

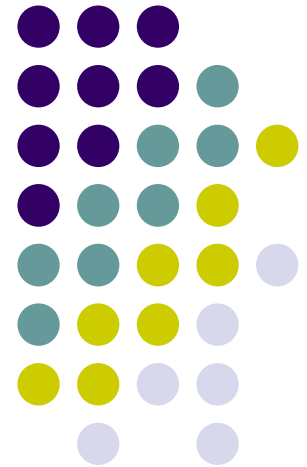
# Introduction to SEIs Capability Maturity Model Integration (CMMI)

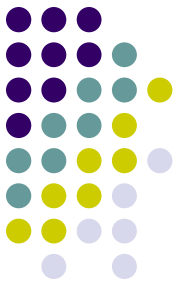
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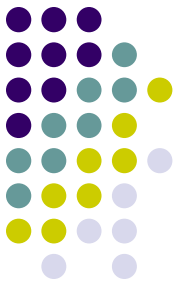




# About the Presentation

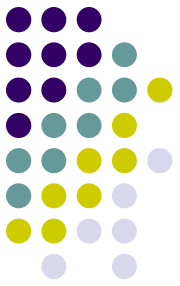
The following sections provide a general idea of CMMI and its role in organizational process improvement.

- **Introduction to CMMI**
- **CMMI and Systems Engineering**
- **History of CMMI**
- **Process Improvement**
- **CMMI Representations - Staged and Continuous**
- **Process Areas**
- **CMMI Appraisals**
- **References**



# Introduction to CMMI

# What is CMMI?



- CMMI is a merger of *process improvement models* for systems engineering, software engineering, integrated teams and supplier sourcing.
- In effect, CMMI codifies the tenets of model-based process improvement and provides a single, integrated framework for improving engineering processes in organizations that span several disciplines.

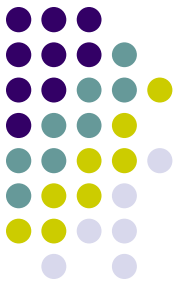
**Systems engineering** focuses on transforming customer needs, expectations, and constraints into product solutions throughout the product lifecycle.

**Software engineering** focuses on the application of systematic, disciplined, and quantifiable approaches to the development, operation, and maintenance of software.

**Integrated Product and Process Development (IPPD)** focuses on collaboration of stakeholders throughout product life cycle to satisfy customer requirements.

**Supplier sourcing** covers the acquisition of products from suppliers. Supplier sourcing best practices must coincide with best practices used to produce products.

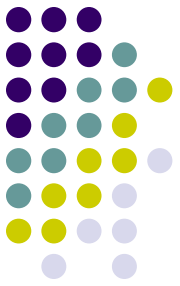
# CMMI and Business Objectives



Following are objectives of CMMI

- **Produce quality products or services:** Quality products are a result of quality processes.
- **Enhance customer satisfaction:** address cost, schedule targets with high quality products validated against customer needs through its emphasis on planning, monitoring, and measuring.
- **Increase market share:** Suppliers have a reputation for meeting their commitments. Number of Silicon Valley companies only work with CMMI ML3 (or greater) suppliers.
- **Gain an industry-wide recognition for excellence:** consistently high performance on projects, delivering quality products and services within cost and schedule parameters.
- **Create value for the stockholders:** *Mature* organizations are likely to make better cost and revenue estimates.

# Organizational Maturity



## What is Maturity ?

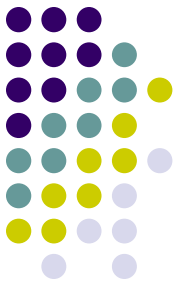
Definitions vary but mature processes are generally thought to be:

- Well defined
- Repeatable
- Measured
- Analyzed
- Improved

And most importantly ... effective. Poor but mature processes are just as bad as no maturity at all!

CMMI defines a set of practices within key process areas and providing a general framework for improving them.

# Organizational Maturity



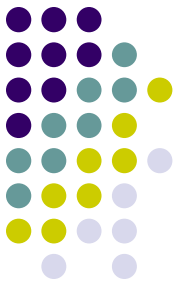
## Immature vs. Mature Organization

### Characteristics of a *immature* organization

- Process improvised during project
- Approved processes being ignored
- Reactive, not proactive
- Unrealistic budget and schedule
- Quality sacrificed for schedule
- No objective measure of quality

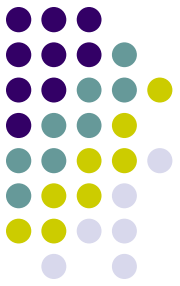
### Characteristics of a *mature* organization

- Inter-group communication and coordination
- Work accomplished according to plan
- Practices consistent with processes
- Processes updated as necessary
- Well defined roles/responsibilities
- Management formally commits



