CMMI

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Objectives

- To present *what* is CMMI.
- To present *why* use CMMI.
- To present *CMMI structure*.

References

1. Margaret K. Kulpa and Kent A. Johnson. Interpreting the CMMI: A Process Improvement Approach. 2003.
2. Tim Kasse. Practical Insight into CMMI. 2nd Edition. Artech House. 2008.

Why Use a Process? [1]

- A *process* is a series of steps that help to solve a problem.

- Why do we want to *do things consistently*?
- Are we promoting turning the workers into *robots*?

➢ No. What focusing on process does for your organization is to *reduce redundant work*.

Why is Process Important?

- So why is focusing on process *important*?
- Why not focus on the *product*, or the *people*, or the *technology* used?
  - Give guidelines to the people responsible for doing this work on *how to do* it.
  - Rather than having people work harder, have them work *smarter*.
  - Most of those companies sold quick-fix technologies without any underlying *analysis of the problems* organizations faced.
- Is process the *only answer*?
  - No. Process is *part of the answer*.
  - Process, when *supported* by training, enough money, enough skilled people, proper tools, and management commitment, can help your organization.

Defining Process Steps

- The steps must be defined in such a way as to be *unambiguous* — that is, readily understood and capable of being followed in a consistent manner *by anyone* using the process.
- A Risk Management Process
  - Identify the risks
  - Analyze the risks
  - Categorize the seriousness and probability of the r
  - Mitigate the risks

- What is the *problem* with this process?

➢ It is *too general*.
➢ Each manager would have interpreted *how* to do this process differently.

Solution: Risk Management Procedures

- *Clarify how* we do the steps in your process?
- *Identify* the risk.
  - Track the problems they have in delivering products and then find trends.
  - From the list of trends, create a list of the ten most frequently occurring problems on the projects.
- *Categorize* the seriousness and probability of the risk.
  - Define risks as 1 — most critical and most likely to occur; 2 — critical but work may continue; and 3 — not critical, work may continue, fix this problem during the next phase or release.
  - Define *procedures* for how to determine what would put a risk into category 1, 2, or 3.

Procedures vs. Processes

- *Procedures* are step-by-step instructions on how to perform a task.
  - Procedures are a subset of processes.
- The process is *what* to do; the procedures are *how* to do the steps in the process.

Procedure Template

Document Number:	Date:
	Revision Number
Description:	
This procedure involves… The activity's primary aim is to…	
Entry Criteria/Inputs:	Exit Criteria/Outputs:
Roles: Role Name: What does s/he do?	
Assets: Standards, reference material, deliverables, previous process descriptions…	
Summary of Tasks (list major tasks/process steps): Task 1 Task 2 Task 3 Task 4	
Procedure Steps:	
Task 1 • Detail Step 1 • Detail Step 2 • Detail Step 3 • Detail Step 4	
Task 2	

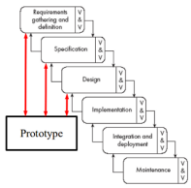
How to Improve A Process?

- *Problem*: We cannot keep up with the number of requirements changes.
- *Goal*: To improve our requirements change process.
- *Question*: How can we improve our requirements change process?
- *Metric*:
  - Number of requirements changes submitted, approved, implemented, or
  - cancelled versus the number of original requirements documented.
  - Time it takes to implement a change in requirements.

➢ *Solution* (What should we do?): ~~Trial-and-Error?~~

Models

- A *model* is considered a guideline of best practices found by studying other, highly functioning and successful organizations.
  - A model does *not contain the steps* needed or the sequence of steps needed to implement a process improvement program.
  - The model used simply says, "this is a *good thing* to do."
- *Why* use a model?
  - Without using a model as your basis of reference, you have nothing around which to *plan your improvement*, and nothing against which to *measure your results*.



Why Don't Create Your Own Model?

- It takes a *long time* and it costs *a lot of money*.
- Most models allow an organization to substitute *alternative practices* for those practices in the chosen model that do not fit the organization.
- *ISO* stands for International Standards Organization.
  - The *ISO 9000/9001* series generates a fundamental quality management framework.
- The *CMM* stands for the Capability Maturity Model.
  - The CMM was created by analyzing the activities of *highly functioning software organizations*; that is, those organizations that consistently delivered software systems to their customers on time, within budget, and that actually worked.

Introduction [2]

Systems engineering	• Covers the development of total systems, which may or may not include software.
Software engineering	• Covers the development of software systems.
Integrated product and process development	• Achieves a timely collaboration of relevant stakeholders throughout the product life cycle to better satisfy customer needs.

