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Understanding Model Representations and Levels: What Do They Mean?

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Topics

➡ Representations: Continuous and Staged

Levels: Capability and Maturity

Process Areas

Selecting a Representation

Summary

Understanding CMMI® Representations

Representations reflect different types of approaches to process improvement and emphasize the organization, use, and presentation of components in a model.

There are two types of representations in CMMI models:
- staged
- continuous

A representation in CMMI is analogous to a view into a data set provided by a database:
- The data viewed is the same for each representation.
- The use, organization, and presentation of the data are different.

Continuous Representation

Allows you to choose a process area to improve and how far you would like to improve it

Uses capability levels to characterize improvement

Allows you to select the order of improvement that best meets your organization's business objectives and mitigates your organization's areas of risk

Enables comparisons across and among organizations on a process area by process area basis
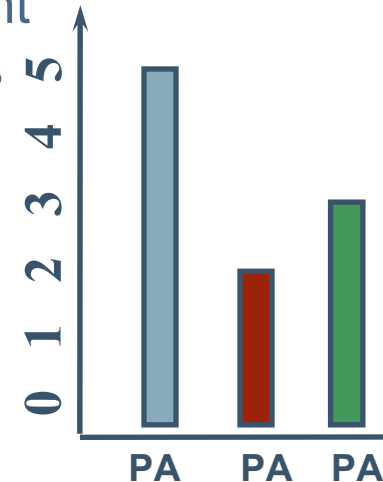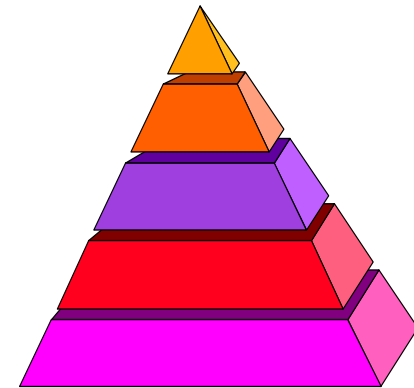
Staged Representation

Uses predefined sets of process areas to define an improvement path for organizations

Uses maturity levels to characterize improvement

Provides a single rating that summarizes appraisal results and allows comparisons among organizations

Comparison of Representations

Staged	**Continuous**
Process improvement is measured using maturity levels.	Process improvement is measured using capability levels.
A maturity level is the degree of process improvement achieved across a predefined set of process areas.	A capability level is the degree of process improvement achieved within an individual process area.
Organizational process maturity describes the degree to which the organization implements the behaviors described in a set of process areas.	Process area capability describes the degree to which the organization implements the behaviors described in a single process area.

Topics

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➡ Levels: Capability and Maturity

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Levels

Levels provide a means to measure process improvement.

What improvement do you want to measure?
- Improvement of a SINGLE process within your organization?
- Improvement of your organization (i.e., collection of processes that characterize organizational behavior)?

CMMI levels are associated with a particular representation:
- The continuous representation has capability levels.
- The staged representation has maturity levels.