# **CMMI and Systems Engineering**

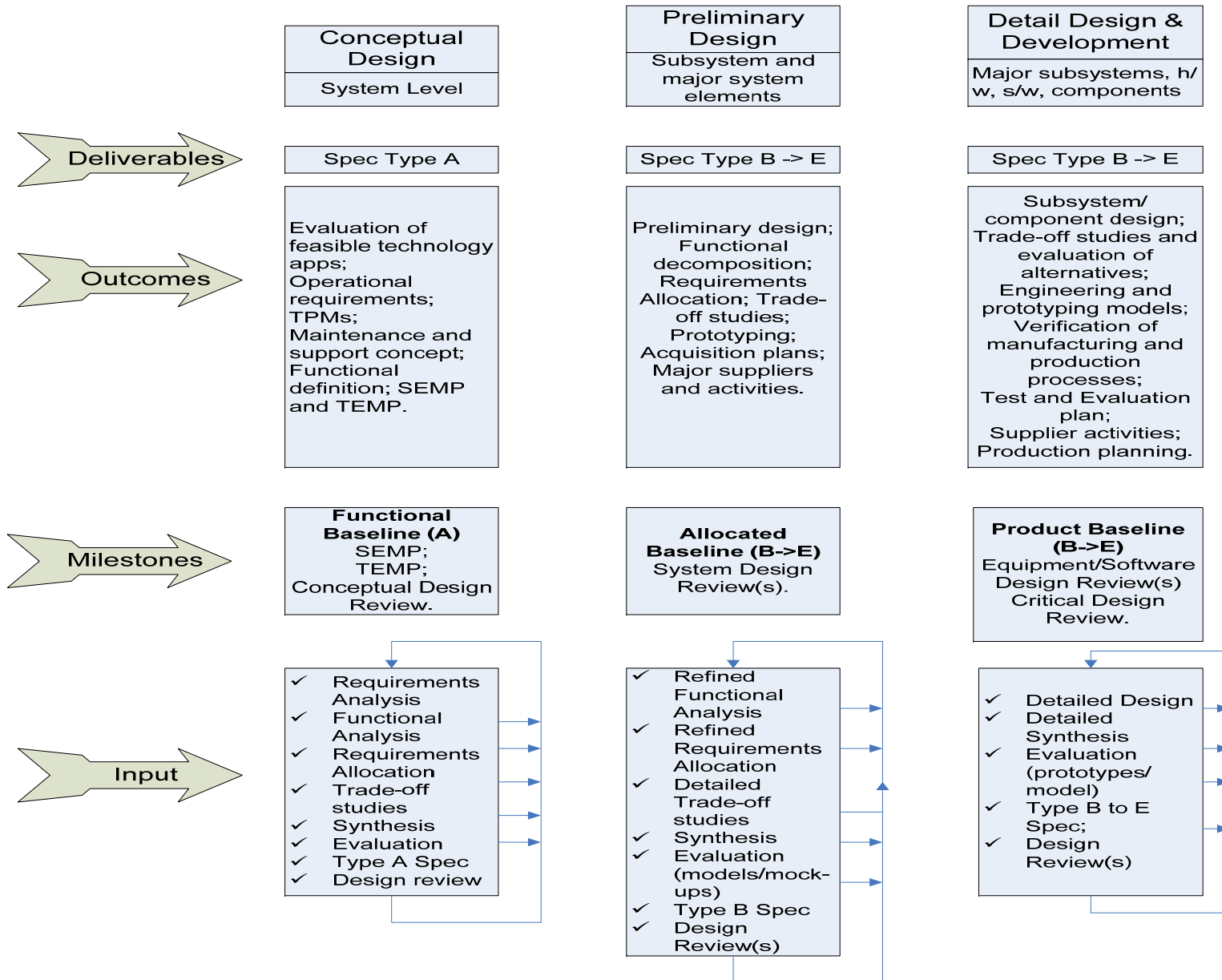
# Systems Engineering Models



- What is model-based process engineering?  
Referential vs Prescriptive?
- The following Systems Engineering Models illustrate several aspects of the System Life Cycle.
  - Representation #1 illustrates the progression of *system design activities* over the life cycle.
  - Representation #2 illustrates the *progression of testing activities* over the life cycle.

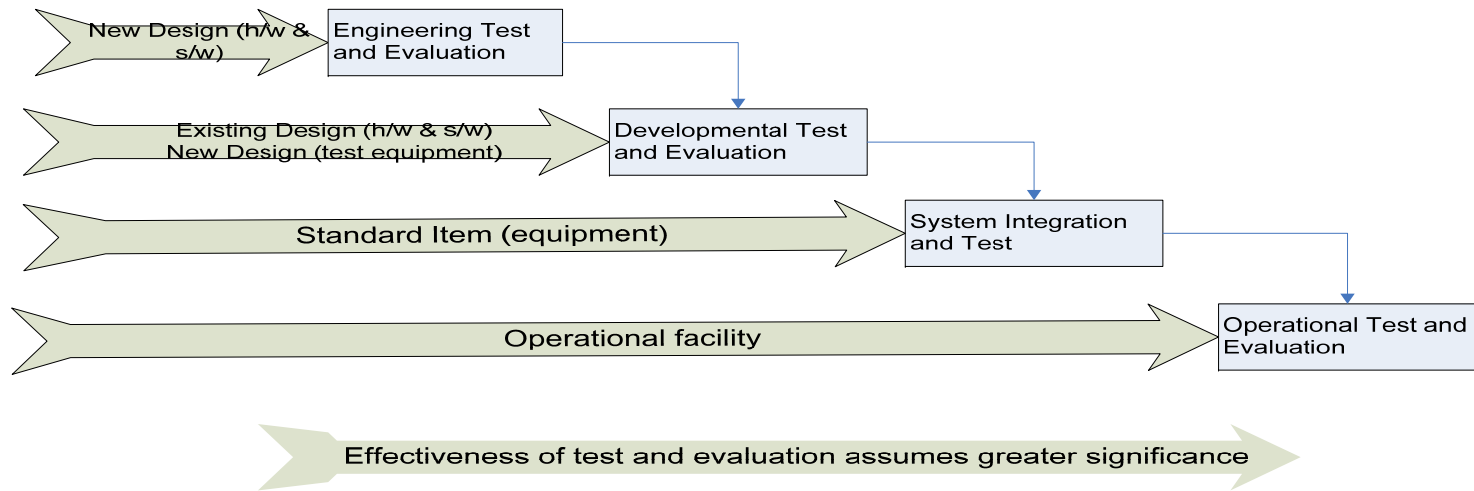
# System activities progression over Life Cycle

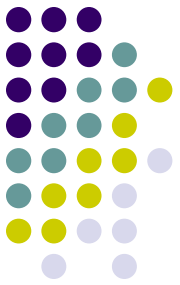
Representation #1



Life Cycle progression of System activities

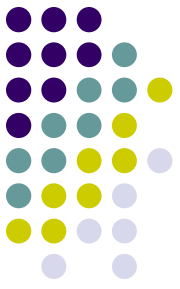
Conceptual Design	Preliminary Design	Detail Design & Development	Production and/or construction	System utilization and life-cycle support
<b>Analytical</b> System Test and Evaluation requirements defined W/Ss and analytical models (CAD, Simulation, ER, DFD) <b>Emphasis:</b> making sure that design is validated through review and information <b>Progressive test and eval plan</b>	<b>Type 1 Testing</b> Evaluation of system components, engg models, bread boards, mock-ups, rapid prototyping. <b>Emphasis:</b> actual testing; ensuring operational performance and actual system characteristics for entire system or components <b>Corrective action</b>	<b>Type 2 Testing</b> Evaluation of prototype (non-qualified system) and production models (for qualified system) for critical design review. <b>Emphasis:</b> formal tests and demos are accomplished during latter stages of detail design including production sampling tests. Performed in producer's facility <b>Corrective action</b>	<b>Type 3 Testing</b> First time in life cycle that all elements of the system evaluated on an <b>integrated basis</b> . However does not represent complete operational situation. <b>Emphasis:</b> accomplished by user personnel at operational test site. For example: ship, aircraft, spacecraft. <b>Integrated test</b>	<b>Type 4 Testing</b> <b>Qualified System.</b> Evaluation of the system in operational use to gain insight in an area. <b>Emphasis:</b> LCC can be reviewed by varying mission profile or system utilization rate. Impact of tech enhancements to ensure MOEs and TPMs are achieved. <b>Complete validation</b>





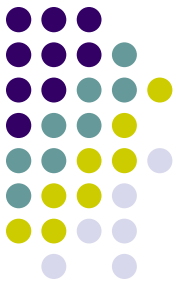
# History of CMMI

# How CMMI (Capability Maturity Model Integration) started?

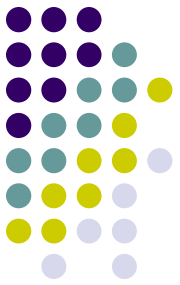


- In the 1930s, Walter Shewhart began work in process improvement with his principles of statistical quality control.
- These principles were refined by Phillip Crosby [1979], W. Edwards Deming [1986], and Joseph Juran [1988].
- Watts Humphrey, Ron Radice, and others extended these principles even further and began applying them to software in their work at IBM and the SEI [1989].
- Humphrey's book, *Managing the Software Process*, provides a description of the basic principles and concepts on which many of the capability maturity models (CMMs®) are based.

