evidence based on participant knowledge and experience. The process is defined below.

#### Process 3.1

CMMI-SE/SW Process Area Capability Gauge Reporting.

#### Purpose

Participants receive a capability report for each of their Process Areas. These reports provide a gauge of how well practice implementation as seen from the participant's experience aligns with what is expected from the CMMI-SE/SW. A Process Area consists of Specific Goals and Generic Goals. Specific Goals consist of Specific Practices. Generic Goals consist of Generic Practices.

#### Activities

- 3.1.1: The artifacts selected for a given practice are compared to what the CMMI-SE/SW recommends for the practice. This determines the acceptability of selected artifacts.
- 3.1.2: Confidence indicators given for each artifact are combined with acceptability to yield the degree of practice satisfaction.
- 3.1.3: A practice satisfaction rating is given to each practice based on the degree of practice satisfaction.
- 3.1.4: Specific and Generic Goal satisfaction is determined from practice satisfaction ratings. An averaging of the practice ratings is recommended.
- 3.1.5: Process Area capability is gauged from component Specific and Generic Goal satisfaction.
- 3.1.6: A Process Area Capability Gauge report is produced.
- 3.1.7: HR receives notification of the assessment for inclusion in participant profile records.

## Process 3.2

### CMMI-SE/SW Maturity Level Gauge Reporting.

#### Purpose

An organizational process maturity level report is produced. This report provides a gauge of how well practice implementation as seen from assessment records across all relevant projects aligns with what the CMMI-SE/SW expects for the chosen maturity level.

#### Activities

- 3.2.1: A Maturity Level Gauge report relative to CMMI-SE/SW (staged) is determined from assessment records by application of PMA Results Reporting activities 3.1.1 – 3.1.6 to the records of each Process Area in the scope of the maturity level.
- 3.2.2: Maturity Level gauging involving records of Process Areas common to more than one project requires two steps. First, a statistical analysis of a given practice in a given Process Area across all relevant projects is performed. Second, Results Reporting activities 3.1.1 – 3.1.5 are applied to the resulting derived practice implementation data.

Activities 3.1.1 and 3.1.2 represent the complete evidence examination approach. Responses supplied by participants during assessment conduct are taken as they are. Use of the SCAMPI practice satisfaction rating scale [12] is suggested in PMA, and should be applied to the satisfaction results that follow activity 3.1.2. Unlike a SCAMPI assessment, however, practices are determined to be Fully Implemented (FI), Largely Implemented (LI), Partially Implemented (PI), or Not Implemented (NI) analytically. NI is a trivial case, and is assigned to any practice for which no artifacts were identified (regardless of confidence level), and any practice for which artifacts are identified without confidence.

For PMA participants truly new to process improvement and process assessment, the expectation is that assessment results will consistently reveal weaknesses in process capability. Assessment records in these cases can provide invaluable insight into focus areas for organizational and/or project process training.

FAs typically address process implementation gaps during the reporting of assessment results. Gap information is generated by team judgment of practice satisfaction relative to reference model requirements across all assessed projects. Naturally, this component of results reporting is intended to be included as input to the organizational plan for process improvement in response to the FA. Owing to the participant-specific practice satisfaction polling used for assessment, process implementation gaps can be readily deduced from PMA Process Area records. Further, the resolution of the gap detail is likely to be better than that resulting from team-based FAs since gap information is recorded per participant, not at team discretion.

#### **3.1.4 PMA Process Flow**

An example high-level view of the PMA process flow is given in the figure below.



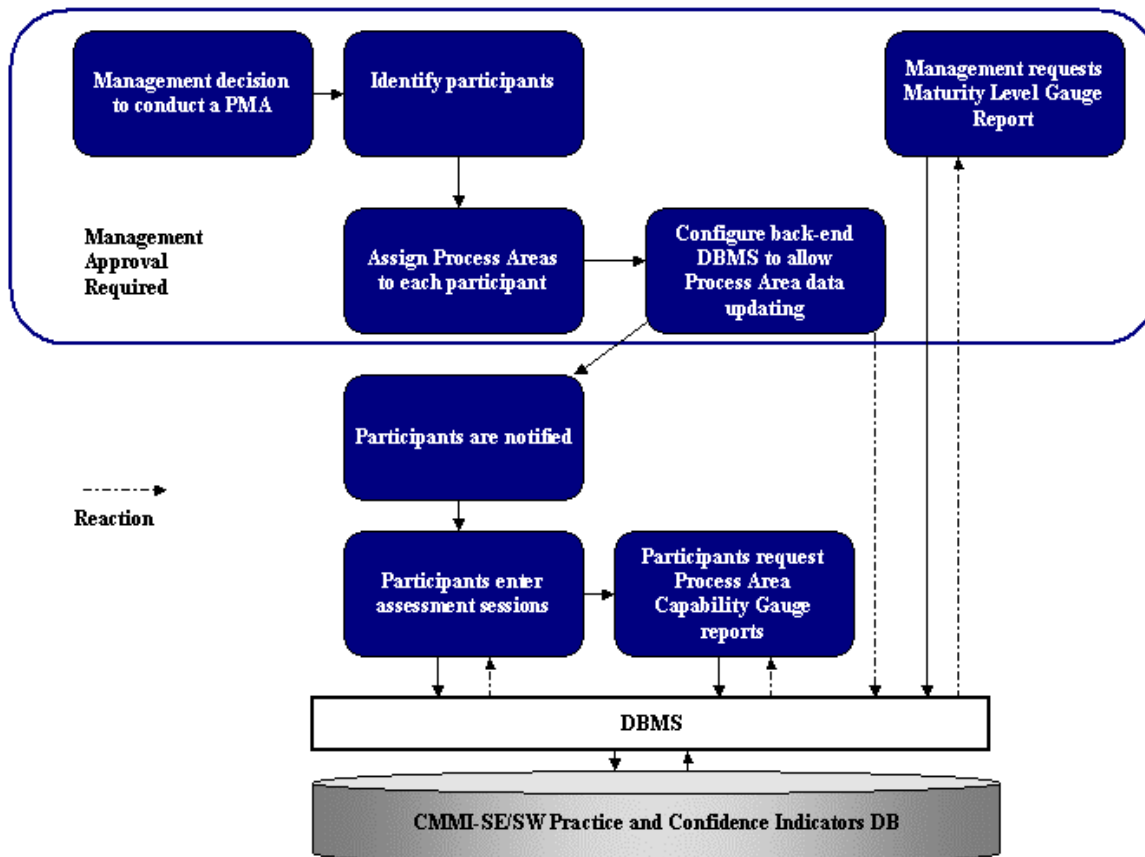


Figure 3.1.4-1 PMA Process Flow

The assessment support technology included in the figure is not part of the PMA definition contained in sections 3.1.1 – 3.1.3. A database and a database management system are included as a natural choice for meeting the needs of PMA. Specifically Planning and Preparation activities 3.4 and 4.4, Conduct activity 1.4, and all Results Reporting activities.

