Exploring CMMI-ISO 9001:2000 Synergy when Developing a Process Improvement Strategy

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Agenda

- Introduction
- Process Improvement Approach
- Framework Overview
- Concepts of ISO-CMMI Synergy
- Changes from Legacy Standards
- Transitioning from Legacy Standards
- Using ISO-CMMI Synergy for Process Improvement

Purpose

- **Need for *Systematic* Process Improvement**
- **ISO 9001 & CMMI Similarities & Differences**
- **ISO 9001 & CMMI Synergy**
- **Transition from Legacy Standards**

Why Use Standards?

- Best practices are captured
- Provide common language
- They establish a basis for improving
  - organizations
  - standards
- Scope is limited
- Supporting infrastructure is developed
  - related standards, guidebooks, tutorials, evaluation methods

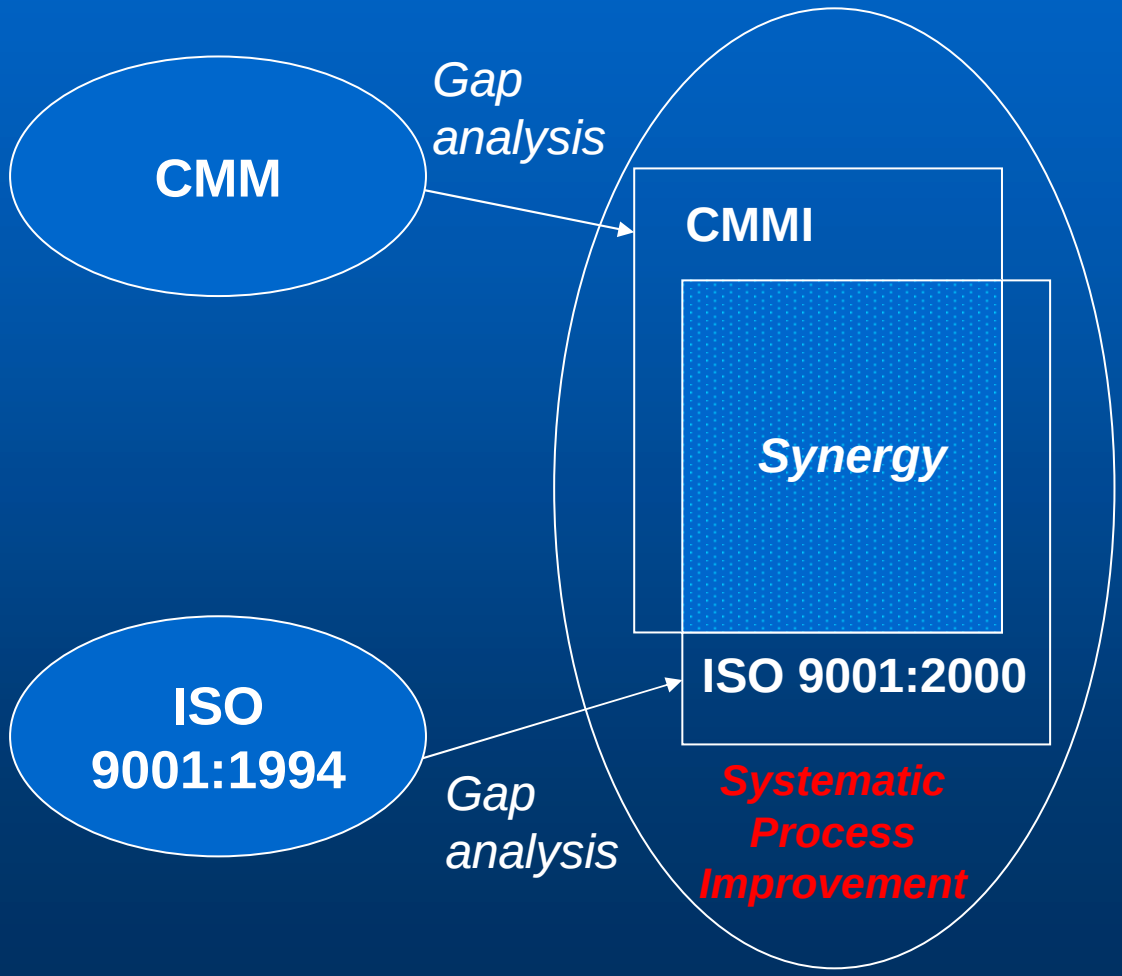
Standards Evolve

- Lessons learned are incorporated
- Activities in emerging fields must be addressed (cf. Frameworks Quagmire)
- When standards change:
  - What happens to the infrastructure?
  - What happens to previous investment?
  - What are the transition steps?

Why ISO 9001:2000 & CMMI?

- **Widely used**
  - **ISO 9000 is an international standard**
  - **CMMI is a *de facto* standard**
- **Often specified in acquisition**
- **Newly revised**
  - **Sunset dates for predecessors are set**

Process Improvement with ISO 9001:2000 and the CMMI



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Process Improvement is Hard

- **Organizations are systems of complex processes**
  - **Differing objectives**
  - **Overlapping objectives**
  - **Ill-defined (or undefined) objectives**
- **Everyday pressure to deliver products**
- **Resistance to change**
- **Lack of clear business goals & objectives**
- **And more...**

Importance of Selecting PI Goals

- **Successful PI feeds itself**
- **Link PI goals to business objectives**
  - **improve productivity**
  - **improve quality**
  - **reduce cycle time**
- **PI goals tied to appraisals bring danger of mere appearance of change**

Process Improvement Approaches

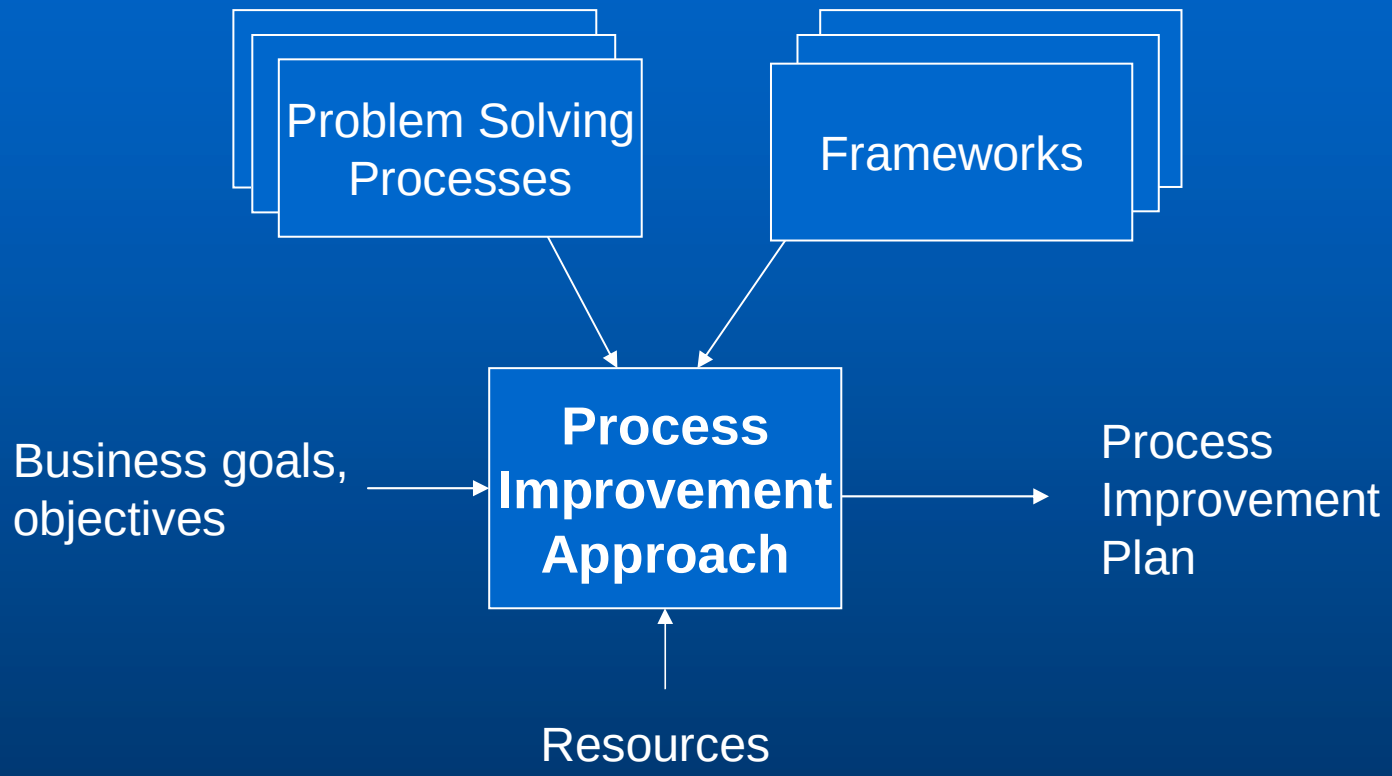
All share common problem solving concepts:

- **identification of goals**
- **analysis of the present situation**
- **development of an approach**
- **construction of a plan**
- **execution of the plan**
- **measurement of results**

Some Problem Solving Processes

- **Brute Force**
- **Plan - Do - Check - Act (PDCA)**
- **ISO 9004:2000**
  - **elaborates 9001, suggests PDCA, doesn't give roadmap**
- **ISO 15504**
- **IDEAL**

Process Improvement Approach: Problem Solving + Framework



Need to select a problem solving process to unify ISO 9001:2000 and the CMMI

IDEAL is Our Selected Process

- Implements PDCA cycle
- Publicly available
- Widely used
- Historically tied to CMM
- Version 1.1 more broadly applicable

IDEAL Phases

- **I - Initiating**
  - Identify goals, establish sponsorship, build infrastructure
- **D - Diagnosing**
  - Determine gaps between current and desired states
- **E - Establishing**
  - Prioritize actions, develop plan
- **A - Acting**
  - Implement plan, transition from pilot to broad use
- **L - Learning**
  - Measure performance, capture lessons

Systematic Process Improvement Concept

ISO 9001:200 Implementation

Step 1 → Step 2 ---- → **ISO Registration**

+

CMMI Implementation

Step 1 → Step 2 ---- → **CMMI Maturity Level**

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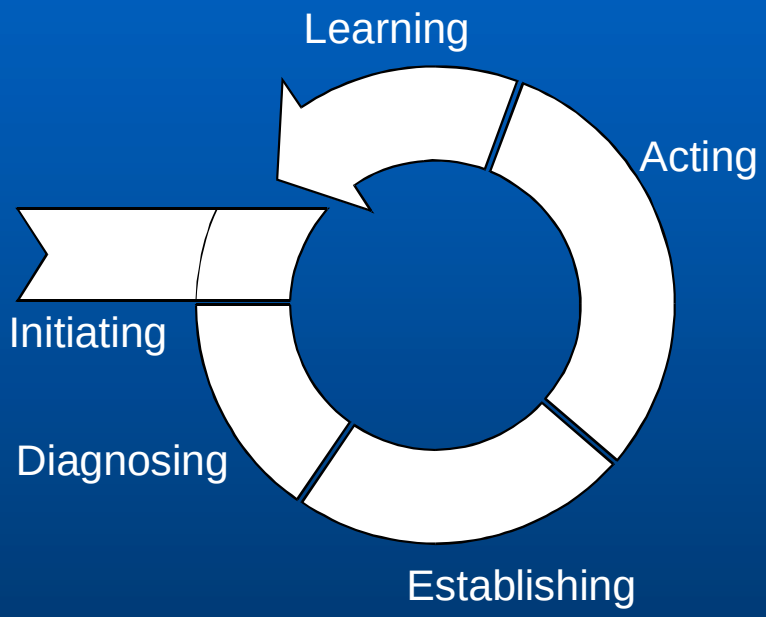

ISO 9001:2000 - CMMI Synergy

Agenda

- Why both standards?
- Process Improvement Approach
- Framework Overview
  - ISO 9001:2000
  - CMMI
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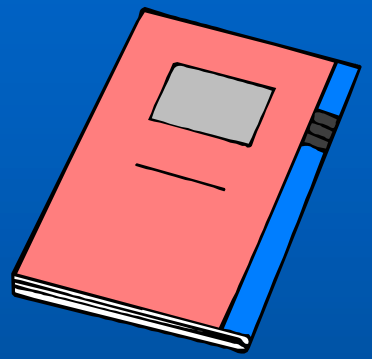
ISO 9000:2000 Standards

- **ISO 9000:2000**
  - **Fundamentals and vocabulary**
- **ISO 9001:2000**
  - **Requirements**
- **ISO 9004:2000**
  - **Guidelines for performance improvements**
- ***ISO 9000-3:2000***
  - ***Guidelines for the Application of ISO 9001:2000 to Computer Software***



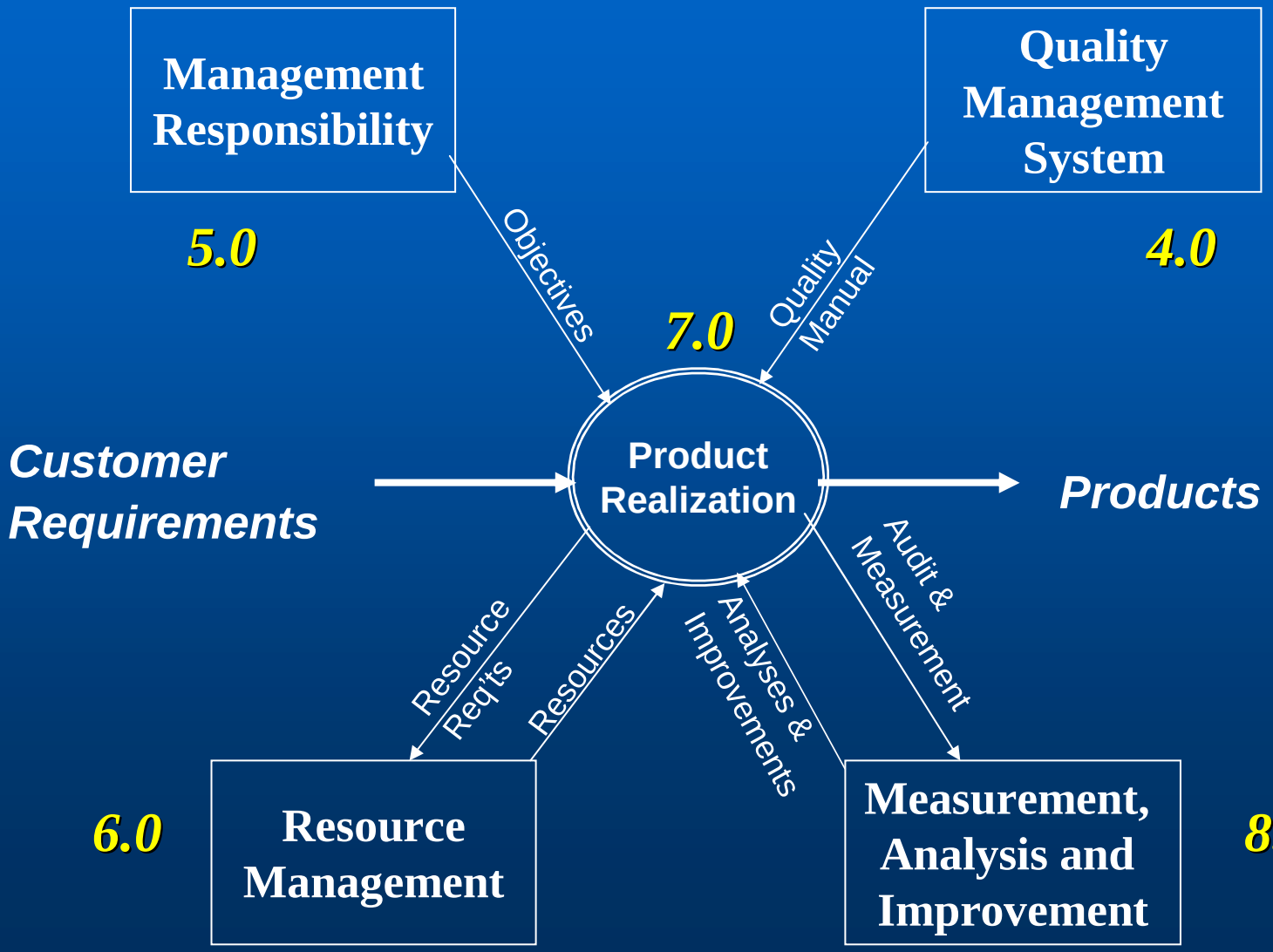
ISO 9000:2000 Principles

- Customer Focus
- Leadership
- Involvement of People
- Process Approach
- System Approach to Management
- Continual Improvement
- Factual Approach to Decision Making
- Mutually Beneficial Supplier Relationships