Maturity Levels
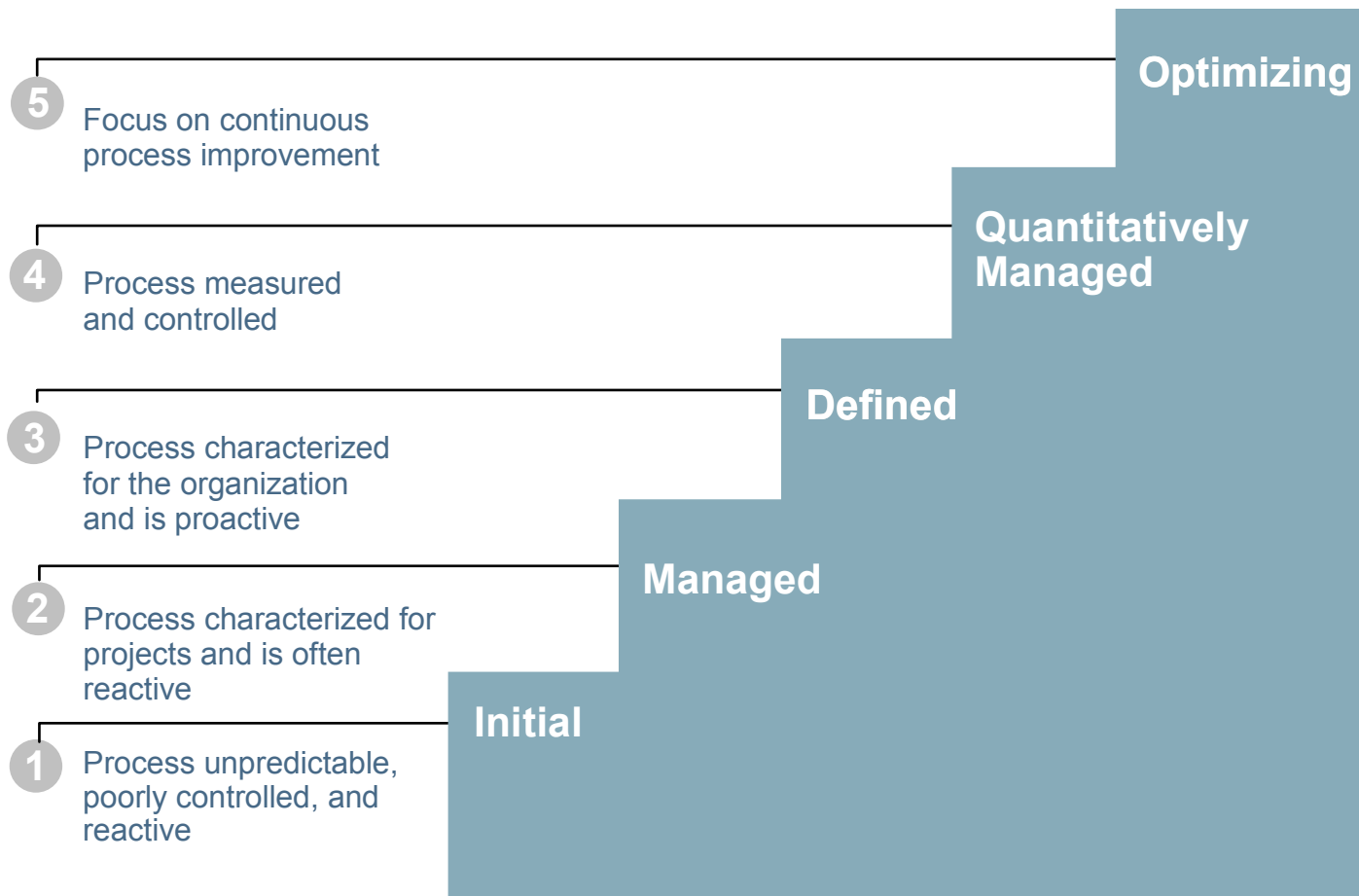
A maturity level is a well-defined evolutionary plateau of process improvement.

There are five maturity levels.

Each maturity level has one generic goal.

Each level is a layer in the foundation for continuous process improvement using a proven sequence of improvements, beginning with basic management practices and progressing through a predefined and proven path of successive levels.

The Maturity Levels

5 Focus on continuous process improvement

4 Process measured and controlled

3 Process characterized for the organization and is proactive

2 Process characterized for projects and is often reactive

1 Process unpredictable, poorly controlled, and reactive

Optimizing

Quantitatively Managed

Defined

Managed

Initial

Capability Levels

A capability level is a well-defined evolutionary plateau describing the organization's capability relative to a process area.

There are six capability levels.

For capability levels 1-5, there is an associated generic goal. Therefore, each process area has five generic goals associated with it.

Each level is a layer in the foundation for continuous process improvement. Thus, capability levels are cumulative (i.e., a higher capability level includes the attributes of the lower levels).

The Capability Levels

5 Optimizing	
4 Quantitatively Managed	
3 Defined	
2 Managed	
1 Performed	
0 Incomplete	

Levels 0 and 1

Capability Level 0: Incomplete
- The process is either not performed or partially performed.
- One or more specific goals of the process area
are not satisfied.

Capability Level 1: Performed
- All specific goals of the process area are satisfied.
- Essential activities are performed and the work is accomplished.
- The process may be unstable and inconsistently implemented.

