CMMI® Version 1.3 and Beyond

SSTC
May 2011

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Report Documentation Page

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CMMI Adoption

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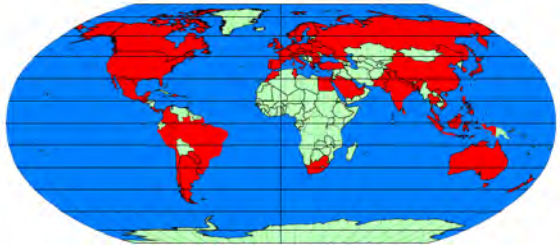
CMMI Transition Status
Reported to the SEI as of 3-31-11

Training	
Introduction to CMMI DEV (cumulative/v1.3)	124,895/2,170
Intermediate Concepts of CMMI (cumulative/v1.3)	3,269 / 31
Understanding CMMI High Maturity Practices (cumulative/v1.3)	659 / 23
Acquisition Supplement for Development (cumulative/v1.3)	1,378 / 36
Services Supplement for CMMI for Development (cumulative/v1.3)	2,769 / 143
Introduction to CMMI for Services	537
Development Supplement for CMMI for Services	37
Certifications	
SEI-Certified Introduction to CMMI for Development Instructors (v1.2/v1.3)	398 / 342
SEI-Certified Acquisition Supplement for CMMI –DEV Instructors (v1.2/v1.3)	65 / 59
SEI-Certified Services Supplement for CMMI –DEV Instructors (v1.2/v1.3)	139 / 141
SEI-Certified Introduction to CMMI for Services Instructors	53
SEI-Certified Development Supplement for CMMI-SVC Instructors	17
SCAMPI-DEV Lead Appraisers (v1.2/v1.3)	347 / 7
SCAMPI High Maturity Lead Appraisers	146
CMMI-ACQ Lead Appraisers (v1.2/v1.3)	66 / 3
CMMI-SVC Lead Appraisers (v1.2/v1.3)	133 / 1

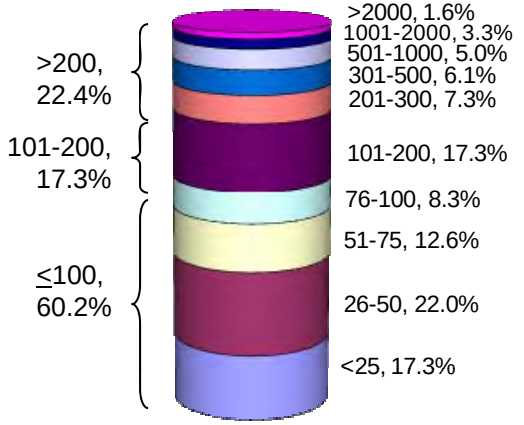
CMMI Adoption

CMMI appraisals are conducted worldwide…



	USA		Non-USA	
	Qty	%	Qty	%
Commercial In-House	425	35.2%	3354	91.8%
Contractor for Military/Government	651	54.0%	223	6.1%
Military/Government Agency	130	10.8%	76	2.1%
	1206	100.0%	3653	100.0%

…in small and large organizations and projects



Organization Size (Employees)
(4863 organizations reporting)

…in a wide range of businesses

Services (72.1%)

- Business Services
- Engineering and Management Services
- Health Services
- Other Services

Manufacturing (15.7%)

- Electronic and Electric Equipt
- Transportation Equipment
- Instruments & Related Products
- Industrial Machinery
- Other Mfg Industries

Other (12.2%)

- Finance, Insurance, Real Estate
- Public Administration/Defense
- Transportation, Communication, Utilities

…at all levels of process maturity

	Commercial In-House	Contractor for Military/ Government	Military/ Government Agency
No Rating Given	5.3%	8.0%	22.3%
Initial (ML1)	0.6%	1.4%	1.0%
Managed (ML2)	25.8%	31.5%	45.6%
Defined (ML3)	58.1%	49.3%	26.7%
Quantitatively Managed (ML4)	2.9%	1.0%	1.5%
Optimizing (ML5)	7.2%	8.9%	2.9%
	(3779 orgs)	(874 orgs)	(206 orgs)

Source: SEI Process Maturity Profile, Sept 2010.
http://www.sei.cmu.edu/cmmi/casestudies/profiles/cmmi.cfm

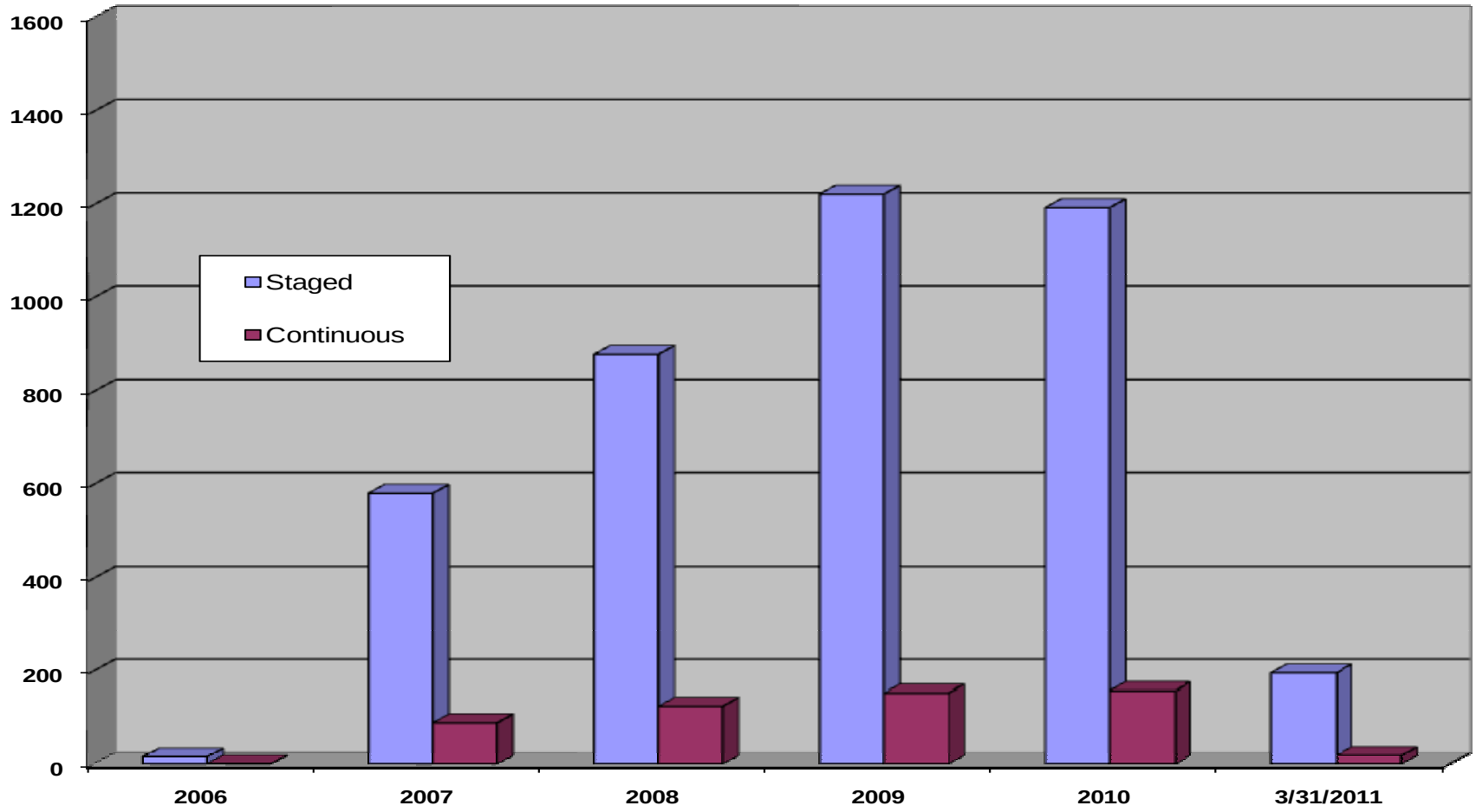
CMMI V1.3 Foreign Language Translation Status Reported to the SEI as of 3-31-11

Language	Status (for CMMI-DEV V1.3)
Chinese Trad.	underway
Dutch	To start, pending agreement
French	underway
German	underway
Japanese	To start, pending agreement
Korean	To start, pending agreement
Spanish	To start, pending agreement
Portuguese	underway