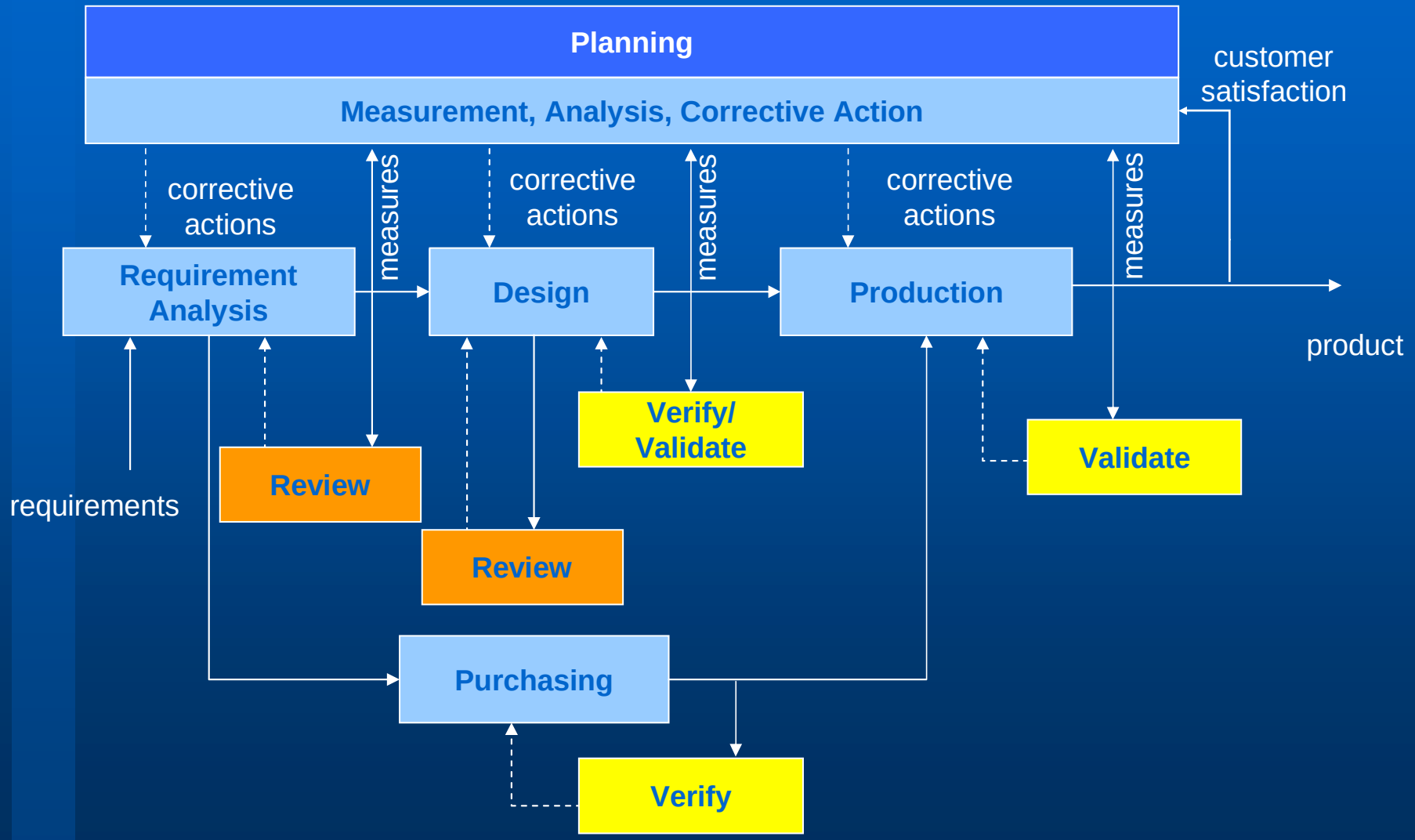
ISO 9001:2000

- Strong process and systems engineering approach
- Impact on process improvement
  - process improvement part of the standard
  - ISO 9004 is devoted to process improvement
- Significance in terms of systems/software engineering
  - easier comparison
  - interpretation of each major section/subsection

Interactions in ISO Processes



Systems & Process Engineering in ISO 9001:2000



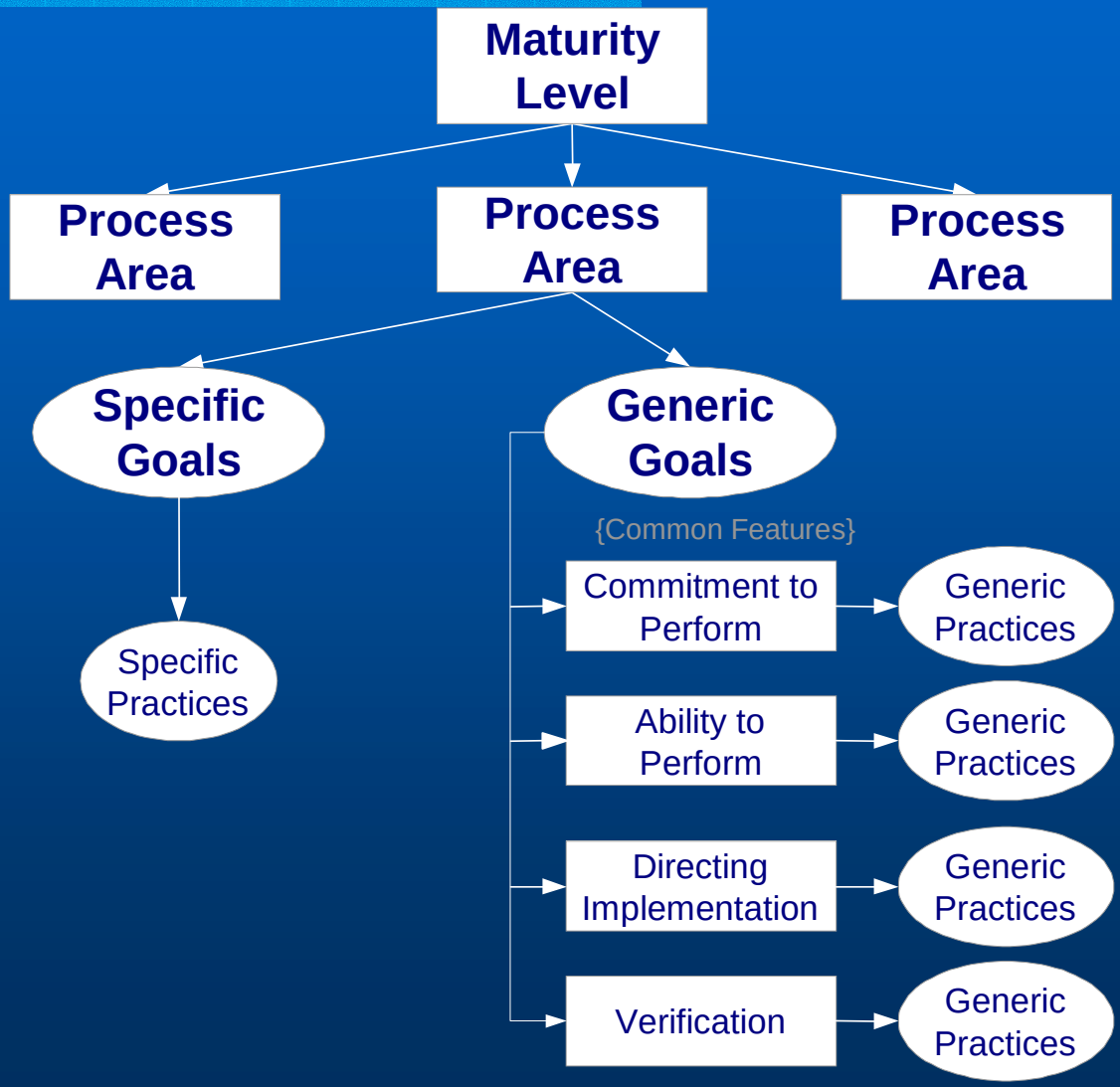
CMMI

- Based on predecessor models
- Addresses several bodies of knowledge
  - Systems engineering, software engineering, integrated product development, acquisition
- Identifies
  - Process Areas
  - Goals
  - Practices

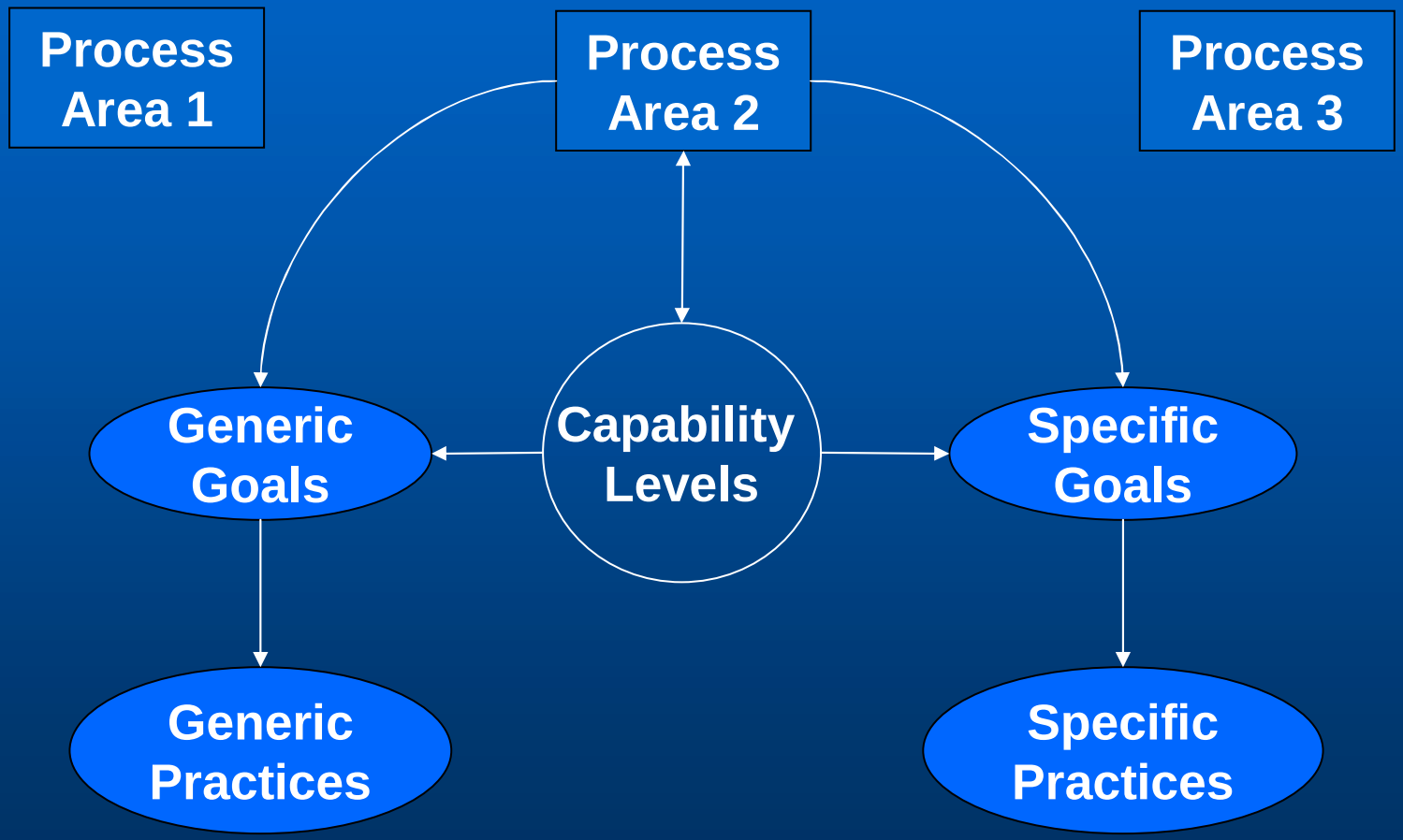
CMMI Structure

- **Representations**
  - **Staged**
  - **Continuous**
- **Generic Goals**
  - **Associated with Maturity or Capability Level**
  - **Generic Practices / Common Features**
- **Specific Goals**
  - **Associated with Process Area (PA)**
  - **Specific Practices**

Staged Representation



Continuous Representation



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Concepts of ISO-CMMI Synergy

- **Similarities / Differences**
- **Terminology Translation**
- **Where is the Synergy?**
- **Synergy is built on the differences**
  - **One framework's strengths helps the other framework's weaknesses**
- **Interpreting ISO with the CMMI**
  - ***mapping GPs/PAs***
  - ***Give each section and interpret***
- **Significance of Institutionalization**