### 3.2 Potential PMA Pitfalls

The results of any process assessment are only as good as the intentions behind the assessment. This is true for PMA instances and formal assessments alike. Anecdotal evidence [1] exists for cases where the objective evidence supplied during an assessment was skewed towards a desired business advantage. This not only undermines process improvement investments, it compromises the integrity of process reference models.

The assessment phase of PMA relies on the knowledge and experience of each participant. This phase was designed with the assumption that participants will provide purely objective

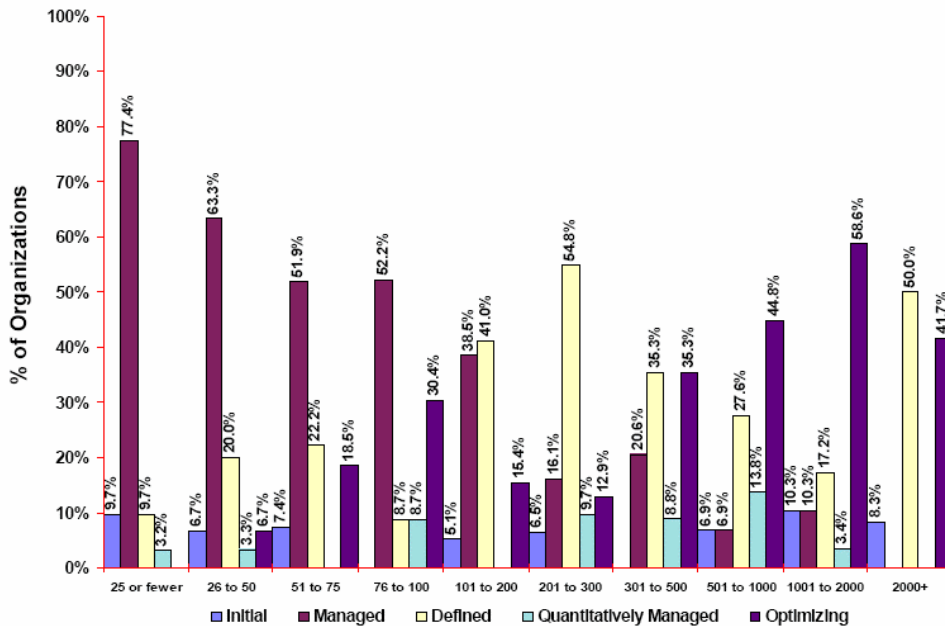
responses. The value of process capability or organizational maturity level gauging will be compromised whenever this assumption is violated.

PMA is designed to motivate process health and process improvement efforts between FAs. The assumption in its use, and in the use of FAs, is that model-based process improvement makes sense in the business context of an organization. Effective process improvement programs require corporate investments. Before investing, an organization should carefully consider the relevance of assessments to its business needs, or risk wasting valuable resources [5].

The following August 2004 SEI profile nicely shows the indirect correlation between organization size and process improvement capability (via CMMI maturity level) based on 285 reporting organizations. (The same data source drives the profiles in Chapter 4.) The smaller organizations are less likely to have the resources (time, money) to devote to formal continuous process improvement programs.

## Maturity Profile by Organization Size

Based on the total number of employees within the area of the organization that was appraised



Based on 285 organizations reporting size data and maturity level rating

Figure 3.2-1 August 2004 SEI Organization Size vs. Maturity Profile

## Chapter 4: Continuous Process Improvement

Software process improvement is usually not easy, not cheap, and those organizations that understand its business value are relatively small in number in the software community. Professional experience and sources considered in this thesis indicate SCAMPI assessments are the most common tool used today to drive process improvement. Consider the following August 2004 SEI maturity profile based on the 288 organizations that chose to report SCAMPI assessment data to the SEI.

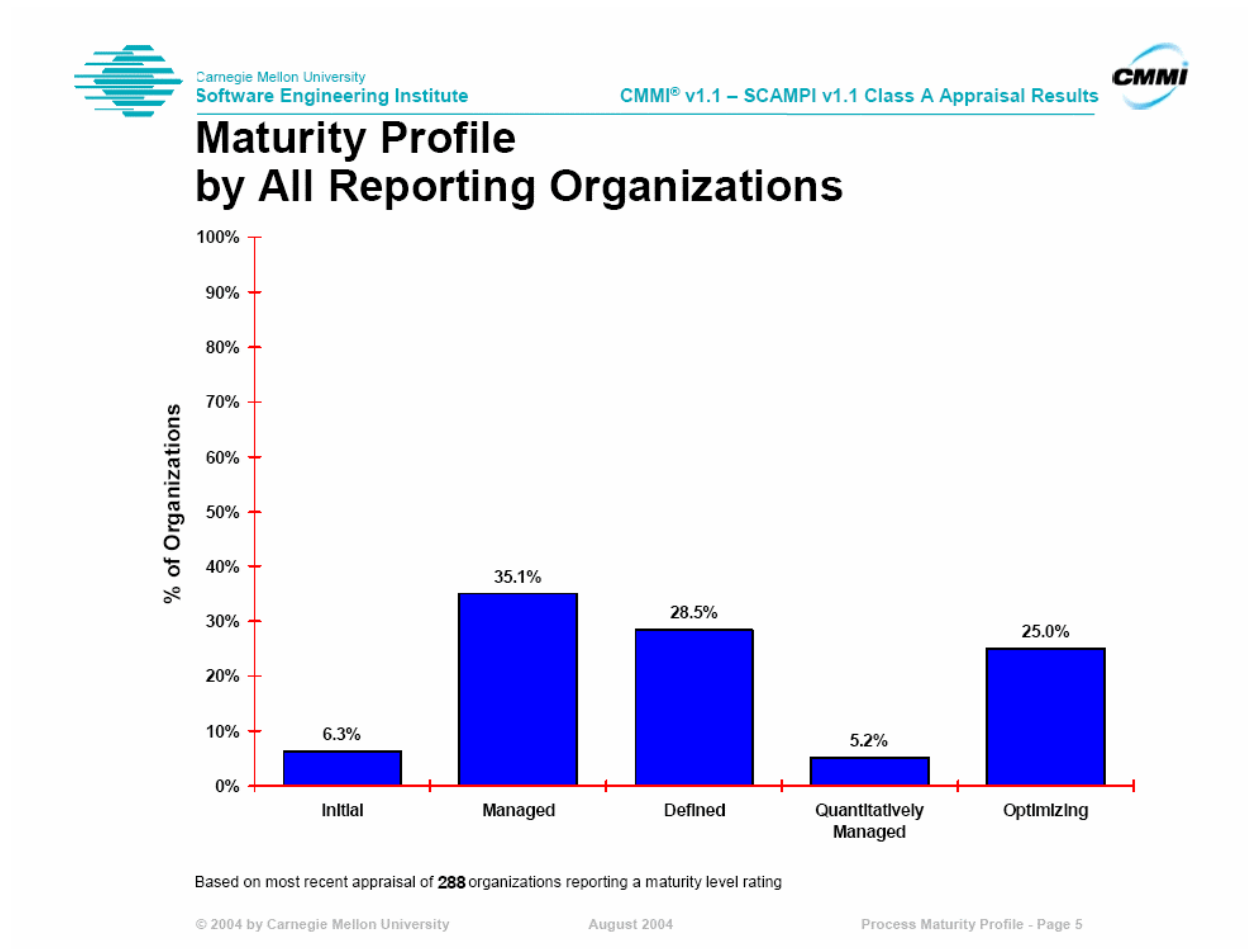


Figure 4-1 SEI August 2004 International CMMI Maturity Profile

Two observations are worth noting. First, nearly half of the organizations are at most Defined (level 3). Second, the SCAMPI rating process uses a team consensus approach to goal satisfaction decisions before rating the capability of Process Areas. Therefore, it is likely that a number of organizations included in 28.5% Defined data, for example, are barely Defined. A

focus on continuous improvement that incorporates a method like PMA can help organizations develop a more detailed approach to their process assessment responses.