# How CMMI started?.....cont



- The CMMI project is an ongoing effort by industry, US Govt and Software Engineering Institute (SEI) of Carnegie Mellon University.
- CMMI started in 1998 and originated with CMM for Software.
- Some Companies using CMMI
  - BMW
  - Accenture
  - US Army, Navy, Air Force, Treasury Department
  - Boeing
  - General Dynamics
  - Intel
  - NASA
  - Honeywell
  - Bosch
  - IBM
  - Nokia
  - KPMG
  - Social Security Administration

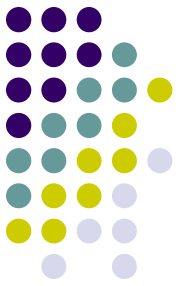


# Introduction to CMM

## What is CMM?

- CMM stands for Capability Maturity Model.
- Focuses on elements of essential practices and processes from various bodies of knowledge.
- Describes common sense, efficient, proven ways of doing business (which you should already be doing) - not a radical new approach.
- CMM measures the maturity of the software development process on a scale of 1 to 5.
- CMM v1.0 was developed by the Software Engineering Institute (SEI) at Carnegie Mellon University in Pittsburgh, USA.

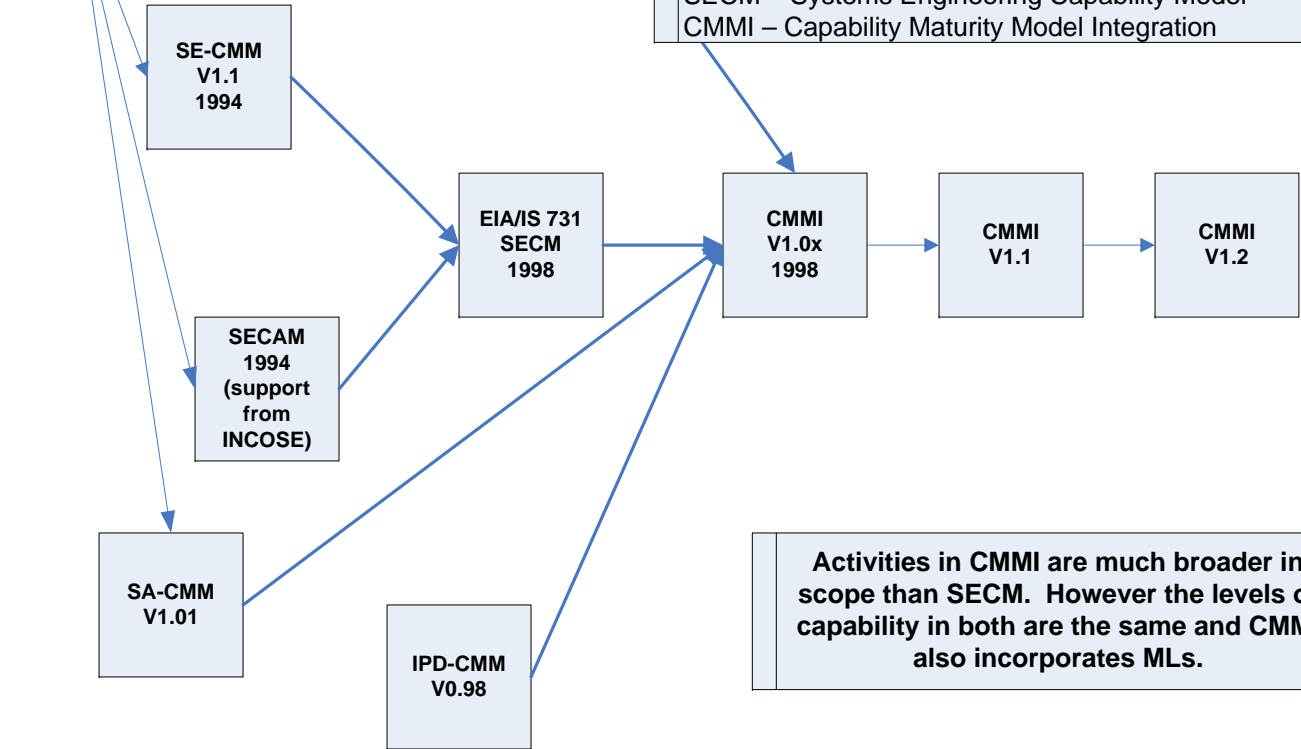
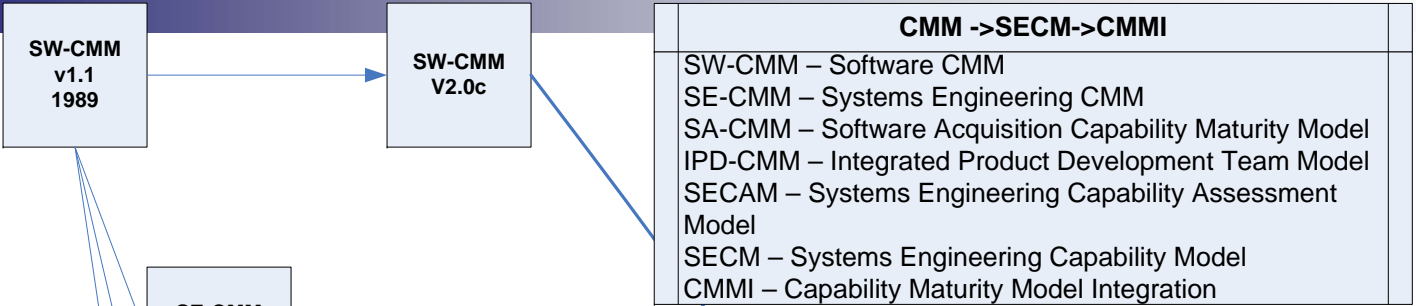
# CMM->SECM->CMMI



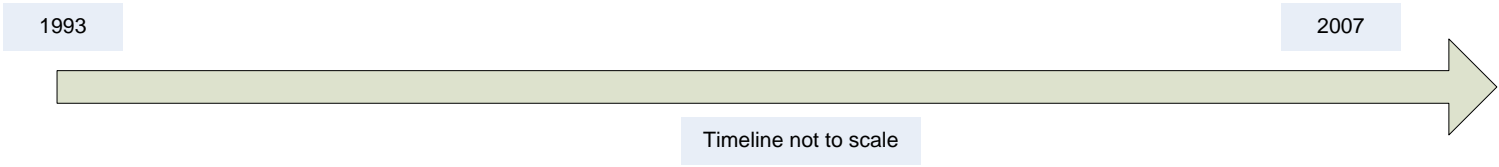
- Since 1980s there has been an effort to develop a model to address organizational assessment.
- CMM is a reference model of matured practices in Systems Engineering CMM, Software CMM, People CMM, Software Acquisition CMM etc.
- In 1998 a study was initiated to assess the feasibility of developing one comprehensive model that would combine the capabilities of SW-CMM, SE-CMM, SECAM and IPPD. The result of this effort produced CMMI (Capability Maturity Model Integration).
- CMMI can be applied to product manufacturing, People management, Software development etc.