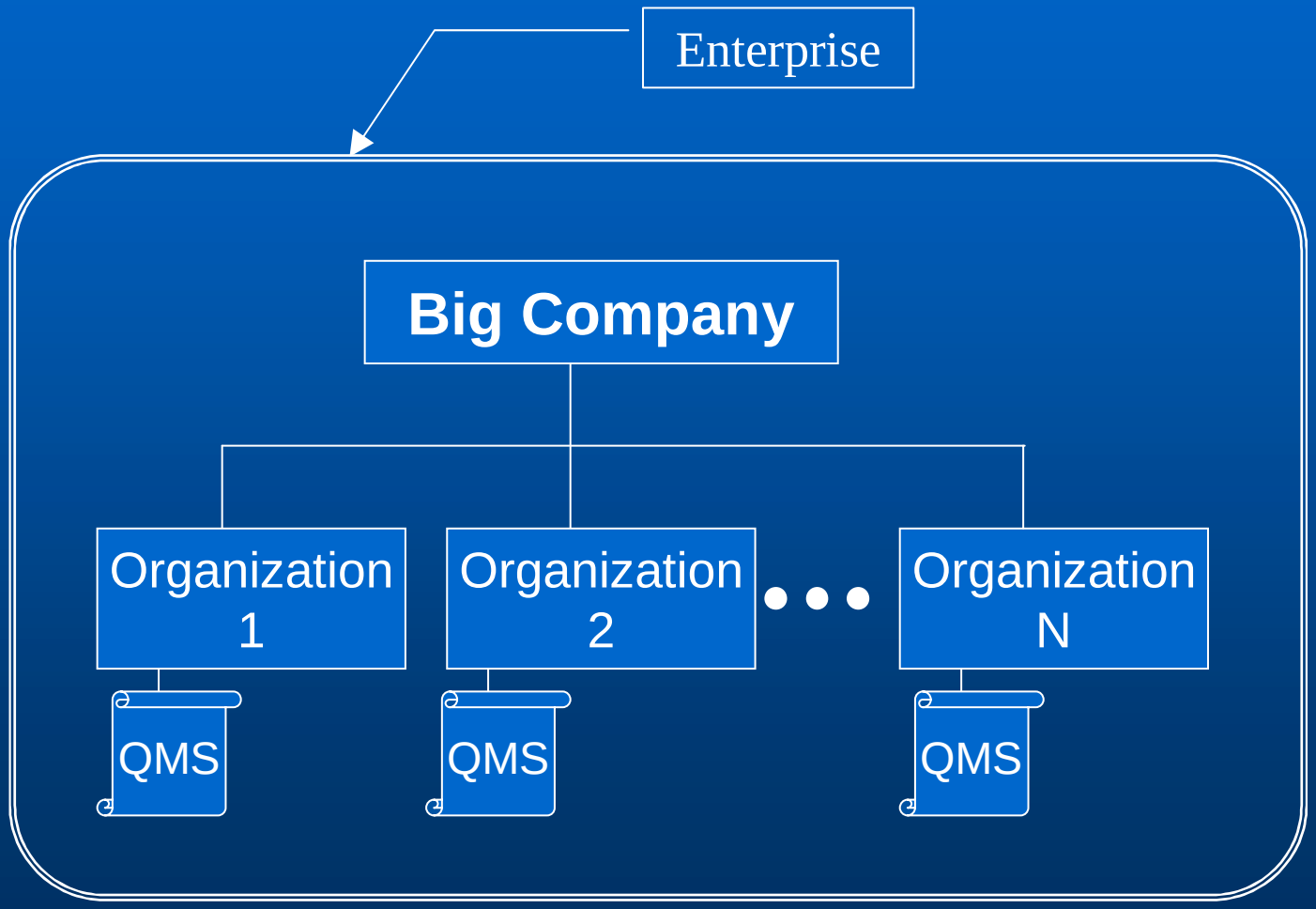
Similarities - Differences

ISO 9001:2000	CMMI
Standard	Model
Broad direction	Detailed
One set of requirements to be satisfied	Progressive steps (levels)
No guidelines for implementation	Institutionalization and implementation guidance
Requires interpretation for organizations with many programs	Accommodates organizations with many programs

Terminology Translation: ISO to CMMI

ISO 9001:2000	CMMI
• Top Management	• Higher-level management; senior management
• Quality Management System (QMS); Quality Manual	• Organization's Set of Standard Processes (OSSP)
• Quality Plan	• Project Plan; Software Development Plan; System Engineering Management Plan; Data Management Plan

Where's the QMS?



Terminology Translation: ISO to CMMI

ISO 9001:2000	CMMI
Customer; Interested Party	Customer; Stakeholder
Documented Procedure	Plan for performing the process; procedure
Record	Work product; record; evidence of implementation
Quality Management – very broad sense	Quality Management – quantitative management

Cross-references - Mapping

- Helps visualize commonalties and differences
  - but misses underlying principles
- Based on “subjective” interpretations
  - Many views of commonalties/differences
- Mapping at very high or very low level means “everything” matches
- Helps initial interpretation of one framework in terms of another (less familiar) framework
  - must understand both to be successful
- Two consistent maps were developed
  - ISO to CMMI (source); CMMI to ISO (derivative)

Cross-references - Mapping Rules

Our Approach:

- **Mapping developed at the ISO "shall" level and the CMMI practice-level**
  - **If there is correspondence, use only the major match**
  - **If correspondence is weak, use several potential matches**
- **Ground Rule: Do not force a match**

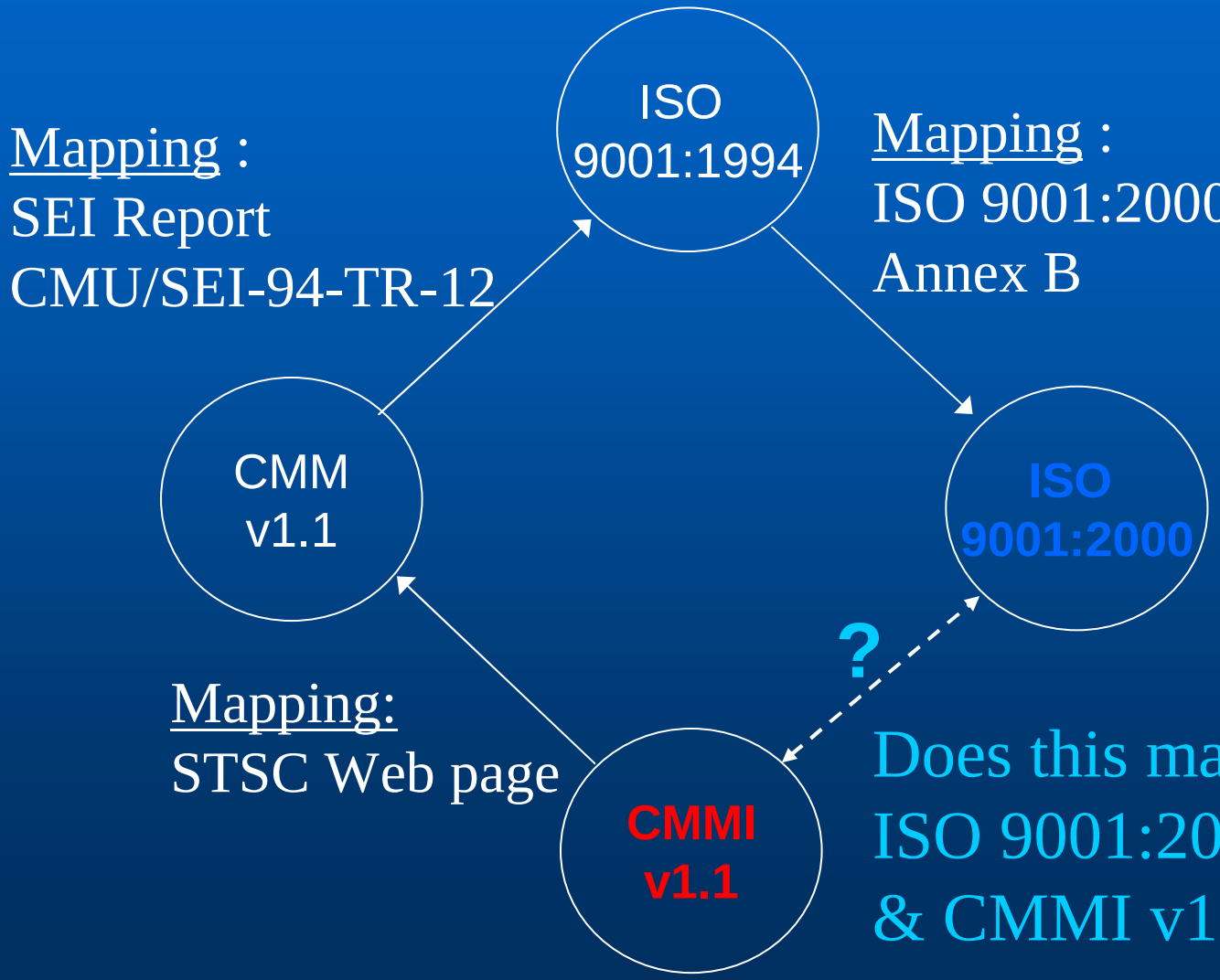
The quest for synergy should not obscure differences between frameworks

Cross-references - Mapping Rules

Our Approach (cont'd):

- **What happens to ISO requirements that were not mapped to CMMI?**
  - **Supplementary procedures must be considered to satisfy that specific requirement**
- **Feedback from reviewers**
  - **some feedback received and incorporated**
  - **completeness; usefulness**
  - **need more feedback after using the approach(es)**

Do Mappings Show Correspondence?



ISO - CMMI Relationships

ISO:
Quality Management System

CMMI:
OPF, OPD, PP, PPQA, CM, SAM;
GP 2.1, 2.2, 2.3, 2.6, 2.7, 2.8, 2.9, 3.1, 3.2

ISO:
Resource Management
CMMI:
PP, OT, OEI;
GP 2.3, 2.5

ISO:
Management Responsibility
CMMI:
OPF, OPD, RD, PMC, OPP, QPM;
GP 2.1, 2.2, 2.3, 2.4, 2.6, 2.7, 2.10, 3.1

ISO:
Product Realization
CMMI:
REQM, RD, TS, PI, MA, QPM, VER, VAL, OPD, PP, PMC, IPM, CM, SAM;
GP 2.1, 2.2, 2.3, 2.4, 2.6, 2.7, 2.8, 2.9, 2.10, 3.1

ISO:
Measurement, Analysis & Improvement
CMMI:
PMC, PPQA, MA, CM, REQM, RD, SAM, OPF, VER, VAL, OID, OPP, QPM, CAR;
GP 2.1, 2.2, 2.4, 2.6, 2.8, 2.9, 3.2

Similarities - 8 ISO Principles

- **Customer Focus**
  - **GP 2.7, *Identify and Involve Relevant Stakeholders***
  - **PP SP 2.6, *Plan Stakeholder Involvement***
  - **RD, TS**
  - **CMMI is not as strong as ISO**
- **Leadership**
  - **GP 2.1, *Establish an Organizational Policy***
  - **GP 2.4, *Assign Responsibility***
  - **GP 2.10, *Review Status with Higher Level Management***
  - **OPF**

Similarities - 8 ISO Principles

- **Involvement of People**
  - **GP 2.3, *Provide Resources***
  - **GP 2.5, *Train People***
  - **GP 2.7, *Identify and Involve Relevant Stakeholders***
- **Process Approach**
  - **GP 2.2, *Plan the Process***
  - **GP 3.1, *Establish a Defined Process***
  - **OPD, IPM**
- **System Approach**
  - **GP 3.1, *Establish a Defined Process***

Similarities - 8 ISO Principles

- **Continual Improvement**
  - **Focus of entire CMMI through capability and maturity levels**
- **Factual Approach to Decision Making**
  - **GP 2.8, *Monitor and Control the Process***
  - **PMC, MA, IPM, DAR**
- **Mutually Beneficial Supplier Relationships**
  - **SAM**
  - **CMMI is less specific about “collaboration”**
  - **CMMI is more concerned with “control”**

Differences

- **Language**
  - **ISO uses “shall” statements (prescriptive); CMMI doesn’t**
  - **Compactness of statements in ISO**
    - **e.g., “determine and provide resources” which is implemented in CMMI with GP 2.2 and GP 2.3 in all PAs)**
- **Details**
  - **ISO is very sparse**
  - **CMMI provides practices, subpractices, typical work products, & amplifications**

Differences

- **Guidance**
  - **ISO has not provided detailed implementation guidance**
  - **CMMI has Capability Levels and Maturity Levels**
- **Process Improvement**
  - **ISO 9004:2000 provides very high level guidance for process improvement**
  - **CMMI is devoted to process improvement**
    - **Distinguishes Organization and Project level process improvement activities**

Differences

- **Institutionalization**
  - **ISO requires organizations to establish QMS but does not explicitly require institutionalization**
    - **building strong process infrastructure is left to the organization**
  - **CMMI very strongly emphasizes institutionalization through Generic Goals and Generic Practices**

This is a major strength of the CMMI and is critical to overall process improvement success

Synergy

- When attempting to satisfy ISO requirements, must consider:
  - Generic Goals / Practices
  - Process Areas
- For the continuous representation, understanding the relationship between the GPs and PAs is very important
  - These relationships help even when using the staged representation

Synergy – Generic Practices

- **ISO requirements are related to *all* Generic Practices**
- **Implication of correspondence: although not explicitly required, ISO espouses institutionalization**
- **Reverse is also true: use of GPs and explicit CMMI institutionalization requirements enables more resilient ISO processes**

Synergy - Section 4 & PAs

- **ISO Section 4 - contains basic requirements for establishing, documenting, implementing, maintaining and improving the QMS.**
  - **Most other ISO sections refer to this section.**
  - **Most requirements are satisfied by the OPD PA**
  - **OPD is more detailed:**
    - **OSSP and tailoring**
    - **Process Asset Library and Measurement Database**
    - **ML 3 PA which enables other PAs**

Synergy - Section 4 & PAs (cont.)