#### 4.1 A Continuous Process Improvement Process

Within the software engineering community, a natural reaction to the availability of a low-cost mini-assessment method such as PMA is the following process:

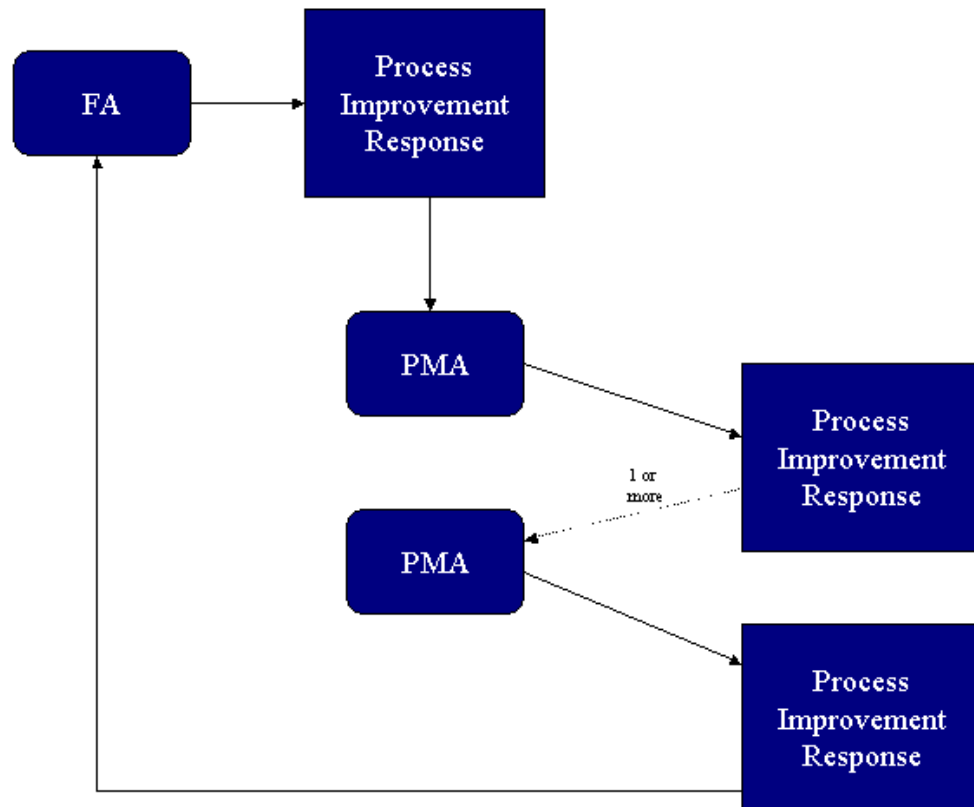


Figure 4.1-1 FA and PMA: Continuous Process Improvement Process

Granted PMA as presented in this thesis has activities defined based on the CMMI-SE/SW, the activities can be defined based on any criteria-based process model [19]. The requirement is that process capability determination relative to the model should consist of an evidence checklist approach.

Output records from the FAs in this continuous improvement approach should be incorporated into the archiving medium used by PMA. This would enable the availability of process state

information as current as the latest formal or mini assessment. To some degree, this process satisfies the State-Coupled Process Certification approach proposed by Dutton [4]. The completion of each assessment event presents an organization with the chance to identify and address process improvement opportunities.

#### **4.2 The PMA Contribution**

With a focus on surveying process practitioners individually, PMA assessment results can provide valuable insight into focus areas for organizational and/or project process training [13,16]. Participants are required to consider their knowledge of organizational and project processes in place and supposedly in use. Those who find it difficult to be assessed in a PMA are good candidates for capability (institutionalization) training.

Having PMA assessment records in an assessment archive to fill the process state gaps left by infrequent FAs enables timely management of process improvement. The regular availability of process data would serve as an encouragement for an organization to treat process improvement as a project [16]. Projects require resources, management, metrics, and tracking. This attention to process would likely produce a visibility to senior management that would result in their continued support of organizational process improvement. The lack of this support is what normally causes such efforts to fail.

Lastly, the PMA practice and goal rating implementation discussed in section 3.2.3 provides enough resolution in ratings results for organizations to predict whether they could be sitting on a maturity level fence.

## Chapter 5: Related Works

A number of systems and software process assessment approaches exist today that are similar to PMA in terms of their goal to support continuous process improvement. Formal assessment methods such as SCAMPI are the most well known. Several mini-assessment methods, either in use or in development, were also discovered during PMA background research.

### 5.1 PMA and Formal Assessments: A Comparison

The table below provides a brief comparison of FAs and PMA. It is based on a table used in a presentation focused on comparing a CBA IPI [3] formal assessment to another mini-assessment method [10]. Modifications reflect estimates applicable to the SCAMPI method and PMA. (The SCAMPI method is chosen to represent FAs due to data availability from professional experience.)

Table 5.1-1 PMA and SCAMPI: A Comparison

## Assessment Method Comparisons

	SCAMPI	PMA
<b>*Resources:</b>		
- # team members	6-8	0
- team member time (plan, prep, conduct)	110-130 hrs.	0 hrs.
- # participants	50-60	Any
- participant time (prep, conduct)	4-8 hrs.	Varies
Team training (CMM and assessment method)	5 days	0 hrs.
Pre On-Site schedule (wall time)	2-3 months	N/A
On-Site schedule (consecutive days)	8-10 days	N/A
Formality (briefings, plans, reports, paperwork)	<ul style="list-style-type: none"> <li>• Formal</li> <li>• Maximum doc. review</li> </ul>	<ul style="list-style-type: none"> <li>• Very informal</li> <li>• Doc. review as needed</li> </ul>

\*Resources are per person; Typical figures for an organization with size 100 SW staff, covering Levels 2 & 3. Total time includes planning, preparing, and conducting.

As seen in the table, and in the anatomy of a FA (Chapter 2), planning and conducting one involves a significant investment of personnel, resources, and travel funds. The requesting organization is aware of this burden, and considers it a necessary part of process improvement. In Chapter 1, this was cited as a key reason for the infrequent use of FAs. The burden for assessment in PMA is reduced to two groups of people, and is considerably less than for FAs. The first group is those who engineer and develop the PMA implementation and any assessment support tool. This burden is heavy during initial development efforts, and tapers into maintenance mode. Maintenance of the archiving tool is included in this effort. The second group is those who use the PMA implementation, and therefore generate a process state sampling. Taking the time to sit through a tool-assisted assessment session is the extent of their burden.