## **Therefore, CMMI**

- builds an initial set of integrated models.
- improves best practices from source models based on lessons learned.
- establishes a framework to enable integration of future models.



Activities in CMMI are much broader in scope than SECM. However the levels of capability in both are the same and CMMI also incorporates MLs.

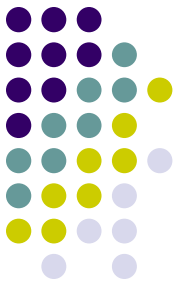


**Models Directly Influencing CMMI**

# Transition - Systems Engineering (SE) to CMMI



- To what extent is the organization completing these tasks effectively and efficiently?
- Is there a commitment from the top-down towards the implementation of the systems engineering process? If so what policies are currently being implemented to support this?
- Have standards, measurable goals, and the appropriate processes been established for the successful implementation of SE objectives?
- Has the organization developed a plan for continuous improvement?



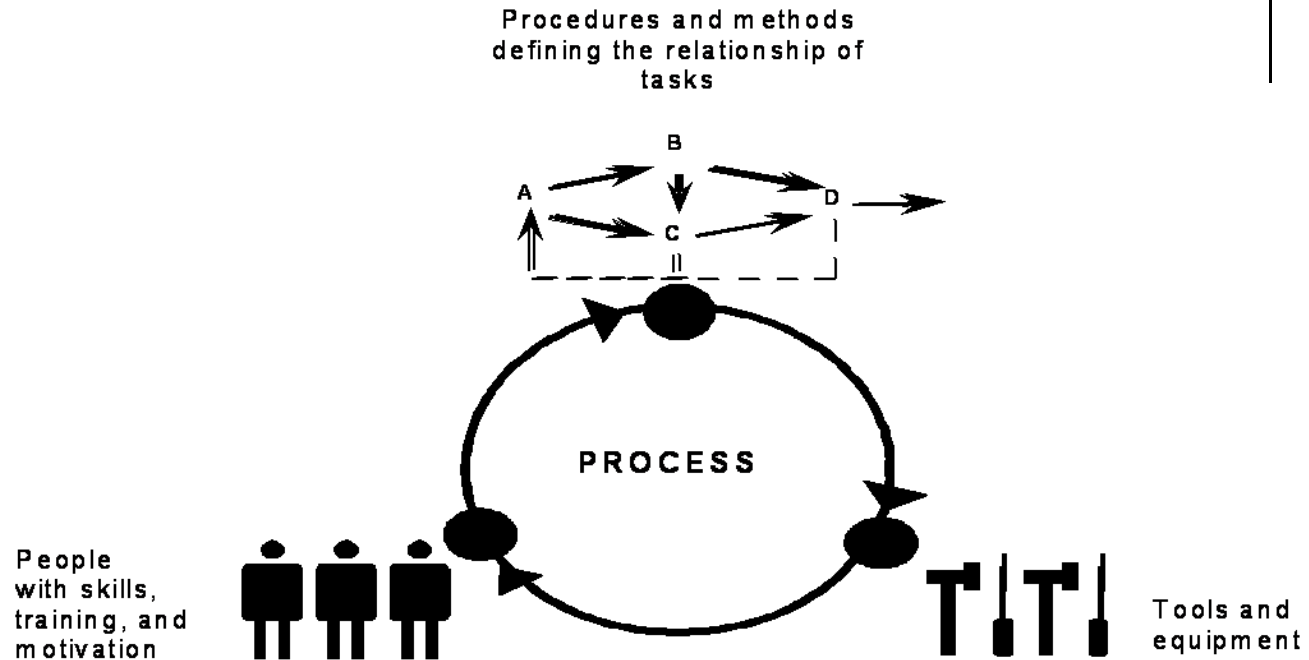
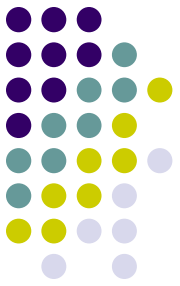
# Process Improvement

# Fundamentals of Process Improvement



- Process improvement is linked to predictability and measurability.
- By improving its process capability, the organization “matures”.
- Maturity improvement requires strong management support and necessitates fundamental changes in the way managers and practitioners perform their jobs.
- Capability models provide a common set of process requirements that capture best practices and practical knowledge.

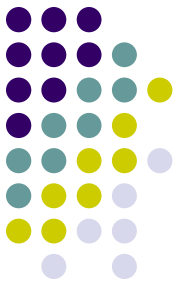
# Quality Leverage Point



Process is the glue that ties the triad together.  
Everyone realizes the importance of a motivated,  
quality workforce but not without well understood  
or operating processes.

Process, people and technology are the major  
determinants of product cost, schedule & quality.

# Approaches to Process Improvement



- **Business Process Reengineering:** *high level business processes* e.g. customer engagement, customer support, manufacturing, distribution and integrated supply chain.
- **Benchmarking:** *any process that needs to be improved.* Involves finding and implementing best practices that lead to superior performance.
- **Process Engineering/Workflow Management:** *selects smaller sub-processes of work tasks* namely assessing workplace functionality for bottlenecks.
- **Reverse Engineering:** *analyze results by taking them apart* to see what works and then reassemble for improved outcome. Used extensively in software development and upgrades.
- **Model-based process improvement:** *select predetermined focus areas that have been traditionally shown to cause problems.* Used by CMMI. Many models available for process improvement viz. ISO, CMMI and Malcolm Baldrige.

# Models for Process Improvement



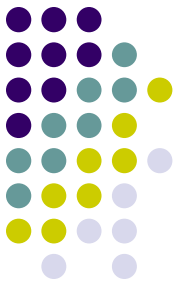
**ISO – International Standards Organization.** The ISO 9000 series generates a quality management framework – a set of documents that discuss quality systems in an organization.

- Developed in Brussels, Belgium for the manufacturing area.
- ISO 9001/9002/9003 deal with external quality assurance. ISO 9004 deals with internal QA.

**CMM was developed for software.** CMM for SW focused on **18** key PAs generated from **316** key practices from best performing software organizations.

- CMM was developed in the US for software systems.
- These two modeling techniques have moved across the oceans.

# Process Illustration

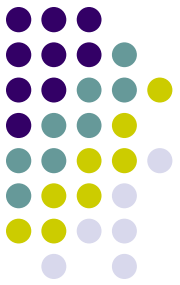


An Organization has project delivery problems. This could be due to staff turnover, staff reassignment or other reasons.