- **Requirement to manage processes using QMS is equivalent to GP 2.1 (or GP 3.1) which will benefit OPD implementation**
- **Other ISO requirements:**
  - **Outsourcing - satisfied by SAM (SP 1.3, 2.2)**
  - **Controlling documentation - GP 2.6 and CM PA**
  - **Controlling records - PP SP 2.3, *Plan for Data Management* will help fulfill this requirement**

Synergy - Section 5 & PAs

ISO Section 5 - Management Responsibility

- Management must provide commitment to QMS and its continual improvement
- Must satisfy requirements and enhance customer satisfaction
- Need to establish quality policy, quality objectives, responsibilities and authorities, QMS reviews
  - GPs listed above
  - difference between ISO “senior management” and CMMI “organization” - but have the same spirit

Synergy - Section 5 & PAs

- **ISO Section 5 (continued)**
  - **"quality objectives" found in OPP SP 1.3**
  - **"Management Representative" equivalent to the CMMI "Management Council"**
    - **CMMI has 2nd tier of responsibility: the "EPG"**
  - **"Customer Focus" established by RD PA and GP 2.7, *Identify and Involve the Relevant Stakeholders***
  - **"Continual Process Improvement" - OPF**
  - **"Process Review" - GP 2.10, PMC SP 1.6, *Conduct Progress Reviews* & SP 1.7, *Conduct Milestone Reviews*, including SG 2, *Manage Corrective Actions to Closure***

Synergy - Section 6 & PAs

ISO Section 6 - Resource Management:

- Resources required for
  - developing, implementing, monitoring and improving the QMS
  - addressing customer requirements and customer satisfaction.
- Resource management functions generally distributed throughout the organization
- ISO distinguishes human resources and infrastructure resources

Synergy - Section 6 & PAs

- **ISO Section 6 (continued)**
  - **GP 2.3, *Provide Resources***
  - **GP 2.5, *Train People***
  - **OT PA**
  - **PP SP 2.4, *Plan Project Resources* & SP 2.5 *Plan for Needed Knowledge and Skills***
  - **OEI SP 1.2, *Establish an Integrated Project Environment* (" … physical infrastructure that people need to perform their jobs effectively.")**

Synergy - Section 7 & PAs

ISO Section 7 - Product Realization:

- **Largest section in the ISO standard, Subdivided into:**
  - **planning,**
  - **customer related processes,**
  - **design and development,**
  - **purchasing,**
  - **production and service provision, and**
  - **control of monitoring and measuring devices**

Synergy - Section 7 & PAs

- **ISO Section 7 - *Planning***
  - **In CMMI terms, this is the implementation of the project's defined process**
  - **GP 2.2 (and GP 3.1) in each PA**
  - **PP SG 3 goes beyond the ISO requirement ("commitment to the plan")**
  - **IPM will benefit the organization, if implemented**
  - **QPM may help too**
    - **may be too difficult to implement "out of context"**

Synergy - Section 7 & PAs

- **ISO Section 7 - *Customer Related Processes***
  - **RD PA (SG 1, *Develop Customer Requirements* and SG 2, *Develop Product Requirements* are sufficient; SG 3, *Analyze and Validate Requirements* supplements the ISO requirements)**
  - **RM PA - manage changes**
  - **Requirements review - GP 2.7, 2.9, 2.10; PMC, PPQA, VER**
  - **Customer Communication: RD PA, GP 2.7; IPM SG 2, *Coordinate and Collaborate with Relevant Stakeholders***
  - **MA PA**

Synergy - Section 7 & PAs

- **ISO Section 7 - *Design and Development***
  - **GP 2.2, 2.8, and 2.9 in RD, RM, TS, VER, VAL provide planning, monitoring & control, and reviews**
  - **PP, PMC cover design & development planning and re-planning; IPM provides additional support**
  - **Interfaces between the groups covered by GP 2.7 in TS, PI, VER, and VAL PAs; IPM SG 2, (and IPM IPPD SG 3 & 4) also address this requirement**
  - **Reviews addressed by PMC, VER and VAL PAs**
  - **Controlling design implemented by GP 2.6 in TS, PI, VER and VAL, and CM PA**

Synergy - Section 7 & PAs

- **ISO Section 7 - *Purchasing***
  - **SAM PA**
  - **SP 1.1, 1.2, 1.3, and SP 2.4 in the TS PA (selection of alternative solutions)**
  - **CMMI does not require verification at the supplier premises**
  - **CMMI discusses transitioning of the products from the supplier to the project, not found in ISO**

Synergy - Section 7 & PAs

- **ISO Section 7 - *Production / Service Provision***
  - **Spirit of requirement satisfied by TS, PI, VER and CM PAs**
  - **CMMI is weaker (replication, delivery, installation, post-delivery)**
  - **Identification & traceability satisfied by RM SP 1.4, *Maintain Bidirectional Traceability of Requirements***
  - **Customer property not addressed by CMMI (implemented to some extent by CM PA)**
  - **Preservation of product not addressed in CMMI**

Synergy - Section 7 & PAs

- **ISO Section 7 - *Control of Monitoring and Measuring Devices***
  - **No CMMI-equivalent for**
    - **“calibration of measurement equipment”**
    - **“assessing the impact of the malfunctioning equipment”**
  - **ISO 9000-3 (draft) interprets this as validation of development & analysis tools**

Synergy - Section 8 & PAs

ISO Section 8 - Measurement, Analysis and Improvement

- Most measurement requirements are in this section
- Other sections also address measurements, monitoring, and analysis.
- Used to identify improvements
- Similar to the MA PA
  - planning measurements and analysis
  - definition of measurements & analysis techniques

Synergy - Section 8 & PAs

- **ISO Section 8 (continued)**
  - **Customer satisfaction**
    - **Not prominently required by CMMI**
      - **customers are "stakeholders"**
    - **Measurement of customer satisfaction not explicitly required in CMMI**
  - **Internal Audit**
    - **OPF, PPQA; GP 2.8, *Objectively Evaluate Adherence* in all PAs**
    - **Selection of auditors not explicitly addressed by CMMI, but is addressed in SCAMPI**

Synergy - Section 8 & PAs

- **ISO Section 8 (continued)**
  - **Monitoring and Measurement of Process**
    - **Addressed in MA, PMC, PPQA, and QPM PAs**
  - **Monitoring and Measurement of Product**
    - **Addressed in VER, VAL, RM**
    - **SAM for "purchased products"**
    - **Release and integrity, and configuration audits covered by the CM PA**

Synergy - Section 8 & PAs

- **ISO Section 8 (continued)**
  - **Control of Nonconforming Product**
    - **Addressed in VER and VAL PAs**
    - **CM ensures that product release is authorized**
  - **Analysis of Data**
    - **Addressed in MA, VER, VAL, & OPF PAs**
    - **RD addresses analysis of requirements**
    - **SAM addresses analysis of data obtained by monitoring suppliers**
    - **OPP and QPM go even further by using quantitative management and SPC**

Synergy - Section 8 & PAs

- **ISO Section 8 (continued)**
  - **Continual improvement**
    - **OPF and MA**
    - **OID (ML 5) may also help**
  - **Corrective Action**
    - **OPF addresses process improvement corrective actions**
    - **PPQA, PMC, and CAR (ML 5) address process and product corrective actions**

Synergy - Section 8 & PAs

- **ISO Section 8 (continued)**
  - **Preventive Action**
    - **OPF addresses preventive actions related to process improvement**
    - **CAR and PPQA address (to some extent) other process preventive actions**

Institutionalization

- **CMMI requires institutionalization**
  - **will enhance ISO requirements and enable effective processes**
- **CMMI advocates a strong infrastructure on which all practices are built**
  - **Generic Goals / Practices**
  - **Gradual capability build-up**
  - **Organizational PAs (OPF, OPD, OT)**
  - **IPPD processes**

Summary of ISO Requirements not Covered by the CMMI

- Appointing management representative
- Internally communicating the effectiveness of the QMS (OSSP)
- Requiring validation prior to delivery or implementation of the product
- Verification of suppliers at their premises
- Handling of customer property
- Control and monitoring of measurement devices

Summary of ISO Requirements not Covered by the CMMI

- Defining a method for obtaining and using customer satisfaction information
- Establishing internal audit criteria, scope, frequency, and methods
- Independence of auditors
- Determining the appropriateness of preventive actions to be commensurable with the effects of potential problems

Discussion

- Are there additional differences between ISO and the CMMI?
  - Can they be explored for process improvement?
  - What are the biggest differences / similarities?
- At this point, do you feel that there is synergy between ISO and the CMMI?

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Differences Between the Legacy and Revised Frameworks

- **Differences between**
  - **CMM and CMMI**
  - **ISO 9001:1994 and ISO 9001:2000**

Transition will be easier for organizations that made process improvement a way of life, instead of aiming at ISO registration or a CMM maturity level

Major Differences Between CMM and CMMI

- **Two representations**
  - **Staged vs. Continuous**
    - **Constagedeous**
    - **Equivalent staging**
- **Institutionalization**
  - **Structure of Common Features**
    - **Generic Practices & Generic Goals**
- **Key Process Areas vs. Process Areas**
  - **Additional PAs in the CMMI**
- **At higher maturity levels, CMM vs. CMMI differences are less important**

Comparison of Common Features

SW CMM v1.1

- Commitment to Perform
  - Establish Organizational Policy
- Ability to Perform
  - Provide Resources
  - Assign Responsibility
  - Train People
- Activities Performed
  - Plan the Process
  - Perform the Process
  - Monitor and Control the Process
- Measurement and Analysis
  - Measure the Process
  - Analyze the Measurements
- Verifying Implementation
  - Review with Sr. Management
  - Review with Project Management
  - Review with SQA

CMMI – SW/SE

- Commitment to Perform
  - Establish Organizational Policy
- Ability to Perform
  - Plan the Process
  - Provide Resources
  - Assign Responsibility
  - Train People
  - Establish a Defined Process (ML 3)
- ***Specific Practices***
- Directing Implementation
  - Manage Configurations
  - Identify & Involve Relevant Stakeholders
  - Monitor and Control the Process
  - Collect Improvement Information
- ***(Measurement & Analysis PA)***
- Verifying Implementation
  - Review with Higher Level Mgmt
  - Objectively verify adherence

Summary of Differences - Common Features

- **Common Features now clearly indicate institutionalization**
  - **process should be planned**
  - **resources available & staff trained**
  - **responsibilities assigned**
  - **monitored/controlled**
  - **under CM**
  - ***stakeholders identified***
  - **reviewed with SQA and higher management**
- **Defined process established and improvement information collected at ML 3**

CMM v1.1 vs. CMMI - Level 2

Software CMM v1.1

Level 2 - Repeatable

- Requirements Management
- Software Project Planning
- Software Project Tracking and Oversight
- Software Subcontract Management
- Software Quality Assurance
- Software Configuration Management

CMMI

Level 2 - Managed

- Requirements Management
- Project Planning
- Project Monitoring and Control
- Subcontract Agreement Management
- Process and Product Quality Assurance
- Configuration Management
- *Measurement and Analysis*

CMM v1.1 vs. CMMI - Level 3

Software CMM v1.1
Level 3 - Defined

- Organization Process Focus
- Organization Process Definition
- Training Program
- Integrated Software Management
- Software Product Engineering
- Intergroup Coordination
- Peer Reviews

CMMI
Level 3 - Defined

- Organization Process Focus
- Organization Process Definition
- Organizational Training
- Integrated Project Management
- *Risk Management*
- *Requirements Development*
- *Technical Solution*
- *Product Integration*
- *Verification*
- *Validation*
- *Decision Analysis and Resolution*

CMM v1.1 vs. CMMI - Level 4 & 5

Software CMM v1.1

Level 4 - Managed

- Quantitative Process Management
- Software Quality Management

Level 5 – Optimizing

- Defect Prevention
- Technology Change Management
- Process Change Management

CMMI

Level 4 - Quantitatively Managed

- Organizational Process Performance
- Quantitative Project Management

Level 5 – Optimizing

- Causal Analysis and Resolution
- Organizational Innovation and Deployment

Summary of Differences - Process Areas

- **Process areas were "realigned"**
  - **some were expanded (SSM, SPE, ISM)**
  - **some were folded into others (IC, PR, TCM, PCM)**
- **New Process Areas**
  - **Measurement and Analysis**
  - **Decision Analysis and Resolution**
- **Many subtle differences, for example:**
  - **Requirements traceability is now at ML 2**
  - **Data Management added to PP**
  - **Need to Plan for Knowledge and skills - now in PP**

Process Activities vs. Process Areas - Level 2

Activity	Associated Process Area
Build a plan	Project planning
Track performance against the plan	Project Monitoring and Control
Manage inputs to the plan	Requirements Management
Make sure the plan is followed	Process and Product Quality Assurance
Control the artifacts being created	Configuration Management
Get basic measurements in place	Measurement and Analysis
Manage your suppliers	Supplier Agreement Management

Process Activities vs. Process Areas - Level 3

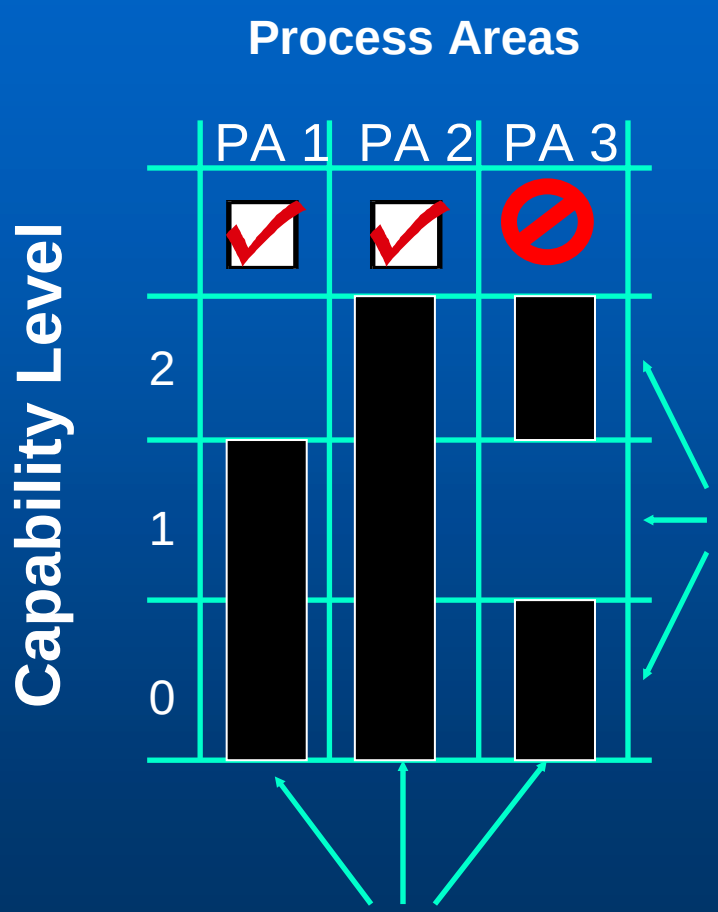
Activity	Associated Process Area
Provide an atmosphere for acceptance of standard processes	Organization Process Focus
Minimize unnecessary process variation	Organization Process Definition
Standardize engineering processes -- now protected by effective project management practices	Organization Process Definition, Requirements Development, Technical Solution, Product Integration, Verification, Validation
Extend project management	Integrated Project Management, Risk Management
Provide engineering and mgmt decision making support	Decision Analysis and Resolution
Ensure organizational knowledge of standard processes	Organizational Training

Continuous Representation

Is there really more freedom
with the Continuous Representation?