Team members in a FA are assumed to have a better collective understanding of the state of the process evidence in an organization with respect to a reference model than the participants at large. In a PMA, the regular exposure to and use of project and organizational processes by the personnel serves as the underlying credibility of process evidence.

Use of purely mathematical techniques to determine process capability in PMA may sacrifice subjective FA team decisions critical to capturing an in-depth, comprehensive process inspection. However, a PMA is only a thermometer. The results can predict formal assessment potential, and can lead to process improvement responses not otherwise initiated.

## **5.2 Other Mini Assessment Approaches**

Several mini-assessment counterparts to formal assessments were discovered in researching PMA. Three are presented here, due to their strong similarities to PMA.

A team-based CBA IPI mini-assessment [10] is in use. The approach streamlines CBA IPI processes, and makes direct use of Maturity Questionnaires from the Software Engineering Institute as assessment conduct tools. A team is used to conduct documents reviews and hold discussions with senior managers, project leaders, middle managers, and practitioners. 3 to 4 key projects are typically included in the scope of an assessment. No ratings are assigned. Assessment focus is on global strengths and high-priority issues.

Another approach makes explicit use of the engineering process group (EPG) within an organization [15]. Management initiates an assessment and selects participants. Afterwards, the EPG assumes a team role by preparing the participants and administering CMMI-SE/SW-based assessment worksheets. The worksheets represent the complete process evidence collection method. No additional data are examined by the team. Once the worksheets are completed, the team consolidates them, and uses a consensus approach to gauge capability. For cases when consensus is not possible, the lowest score for the given practice or goal is retained. The EPG facilitates the organizational process improvement response. The company using this approach reports it as having a high correlation to SW-CMM [17] formal assessments, and widespread adoption internally. Similar results are expected for CMMI formal assessments.

The final approach to present is referred to as Verification [13]. It is a CMMI-based assessment method that offers a seemingly strong focus on educating personnel on Process Area practices. A Microsoft Access-based Process Area mapping tool is used to track realized practice implementation indicators (artifacts) against CMMI practices. Workshops are available to help personnel learn the practices, their associated artifacts, and populate the mapping tool. The workshops also provide instruction in CMMI-to-PII gap analysis. The Access DB is offered to teams during formal appraisals.



## Chapter 6: PMA Implementation Experiment

IBM WebSphere Studio Application Developer v5.1.2 and IBM WebSphere Application Server v5.1 were used to develop an experimental multi-tier technology support framework for PMA. The framework consists of a business tier containing entity Enterprise JavaBeans (EJBs) for creating PMA input and output (records) persistence, and a session EJB for the provision of the PMA business processes; a Web tier consisting of a servlet capable of accessing the session EJB services on behalf of an HTTP client; and a web browser interface for user interaction with PMA phases.

### 6.1 Persistence of PMA Records

The entity EJBs used to represent PMA persistence needs (records) are shown in the figure below.

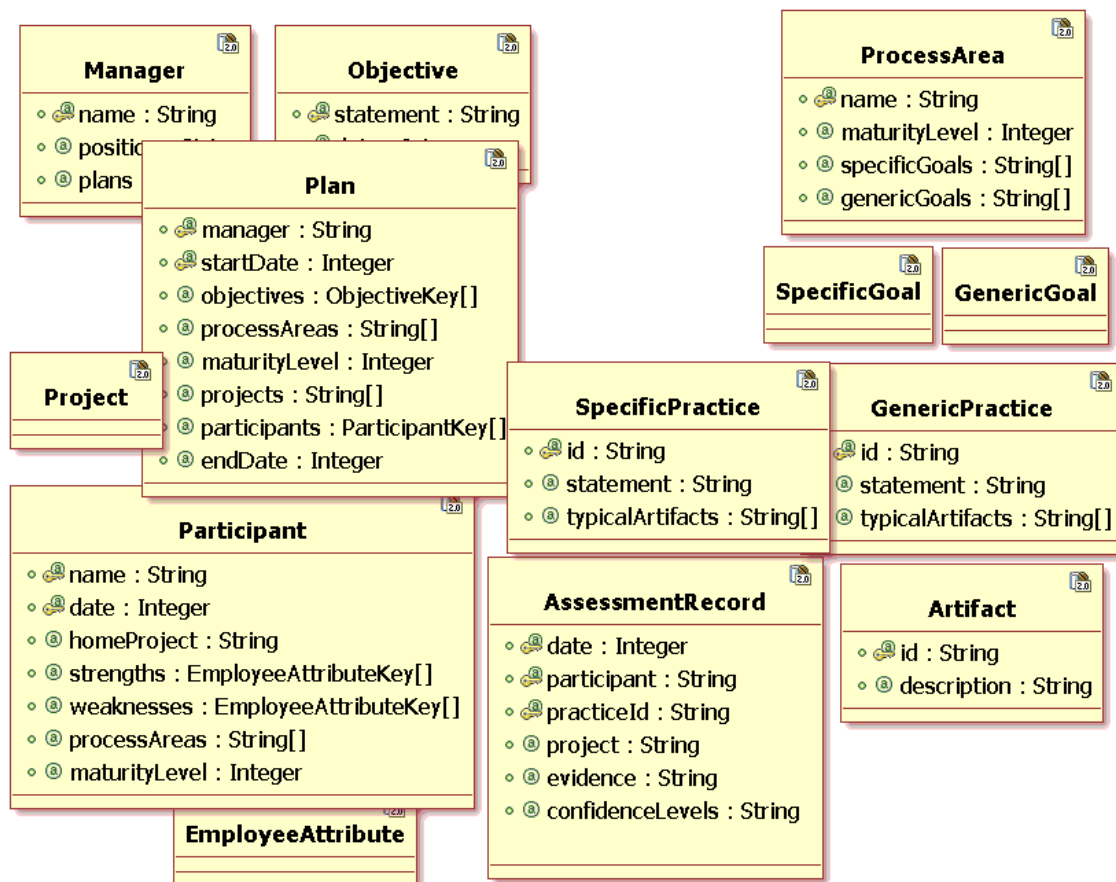


Figure 6.1-1 PMA Entity Enterprise JavaBeans

Within the Application Server EJB container, these entities are mapped to permanent store in a Cloudscape relational database. Given the compositional structure of the CMMI-SE/SW, a relational database is a natural candidate for providing the archiving support needed by PMA. Records of past and current assessment instances can be reliably created and maintained. The information stored comes from all phases of PMA, and lends readily to the generation of various types of process improvement metrics such as participant capability trend analysis, maturity level trend analysis, risk analysis, and weakness distributions.

## 6.2 Assessment Session

Assessment conduct is arguably the most important phase of PMA. Given the apparent uniqueness of the approach (section 3.1.2) relative to other known mini-assessment methods found in the process improvement community [10,11,15], a walk through a few of the browser views seen during a session is worth taking.