- The PMs collectively develop a risk management process
  - **Identify the risk**
  - **Analyze the risk**
  - **Categorize the seriousness and probability of the risk**
  - Mitigate the risk

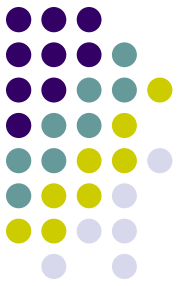
However these processes are too broad and focus on the “*what*”. The PMs need to develop procedures for the “*how*”.

- **Identify the risk:** track problems over a period of time; develop trends; generate a list of the 10 most frequently occurring problems.
- **Analyze the risk:** use the information in the list to estimate risks that might occur in another project (using frequency distribution probabilities)
- **Categorize the risk:** risk category 1 – most critical and most likely to occur; 2-critical but work may continue; 3 – not critical, work may continue.



# **CMMI Representations Staged and Continuous**

# CMMI Representations



The CMMI is structured as follows:

- Maturity Levels (staged representation) or Capability Levels (continuous representation)
  - Process Areas
  - Goals: Generic and Specific
  - Common Features
  - Practices: Generic and Specific

A representation allows an organization to pursue different improvement objectives. An organization can go for one of the following two improvement paths.

# Staged Representation



The staged representation uses predefined sets of process areas to define an improvement path for an organization. This improvement path is described by a model component called a Maturity Level (ML).

## CMMI Staged Representation

- Provides a proven sequence of improvements, each serving as a foundation for the next.
- Permits comparisons across and among organizations by the use of MLs.
- Provides an easy migration from the SW-CMM to CMMI.
- Provides a single rating that summarizes appraisal results and allows comparisons among organizations.

Thus Staged Representation provides a pre-defined roadmap for organizational improvement based on proven grouping and ordering of processes and associated organizational relationships. You cannot divert from the sequence of steps.



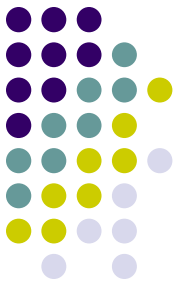
# ML Details

- MLs consist of a predefined set of PAs. The MLs are measured by the achievement of the **specific** and **generic goals** that apply to each predefined set of PAs.

## ML1 - Initial

- **In General:**
  - **Processes are ad hoc and chaotic. Success in these organizations depends on the competence of individuals not on proven processes.**
  - **Projects frequently exceed the budget and schedule.**
  - **Processes/performances cannot be replicated.**

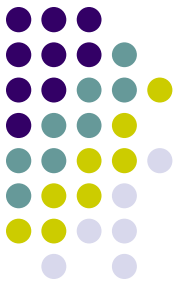
# ML Details



## ML2 - Managed

- **In General: ML2 begins with basic management practices and continues with increasingly sophisticated focus areas within a specific level.**
- An ML2 organization has achieved all the **specific** and **generic goals** of the ML2 process areas.
- Requirements are managed and processes are planned, performed, measured, and controlled.
- The work products and services satisfy their specified requirements, standards, and objectives.
- ML2 standards, process descriptions, and procedures may be quite different in each specific instance of the process (for example, on a particular project).

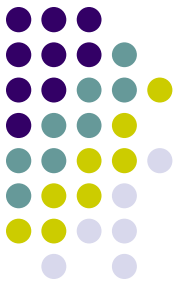
# ML Details



## ML 3 - Defined

- **In General: ML3 processes are defined in more detail and more rigorously than ML2 processes. ML3 establishes an organizational identity – a way of doing business particular to this organization.**
- An ML3 organization has achieved all the **specific** and **generic goals** of the process areas assigned to MLs 2 and 3.
- At ML3, processes are well characterized and understood, and are described in standards, procedures, tools, and methods.
- ML3 standards, process descriptions, and procedures for a project are tailored from the organization's set of standard processes to suit a particular project or organizational unit.

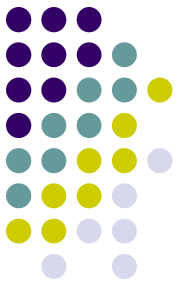
# ML Details



## ML 4 - Quantitatively Managed

- In General: **ML3 processes are *qualitatively predictable* whereas ML4 processes are *quantitatively predictable*.**
- An ML4 organization has achieved all the **specific goals** of the process areas assigned to MLs 2, 3, and 4 and the **generic goals** assigned to MLs 2 and 3.
- At ML4 ***sub-processes*** are selected that significantly contribute to overall process performance.
- For these processes, detailed measures of process performance are collected and statistically analyzed. Special causes of process variation are identified and corrected.

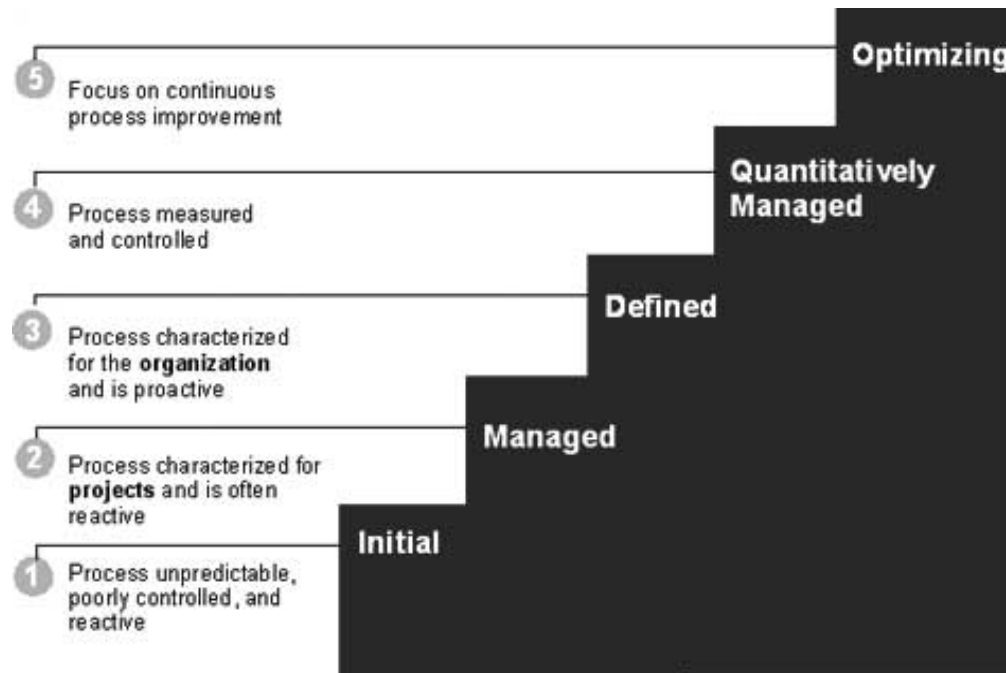
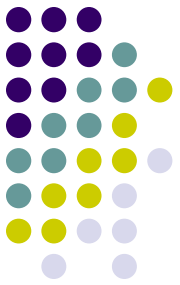
# ML Details

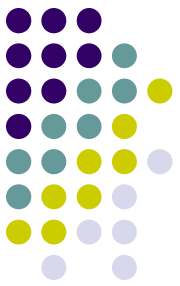


## ML5 - Optimizing

- In General: **ML4 processes address *special causes of process variability* and provide statistical predictability of results; whereas ML5 processes address *common causes of process variability* and change the process i.e. shift the mean of process performance.**
- An ML5 organization has achieved all the **SGs** of the process areas assigned to MLs 2, 3, 4, and 5 and the **GGs** assigned to MLs 2 and 3.
- Processes are continually improved based on a quantitative understanding of the common causes of variation inherent in processes.