Language	Status (for CMMI-SVC)
Arabic	To start, pending agreement

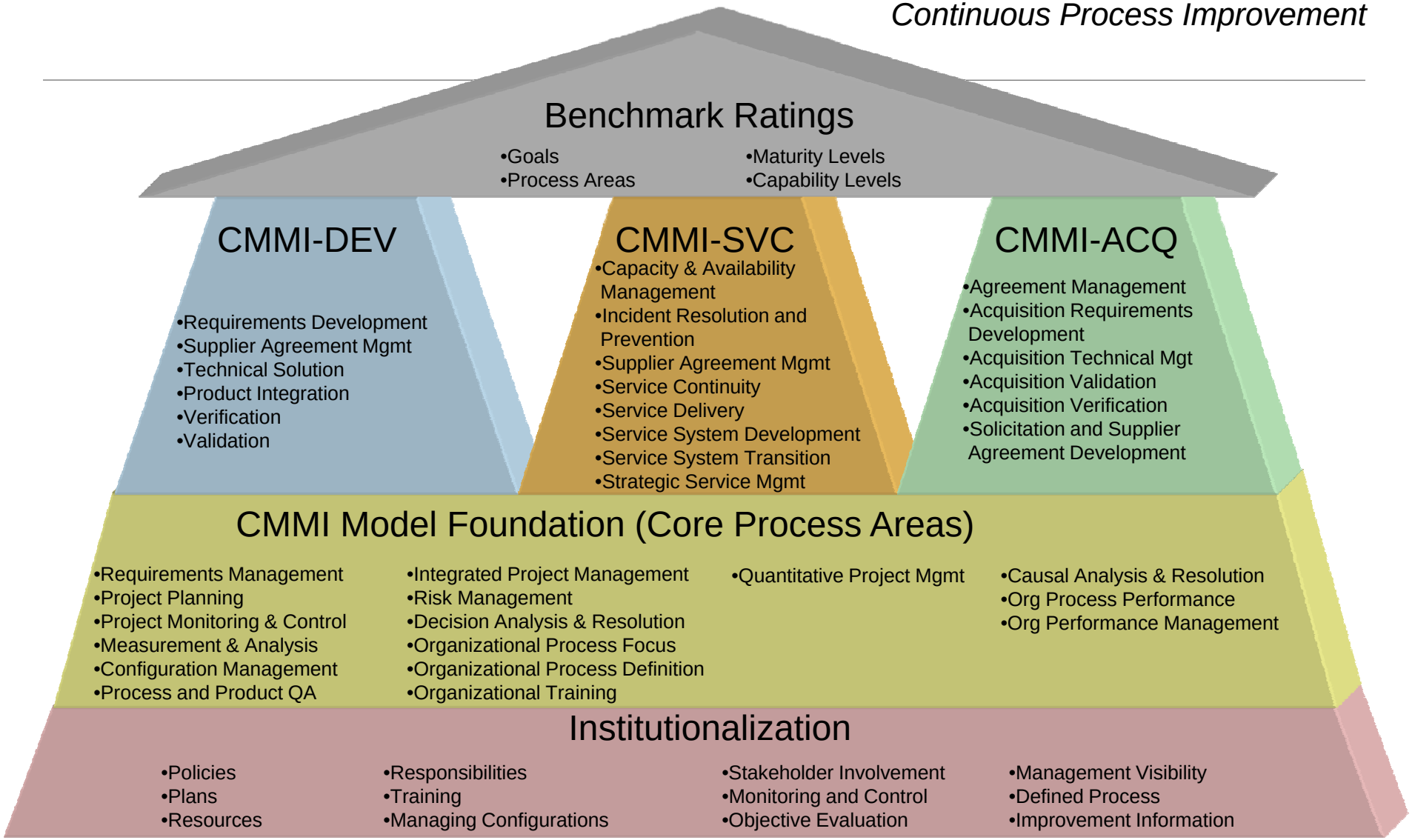
Number of SCAMPI V1.2, Class A Appraisals Conducted by Year by Representation* Reported as of 3-31-11

***Where Representation is reported**



CMMI Model Structure

Incremental Frameworks for Continuous Process Improvement



CMMI Product Suite, Version 1.3

Version 1.3 focused on but was not limited to the following:

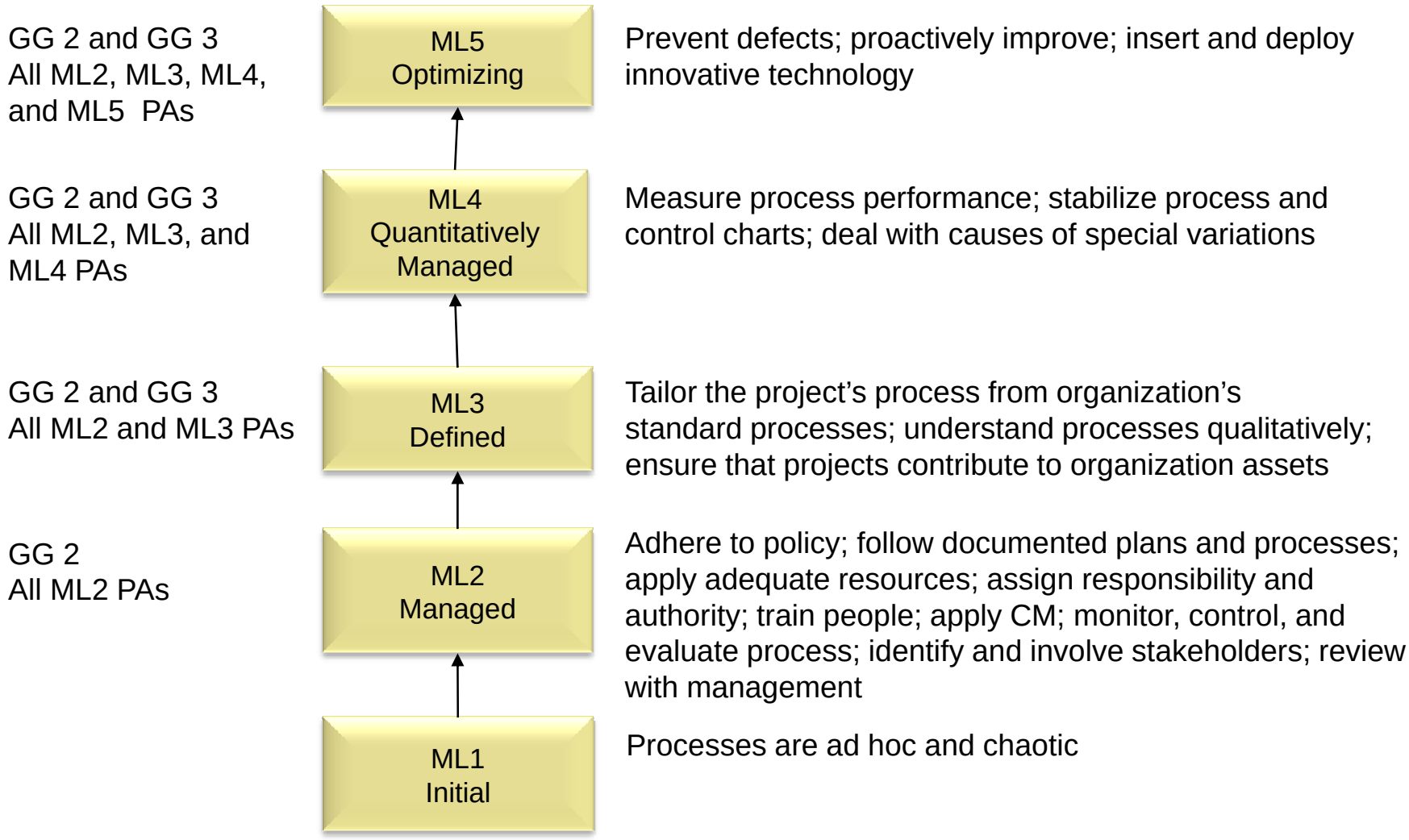
- High Maturity
- Appraisal efficiency
- Consistency across constellations
- Simplify the generic practices

Version 1.3 was change request (CR) driven.

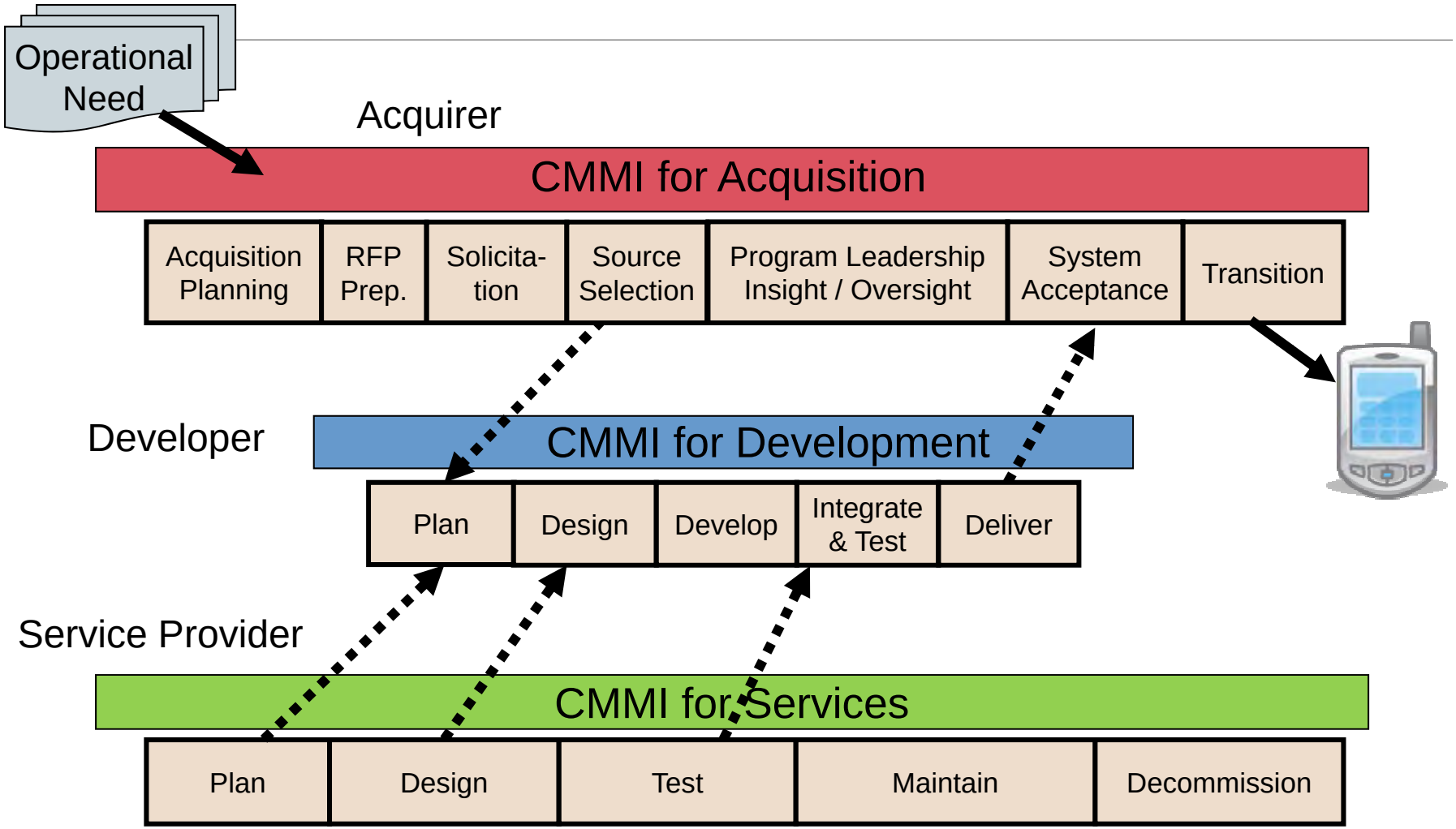
Comparison of Models

Measure	CMMI for Development					CMMI for Acquisition			CMMI for Services	
	V1.1 Staged	V1.1 Cont	V1.2	V1.3		V1.2	V1.3		V1.2	V1.3
Pages	715	710	560	482		428	438		531	520
Process Areas	25	25	22	22		22	22		24	24
Generic Goals	2	5	5	3		5	3		5	3
Generic Practices	12	17	17	13		17	13		17	13
Specific Goals	55	55	50	49		46	47		52	53
Specific Practices	185	189	173	167		161	163		182	181