An assessment session is started by choice from the mini-assessment menu.

Recall from the last step in Assessment Planning and Preparation (section 3.1.1) that management enables participant access to the assessment environment. Therefore, a participant is required to enter his/her name and the assessment date in the appropriate fields of the first row in the menu.

The screenshot shows a web browser window titled "Menu.html - Microsoft Internet Explorer". The address bar shows "http://localhost:9080/MAnTWeb/Menu.html". The main content area displays the "CMMI-SE/SW 1.1 (Staged) Mini-Assessment Menu". Below the title is a table with three rows of input fields and buttons.

<b>Enter An Assessment:</b>	Participant Name	<input type="text" value="(type name)"/>	Date	<input type="text" value="(YYYYMMDD)"/>	<input type="button" value="Begin Assessment"/>
<b>Process Area Capability Report:</b>	Participant Name	<input type="text" value="(type name)"/>	Process Area	<input type="text" value="Requirements Management"/>	<input type="button" value="Display PA Gauge Report"/>
<b>Maturity Level Report:</b>	Maturity Level	<input type="text" value=""/>	Projects to Include	<input type="text" value="(type comma-separated names)"/>	<input type="button" value="Display ML Gauge Report"/>

After pressing the “Begin Assessment” button, a participant is walked through the practice polling screens for each practice in the goals of his/her assigned CMMI-SE/SW Process Areas. The goals are Specific and Generic. Accordingly, the constituent practices are defined as Specific and Generic.

Specific Practices address the existence of a specific activity in a Process Area. The question of how well a person or project performs the activity is a generic concern. Generic Practices therefore target capability, rather than existence.

Consider the polling of a Specific Practice (SP). Specifically, SP1.1 from the Level 2 Requirements Management Process Area. Note that the name and home project of the participant are stated at the top of the screen.

**CMMI-SE/SW 1.1 (Staged) Polling**

John Doe  
Project A

Process Area: REQM  
Practice: REQMSP1.1 Obtain an Understanding of Requirements

4 typical work products and/or activities associated with the implementation of this practice are listed below. Based on your knowledge and experience, select those that apply to your project/organization.

To the right of each selection, choose your level of confidence that the selection can indeed be found in the process assets of your project/organization. Verify all of your selections, then submit.

Lists of criteria for distinguishing appropriate requirements providers	<input checked="" type="checkbox"/>	Likely
Criteria for evaluation and acceptance of requirements	<input type="checkbox"/>	Unsure
Results of analyses against criteria	<input type="checkbox"/>	Unsure
An agreed-to set of requirements	<input checked="" type="checkbox"/>	Confident

Submit Response

The practice implementation indicators (artifacts), like the practice name itself, are notably specific to the Requirements Management Process Area.

As required by Assessment Conduct activities 2.1.1 and 2.1.2 (section 3.1.2), the participant identifies the typical practice implementation indicators (artifacts) s/he has some awareness of. Confidence is then associated with each artifact identified. The choice is made from Certain, Confident, Likely, or Unsure.

Consider the polling of a Generic Practice (GP). Specifically, GP2.7. As stated above, GPs target the general notion of capability. Therefore, they do not contain practice or artifact/activities language specific to a given Process Area.

http://localhost:9080/MAnTWeb/AssessmentServlet - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Search Favorites Media Print

Address http://localhost:9080/MAnTWeb/AssessmentServlet Go Links

## CMMI-SE/SW 1.1 (Staged) Polling

John Doe  
Project A

Process Area: REQM  
Practice: GP2.7 Identify and Involve Relevant Stakeholders

typical work products and/or activities associated with the implementation of this practice are listed below. Based on your knowledge and experience, select those that apply to your project/organization.

To the right of each selection, choose your level of confidence that the selection can indeed be found in the process assets of your project/organization. Verify all of your selections, then submit.

Identify and involve the relevant stakeholders of this process as planned	<input checked="" type="checkbox"/>	Likely
Select relevant stakeholders from customers, end users, developers, and others who may be affected by, or may affect, the product as well as the process	<input checked="" type="checkbox"/>	Confident

Submit Response

Done Local intranet

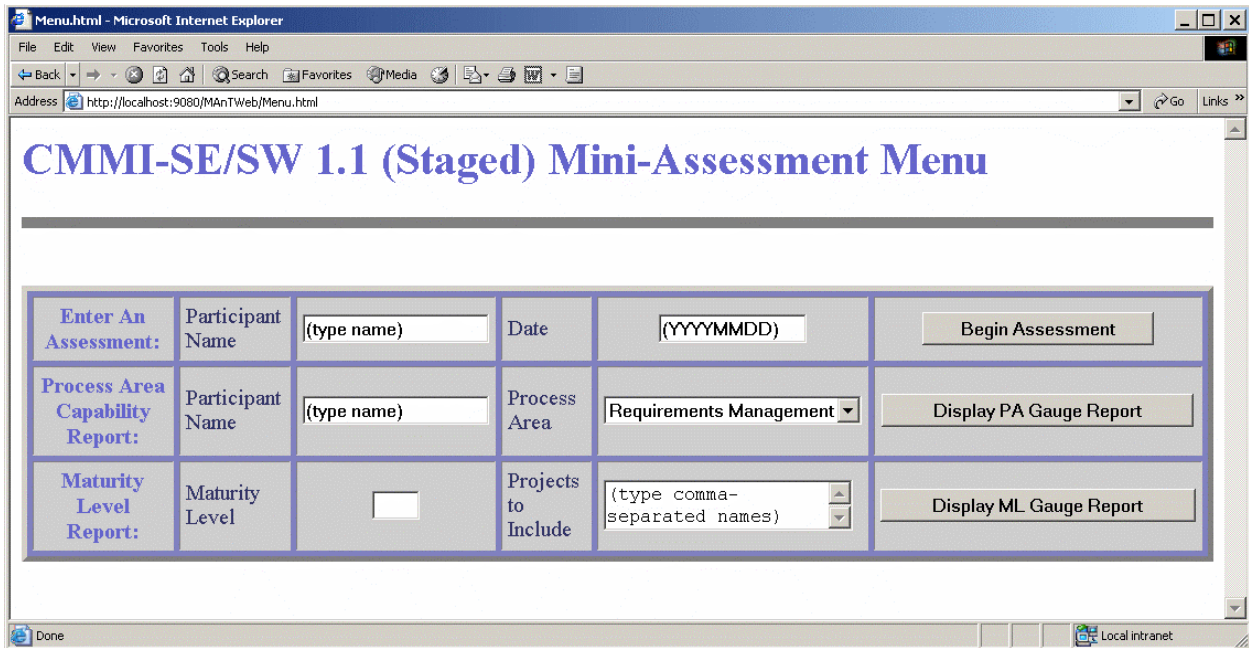
As with the SP polling, the participant identifies the typical practice implementation indicators (artifacts/activities) s/he has some awareness of. Confidence is associated with each.