- **Capability levels of individual PAs**
- **Dependence of GPs on the PAs, for example:**
  - **GP 2.6, *Manage Configurations* enabled by CM PA**
  - **GP 2.9, *Objectively Evaluate Adherence* enabled by PPQA PA**
  - **GP 3.1, *Establish a Defined Process* subsumes IPM PA**
- **Concept of Threads**
  - **Points to an "optimum" GP-PA-GP relationship**

Capability Levels Cannot be Skipped



Capability Levels are Cumulative

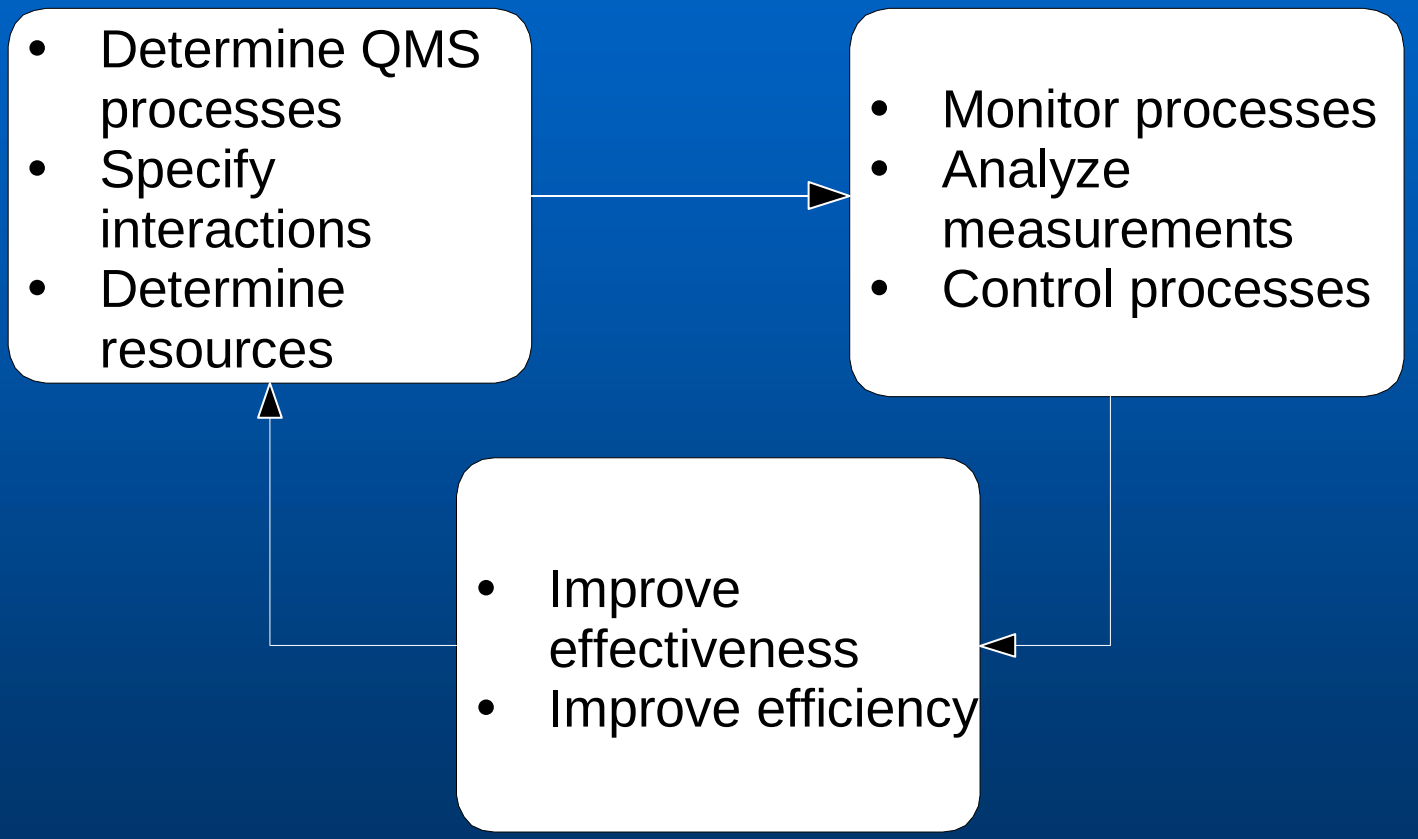
Generic Goals & Generic Practices

Specific Goals & Specific Practices

ISO 9001:2000
Section 4 Changes

- **4.1, General requirements**
  - **The Quality Management System must now describe processes, measurement, and improvement as a system**
- **4.2.1, Documentation - general**
  - **Fewer documented procedures required**
  - **Must include documents related to planning, operation and control of processes**
  - **Extent based on organization's size, activity types, complexity and process interfaces.**

Quality Management as a Process



ISO Section 4 Changes

- **4.2.2, Quality manual**
  - Quality manual defines scope of QMS
  - Includes justification for any exclusions
  - Must describe interactions among processes
- **4.2.3, Control of documents**
  - No change; requires procedure for controlling documents
- **4.2.4, Control of records**
  - No change; records must remain legible, identifiable, and retrievable
  - requires procedure for controlling documents

ISO Section 5 Changes

- **5.1, Management commitment**
  - Required for developing the QMS
  - Must provide the necessary resources
  - Ensure processes are continually improving
  - Communicate importance of meeting customer and regulatory and statutory requirements.
- **5.2, Customer focus**
  - Ensure that customer requirements are determined, understood, and met.
- **5.3, Quality policy**
  - Must be appropriate for the organization
  - Create framework for setting objectives

ISO Section 5 Changes

- **5.4.1, Quality Objectives**
  - Measurable and linked to quality policy
- **5.4.2, Quality management system planning**
  - Plans for developing QMS address all requirements including quality objectives and improvement
  - Maintain integrity of QMS when it is changed
- **5.5.2, Management representative**
  - Must ensure awareness of customer requirements
- **5.5.3, Internal communication**
  - Communicate QMS effectiveness.
- **5.6.2 and 5.6.3, Review input & Review output**
  - Specifies minimum review input items and output actions

ISO Section 6 Changes

- **6.1, Provision of resources**
  - Determine and provide resources needed to implement, maintain, and improve the QMS
- **6.2.2, Competence, awareness and training**
  - Determination of needed competencies is introduced
  - Emphasis on acting to close competency gaps and keeping employees aware of the importance of their work
- **6.3 and 6.4, Infrastructure & Work environment**
  - Determine and manage the infrastructure and work environment (such as buildings, workspace, or process equipment) needed for to meet product requirements

ISO Section 7 Changes

- **7.0, Product realization**
  - **Most 1994 requirements still included but are more generic**
- **7.1, Planning of product realization**
  - **Provides the essence of the process and system approaches: all processes are linked to result in delivery of products**
- **7.2.1, Determination of product requirements**
  - **Address product requirements not specified by the customer but necessary for the intended process**
- **7.2.3, Customer communication**
  - **New requirement for implementing customer communications**
- **7.5.2, Validation of production and service processes**
  - New requirement for defining process validation

ISO Section 8 Changes

- **8.2.1, Customer satisfaction**
  - **Requirement for measuring and monitoring customer satisfaction.**
- **8.2.2, Internal audit**
  - **Requires consideration of previous audits when planning new audits**
  - **Must define audit scope, frequency, and methodology**
  - **Auditors must be objective**
  - **Audits can identify improvement opportunities**
  - **Audit procedure is required**

ISO Section 8 Changes

- **8.3, Control of nonconforming product**
  - **Requires procedure for controlling non-conformances**
- **8.4, Analysis of data**
  - **Requires data analysis to**
    - **eliminate potential causes of nonconformity**
    - **determine suitability and effectiveness of the QMS**
    - **identify improvements to QMS**

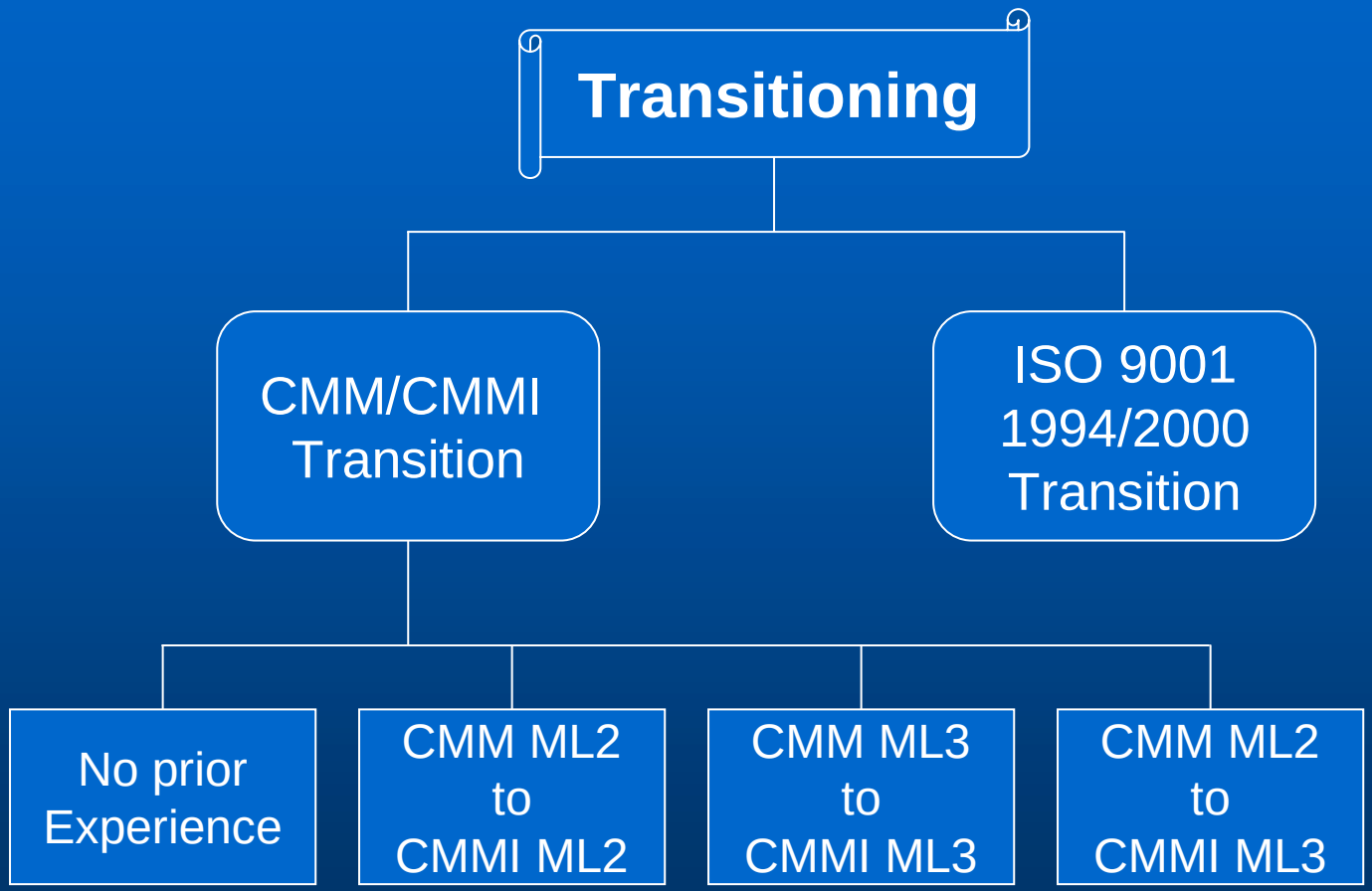
ISO Section 8 Changes

- **8.5.1, Continual improvement**
  - **Continual improvement must be planned and implemented.**
- **8.5.2, Corrective action**
  - **Once corrective action has been determined it must be implemented.**
  - **results of corrective action must be recorded**
  - **Requires a procedure for corrective action.**
- **8.5.3, Preventive action**
  - **Results of preventive actions must be recorded**
  - **Requires a procedure for preventive action**

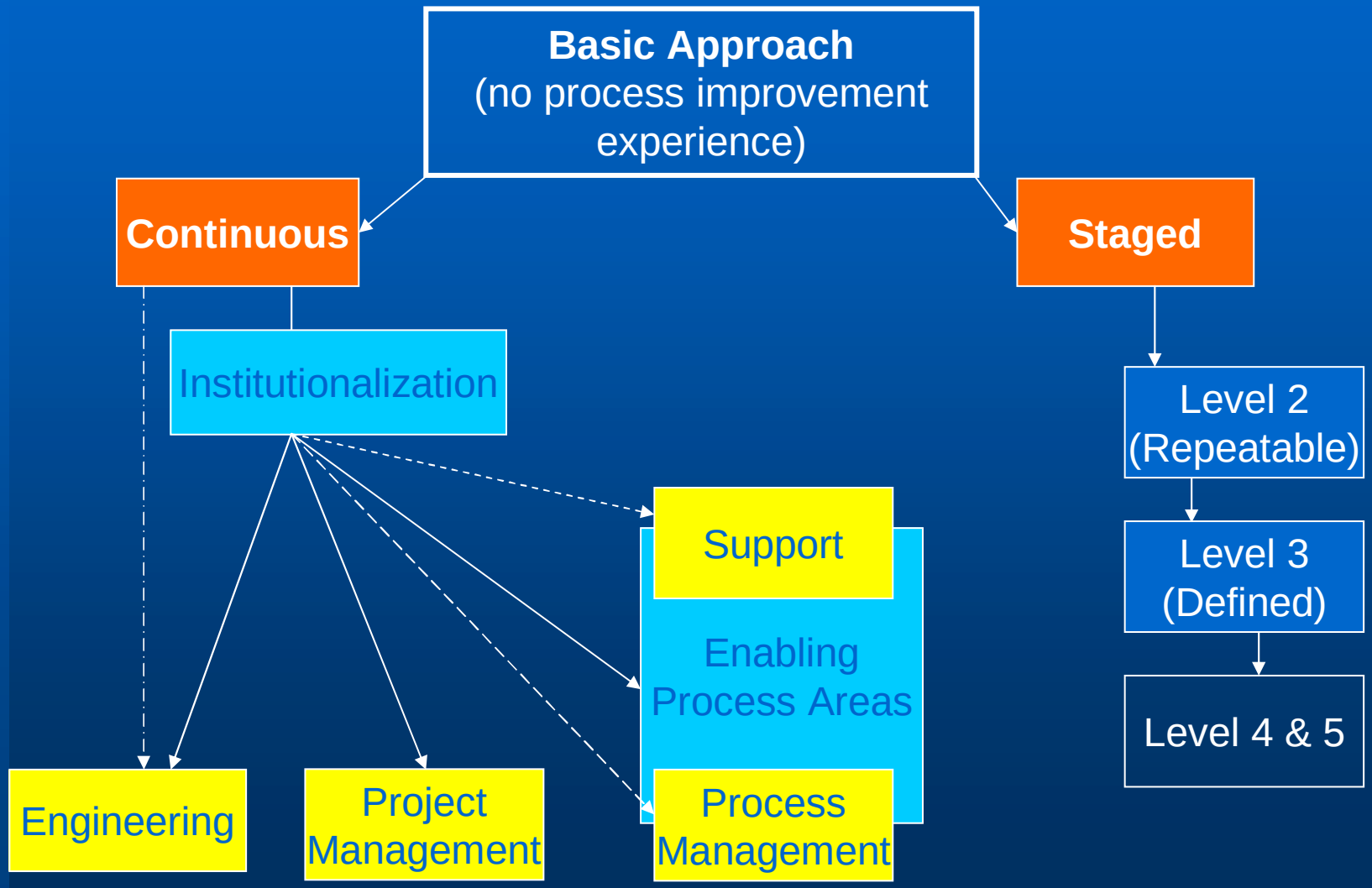
Agenda

- Introduction
- Process Improvement Approach
- Framework Overview
- Concepts of ISO-CMMI Synergy
- Changes from Legacy Standards
- Transitioning from Legacy Standards 
- Using ISO-CMMI Synergy for Process Improvement