Maturity Level 1: Initial
- Processes are performed but often in an ad-hoc and occasionally chaotic manner.
- Performance is dependent on the competence and heroics of the people.
- Performance is difficult to predict.

Level 0 and 1 Behavior

The process is ad hoc.

In ⇒⇒⇒ Out

Requirements flow in.

A product is (sometimes) produced by some amorphous process.

The product flows out and (we hope) works.

Level 2: Managed

A managed process is a performed process that is also planned and executed in accordance with policy; employs skilled people having adequate resources to produce controlled outputs; involves relevant stakeholders; is monitored, controlled, and reviewed; and is evaluated for adherence to its process description.
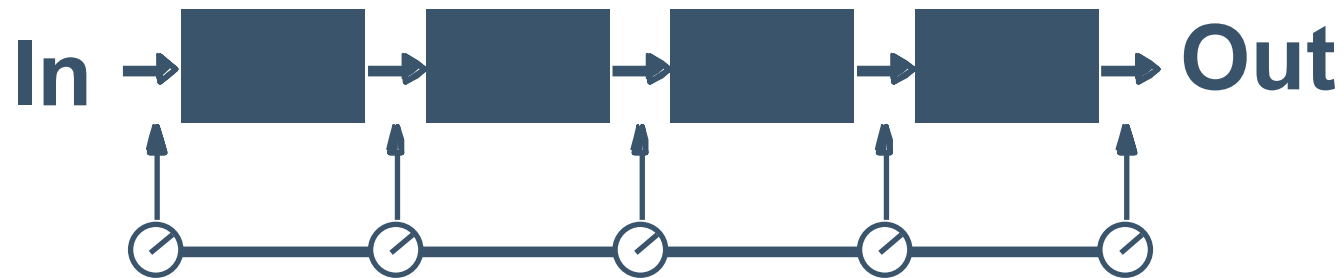
A managed process is institutionalized (i.e., ingrained in the way work is performed).

Discipline helps ensure that existing practices are retained during times of stress.

The status of activities and work products is visible to management at defined points.

Level 2 Behavior

The process is managed.

In → □ → □ → □ → □ → Out

Requirements flow in.

Plans are developed in accordance with policies.

Activities are performed in accordance with plans.

Measurements and reviews occur at defined points.

The product flows out and (usually) works.

Level 3: Defined

A level 3 process is a defined process.

This level builds on the foundation of level 2.

A defined process is a managed process whose description is tailored from the organization's set of standard processes according to the organization's tailoring guidelines.

This contributes work products, measures, and other process-improvement information to the organizational process assets.

The organization's set of standard processes are established and improved over time.

Level 3 Behavior

The process is managed according to a defined process.
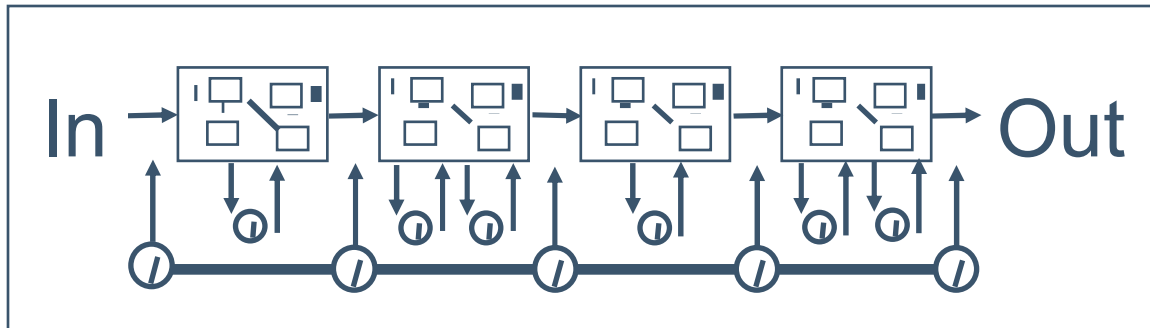
Commonality allows more uniform estimation of performance and sharing of resources.

Level 4: Quantitatively Managed

A level 4 process is a quantitatively managed process. A quantitatively managed process is a defined process that is controlled using statistical and other quantitative techniques.

Statistical predictability is achieved.

Projects use measurable objectives to meet the needs of the customers, end-users, and the organization.