### 6.3 Assessment Results Reporting

The PMA Assessment Results Reporting phase (section 3.1.3) requires a PMA implementation framework to be capable of producing a Process Area Capability Gauge report, and a Maturity Level Gauge report. The Capability Gauge Report is specific to a participant. It is intended to provide him/her with a quantitative view of how their identified practice implementation indicators (artifacts) compare with what the CMMI-SE/SW expects for a given Process Area.

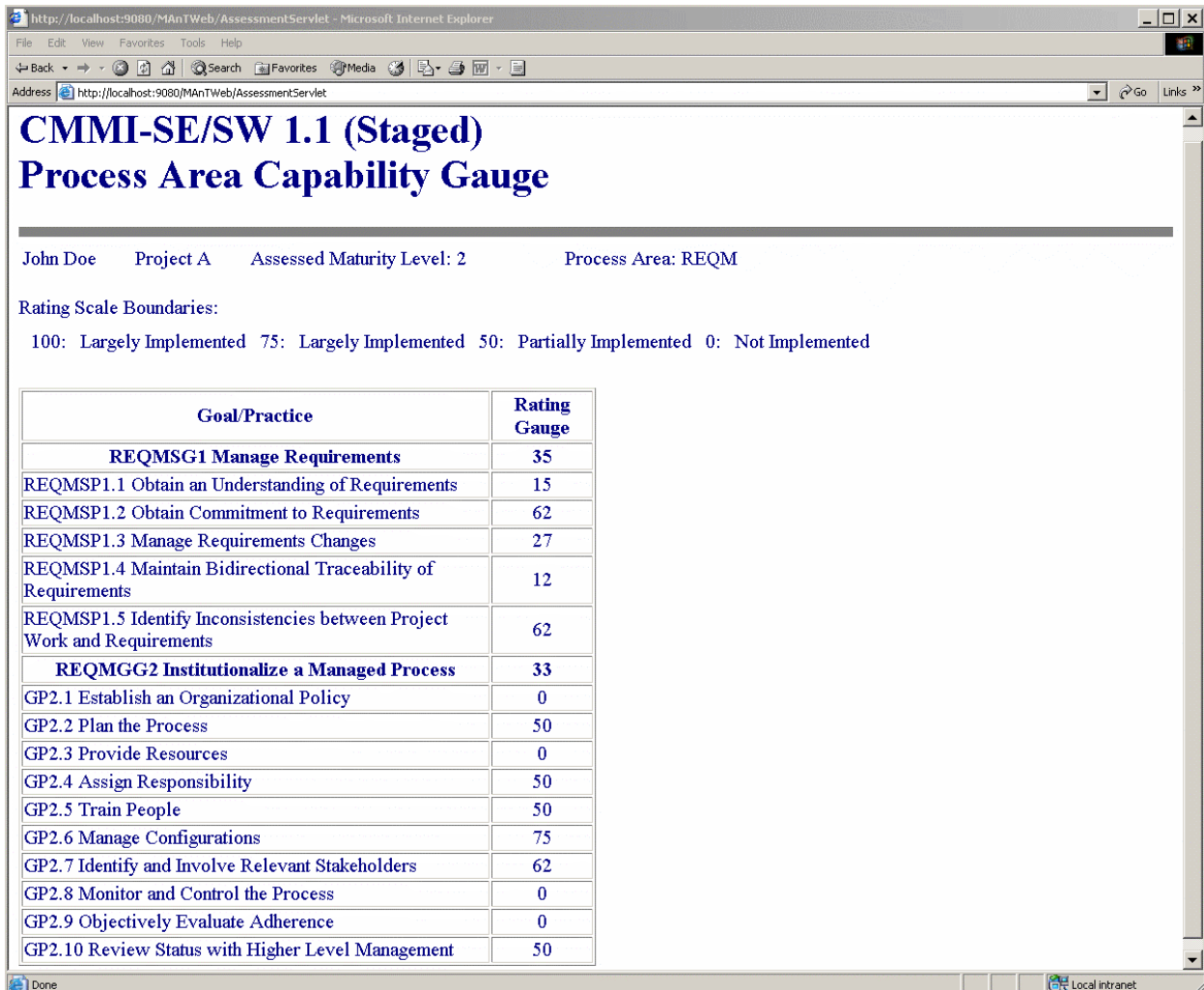
The Maturity Level Gauge Report applies to a list of provided projects within an organization. Through the Generic Practices of any Process Area, both reports also apply to the state of various organizational process assets as seen from the perspectives of employees whose assessment participation records are part of PMA archives.

Report generation is selected from the mini-assessment menu shown in section 6.2. For the sake of discussion, the menu is shown again here.



Consider the Capability Gauge Report for a participant named “John Doe” of project “Project A” who has been assessed in the Requirements Management Process Area. The name is entered in the second row of the menu, Requirements Management is selected from the Process Area drop-down list, and the “Display PA Gauge Report” button is pressed.





Notice the maturity level indication on the participant information line.

The manager who initiated the PMA instance John Doe was a part of assigned this level. This was recorded as part of Mr. Doe’s Participant profile (see the Participant entity EJB in figure 6.1-1), as was his Process Area (REQM).

Practices and goals are assigned satisfaction ratings based on archived practice assessment data. The AssessmentRecord Entity EJB (figure 6.1-1) is used to write practice assessment data for a given participant to the Cloudscape database. A new Cloudscape AssessmentRecord table entry is made each time the “Submit Response” button is pressed during an assessment (see section 6.2).

As discussed in section 3.1.3, PMA practice satisfaction data are based on the acceptability and confidence of practice evidence. The discussion also suggested the application of the SCAMPI ratings scale to the satisfaction data. The session EJB implementing the PMA assessment results reporting in the WebSphere Application Server framework takes this suggestion. It also extends the scale to the evidence level, where team decisions would prevail in a FA. The combined acceptability and confidence calculation per practice is then based on applying the SCAMPI

scale to the confidence associated with each artifact. This increases the resolution of the practice satisfaction scale: ratings are determined to fall between boundaries defined by Fully Implemented (FI), Largely Implemented (LI), Partially Implemented (PI), and Not Implemented (NI). These boundaries are mapped to integer value ranges: FI -> 100, LI -> 75, PI - 50, NI -> 0. The goal satisfaction ratings are then calculated as an average of the constituent practice ratings. Thus, both practice and goal satisfaction ratings are values falling into an implementation “bin” defined based on the SCAMPI ratings scale. The Capability Gauge Report shown above reveals this for John Doe’s Requirements Management assessment results.

For those goals and practices having a rating below 75, project and organizational training programs can be tailored to address the weaknesses and build on strengths. For ratings below 50, several dimensions of training should be considered. It is assumed that a profile of ratings across Process Areas will be generated based on numerous participants before an investment in organizational training resources is made.

A Maturity Level Gauge Report provides a gauge of organizational process state relative to the CMMI-SE/SW Process Areas present at a given maturity level. The Process Areas at each level are shown in the figure below.