Transitioning Cases



CMM to CMMI Transitioning Approaches



No Process Improvement Experience: Continuous Representation

- **Importance of GG1**
  - **All base practices (SP x.y-1) must be implemented**
  - **Only Engineering PAs have SP at different CLs**
- **Importance of GP - PA relationships**
  - **enabling PAs**
  - **subsuming PAs**
- **There is less freedom in implementing the Continuous Representation than appears on the surface**

Continuous Representation - Institutionalization

- **Establish infrastructure**
  - **Implement OPF**
  - **Establish policies (implement GP 2.1 for all PAs)**
  - **Plan process (implement GP 2.2)**
  - **Ensure resources (implement GP 2.3)**
  - **Assign responsibility (implement GP 2.4)**
  - **Train people (implement GP 2.5)**
- **Implement ML 2 PAs (needed to enable GPs)**
  - **PP, PMC, CM, PPQA and MA**
  - **Implement SAM (may implement just first two goals)**

Continuous Representation - Institutionalization

- **More infrastructure**
  - **Manage configurations (implement GP 2.6)**
  - **Monitor and control the process (implement GP 2.8)**
  - **Evaluate adherence (implement GP 2.9)**
  - **Identify & involve stakeholders (implement GP 2.7)**
  - **Perform senior management review (implement GP 2.10)**
- **Implement organizational PAs**
  - **OPF (SG 2), OPD, OT**

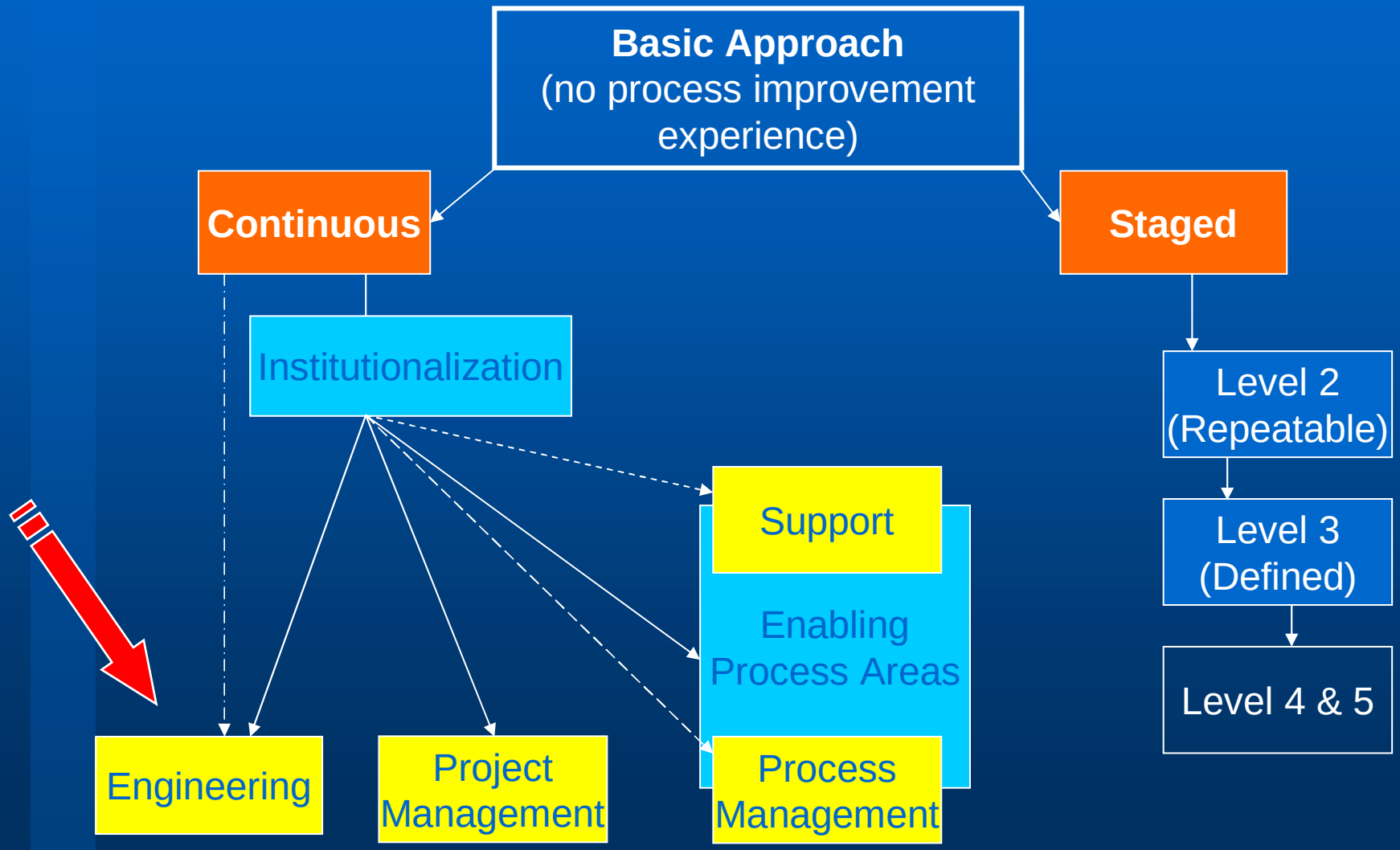
Continuous Representation - Institutionalization

- **Prepare for CL 3**
  - **Implement Integrated Project Management**
- **Establish CL 3 infrastructure**
  - **Institutionalize a Defined Process (implement GP 3.1)**
- **Execute processes (Implement Engineering PAs: REQM, RD, TS, PI, VER, VAL)**
- **Revisit all PAs to ensure that they operate at CL 3**
  - **collect improvement information (implement GP 3.2)**

Continuous Representation - Institutionalization: Discussion

- **How difficult this approach will be?**
  - **GG1 vs. GG2 vs. GG3**
  - **As shown, the approach gradually builds up**
- **Is it possible to set up OSSP (GP 3.1) for all PAs and implement IPM SP1, *Use the Project's Defined Process?***
  - **approach avoids revisiting PAs and revising processes**
  - **may be effective if the organization understands CMMI and is ready & committed to process improvement**

CMM to CMMI Transitioning Approaches



Continuous Representation - Engineering Process Areas

- **Many organizations have strong engineering processes**
  - **they may be operating at CL 1 or CL 2**
- **May be an effective approach for an organization without PI experience**
  - **helps overcome resistance to change**

Continuous Representation - Engineering Process Areas

- **Establish high-level commitment**
  - **Implement OPF**
  - **Establish policies (implement GP 2.1 for all PAs)**
- **Implement Base Practices for the Engineering PAs: REQM, RD, TS, PI, VER, VAL**
- **Establish infrastructure**
  - **Plan process (implement GP 2.2)**
  - **Ensure resources (implement GP 2.3)**
  - **Assign responsibility (implement GP 2.4)**
  - **Train people (implement GP 2.5)**

Continuous Representation - Engineering Process Areas

- **More infrastructure**
  - **Identify & involve stakeholders (implement GP 2.7)**
  - **Perform senior management review (implement GP 2.10)**
- **Implement PP and CM PAs**
  - **Establish configuration management for implemented PAs (GP 2.6)**
- **Implement PMC and MA**
  - **Monitor & control the process (implement GP 2.8)**

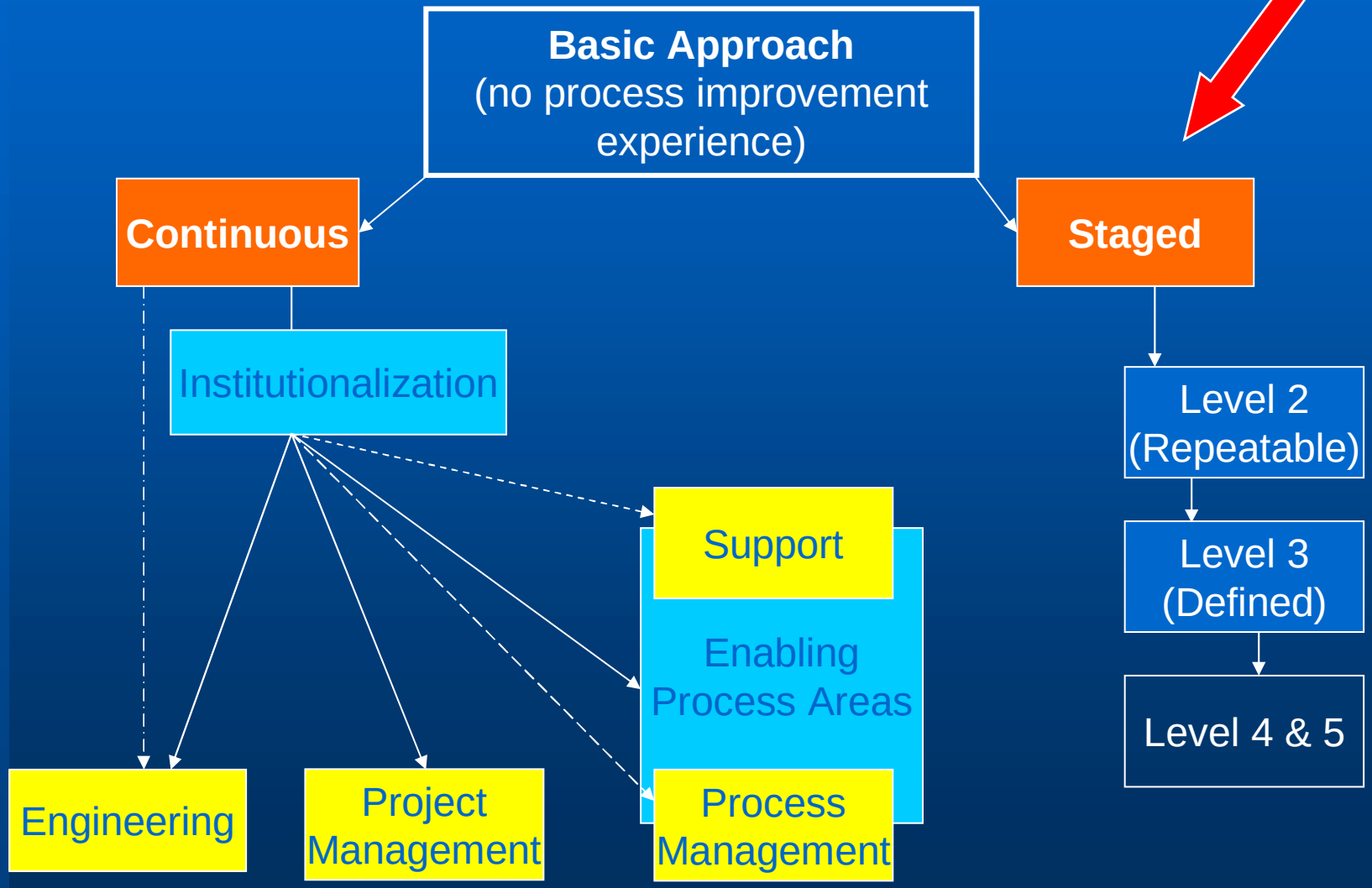
Continuous Representation - Engineering Process Areas

- **Implement PPQA**
  - **Evaluate adherence (implement GP 2.9)**
- **For each Engineering PA, implement SP x.y-2**
- **Prepare for CL 3**
  - **Implement OPF, OPD, OT and IPM**
- **Establish CL 3 infrastructure**
  - **Institutionalize a Defined Process (implement GP 3.1)**
  - **Collect improvement information (implement GP 3.2)**
- **Revisit PAs to ensure they operate at CL 3**

Continuous Representation - Engineering Process Areas: Discussion

- **How difficult will this approach be?**
  - **Elevating Engineering PAs to CL2 and CL3**
  - **As shown, the approach gradually builds up**
- **Is it possible to set up OSSP (GP 3.1) for all PAs and implement IPM SP1, *Use the Project's Defined Process?***
  - **Approach may be effective if the organization understands CMMI and is ready & committed to process improvement (avoids revisiting PAs and revising processes)**

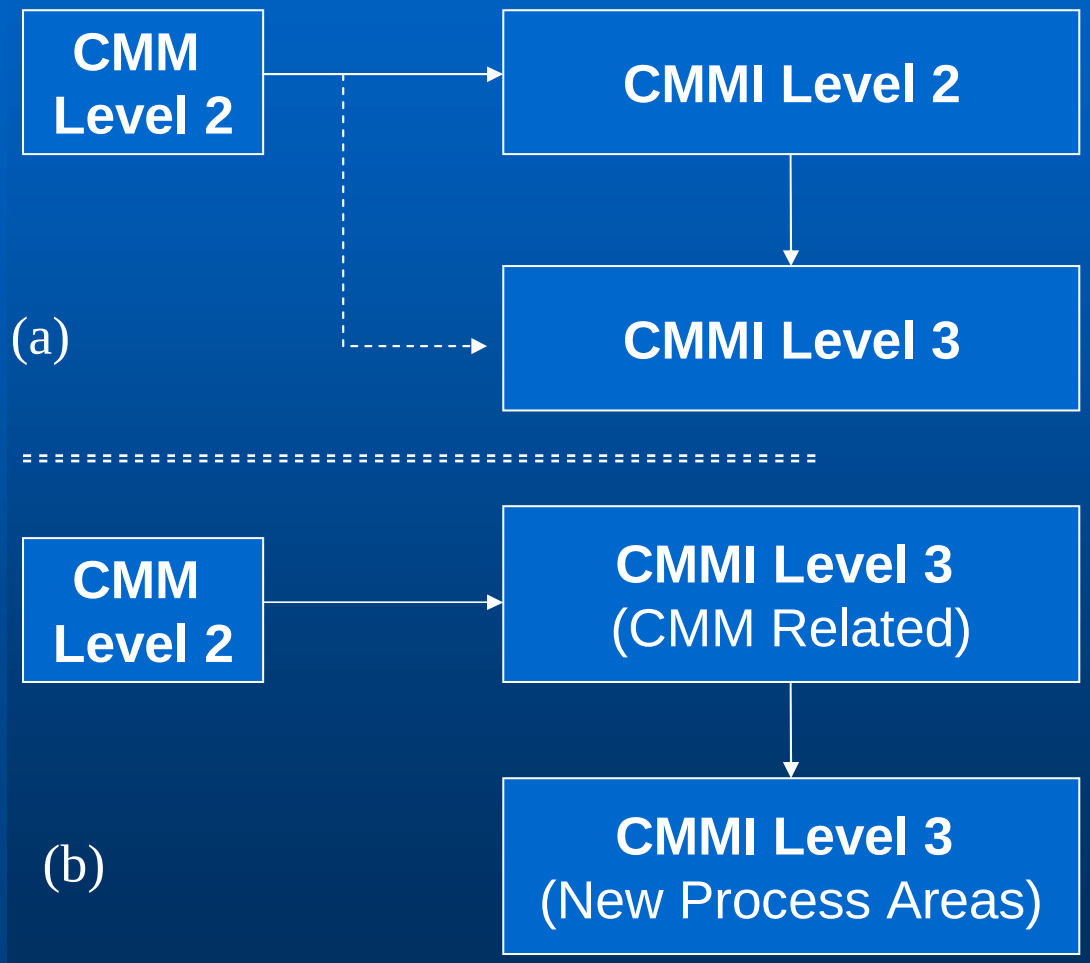
CMM to CMMI Transitioning Approaches



Staged Representation - No PI Experience: Discussion

- **Order of implementation is "fixed"**
  - **Start with ML 2, then ML 3, etc.**
- **Can we start with ML 3? "Parts" of ML 3?**
  - **Having the OSSP and implementing OPF, OPD, & IPM enables implementation of GG 3**
    - **avoids revisiting ML 2 PAs when attempting to achieve ML 3**
  - **What does an organization require to do that?**
    - **Can they implement Engineering PAs (ML 3) early?**