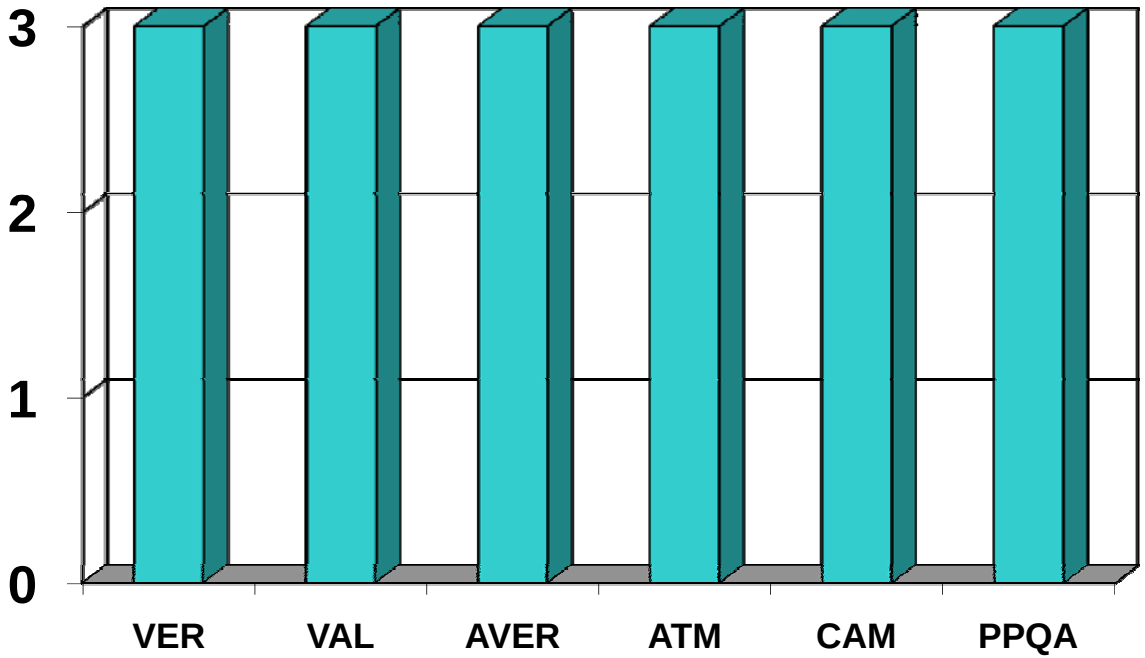
Achieving Maturity Levels



Visibility into the Team's Performance



Capability Profiles with Multiple Constellations



CMMI Appraisal Methods

Common Themes to SCAMPI Improvements

Scoping Appraisals

- Confusion caused by “focus-” and “non-focus” projects
- Minimum scoping rules for a wide range of organization types

Collecting Data

- Confusion caused by “direct” and “indirect” artifacts
- Data sufficiency

Pain Points that Make SCAMPI Difficult to Sustain

- Need to achieve efficiency
- Expanding organizational scope
- True cost of PIIDs

Attaining/Maintaining Appraisal Ratings

- Period of validity
- Multi-constellation appraisals

Appraisal Transition

Once CMMI Version 1.3 is released:

- During a period of one year, organizations may use either V1.2 or V1.3 models for their appraisals until November 30, 2011, except for uses dependent on translated versions of products that are approved in advance.
- SCAMPI A MDD V1.2 may be used until November 30, 2011.
- All appraisals will be valid for 3 years.

CMMI Training

Training Updates

The following courses will be updated for Version 1.3:

- Introduction to CMMI-DEV
- Introduction to CMMI-SVC
- ACQ Supplement for CMMI-DEV
- SVC Supplement for CMMI-DEV
- SCAMPI Team Training & SLAT
- Advanced DEV courses

New courses:

- Development Supplement for CMMI-SVC

Training Transition

The SEI will provide on-line upgrade training:

- Users make the transition by taking the upgrade course.
- Instructors make the transition by taking upgrade course.
- Lead Appraisers make the transition by taking upgrade course and specific SCAMPI method upgrade training.

V1.3 CMMI Model Updates: Core PAs

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V1.3 Changes to GGs, GPs, and GP Elaborations

Positioned generic goals, generic practices, and GP elaborations in one central location as the first section of Part 2 in all three models.

Simplified GG1 to make it more readable.

Renamed GP 2.6 to “Control Work Products.”

Added “selected work products” to the GP 2.9 statement.

Simplified the GP 3.2 statement to replace “collect work products, measures, measurement results, and improvement information” with “collect process related experiences.”

Eliminated GG4 and GG5.

Core PAs: Support Category

Configuration Management

Establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits

Decision Analysis and Resolution

Analyze possible decisions using a formal evaluation process that evaluates identified alternatives against established criteria

Measurement and Analysis

Develop and sustain a measurement capability used to support management information needs

Process and Product Quality Assurance

Provide staff and management with objective insight into processes and associated work products

CM: Clarified that CM can apply to hardware, equipment, and other **tangible assets**.

DAR: Added guidance on **defining the scope of the decision** and communicating results.

MA: More clearly distinguished between information needs and objectives, measurement objectives, and business/project objectives. Included a **table of examples** (as in ACQ) for DEV and SVC.

Clarified that PPQA also applies to **organization** level activities and work products.

Core PAs: Process Management Category

Organizational Process Definition

Establish and maintain a usable set of organizational process assets, work environment standards, and rules and guidelines for teams

Converted goal on teaming to a single practice, which is no longer an "addition" for IPPD only.

Organizational Process Focus

Plan, implement, and deploy organizational process improvements based on a thorough understanding of current strengths and weaknesses of the organization's processes and process assets

Simplified SP 3.4 to replace "process-related work products, measures, and improvement information" with "**process related experiences**".

Organizational Training

Develop skills and knowledge of people so they can perform their roles effectively and efficiently

Expanded applicability to training development and delivery methods such as **self study, mentoring, and online training**.

Core PAs: Project and Work Management Category -1

Integrated Project Management

Establish and manage the project and the involvement of relevant stakeholders according to an integrated and defined process that is tailored from the organization's set of standard processes

Simplified SP 1.7 to replace "work products, measures, and documented experiences" with "**process related experiences**."

Converted goal on IPPD or Integrated Teaming to a single practice (IPPD no longer an addition).

Project Monitoring and Control

Provide an understanding of the project's progress so that appropriate corrective actions can be taken when the project's performance deviates significantly from the plan

Added guidance for monitoring risks, data management, stakeholder involvement, project progress, and milestone reviews.

Project Planning

Establish and maintain plans that define project activities

Added guidance on determining project lifecycle and milestones.

Added subpractices on determining data rights and need for configuration control, and determining communication requirements and other continuing resource needs.

Core PAs: Project and Work Management Category -2

Requirements Management

Manage requirements of the project's products and product components and to ensure alignment between those requirements and the project's plans and work products

Changed the focus of SP 1.5 so that it now reads "Ensure that project plans and work products **remain aligned with requirements**."

Risk Management

Identify potential problems before they occur so that risk handling activities can be planned and invoked as needed across the life of the product or project to mitigate adverse impacts on achieving objectives

Included examples related to: architectural risks, use of industry standards to identify risks, FMEA, and consequence monetization.

Provided guidance on maintaining risk parameters through life of the project.

SAM – the Shared PA

SG 1: Establish Supplier Agreements

- SP 1.1 Determine Acquisition Type
- SP 1.2 Select Suppliers
- SP 1.3 Establish Supplier Agreements

SG 2: Satisfy Supplier Agreements

- SP 2.1 Execute the Supplier Agreement
- SP 2.2 Accept the Acquired Product
- SP 2.3 Ensure Transition of Products

Clarified the **applicability** of SAM practices.

Demoted SP 2.2 and SP 2.3 to subpractices of SP 2.1 and renumbered the remainder of the practices.

Revised SP 2.3 to allow its applicability to times when the product or service is **delivered directly to the customer or end user from the supplier**.

New Informative Material

Update selected process areas to provide interpretation of practices for organizations with respect to the following topics:

- Agile methods
- Quality attributes (i.e., non functional requirements or “ilities”)
- Allocation of product capabilities to release increments
- Product lines
- System of systems
- Architecture-centric development practices
- Technology maturation
- Customer satisfaction

Software System Drivers

Mission Drivers

Functional Software Requirements

If function were all that mattered, any monolithic software would do, ..*but other things matter*…

The important quality attributes and their characterizations are key.

- Performance
- Availability
- Modifiability
- Interoperability
- Availability
- Security
- ...

analysis, design, development

Quality Attribute Drivers → Software Architecture → Software

has these qualities

Business Drivers

What about Agility?

Agility in acquisition and development, as with operational forces, requires a highly disciplined team.