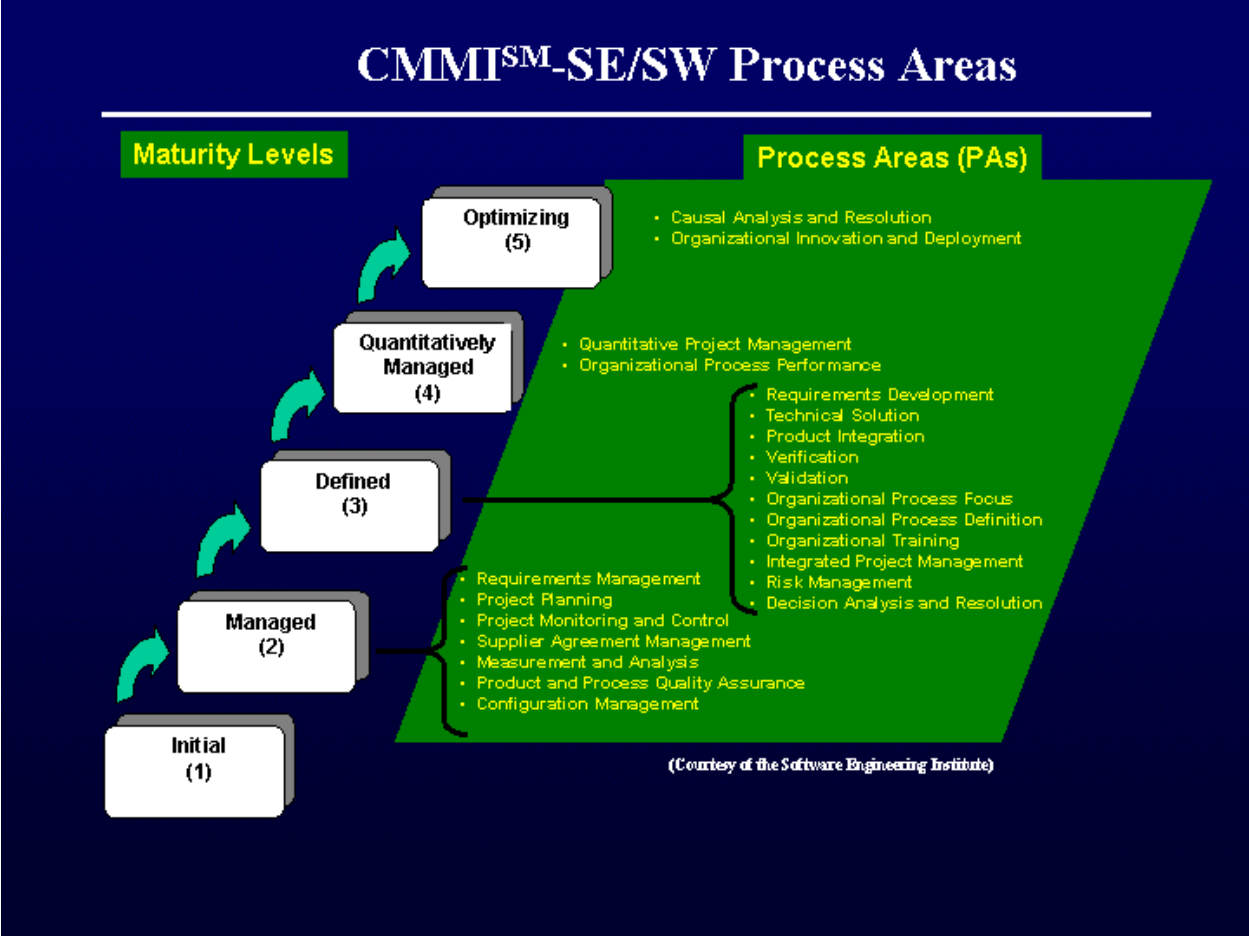
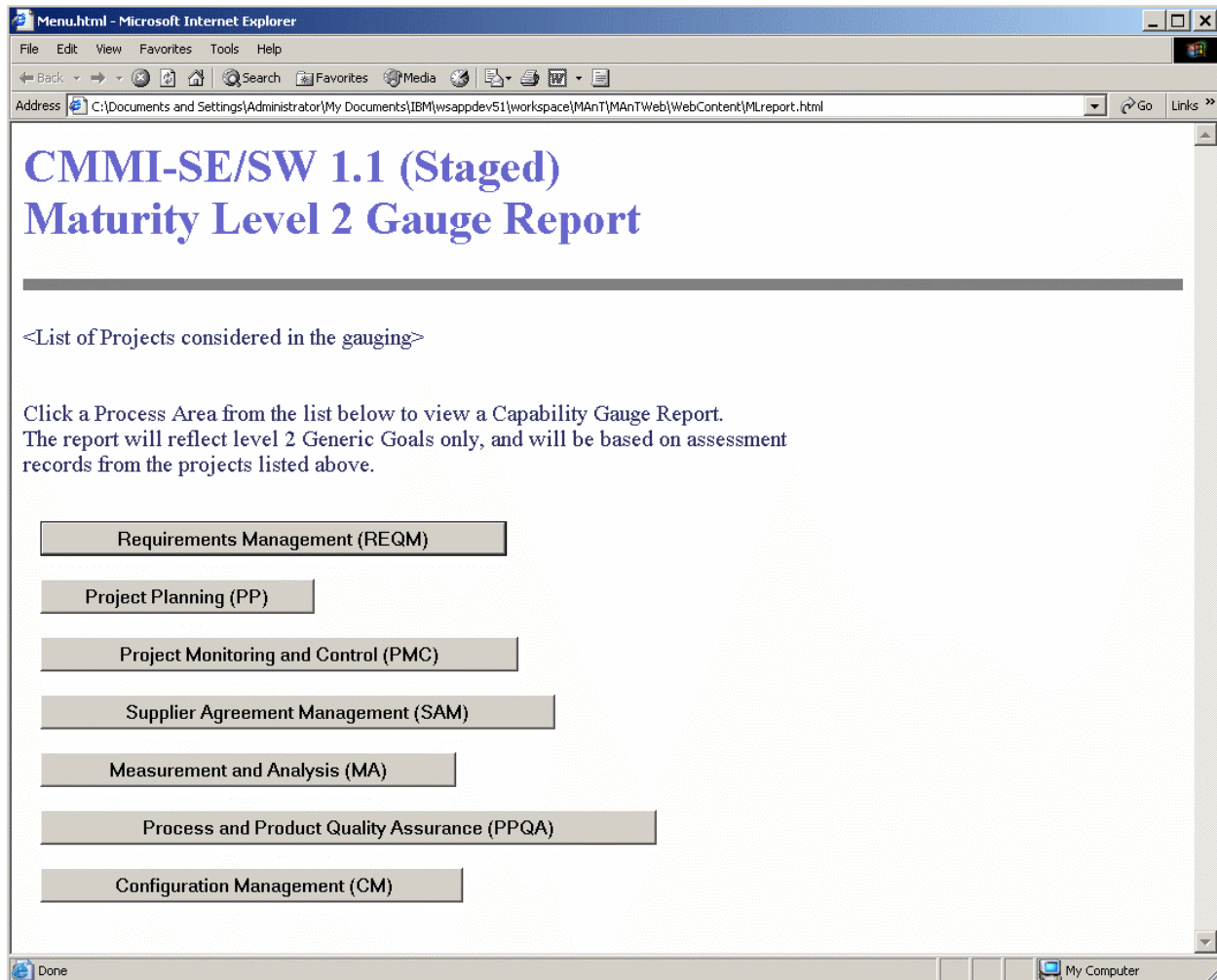


Figure 6.3-1 CMMI-SE/SW (staged) Maturity Level Process Areas

A Maturity Level Gauge Report consists of all Process Areas (PAs) at the requested maturity level, and is based on the assessment records from all projects submitted as part of the report request. Each PA is reported separately. For each PA, the Capability Gauge Report format is used, but with the participant name and home project labels replaced with a list of the projects considered. Further, the practice and goal ratings displayed are not necessarily based on practice evidence from just one participant. Rather, they are based on the practice evidence from all participants on each project who have assessment records for the PA.