Organizations with Experience: Transitioning from CMM to CMMI



Each case requires a gap analysis to determine what needs to be done

Transitioning from CMM ML 2 to CMMI ML 2

- **Infrastructure**
  - **Ensure that infrastructure is still valid**
    - **include systems engineering on management council and engineering process group**
  - **Review and revise policies**
    - **systems engineering, new PAs**
  - **Evaluate and understand Common Features**
    - **account for differences from CMM**
- **Process Areas**
  - **Account for ML 2 CMMI PA - CMM KPA differences**
  - **Address Measurement and Analysis PA (new)**

Transitioning from CMM ML 2 to CMMI ML 2

- **Process Areas (continued)**
  - **For all CMMI ML 2 PAs**
    - **review process descriptions and associated plans, revise as necessary**
    - **ensure adequate resources**
    - **add new responsibilities where needed**
    - **identify and include stakeholders ("other groups" in CMM)**
    - **train staff in new policies, processes, plans**
    - **monitor and control the processes**
    - **periodically review with senior management and QA**

Transitioning from CMM ML 2 to CMMI ML 2 - Discussion

- **What seems to be the biggest transitioning problem?**
  - **New MA PA?**
  - **Additional Generic Goal?**
  - **Differences between CMM and CMMI PAs?**
  - **Where to put transitioning emphasis?**

Transitioning from CMM ML 3 to CMMI ML 3

- **Infrastructure**
  - **Ensure that the infrastructure is still valid**
    - **include systems engineering on management council and engineering process group**
  - **Review and revise policies**
    - **systems engineering, new PAs**
  - **Review/Revise OSSP and tailoring guidelines**
  - **Review implementation of IPM (integrated plans!)**
- **Process Areas**
  - **Account for ML 2 & 3 CMMI PA - CMM KPA differences**
  - **Address all new PAs**

Transitioning from CMM ML 3 to CMMI ML 3

- **Process Areas (continued)**
  - **For all CMMI ML 2 and 3 PAs**
    - **review process descriptions and associated plans, revise as necessary**
    - **ensure adequate resources**
    - **add new responsibilities where needed**
    - **identify and include stakeholders ("other groups" in CMM)**
    - **train staff in new policies, processes, plans**
    - **monitor and control the processes**
    - **collect improvement information**
    - **periodically review with senior management and QA**

Transitioning from CMM ML 3 to CMMI ML 3 - Discussion

- **What seems to be the biggest transitioning problem?**
  - **New / Expanded PAs?**
  - **Additional Generic Goals?**
  - **Differences between CMM and CMMI PAs?**
  - **Where to put transitioning emphasis?**

Transitioning from CMM ML 2 to CMMI ML 3

- **Infrastructure**
  - **Augment the infrastructure**
    - **include systems engineering on management council and engineering process group**
  - **Review and revise policies**
    - **systems engineering, new PAs**
  - **Establish OSSP and tailoring guidelines, process library and database**
  - **Implement OPF, OPD, and IPM**
  - **Review / Revise / Define process descriptions and develop required process plans**

Transitioning from CMM ML 2 to CMMI ML 3

- **Infrastructure (continued)**
  - Assigned responsibilities
  - Ensure adequate resources
  - Train staff in the new/revised processes
- **Process Areas**
  - Address MA PAs
  - identify and include stakeholders ("other groups" in CMM)
  - Review implementation of CMM ML 2 PAs from the CMMI ML 3 point of view to ensure that differences are addressed

Transitioning from CMM ML 2 to CMMI ML 3

- **Process Areas (continued)**
  - Make sure that configurations are managed
  - Monitor and control the processes
  - Develop and execute Engineering PAs
  - Collect improvement information
  - Periodically review with senior management and QA

Transitioning from CMM ML 2 to CMMI ML 3 - Discussion

- **What seems to be the biggest transitioning problem?**
  - **New / Expanded PAs?**
  - **Additional Generic Goals?**
  - **Differences between CMM and CMMI PAs?**
  - **Is the "jump" from CMM ML2 to CMMI ML 3 too big? What can go wrong?**
  - **Where to put transitioning emphasis?**
  - **Advantages / Disadvantages from the other cases**

Transitioning form ISO 9001:1994 to ISO 9001:2000

- **Transitioning appears to be more "monolithic" than CMM-to-CMMI transitioning**
  - **Very little ISO guidance**
    - **No indication what to do first, next**
  - **Lots of books on the subject**
- **Major theme**
  - **Organizations that built their QMS on 20 ISO 9001:1994 clauses may have difficulty transitioning to ISO 9001:2000 systems- and process-based requirements**
  - **No organization should start from scratch**

Transitioning Steps

- **Obtain management commitment**
  - **get wide participation (needed for both systems and software)**
- **Train staff in ISO 9001:2000**
  - **important to understand differences**
- **Perform gap analysis**
  - **determine what is missing**
- **Revise the QMS to conform to ISO 9001:2000**
  - **implementation of many clauses is still valid**
    - **ensure the newly required procedures are implemented**

Transitioning Steps

- **New requirement: determine processes and their interactions**
- **Train staff on new QMS, quality manual, procedures**
- **Re-run gap analysis**
  - **correct outstanding problems**
- **Transition steps are large**
  - **require a lot of work**
  - **organization must prioritize activities and develop manageable steps**

Transitioning - Summary

- **Transitioning approach must be based on PI goals/objectives and gap analysis results**
- **Cases presented are just indicators**
  - **there are as many "sub-classes" as there are organizations**
- **Organizations must preserve their process improvement investments**
  - **base transition on the similarities of the legacy and revised frameworks**

Agenda

- Introduction
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- Concepts of ISO-CMMI Synergy
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Putting It All Together

- **At this point we have:**
  - **selected a problem solving process - IDEAL**
  - **selected two major frameworks (ISO 9001 & CMMI)**
  - **explored ISO 9001 and CMMI synergy**
  - **outlined changes from legacy standards**
  - **described transitioning from legacy standards**

- **Now, we can address the process improvement approach using:**
  - **the problem solving process, and**
  - **ISO 9001 & CMMI synergy**

I - Initiating Phase

- **Establish process improvement sponsorship**
  - **CMMI OPF distinguishes:**
    - **senior management support**
    - **implementation support vested in the engineering process group**
- **Set process improvement goals & objectives:**
  - **reduce time to market**
  - **increase productivity**
  - **improve delivery timeliness and predictability**
  - **reduce number of delivered defects**
  - **increase market share**
  - **achieve ISO registration and/or CMMI maturity level (this should NOT be the only goal)**

D - Diagnosing Phase

- **Perform a gap analysis**
  - **ISO pre-registration gap analysis**
    - **No standard reporting format**
  - **SCAMPI Class A, B, C**
    - **Class C - adequate for experienced organizations**
    - **Class A - preferred for inexperienced organizations (easier to get staff buy-in)**
- **Gap Analysis report(s) will be used in process improvement planning**
  - **SCAMPI report is quite detailed**

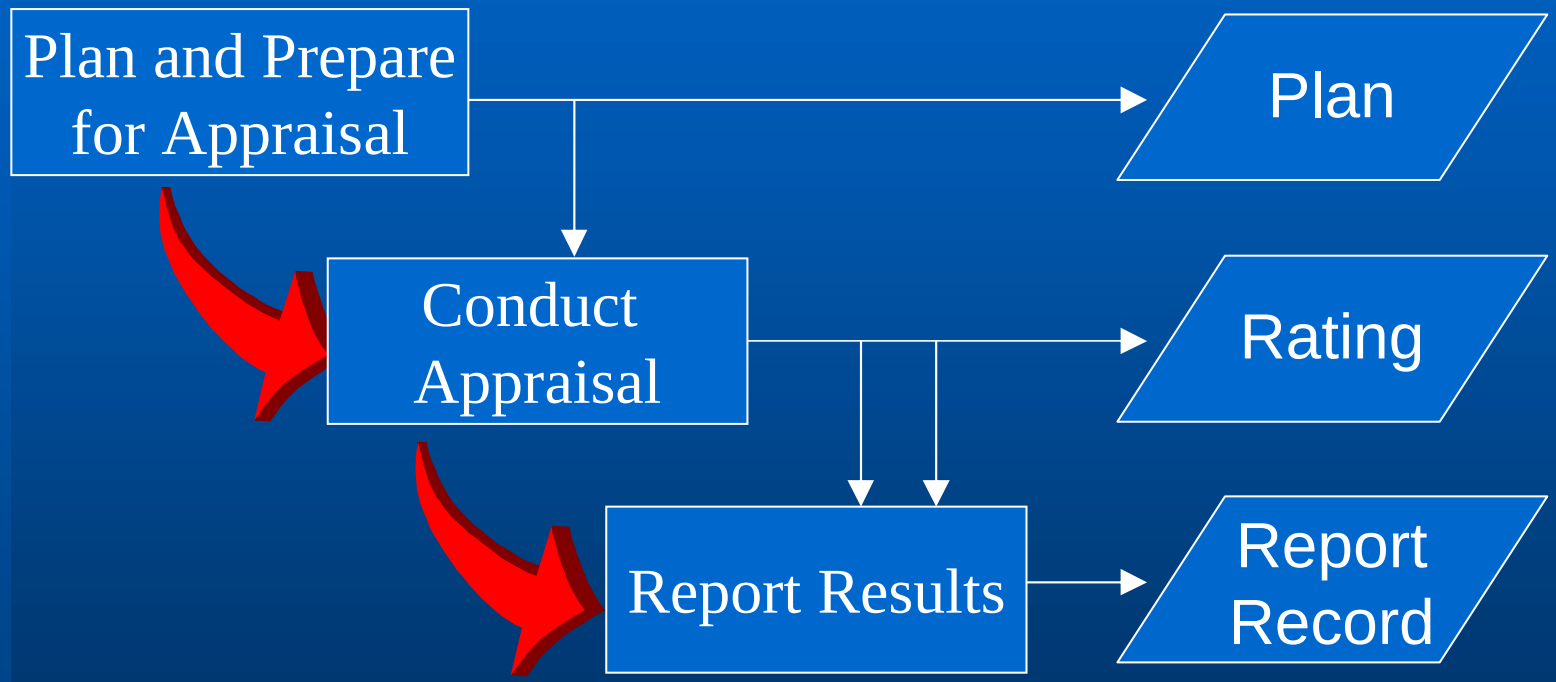
Appraisal / Registration

- **In Diagnosing Phase**
  - **ISO Pre-Registration gap analysis**
  - **SCAMPI^{SM} - Class A, B, C**
- **Is there synergy between those diagnosing tools?**
  - **Intuitively - YES, but not yet proven**
  - **May use SCAMPI to prepare for the ISO registration**

Selecting a Gap Analysis Method

- **Characteristics**
  - **Accuracy**
  - **Repeatability**
  - **Maturity / Capability Level ratings**
  - **Duration / Cost**

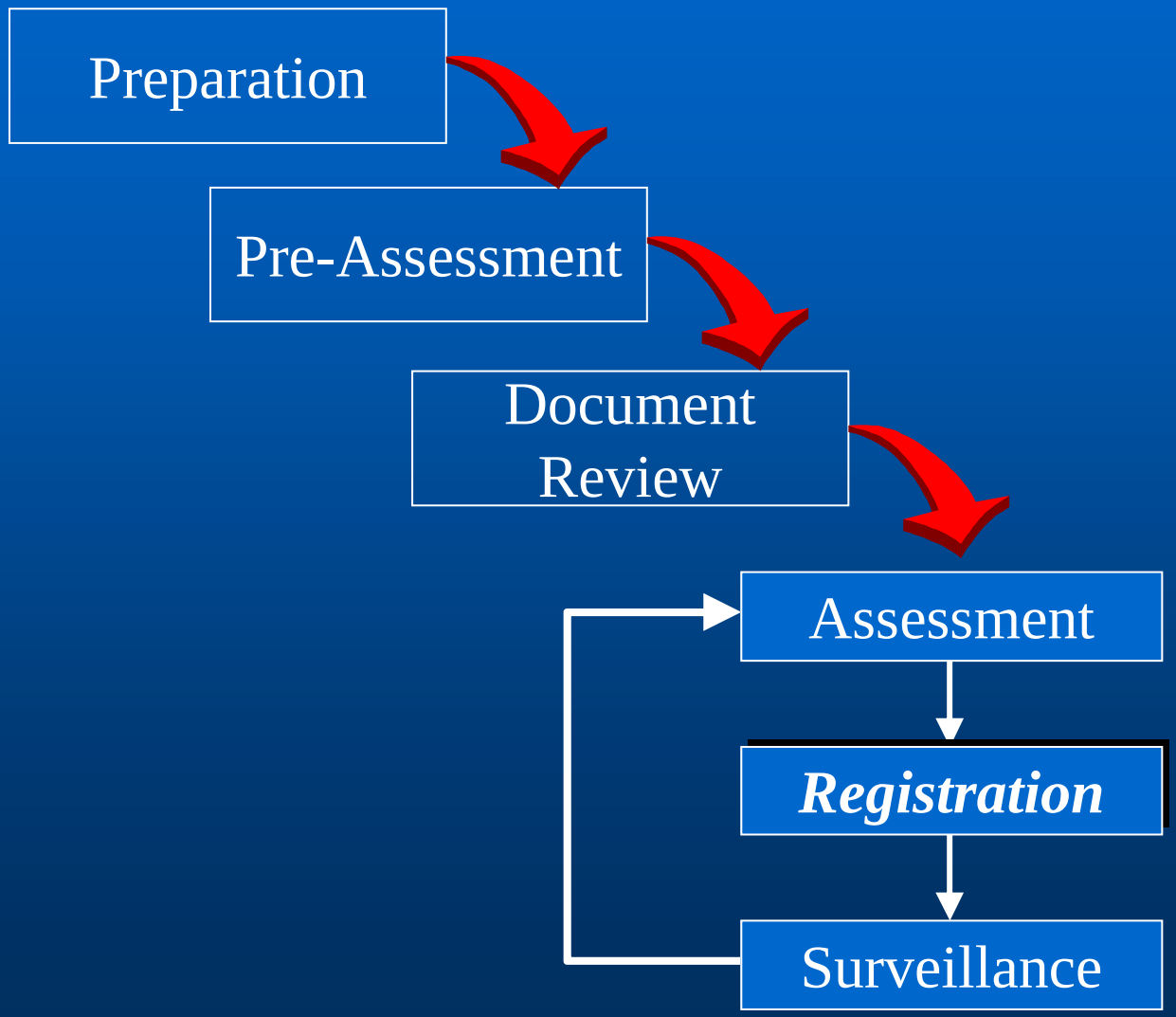
SCAMPI Phases



SCAMPI Phases - Details

Phase		Process	
1	**Plan and prepare for appraisal**	1.1	Analyze requirements
		1.2	Develop appraisal plan
		1.3	Select and prepare team
		1.4	Obtain and analyze initial objective evidence
2	**Conduct appraisal**	2.1	Examine objective evidence
		2.2	Verify and validate objective evidence
		2.3	Document objective evidence
		2.4	Generate appraisal results
3	**Report results**	3.1	Deliver appraisal results
		3.2	Package and archive appraisal results