An agile team

- is trained
- is orchestrated
- has a plan
- knows when they deviate
- can predict the impact of changes
- measures and reports its own performance
- can respond quickly

V1.3 Changes to High Maturity PAs

Many of the most significant changes to CMMI models as part of Version 1.3, are the changes to the high maturity process areas (CAR, OPM, OPP, and QPM).

These process areas are core process areas, but we've focused on these four over the others because of their significance in this release.

High Maturity Changes for V1.3

Terminology Confusion

- Common Cause (Statistical versus Quantitative Techniques)
- Process Models and Process Modeling
- Business Objectives
- Subprocesses

Requirements implied versus explicit/ Explanations not central or consistent

- Model/ Audit Criteria/ Presentations (Healthy Ingredients)/ UCHMP

Perceptions

- Customers – ML 5 is expensive – no better than 3
- Industry – ML 5 is NOT RIGHT for every business

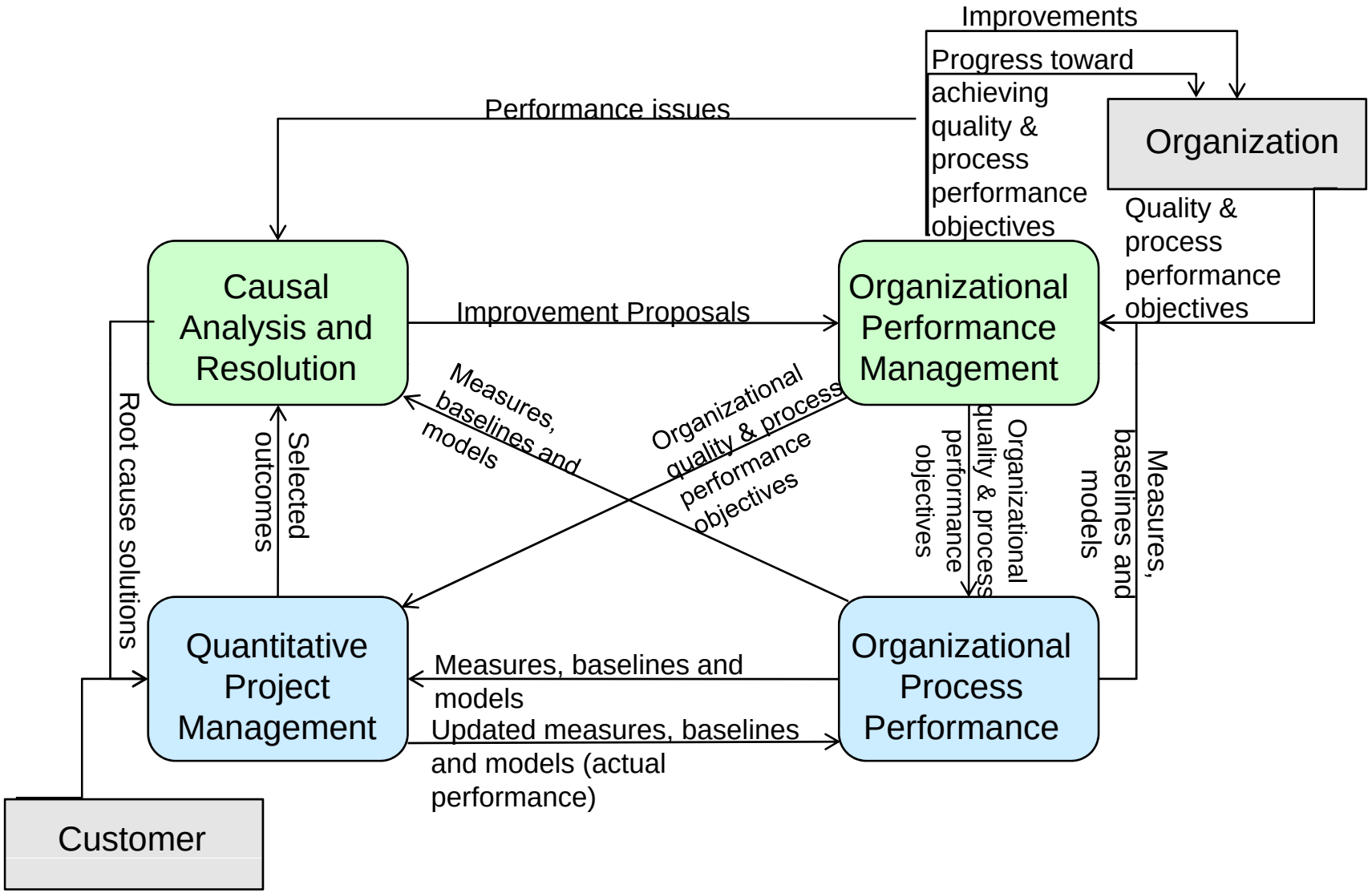
High Maturity in ALL constellations

- Examples are focused on Development

High Maturity Restructuring for V1.3

- Insufficient link between process improvement, business objectives, and performance
- Clarify distinction between ML4 and ML5
- Eliminate GG4 and GG5
- Make CAR more relevant for organizational benefit

Combined OID and OPM into One PA



Causal Analysis and Resolution

SG 1: Determine Causes of Selected Outcomes

- SP 1.1 Select Outcomes for Analysis
- SP 1.2 Analyze Causes

SG 2: Address Causes of Selected Outcomes

- SP 2.1 Implement Action Proposals
- SP 2.2 Evaluate the Effect of Implemented Actions
- SP 2.3 Record Causal Analysis Data

Used "**outcomes**" instead of "defects and problems."

Added **examples** for service organizations and for selecting outcomes for analysis.

Added **subpractices** in SP 1.1 for defining the problem, and in SP 2.2 for following up when expected results did not occur.

Added more information about **how PPMs can be used**.

Added emphasis on **prevention** and reducing recurrence.

Organizational Performance Management

SG 1: Manage Business Performance
- SP 1.1 Maintain Business Objectives
- SP 1.2 Analyze Process Performance Data
- SP 1.3 Identify Potential Areas for Improvement

SG 2: Select Improvements
- SP 2.1 Elicit Suggested Improvements
- SP 2.2 Analyze Suggested Improvements
- SP 2.3 Validate Improvements
- SP 2.4 Select and Implement Improvements for Deployment

SG 3: Deploy Improvements
- SP 3.1 Plan the Deployment
- SP 3.2 Manage the Deployment
- SP 3.3 Evaluate Improvement Effects

Renamed the PA to be **Organizational Performance Management (OPM)**.

Added a **new goal** about managing business performance using statistical and other quantitative techniques.

Provided more information about how improvements can be **selected for deployment**.

More explicitly described and discussed using **process performance models**.

Clarified that **not all improvement validations include piloting**.

Organizational Process Performance

SG 1: Establish Performance Baselines and Models

- SP 1.1 Establish Quality and Process Performance Objectives
- SP 1.2 Select Processes
- SP 1.3 Establish Process Performance Measures
- SP 1.4 Analyze Process Performance and Establish Process Performance Baselines
- SP 1.5 Establish Process Performance Models

Re-ordered SPs, moving the old SP 1.3 (Establish Quality and Process Performance Objectives) to SP 1.1

Revised SP 1.4 to include **process performance analysis** and assessment of subprocess stability.

Revised SP 1.5 to note that under certain circumstances, **projects may need to create their own process performance models**.

Clarified the **relationship** of OPP to other high maturity process areas.

Quantitative Project Management

SG 1: Prepare for Quantitative Management

- SP 1.1 Establish the Project's Objectives
- SP 1.2 Compose the Defined Process
- SP 1.3 Select Subprocesses and Attributes
- SP 1.4 Select Measures and Analytic Techniques

SG 2: Quantitatively Manage the Project

- SP 2.1 Monitor the Performance of Selected Subprocesses
- SP 2.2 Manage Project Performance
- SP 2.3 Perform Root Cause Analysis

Restructured QPM so that SG1 focuses on preparation and SG2 focuses on managing the project.

Added **guidance** about using process performance baselines and process performance models.

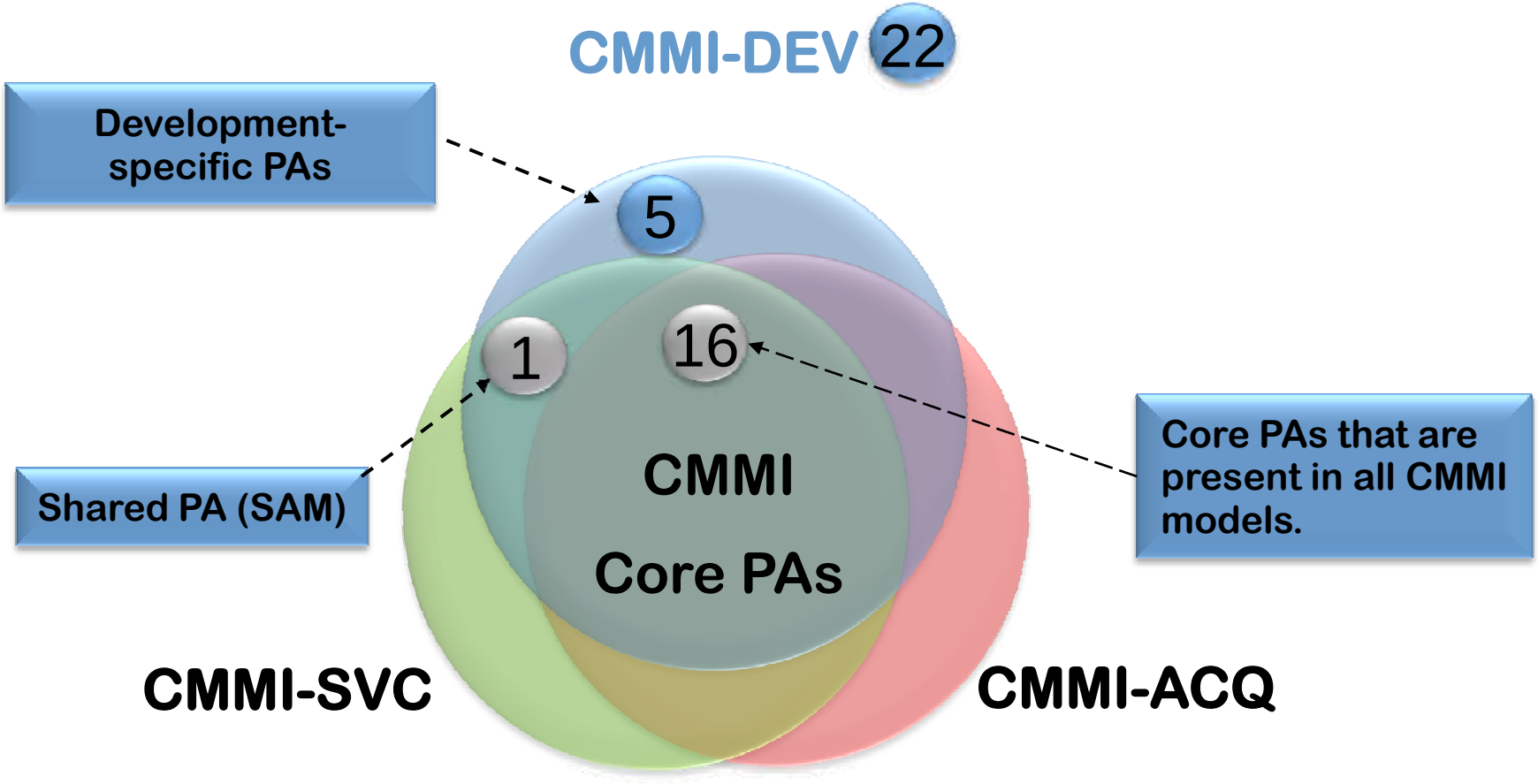
Define quantitative management in the glossary to include **statistical management** and use that definition for use of the terms throughout QPM.