Managers and engineers use the data with statistical and other quantitative techniques in managing the processes and results.
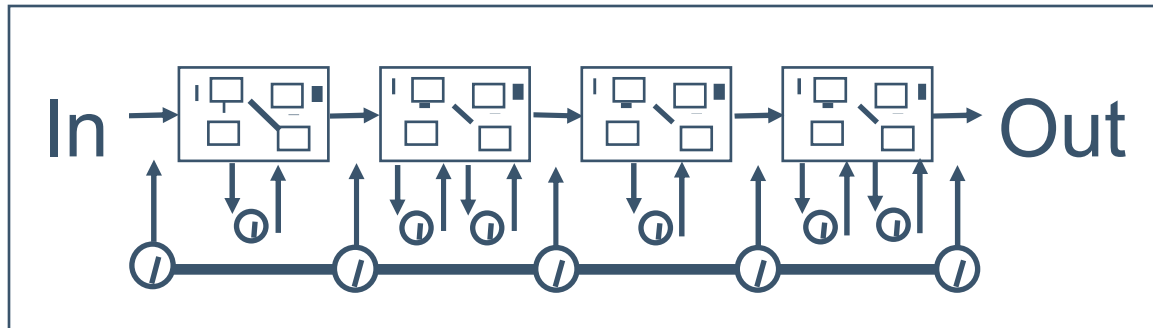
Level 4

Levels 2 and 3 build a foundation
- defined processes, which
  - achieve consistency across the organization
  - provide a qualitative understanding of sub-processes and their relationships
- measures are collected and analyzed to understand and manage activities and results.
  - threshold limits are set, but not using statistical and other quantitative methods.
  - exceeding threshold limits triggers actions.

Statistical and other quantitative methods are used, at the organizational and project levels, to
- understand past process performance, past product quality, and past service quality
- predict future process performance, future product quality, and future service quality

Level 4 Behavior

Processes are quantitatively managed.

The behavior of the process is predictable and quantitatively understood.

A quantitative basis exists for decisions to achieve established product quality, service quality, and process-performance goals.

Level 5: Optimizing

A level 5 process is an optimizing process.

An optimizing process is a quantitatively managed process that is changed and adapted to meet relevant current and projected business objectives.

The focus is on continually improving the range of process performance through incremental and innovative technological improvements.

Process improvement is inherently part of everybody's role, resulting in cycles of continual improvement.

Level 5 Behavior

Processes and products are measurably improved.
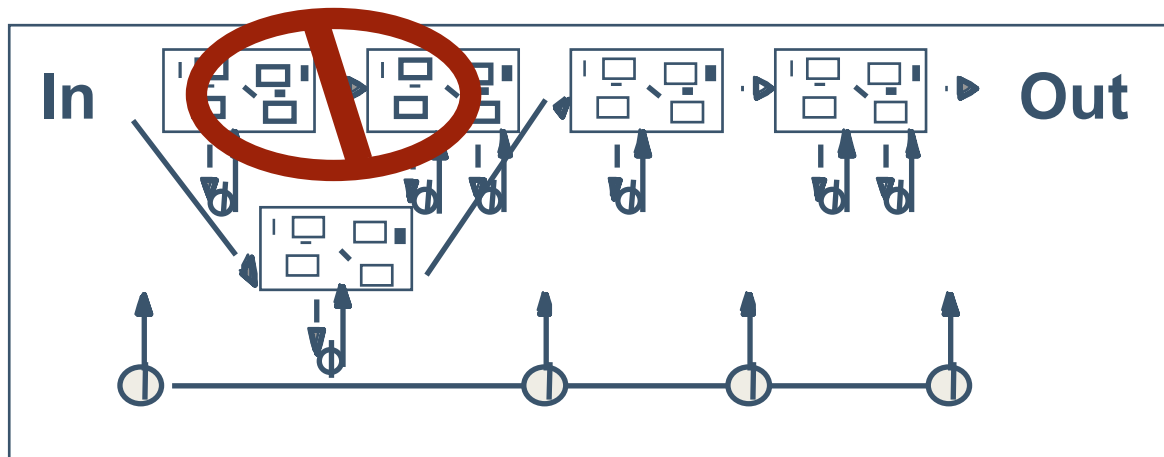
Continual and measurable process improvement
(while managing process stability) is a way of life.