Capability Maturity Model Integration

CMMI is a merger of process improvement models for systems engineering, software engineering, integrated product development, and software acquisition.

Goals	Views
Customer's force	The assessment view
Process improvement	The process improvement view

Maturity Levels

A maturity level signifies the level of performance that can be expected from an organization.

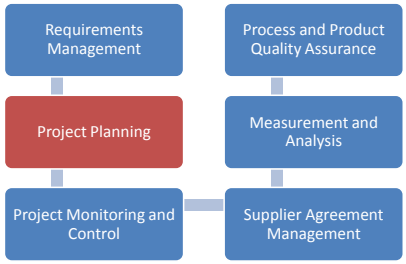
Maturity Level 5: Optimizing	The process is institutionalized as an optimizing process.
Maturity Level 4: Quantitatively Managed	The process is institutionalized as a quantitatively managed process.
Maturity Level 3: Defined	The process is institutionalized as a defined process.
Maturity Level 2: Managed	The process is institutionalized as a managed process
Maturity Level 1: Initial	The process supports and enables achievement of the specific goals.

Maturity Level/Key Challenges [2]

Level	Characteristic	Key Challenges	Result
5 Optimizing	Improvement fed back into process	Still human intensive process Maintain organization at optimizing level	Productivity & Quality
4 Managed	(quantitative) Measured process	Changing technology Problem analysis Problem prevention	
3 Defined	(qualitative) Process defined and institutionalized	Process measurement Process analysis Quantitative quality plans	
2 Repeatable	(intuitive) Process dependent on individuals	Training Technical practices •reviews, testing Process focus •standards, process groups	
1 Initial	(ad hoc/chaotic)	Project Management Project Planning Configuration management Software quality assurance	Risk

Process Areas (PAs) [1]

A *process area* is a group of practices performed collectively to achieve a specific goal.

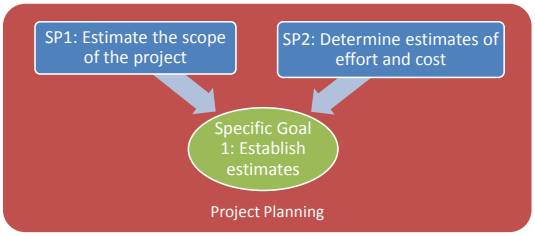


Process Area Groups

Process Management	• Organizational Process Focus, Definition, Training...
Project Management	• Project Planning, Monitoring, Control...
Engineering	• Requirements Management, Development, Technical Solution, Product Integration...
Support	• Configuration Management, Process and Product Quality Assurance...

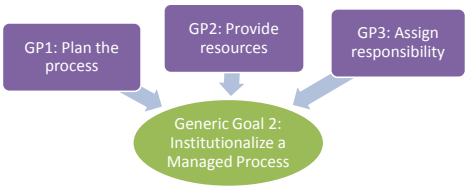
Specific Goals

- *Specific goals* (SG): activities that relate to the specific PA under study.
- *Practices* are activities that must be performed to satisfy the goals for each PA. Each practice relates to only *one goal*.



Generic Goals

- *Generic goals* (GG): goals that are common to multiple PAs throughout the model; they help determine whether the PA has been institutionalized.
- *Generic practices* (GP): are associated with the generic goals for institutionalization.



Generic Practices Functions (I)

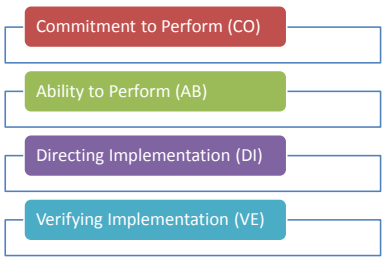
- *Commitment to Perform (CO)* is shown through
  - senior management commitment and
  - written policies.
- *Ability to Perform (AB)* is shown through
  - training personnel in their duties,
  - providing adequate resources and funding,
  - assigning responsibility,
  - planning the process, and
  - establishing a tailored and defined process.

Generic Practices Functions (II)

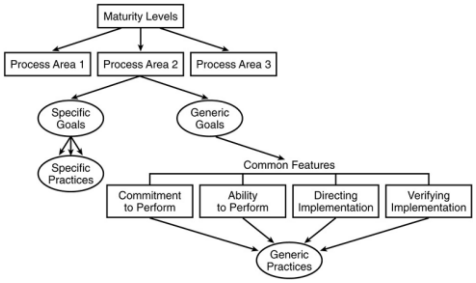
- *Directing Implementation (DI)* is demonstrated by
  - managing configurations,
  - identifying and involving relevant stakeholders,
  - monitoring and controlling the process, and
  - collecting improvement information.
- *Verifying Implementation (VE)* is demonstrated via
  - objectively evaluating adherence (both process and product adherence to organizational policies, procedures, and standards) and by
  - reviewing status with higher-level management.