# CMMI MLs (staged representation)

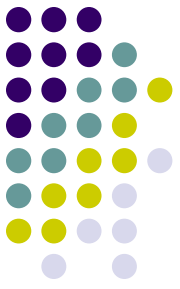




# Maturity Levels and PAs

Level	Focus	Result
5 Optimizing	Continuous process improvement; <b>address common causes of variation</b> ; make improvement to stable processes to improve organizational functioning.	Highest Quality / Lowest Risk
4 Quantitatively Managed	Quantitative management; processes quantitatively stable and predictable; analyze data collected, <b>address special causes of variation from the norm.</b>	Higher Quality / Lower Risk
3 Defined	Processes qualitatively stable and predictable; measurement data somewhat inconsistent and dirty; <b>process standardized at the organizational level</b> ; tailored to the needs of the project.	Medium Quality / Medium Risk
2 Managed	<b>Basic project management</b> ; measurement data collected but not clean because processes used in projects are not stable and consistent.	Low Quality / High Risk
1 Initial	<b>Process is informal and Ad hoc.</b>	Lowest Quality / Highest Risk

# Continuous Representation



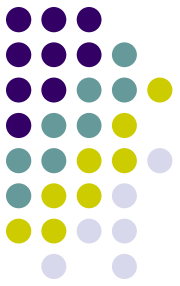
Capability levels focus on maturing the organization's ability to perform, control, and improve its performance in a process area.

## CMMI Continuous Representation

- Allows order of improvement that best meets an organization's business objectives and mitigates an organization's areas of risk.
- Enables comparisons across and among organizations on a process-area-by-process-area basis.
- Each CL builds on the previous level. So to be CL5, the organization must satisfy the specific practices for the PA (CL1) plus the generic practices for CLs 2,3,4 and 5.

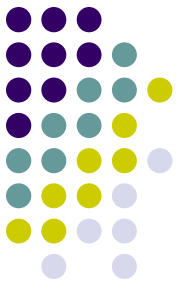
Thus Continuous Representation provides flexibility for organizations to choose which processes to emphasize for improvement, as well as how much to improve each process.

# SEI CMMI Process Areas - GGs



- GG 1 Achieve Specific Goals
  - GP 1.1 Perform Specific Practices
- GG 2 Institutionalize a Managed Process
  - GP 2.1 Establish an Organizational Policy
  - GP 2.2 Plan the Process
  - GP 2.3 Provide Resources
  - GP 2.4 Assign Responsibility
  - GP 2.5 Train People
  - GP 2.6 Manage Configurations
  - GP 2.7 Identify and Involve Relevant Stakeholders
  - GP 2.8 Monitor and Control the Process
  - GP 2.9 Objectively Evaluate Adherence
  - GP 2.10 Review Status with Higher Level Management
- GG 3 Institutionalize a Defined Process
  - GP 3.1 Establish a Defined Process
  - GP 3.2 Collect Improvement Information
- GG 4 Institutionalize a Quantitatively Managed Process
  - GP 4.1 Establish Quantitative Objectives for the Process
  - GP 4.2 Stabilize Sub-process Performance
- GG 5 Institutionalize an Optimizing Process
  - GP 5.1 Ensure Continuous Process Improvement
  - GP 5.2 Correct Root Causes of Problems

# Description of Capability Levels (CLs)



- In CMMI models with a continuous representation, there are six capability levels designated by the numbers 0 through 5.
  - 0 - Incomplete
  - 1 - Performed
  - 2 - Managed
  - 3 - Defined
  - 4 - Quantitatively Managed
  - 5 - Optimizing

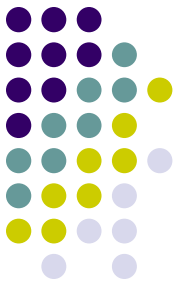
## **CL0 – Incomplete**

- Process that either is not performed or partially performed.

## **CL1 - Performed**

- Satisfies the specific practices of the process area.
- Enables the work needed to produce work products; however, performance may not meet quality, cost and schedule objectives.
- CL1 improvements can be lost over time if they are not institutionalized.

# Description of CLs....cont.

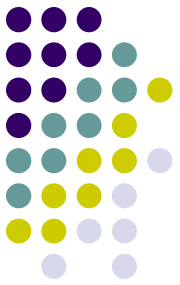


## **CL2 - Managed**

- Planned, performed, monitored and controlled.
- Achieves the model objectives as well as cost, schedule and quality.
- Processes are actively managed.
- Some metrics are consistently collected and applied to management approach.

## **CL3 - Defined Process**

- A managed (CL2) process that is tailored from the organization's set of standard processes according to the organization's tailoring guidelines.
- Contributes work products, measures, and other process improvement information to the organizational process assets.



# Description of CLs....cont.

## CL4 – Quantitatively Managed Process

- A defined (CL3) process that is controlled using statistical and other quantitative techniques.
- Quantitative objectives for quality and process performance are established and used as criteria in managing the process.
- Use Statistical Process Control and simplified metrics.

### PROCESS

Customers complain that PC monitors arrive smashed with box intact and unopened.

Step 1: Count # calls.

Step 2: Analyze where problem was injected in the shipping process,

Step 3: Institute a process for fixing the defect and track effectiveness of process.

Step 4: Track process effectiveness by analyzing expected value of defects vs. actual defects.

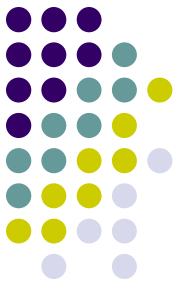


# Description of CLs....cont.

## CL5 – Optimizing Process

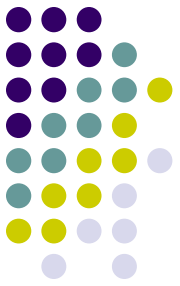
- A quantitatively managed (CL4) process that focuses on studying performance results across the organization, finding common causes of problems in the process(es) used and fixing the problems.
- Organizational standard processes are ALSO targets for improvement.
- Focus on continually improving the range of process performance through both incremental and innovative improvements.