Removed the practice about applying statistical methods to understand variation to reduce the over-emphasis on control charts.

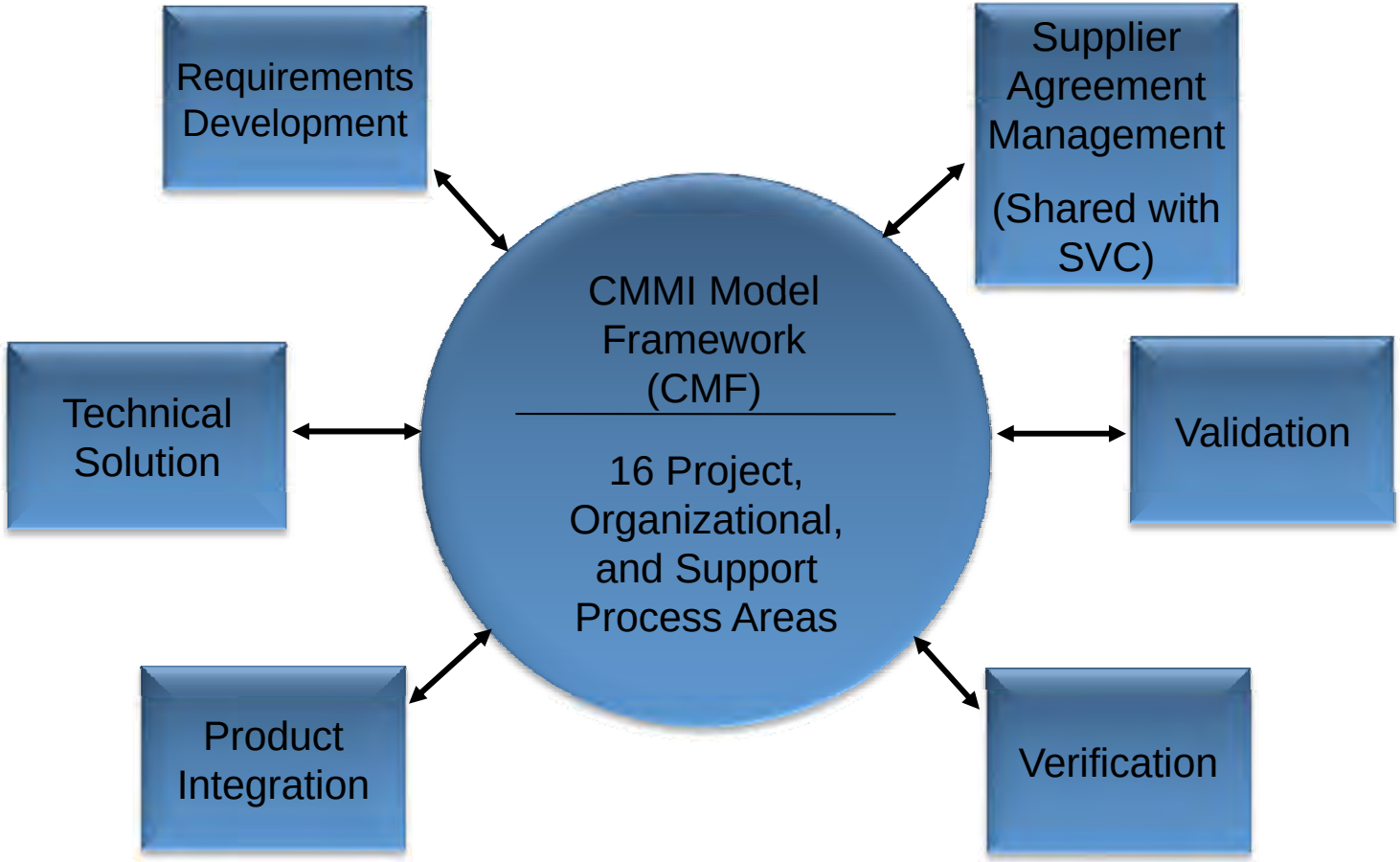
Added **new practices** about managing performance and performing root cause analysis.

CMMI for Development

CMMI for Development Model



Development-Specific PAs



CMMI-DEV PAs by Maturity Level

Maturity Level		Process Areas
5	Optimizing	Causal Analysis and Resolution Organizational Performance Management
4	Quantitatively Managed	Organizational Process Performance Quantitative Project Management
3	Defined	Decision Analysis and Resolution Integrated Project Management Organizational Process Definition Organizational Training Organizational Process Focus Product Integration Requirements Development Risk Management Technical Solution Validation Verification
2	Managed	Configuration Management Measurement and Analysis Project Monitoring and Control Project Planning Process and Product Quality Assurance Requirements Management Supplier Agreement Management

For the V1.3 release, there were no changes that affected the DEV PAs' positioning by maturity level.

CMMI-DEV PAs by Category

Process Management

Organizational Process Definition (OPD)
Organizational Process Focus (OPF)
Organizational Performance Management (OPM)
Organizational Process Performance (OPP)
Organizational Training (OT)

Support

Causal Analysis and Resolution (CAR)
Configuration Management (CM)
Decision Analysis and Resolution (DAR)
Measurement and Analysis (MA)
Process and Product Quality Assurance (PPQA)

For the V1.3 release, REQM was moved from "Engineering" to "Project Management."

Project Management

Integrated Project Management (IPM)
Project Monitoring and Control (PMC)
Project Planning (PP)
Quantitative Project Management (QPM)
Requirements Management (REQM)
Risk Management (RSKM)
(+) Supplier Agreement Management (SAM)

Engineering

Product Integration (PI)
Requirements Development (RD)
Technical Solution (TS)
Validation (VAL)
Verification (VER)

Product Integration

SG 1: Prepare for Product Integration
- SP 1.1 Establish an Integration Strategy
- SP 1.2 Establish the Product Integration Environment
- SP 1.3 Establish Product Integration Procedures and Criteria

SG 2: Ensure Interface Compatibility
- SP 2.1 Review Interface Descriptions for Completeness
- SP 2.2 Manage Interfaces

SG 3: Assemble Product Components and Deliver the Product
- SP 3.1 Confirm Readiness of Product Components for Integration
- SP 3.2 Assemble Product Components
- SP 3.3 Evaluate Assembled Product Components
- SP 3.4 Package and Deliver the Product or Product Component

Revised the purpose statement to ensure proper **behavior** instead of proper function, thereby more explicitly including **quality attributes** and required functionality.

Changed emphasis on integration sequence to an emphasis on **integration strategy**.

Described an integration strategy and **how it relates** to an integration sequence.

Requirements Development

SG 1: Develop Customer Requirements
- SP 1.1 Elicit Needs
- SP 1.2 Transform Stakeholder Needs into Customer Requirements

SG 2: Develop Product Requirements
- SP 2.1 Establish Product and Product Component Requirements
- SP 2.2 Allocate Product Component Requirements
- SP 2.3 Identify Interface Requirements

SG 3: Analyze and Validate Requirements
- SP 3.1 Establish Operational Concepts and Scenarios
- SP 3.2 Establish a Definition of Required Functionality and Quality Attributes
- SP 3.3 Analyze Requirements
- SP 3.4 Analyze Requirements to Achieve Balance
- SP 3.5 Validate Requirements

SP1.2 revised to add that customer requirements should be **prioritized** based on their criticality to the **customer** and other stakeholders.

Broadened emphasis from "operational scenarios" to a more balanced "**scenarios (operational, sustainment, and development)**."

Added a focus on **architectural requirements**.

Because "Q**uality attributes**" needs to be considered in addition to "functionality," SG3 and SP 3.2 were revised.

Added informative material that requirements can be monitored through development based on their **criticality to the customer**.