Common Features

Common features group together the generic practices within a PA, according to the function that the practices fulfill.

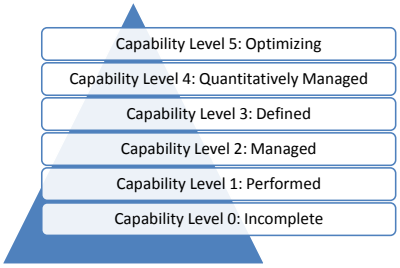


Staged Representation

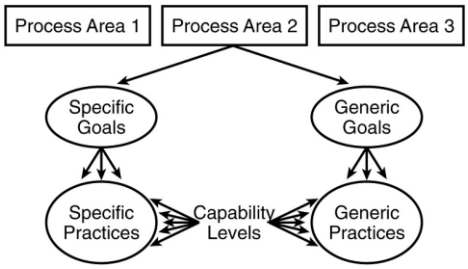


Capability Levels

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



Continuous Representation



CMMI Other Terms (I)

- *Typical Work Products*: each process area gives examples of typical
  - documents,
  - deliverables, or
  - other outputs produced within the process area.
- *Sub-practices*: lower-level practices that provide more information about the practice.
  - For example, the Practice may be to write a project plan.
  - The sub-practice would offer information as to what should go into the project plan itself.

CMMI Other Terms (II)

- *Discipline Amplifications*: simple guidance offered to direct the user as to which discipline is more relevant for specific practices, or to offer some guidance in applying the PA to the discipline.
  - The disciplines are Systems Engineering, Software Engineering, Supplier Sourcing, and Integrated Product and Process Development (IPPD).
- *Elaborations*: more information and examples concerning generic practices.
- …

The Five-Level Model [2]

Level	Process Characteristics	Process Areas	
5 Optimizing	Focus is on quantitative continuous process improvement	Causal Analysis and Resolution Organizational Innovation and Deployment	
4 Quantitatively Managed	Process is measured and controlled	Quantitative Project Management Organizational Process Performance	
3 Defined	Process is characterized for the organization and is proactive	Requirements Development Technical Solution Product Integration Verification Validation Decision Analysis & Resolution	Organizational Process Focus Organization Process Definition Organizational Training Integrated Project Management Risk Management
2 Managed	Process is characterized for projects and is often reactive	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management	Product and Process Quality Assurance Configuration Management Measurement & Analysis
1 Initial	Process is unpredictable, poorly controlled, and reactive		

PA: Requirements Management [1]

SG1: Managed Requirements

- SP1.1: Obtain an understanding of requirements
- SP1.2: Obtain commitment to requirements
- SP1.3: Manage requirements changes
- SP1.4: Maintain bi-directional traceability of requirements
- SP1.5: Identify inconsistencies between project work and requirements

PA: Project Planning

SG1: Establish estimates

- SP1.1: Estimate the scope of the project
- SP1.2: Establish estimates of work product and task attributes
- SP1.3: Define project life cycle
- SP1.4: Determine estimates of effort and cost

PA: Project Planning

SG2: Develop a project plan

- SP2.1: Establish the budget and schedule
- SP2.2: Identify project risks
- SP2.3: Plan for data management
- SP2.4: Plan for project resources
- SP2.5: Plan for needed knowledge and skills
- SP2.6: Plan stakeholder involvement
- SP2.7: Establish the project plan

PA: Project Planning

SG3: Obtain commitment to the plan

- SP3.1: Review plans that affect the project
- SP3.2: Reconcile work and resource levels
- SP3.3: Obtain plan commitment

PA: Process and Product Quality Assurance

SG1: Objectively evaluate processes and work products

- SP1.1: Objectively evaluate processes
- SP1.2: Objectively evaluate work products and services

SG2: Provide objective insight

- SP2.1: Communicate and ensure resolution of noncompliance issues
- SP2.2: Establish records

PA: Configuration Management

- SG1: Establish baselines
  - SP1.1: Identify configuration items
  - SP1.2: Establish a configuration management system
  - SP1.3: Create or release baselines
- SG2: Track and control changes
  - SP2.1: Track change requests
  - SP2.2: Control configuration items
- SG3: Establish integrity
  - SP3.1: Establish configuration management records
  - SP3.2: Perform configuration audits

Appraisals using the CMMI

Thank You For Your Time