A Maturity Level Gauge Report is requested from the third row of the assessment menu. The maturity level and projects list are given. A view of the interface to a level 2 report is given below.





## 6.4 Adding Support for ISO/IEC 15504 Gauging

The PMA implementation framework discussed in the sections above can be extended to support the gauging of ISO/IEC 15504 [8] Process Capability Profiles. Specifically, the Enterprise JavaBeans discussed in sections 6.1 and 6.2 used for persistence and business logic would need to include a mapping from CMMI-SE/SW Specific Practices and Generic Practices to 15504 process outcomes and achievements. The mapping done by the Software Quality Institute [18] would be a good candidate to implement.

If 15504 support is built into a PMA implementation, those who intend to use the resulting profiles should be reminded to consider the PMA context during external comparisons. The 15504 definition documents address this issue.

## **Chapter 7: Conclusion**

Software process assessments are an essential component of organizational process improvement programs in the systems and software engineering communities. Assessments provide the process state information necessary to identify process weaknesses and strengths, identify organizational and project process training needs, measure process improvement between assessments, and maintain senior management support for continuous process improvement. Formal assessments are a proven technique for satisfying these needs, but their cost prevents frequent use. The interim period between formal assessments normally results in a lack of regular process state information samples that can handicap organizational process improvement efforts. The Personnel-driven Mini Assessment (PMA) approach fills this void, and offers a number of indirect benefits including process reference model education, personnel process awareness, organizational and project process education, and the opportunity to identify the strengths and weaknesses of organizational and project process institutionalization efforts.

## References

- [1] Baker, Richard, *The Corporate Politics of CMM Ratings*, Communications of the ACM, September 1996/Vol. 39, No. 9, pp 105-106.
- [2] CMMI<sup>SM</sup> Product Team, *CMMI<sup>SM</sup> for Systems Engineering and Software Engineering (CMMI-SE/SW, V1.1), Staged Representation*, Technical Report CMU/SEI-2002-TR-002, Software Engineering Institute, Carnegie Mellon University, December 2001.
- [3] Dunaway, Donna K. and Masters, Steve, *CMM®-Based Appraisal for Internal Process Improvement (CBA IPI) Version 1.2 Method Description*, Technical Report CMU/SEI-2001-TR-033, Software Engineering Institute, Carnegie Mellon University, November 2001.
- [4] Dutton, Jeffrey L., *The Window for Break-Through Advances in Process Assessment and Evaluation Methods*, presentation to the GEIA Assessment Workshop, September 27, 2000.
- [5] Fayad, Mohamed E. and Laitinen, Mauri, *Process Assessment Considered Wasteful*, Communications of the ACM, November 1997/Vol. 40, No. 11, pp 125-128.
- [6] Garcia, Suzanne M., *Evolving Improvement Paradigms: CMMs and ISO/IEC 15504 (PDTR)*, Software Engineering Institute, Carnegie Mellon University.
- [7] Integrated System Diagnostics, Inc., Appraisal Wizard Software, <http://www.isd-inc.com/>.
- [8] ISO/IEC Joint Technical Committee 1 (JTC1), Subcommittee 7 (SC7), Working Group 10 (WG10), *ISO/IEC 15504: Information Technology – Software Process Assessment*, Technical Report series (TR 15504-1 through TR 15504-9), 1998.
- [9] Kitson, David H., *An Emerging International Standard for Software Process Assessment*, Software Engineering Institute, Carnegie Mellon University.
- [10] McDonald, Diane, *Software Process Assessment Methods*, presentation to the Silicon Valley SPIN, February 28, 2001.
- [11] McDonald, Diane L. and Pilch, Carol A., *A Tailorable Software Process Mini-Assessment Method*, SEPG '99 Conference presentation.
- [12] Members of the Assessment Method Integrated Team, *Standard CMMI<sup>SM</sup> Appraisal Method for Process Improvement (SCAMPI<sup>SM</sup>), Version 1.1: Method Definition*

- Document*, Technical Report CMU/SEI-2001-HB-001, Software Engineering Institute, Carnegie Mellon University, December 2001.
- [13] Moon, Jane, *Experiences with Indicator-based CMMI Appraisals at Raytheon*, presentation for the National Defense Industrial Association 2<sup>nd</sup> Annual CMMI Technology Conference and User Group, November 11-14, 2002.
- [14] Morin, Joseph and Hollenbach, Craig, *2002 Northrop Grumman IT / DES Appraisal*, presentation to the Software Engineering Institute, Carnegie Mellon University, January 23, 2003.
- [15] Natwick, Gary, *CMMI Mini-Assessments*, presentation for the 2002 CMMI Technology Conference and User Group, November 13, 2002.
- [16] O'Hara, Fran, *European Experiences with Software Process Improvement*, proceedings of the 22<sup>nd</sup> International Conference on Software Engineering, Limerick, Ireland, 2000, pp 635-640, ISBN:1-58113-206-9.
- [17] Paulk, Marc C. et al., *Capability Maturity Model<sup>SM</sup> for Software, Version 1.1*, Technical Report CMU/SEI-93-TR-024, Software Engineering Institute, Carnegie Mellon University, February 1993.
- [18] Rout, Terrence P. et al., *CMMI Evaluation, CAPABILITY MATURITY MODEL INTEGRATION MAPPING TO ISO/IEC 15504-2:1998*, Software Quality Institute, Griffith University, November 7, 2001. Prepared for the Defence Materiel Organisation, Purchase Order and Contract No 3726732, dated 28 March 2000.
- [19] Weiss, David M. et al., *Goal-oriented Software Assessment*, proceedings of the 24<sup>th</sup> International Conference on Software Engineering, Orlando, Florida, 2002, pp 221-231, ISBN:1-58113-472-X.

## **Vita**

Lee McKinney was born in 1972 on Ramey Air Force Base, Puerto Rico. He received a B.Sc. in Meteorology from Texas A&M University in 1995. Afterwards, he provided seven years of scientific programming support to the United States Naval Research Laboratory. He currently directs the process improvement and quality assurance programs of a United States Department of Defense engineering services contractor. His research interests are in distributed computing, data visualization, and process improvement.