CMMI and Other Models and Standards

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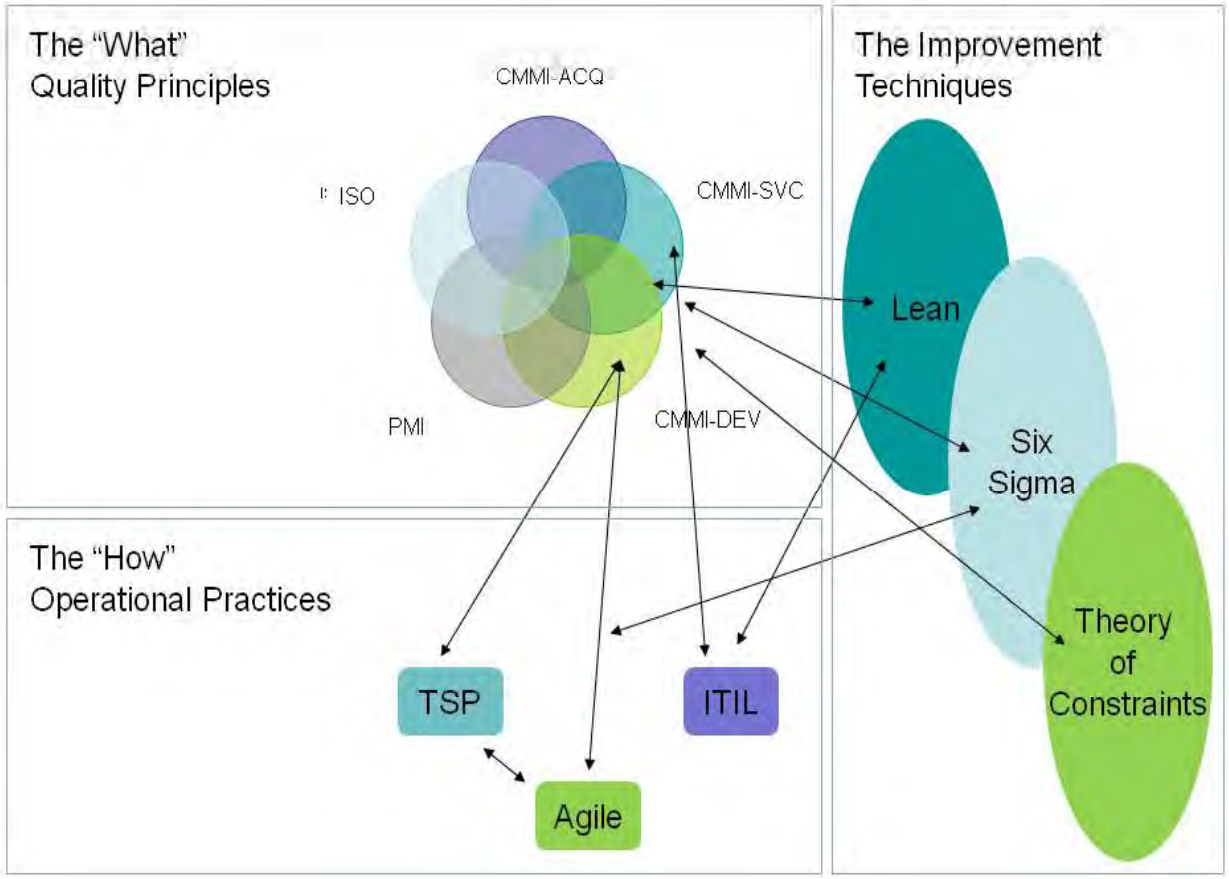
CMMI Planned Elements: Multi-Model

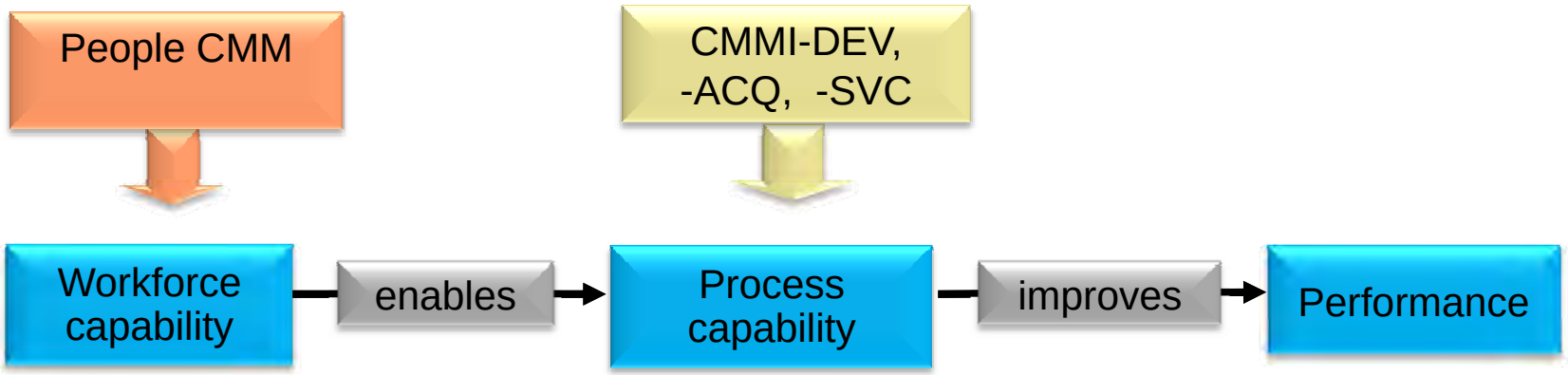
Improving interfaces is of interest to both government and industry….



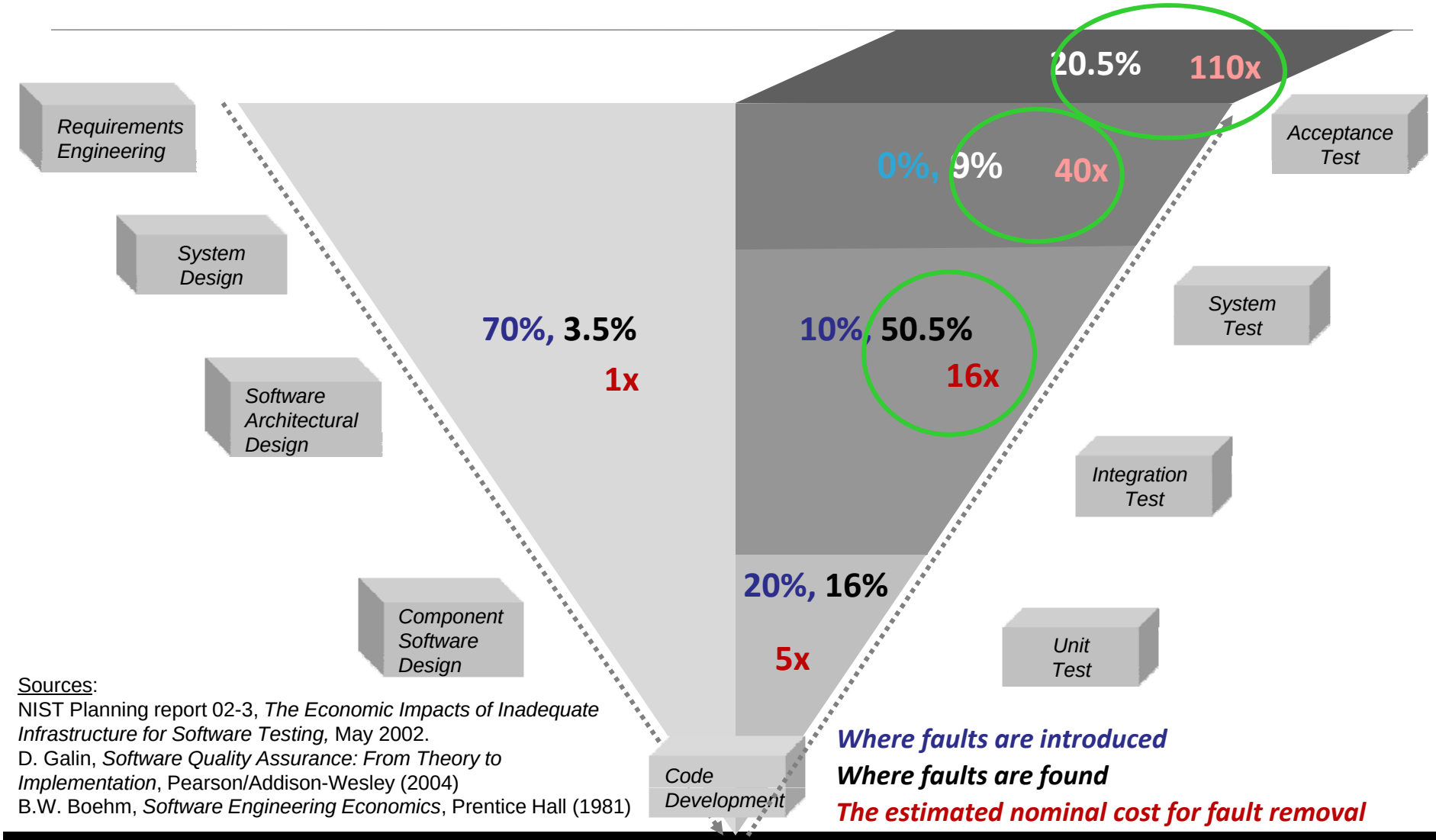
CMMI and the People CMM

CMMI (DEV, ACQ, SVC) improves the **capability** of organizations' processes within specific domains.

The People CMM improves the **capability** of organizations' workforces through enhanced management and human capital. *(The People CMM defines **capability** as the **level** of **knowledge**, **skills**, and **process abilities** available within each workforce competency of the organization to build its products or deliver its services.)*



Late Discovery of System-Level Problems



Sources:
NIST Planning report 02-3, *The Economic Impacts of Inadequate Infrastructure for Software Testing,* May 2002.
D. Galin, *Software Quality Assurance: From Theory to Implementation*, Pearson/Addison-Wesley (2004)
B.W. Boehm, *Software Engineering Economics*, Prentice Hall (1981)

Where faults are introduced
Where faults are found
The estimated nominal cost for fault removal

The Case for “Multi-Model” -- 1

Alignment of processes and improvement activities with specific business objectives

- Business challenges are complex, often not monolithic, and require the ‘right’ combination of capability, targeted to business needs.