# Comparison of Capability and MLs

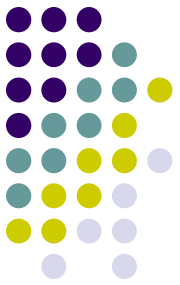


<i>Level</i>	<i>Continuous Representation Capability Levels</i>	<i>Staged Representation MLs</i>
Level 0	Incomplete	N/A
Level 1	Performed	Initial
Level 2	Managed	Managed
Level 3	Defined	Defined
Level 4	Quantitatively Managed	Quantitatively Managed
Level 5	Optimizing	Optimizing

# Comparison - Continuous and Staged Representations

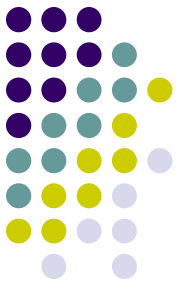


<i>Continuous Representation</i>	<i>Staged Representation</i>
Grants explicit freedom to select the order of improvement that best meets the organization's business objectives and mitigates the organization's areas of risk	Enables organizations to have a predefined and proven improvement path
Enables increased visibility of the capability achieved in each individual process area	Focuses on a set of processes that provide an organization with a specific capability that is characterized by each maturity level
Allows improvements of different processes to be performed at different rates	Summarizes process improvement results in a simple form—a single maturity level number
Reflects a newer approach that does not yet have the data to demonstrate its ties to return on investment	Builds on a relatively long history of use that includes case studies and data that demonstrate return on investment



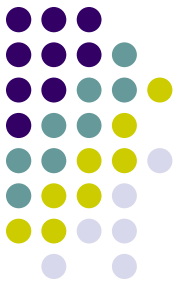
# Process Areas (PAs)

# SEI CMMI Process Areas (PAs)



- A PA is a cluster of related practices that, when implemented collectively, make significant improvement in that area.
- CMMI PAs are common to both continuous and staged representations.
- PAs are dependent and therefore “linked” to one another.

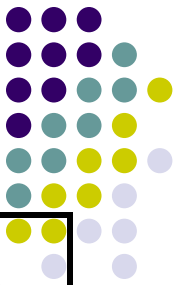
# SEI CMMI Process Areas – Common Features



Attributes that indicate whether the implementation and institutionalization of a key process area is effective, repeatable, and lasting.

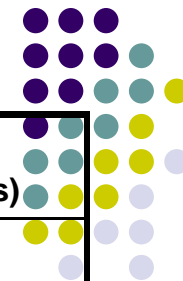
- **Commitment to Perform:** describes the actions the organization must take to ensure that the process is established and will endure. Commitment to Perform typically involves establishing organizational policies and senior management sponsorship.
- **Ability to Perform:** describes the preconditions that must exist in the project or organization to implement the process competently. Ability to Perform typically involves resources, organizational structures, and training.
- **Activities Performed:** describes the roles and procedures necessary to implement a key process area. Activities Performed typically involve establishing plans and procedures, performing the work, tracking it, and taking corrective actions as necessary.
- **Measurement and Analysis:** describes the need to measure the process and analyze the measurements. Measurement and Analysis typically includes examples of the measurements that could be taken to determine the status and effectiveness of the Activities Performed.
- **Verifying Implementation:** describes the steps to ensure that the activities are performed in compliance with the process that has been established. Verification typically encompasses reviews and audits by management and quality assurance.

# CMMI Process Areas – MLs and CLs



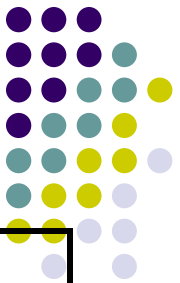
PA	Process Area	Maturity Level (staged)	PA Category (CLs: continuous)
RM	<b>Requirements Management</b> - manage the requirements of the project's products and product components and identify inconsistencies between those requirements and the project's plans.	2	Engineering
PP	<b>Project Planning</b> – establish and maintain plans that define project activities.	2	Project Management
PMC	<b>Project Monitoring and Control</b> - provide an understanding of the project's progress and take corrective actions when the project's performance deviates significantly from the plan.	2	Project Management
SAM	<b>Supplier Agreement Management</b> - manage acquisition of products from suppliers.	2	Project Management
M&A	<b>Measurement and Analysis</b> - develop and sustain a measurement capability that is used to support management information needs.	2	Support
PPQA	<b>Process and Product Quality Assurance</b> – provide staff and management objective insight into processes and associated work products	2	Support
CM	<b>Configuration Management</b> – establish and maintain integrity of work products.	2	Support

# CMMI Process Areas – MLs & CLs



PA	Process Area	ML (staged)	PA Category (CLs: continuous)
RD	<b>Requirements Development</b> – produce and analyze customer, product and product-component requirements.	3	Engineering
TS	<b>Technical Solution</b> – design, develop and implement solutions to requirements for products, components and life cycle processes.	3	Engineering
PI	<b>Product Integration</b> – assemble the product from product components, ensure that the product, as integrated, functions appropriately.	3	Engineering
VER	<b>Verification</b> - ensure selected work products meet their specified requirements.	3	Engineering
VAL	<b>Validation</b> – demonstrate that a product or product-component fulfills its intended use when placed in its intended environment.	3	Engineering
OPF	<b>Organizational Process Focus</b> - plan and implement organizational process improvement of the organization's processes and process assets.	3	Process Management
OPD	<b>Organizational Process Definition + IPPD</b> – establish and maintain a usable set of organizational process assets – using integrated teams..	3	Process Management
OT	<b>Organizational Training</b> – develop skills and knowledge so people can function effectively and efficiently.	3	Process Management
IPM	<b>Integrated Project Management + IPPD</b> - use integrated and defined process tailored from the organization's set of standard processes – using integrated teams.	3	Project Management
RSKM	<b>Risk Management</b> - plan for current/future risks to projects	3	Project Management
DAR	<b>Decision Analysis and Resolution</b> - analyze possible decisions using a formal evaluation process that evaluates identified alternatives against established criteria.	3	Support

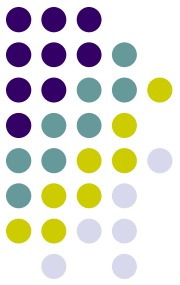
# CMMI Process Areas – MLs and CLs



PA	Process Area	Maturity Level (staged)	PA Category (CLs: continuous representation)
OPP	<b>Organizational Process Performance</b> - establish and maintain a quantitative understanding of the performance of the organization's set of standard processes in support of quality and process-performance objectives.	4	Process Management
QPM	<b>Quantitative Project Management</b> – quantitatively manage the project's defined process to achieve the project's quality and process-performance objectives.	4	Project Management
OID	<b>Organization Innovation and Deployment</b> - select and deploy incremental and innovative improvements that measurably improve the organization's processes and technologies. The improvements support the organization's quality and process-performance objectives as derived from the organization's business objectives.	5	Process Management
CAR	<b>Causal Analysis and Resolution</b> - Track service issues to root causes and eliminate them.	5	Support