Topics

Representations: Continuous and Staged

Levels: Capability and Maturity

➡ Process Areas

Selecting a Representation

Summary

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Maturity Level	Process Management	Project Management	Engineering	Support
5	Organizational Innovation and Deployment			Causal Analysis and Resolution
4	Organizational Process Performance	Quantitative Project Management		
3	Organizational Process Focus Organizational Process Definition Organizational Training	Integrated Project Management for IPPD Risk Management Integrated Teaming Integrated Supplier Management	Requirements Development Technical Solution Product Integration Verification Validation	Decision Analysis and Resolution Organizational Environment for Integration
2		Project Planning Project Monitoring and Control Supplier Agreement Management	Requirements Management	Measurement and Analysis Process and Product Quality Assurance Configuration Management
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Topics

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➡ Selecting a Representation

Summary

Selecting a Representation

The most important consideration is which business objectives you would like your process improvement program to support and how these business objectives align with the two representations.

When choosing a representation, consider the following factors:
- Business/Cultural
- Historical/Legacy

Business/Cultural Factors

Business	Culture
Business • senior management vision • knowledge of business objectives • product line focus • strategic alliance partners • competition • political pressure • market pressure	**Culture** • process-based culture • management's attitude toward change • knowledge of organizational change management • experience in process improvement • TQM exposure • strong engineering discipline culture

Historical/Legacy Factors

Historical

- availability of case studies and return on investment data
- papers and publications
- SEI Process Appraisal Information System (PAIS) data
- ISO 9000 audit results
- quality improvement programs
- self-assessments

Legacy

- experience with previous models (e.g., EIA-731, SE-CMM, SW-CMM)
- familiarity with existing CMMI terminology
- international standards such as ISO/IEC TR 15504
- certification in ISO 9001 or Tickit
- PSP and TSP influences

Align with Business Goals

Remember:

Process improvement should be the driver behind the choice.

The focus behind process improvement is the organization's business goals.

Advantages of Each Representation

Continuous Representation	Staged Representation
Maximum flexibility to select the order of process improvement	Predefined and proven path with case study and ROI data
High visibility of improvement within process areas	Organizational improvement focus
Easy upgrade from EIA 731	Easy upgrade from SW-CMM
Easy comparison to ISO 15504	Familiar benchmarking capability
Ability to improve process areas at different rates	Results that reflect maturity of the organization

Both Representations Support Each Other

The continuous representation can be useful to an initiative focused on the staged representation
- as a guide for detailed planning for improvement within each process area
- as a way to track and report intermediate progress short of achieving a full maturity level

The staged representation can be useful for an initiative focused on the continuous representative
- as a guide to understanding how process areas support each other
- as a guide for big picture, organization-based planning
- as a means for benchmarking success

Summary

Both representations are designed to offer essentially equivalent results.

Most of the content is similar.

Why not choose both representations?

The Addison-Wesley CMMI book and V1.2 (will) package the representations together to make it easier to use both representations.

Much of this material in this presentation came from the section on "Choosing a Representation" in the book *CMMI® Guidelines for Process Integration and Product Improvement*
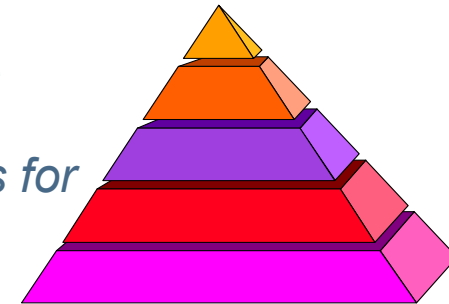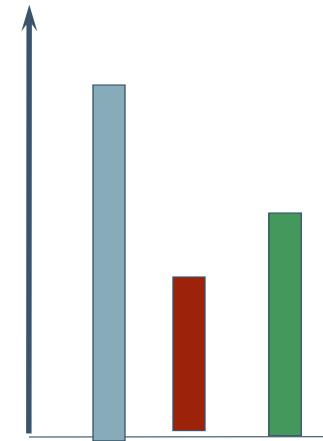
For More Information

For more information about CMMI, see
http://www.sei.cmu.edu/cmmi/

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Questions?