A Multi-Model approach is well suited to this environment.

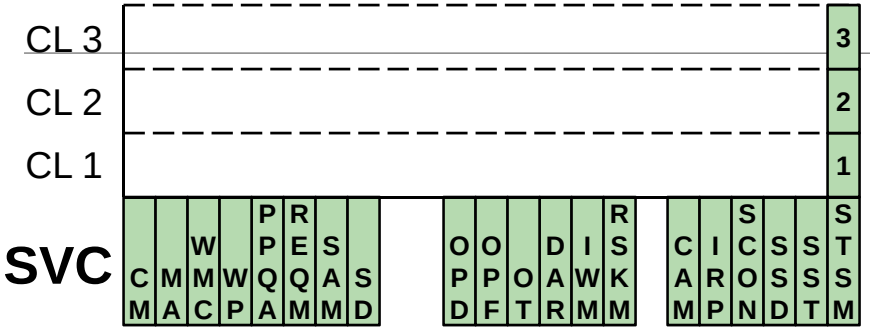
- The different CMMI constellations (DEV, ACQ, SVC) can allow Orgs to achieve ratings appropriate to the type of work they do.
- P-CMM can support the development and retention of a world-class workforce.
- Multi-model improvement will create an Enterprise “profile” of qualifications to enhance offerings to customers, based on their need, and the ability of the Org to deliver real value.

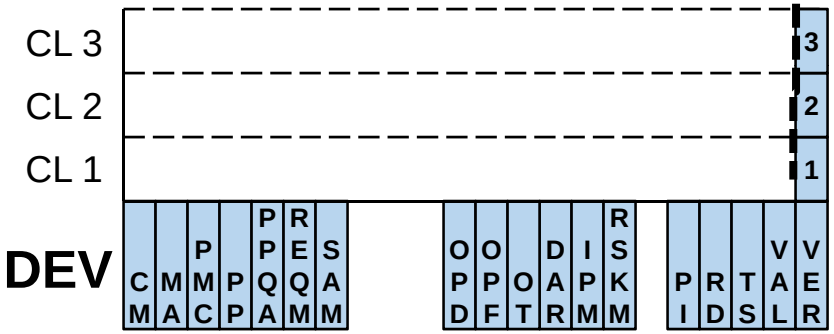
The Case for “Multi-Model” -- 2

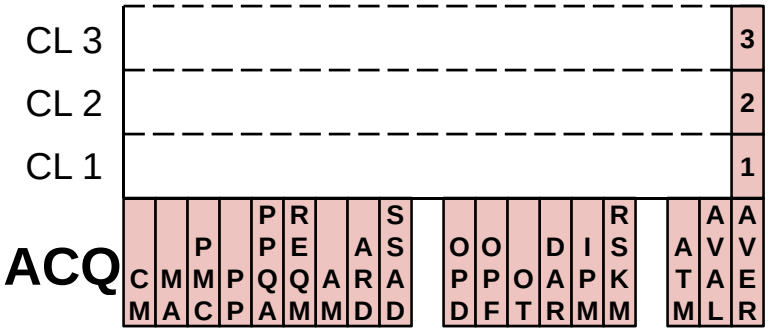
Create an Org-specific “constellation”

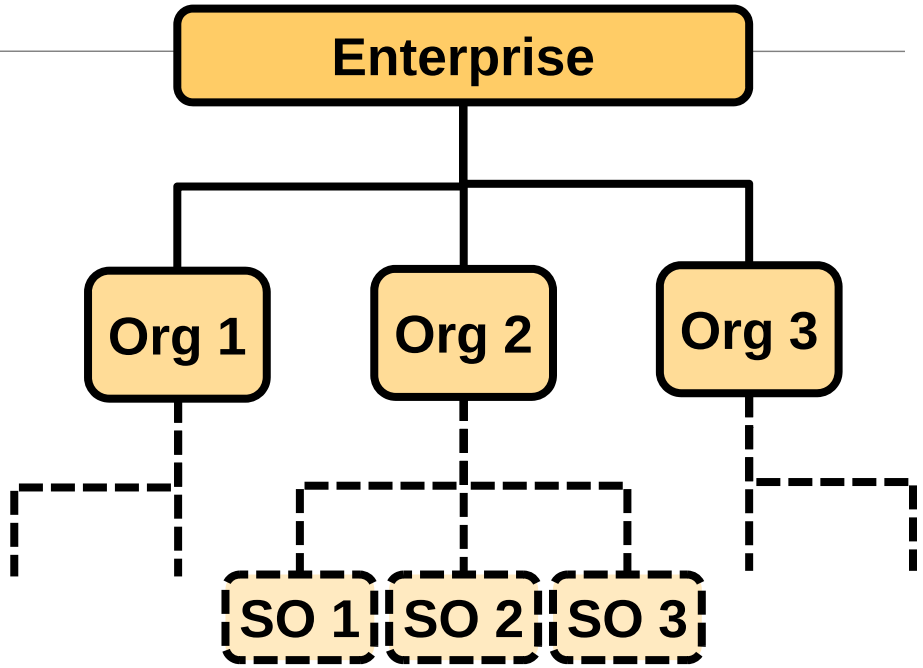
- Using the Org capability profile, identify an integrated set of process areas from the different models and constellations that can be used to create a unique model for the enterprise.
- As needed, create specific models for each Org that fit their specific process needs
- Within some of the Orgs, if the process diversity is great enough, it may be beneficial to create specific models for sub-organizations of the Org.

A PA Look





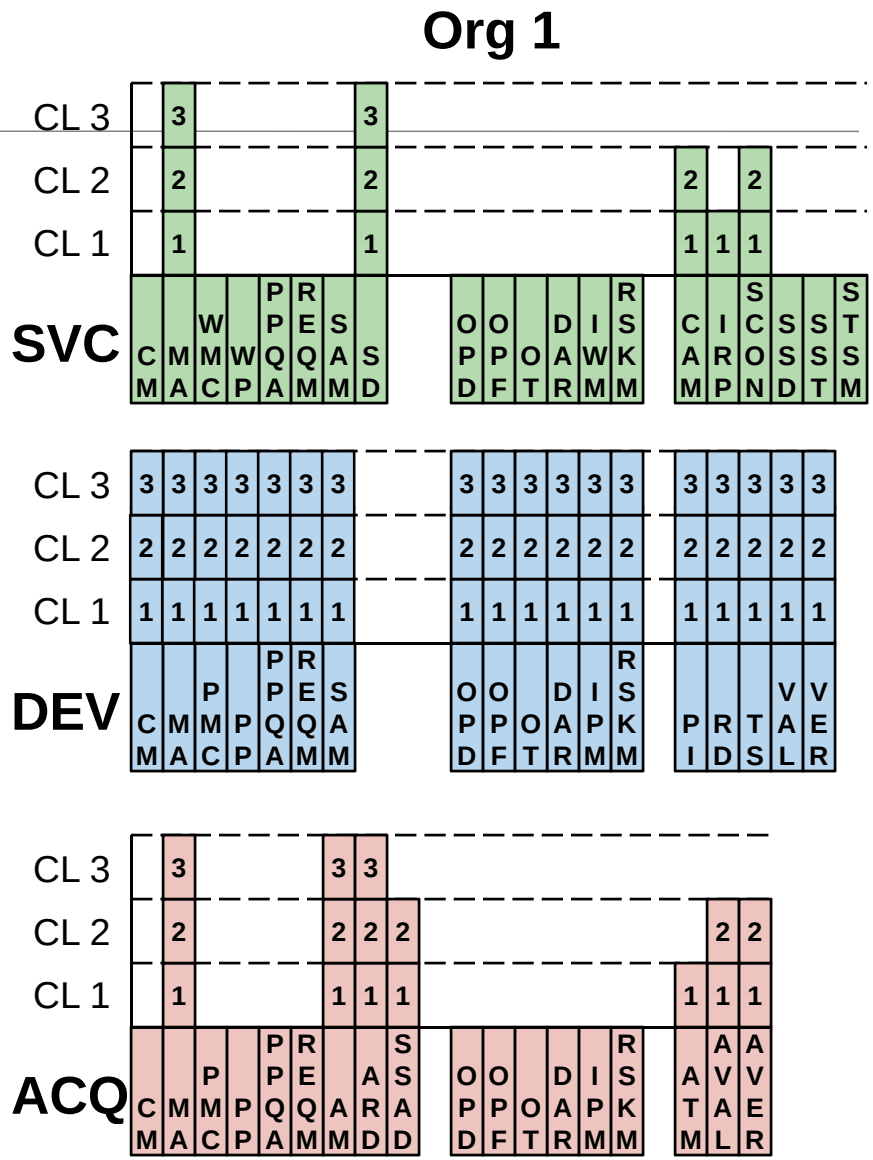




Example for Org 1

Org 1 is assumed to be:

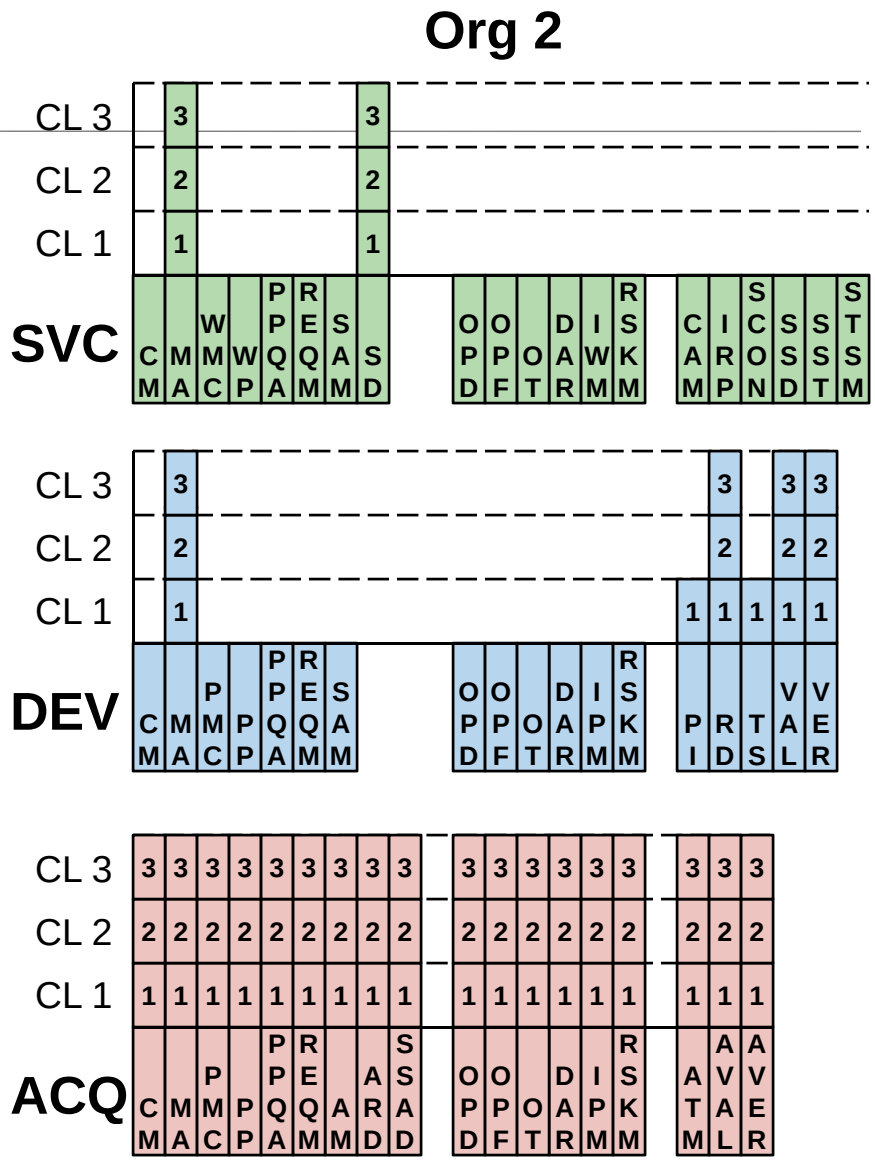
- Primarily software development
- With:
  - Helpdesk service
  - Some procurement



Example for Org 2

Org 2 is assumed to be:

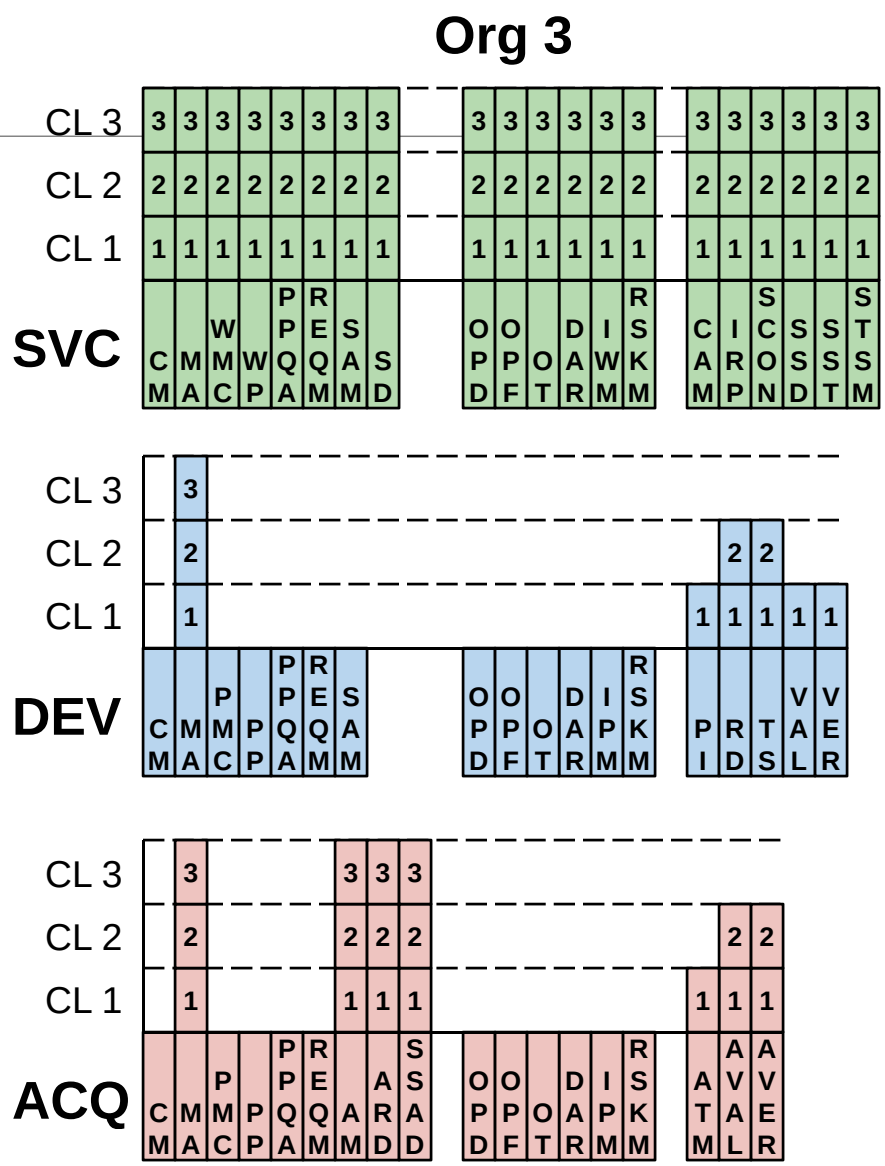
- Primarily acquisition
- With:
  - Helpdesk service
  - Some software development



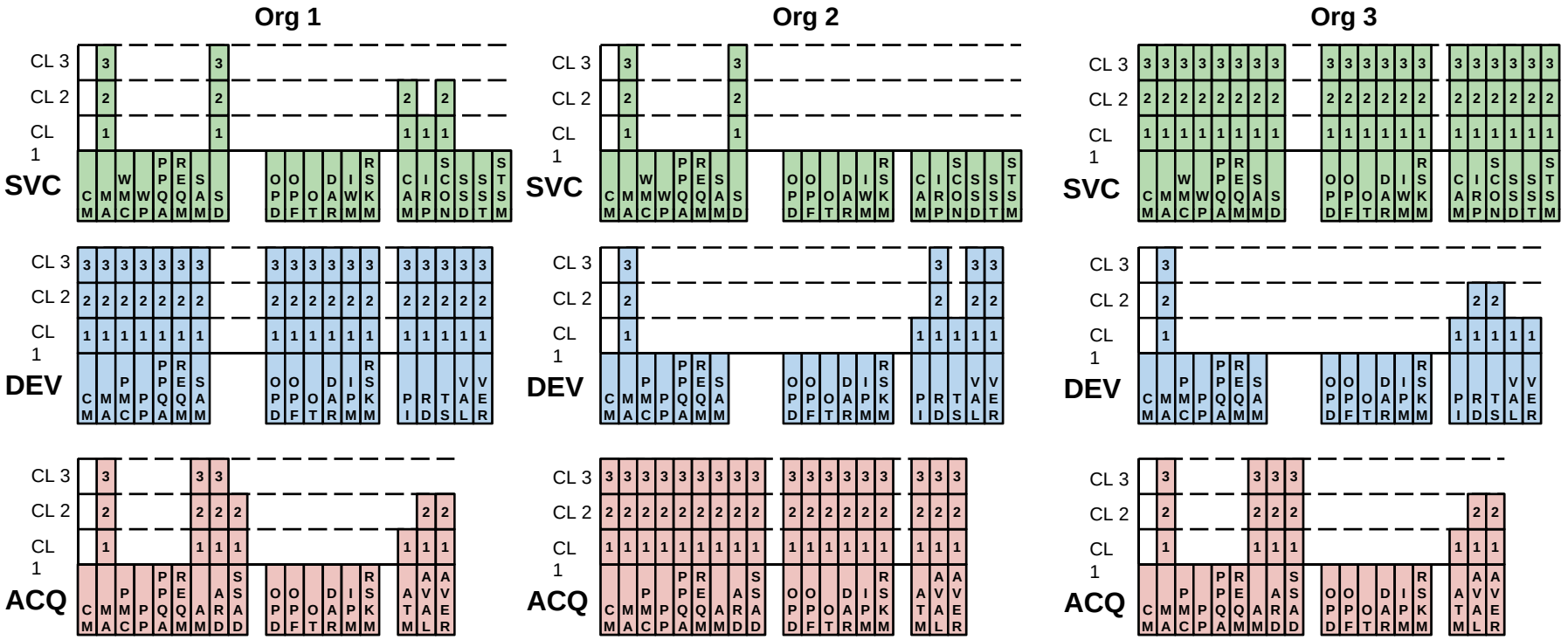
Example for Org 3

Org 3 is assumed to be:

- Primarily services
- With:
  - Some software development
  - Some procurement



A Tale of Three Orgs



Multi-Model Improvement Strategy

At the Enterprise Level

- Define Multi-Model Improvement for the Org.
- Define overall objectives.
- What does Success Look Like?
- How do we sell to our customers?
- Benefits of Multi-Model Improvement

At the Org Level

- Identify what models or process areas make sense for each Org
- Ensure alignment of PI objectives within each Org with overall Enterprise strategic objectives
  - Leverage other improvement initiatives wherever possible
- Identify areas of commonality and build on them
- Document the standard process architecture
- Revise and update PAL structure to minimize redundancy
  - Use existing resources to maximize value out of investment
- Use P-CMM practices to foster the organizational culture of change and improvement

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