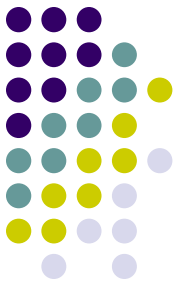
## CMMI - Process Area Dependencies

		OID	OPD	OPF	OT		IPM	PMC	PP	RSKM	QPM	SAM		REQM	RD		CM	PPQA	M&A	DAR	CAR
<b>Process Management</b>	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-
Organizational Innovation and Deployment	OID	-	-	X	X	X	-	X					-			-			X	X	
Organizational Process Definition	OPD	-		-	X		-						-			-					
Organizational Process Focus	OPF	-			-		-						-			-					
Organizational Training	OT	-		X		-	-		X				-			-				X	
<b>Project Management</b>	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-
Integrated Project Management	IPM	-		X			-	-	X	X			-			-			X		
Project Monitoring and Control	PMC	-					-	X	-	X	X		-			-			X		
Project Planning	PP	-					-	X	X	-	X		-			-					
Risk Management	RSKM	-					-				-		-			-					
Quantitative Project Management	QPM	-	X	X			-	X	X			-	-			-			X		X
Supplier Agreement Management	SAM	-					-		X			-	-			-					
<b>Engineering</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Requirements Management	REQM	-					-		X	X	X		-	-	X	-	X				
Requirements Development	RD	-					-		X	X	X		-	X	-	-	X				
<b>Support</b>	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-
Configuration Management	CM	-					-		X	X			-			-	-				
Process and Product Quality Assurance	PPQA	-					-						-			-		-			
Measurement and Analysis	M&A	-		X			-		X	X		X	-			-	X		-		
Decision Analysis and Resolution	DAR	-					-	X		X	X		-			-				-	
Causal Analysis and Resolution	CAR	-	X				-					X	-			-			X		-



# CMMI Appraisals

# CMMI Appraisals



Appraisals consider three categories of model components as defined in the CMMI:

- **Required:** specific and generic goals only.
- **Expected:** specific and generic practices only.
- **Informative:** includes sub-practices and typical work products.

The SEI has released two guiding documents for CMMI assessments:

- **Appraisal Requirements for CMMI (ARC):** contains the requirements for three classes of appraisal methods Class A, Class B, and Class C. These requirements are the rules for defining each class of appraisal method.
- **Standard CMMI Appraisal Method for Process Improvement (SCAMPI):** Method Description Document (MDD).

SCAMPI is currently the only approved CMMI Class A Appraisal Method. That is, SCAMPI satisfies all the requirements of an ARC Class A Appraisal Method and has been approved by the SEI.

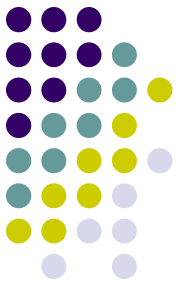
# CMMI Appraisals – Class A



## SCAMPI Class A Appraisal

- SCAMPI A appraisal is typically conducted when an organization has implemented a number of significant process improvements and needs to formally benchmark its process relative to the CMMI. A SCAMPI A is the only appraisal method that provides CMMI Maturity Level or Capability Level ratings.
- The following outcomes can be expected from SCAMPI A:
  - A Maturity Level rating or Capability Level ratings.
  - Findings that describe the strengths and weaknesses of your organization's process relative to the CMMI.
  - Consensus regarding the organization's key process issues.
  - An appraisal database that the organization can continue to use to monitor process improvement progress.

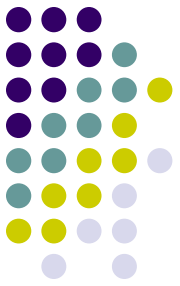
# CMMI Appraisals – Class B



## SCAMPI Class B Appraisal

- **A SCAMPI B is conducted when an organization needs to assess its progress towards a target CMMI Maturity Level, but at a lower cost than a SCAMPI A. SCAMPI B appraisals provide detailed findings and indicate the likelihood that the evaluated practices would be rated as satisfactorily implemented in a SCAMPI A appraisal.**
- **You can expect following outcomes from a SCAMPI B:**
  - **Detailed findings that describe the strengths and weaknesses of your organization's process relative to the CMMI.**
  - **Practice characterizations indicating the likelihood that the examined practices would satisfy the goals and meet the intent of the CMMI.**
  - **Consensus regarding the organization's key process issues.**
  - **An appraisal database that the organization can continue to use to monitor process improvement progress.**

# CMMI Appraisals – Class C



## SCAMPI Class C Appraisal

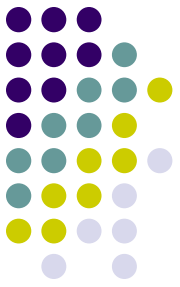
- **SCAMPI C appraisals are shorter and more flexible than SCAMPI A and B appraisals and are conducted to address a variety of special needs, from a quick gap analysis to determining an organization's readiness for a SCAMPI A.**
- **SCAMPI Class C appraisals, the least formal of the SEI's suite of appraisal methods, are highly flexible and can be conducted to address a variety of needs. Typically much shorter in duration than Class A and B appraisals.**
- **You can expect following outcomes from a SCAMPI C:**
  - Findings that describe the strengths and weaknesses of the assessed processes.
  - Characterizations that summarize the adequacy of the assessed processes vis-à-vis the CMMI.
  - Recommended process improvement actions.
  - Determine an organization's readiness for a SCAMPI A.
  - Support the selection of a supplier.
  - An appraisal database that the organization can continue to use to monitor process improvement progress.



# Appraisal Class Characteristics

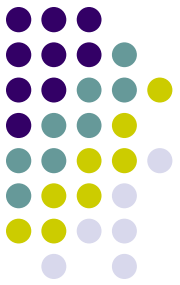
Characteristics	Class A	Class B	Class C
Amount of Objective evidence gathered (relative)	High	Medium	Low
Organizational Unit Coverage	Required	Not Required	Not Required
Rating Generated	Allowed	Not Allowed	Not Allowed
Resource Needs (relative)	High	Medium	Low
Team size (relative)	Large (min 4)	Medium (min 2)	Low (min 1)
Type of Objective Evidence Gathered	Documents and Interviews Required	Documents and Interviews Required	Documents or Interviews Required
Appraisal Team Leader Requirements	Authorized Lead Appraiser	Person Trained and Experienced	Person Trained and Experienced

# CMMI Players – Roles and Responsibilities



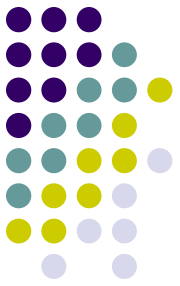
**Process improvement efforts generally require the following individuals and groups:**

- **PI Sponsor:** responsible for over-seeing the entire PI effort @ the directorate level or above.
- **PI Champion:** public relations person for the PI effort. This person markets the idea, approach, and results of PI.
- **Engineering Process Group (EPG) Lead:** leads the group that reviews processes. Assigns tasks to the EPG members, monitors their efforts, and plans the daily duties of the EPG.
- **EPG Members:** responsible for ensuring that process improvement documentation is written and followed. They are also responsible for generating metrics to track the process improvement process. They lead the PATs.
- **Process Action Teams (PATs):** generate the process improvement documentation, policies, processes, procedures, charters, and action plans.
- **Transition Partner:** Outside consultants brought in to help set up, plan, lead, and monitor progress in organizational process improvement. These individuals bring experience doing process improvement from several other organizations and industries.



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