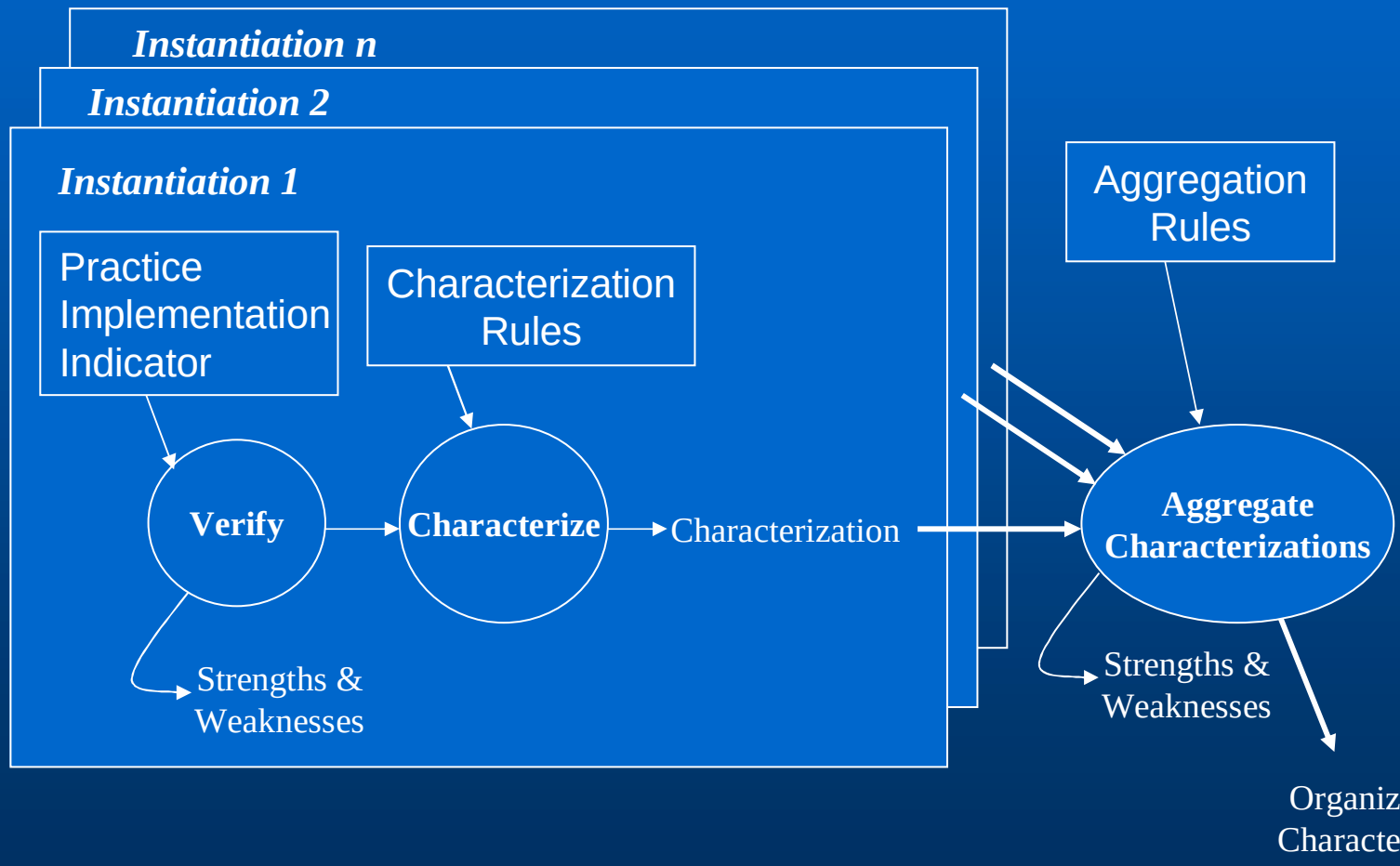
ISO Registration Process



ISO Registration Process - Details

Phase		Process	
1	**Plan and Prepare for Gap Analysis**	1.1	Analyze requirements
		1.2	Develop appraisal plan
		1.3	Obtain and analyze initial objective evidence
		1.4	Develop Questions
2	**Conduct Gap Analysis**	2.1	Examine objective evidence and perform interviews
		2.2	Document findings
		2.3	Note Non-Compliance
		2.4	Generate appraisal results
3	**Present and Document Results**	3.1	Present identified non-compliance
		3.2	Develop recommendation for registration and write report

SCAMPI - Conduct Appraisal



Typical SCAMPI Report

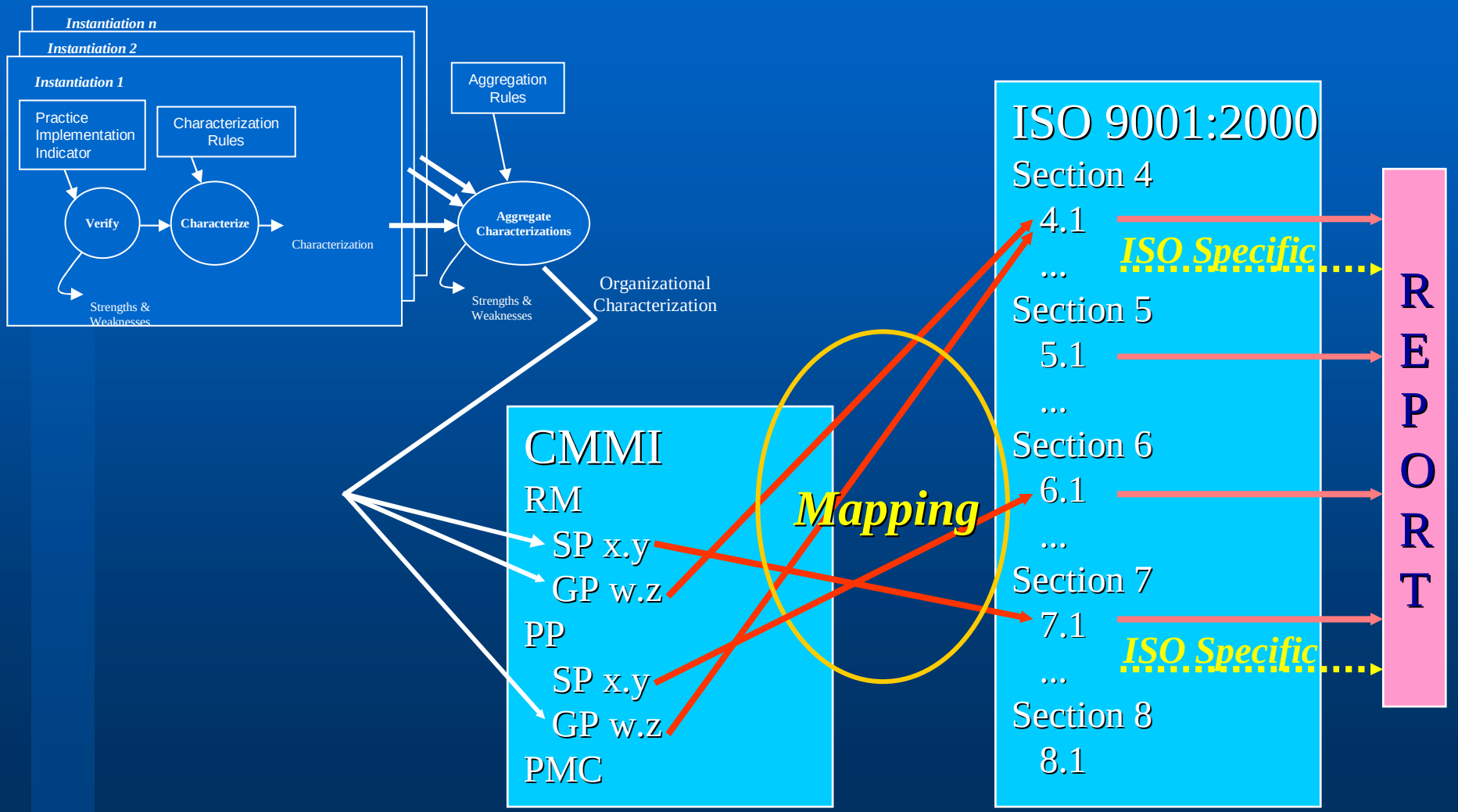
SCAMPI ASSESSMENT RESULT - SUMMARY

	PA ->	RM	PP	PMC	SAM	MA	PPQA	CM	RD	TS	PI	VE	VAL	OPF	OPD	OT	IPM	RSKM	IT	DAR
PA Rating ->		U	U	U	NR	U	S	S	S	U	U	U	U	S	S	S	U	U	NR	U
Specific Goal 1		S	S	U	NR	U	S	S	S	U	S	S	U	S	S	S	U	U	NR	U
	SP1.1	LI	FI	LI	NR	PI	FI	FI	LI	LI	FI	FI	PI	FI	FI	FI	FI	NI	NR	NI
	SP1.2	FI	FI	FI	NR	LI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	NI	FI	NR	NI
	SP1.3	FI	FI	FI	NR	PI		FI		PI	FI	FI	PI	FI	FI	FI	FI	LI	NR	NI
	SP1.4	FI	FI	NI		PI				FI						FI	PI		NR	NI
	SP1.5	FI		NI													PI			NI
	SP1.6																			NI
	SP1.7																			
Specific Goal 2			U	S	NR	U	S	S	S	U	S	S	U	S	S	S	U	S	NR	
	SP2.1		FI	FI	NR	PI	FI	FI	FI	FI	FI	FI	LI	FI	FI	FI	LI	FI	NR	
	SP2.2		FI	FI	NR	PI	FI	FI	FI	FI	FI	FI	PI	FI	FI	FI	NI	LI	NR	
	SP2.3		PI	FI	NR	PI			LI	LI		LI	NR	FI		FI	LI		NR	
	SP2.4		FI		NR	PI				PI				FI					NR	
	SP2.5		FI																NR	
	SP2.6		NI																	
	SP2.7		FI																	
	SP2.8																			
Specific Goal 3			S					S	S	S	U	U						S		
	SP3.1		FI					FI	FI	FI	FI	FI						LI		
	SP3.2		FI					FI	FI	FI	PI	PI						FI		
	SP3.3		FI						FI		PI	FI								
	SP3.4								LI		PI									
	SP3.5								FI											
Generic Goal 2		U	U	S	NR	U	S	S	S	U	U	U	U	S	S	S	U	U	NR	U
	GP2.1	FI	FI	FI	NR	NI	FI	FI	FI	LI	NI	FI	PI	FI	FI	FI	PI	PI	NR	NI
	GP2.2	FI	FI	FI	NR	PI	FI	FI	FI	LI	LI	FI	NI	FI	FI	FI	FI	FI	NR	NI
	GP2.3	FI	FI	FI	NR	PI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	PI	NR	NI
	GP2.4	FI	FI	FI	NR	PI	FI	FI	FI	FI	LI	FI	NI	FI	FI	FI	FI	FI	NR	NI
	GP2.5	FI	FI	FI	NR	NI	FI	FI	FI	LI	LI	LI	NI	FI	FI	FI	FI	NI	NR	NI
	GP2.6	FI	FI	FI	NR	PI	FI	FI	FI	FI	FI	FI	NI	FI	FI	FI	FI	FI	NR	NI
	GP2.7	PI	PI	FI	NR	NI	FI	LI	LI	PI	PI	PI	NI	FI	FI	FI	FI	FI	NR	NI
	GP2.8	FI	FI	FI	NR	NI	FI	FI	FI	FI	LI	FI	NI	FI	FI	FI	FI	LI	NR	NI
	GP2.9	FI	FI	FI	NR	NI	FI	FI	FI	PI	PI	PI	NI	FI	FI	FI	FI	FI	NR	NI
	GP2.10	FI	FI	FI	NR	NI	FI	FI	FI	PI	PI	LI	NI	FI	FI	FI	FI	FI	NR	NI
Generic Goal 3									U	U	U	U	U	S	S	S	U	U	NR	
	GP3.1								LI	LI	PI	LI	NI	FI	FI	FI	FI	FI	NR	
	GP3.2								PI	PI	PI	PI	NI	FI	FI	FI	NI	NI	NR	

LEGENDS

FI	Fully Implemented or Satisfied
LI	Largely Implemented
PI	Partially Implemented
U	Unsatisfied (Goals)
NI	Not Implemented
NR	Not Rated
	Not in Process Area

SCAMPI-ISO Gap Analysis
A Concept

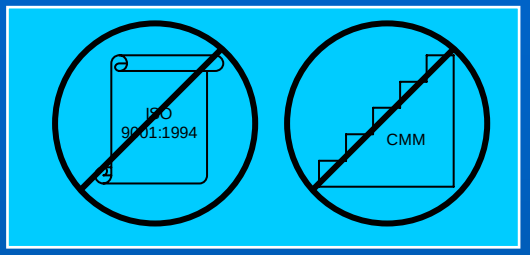


E - Establishing Phase

Armed with the identified gaps,
develop the process improvement approach

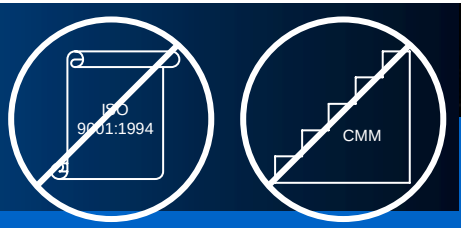
Experience with			Case Number
ISO 9001:1994	CMM v1.1 Level 2	CMM v1.1 Level 3	
No	No	No	*Case 1*
No	Yes	No	*Case 2 (a)*
No	Yes	Yes	*Case 2 (b)*
Yes	No	No	*Case 3*
Yes	Yes	No	*Case 4 (a)*
Yes	Yes	Yes	*Case 4 (b)*

Case 1: No PI Experience



- **Organization MUST**
  - **understand both frameworks**
    - **mappings are just indicators**
  - **understand their strengths and weaknesses**
  - **select process improvement approach**
- **Using ISO-CMMI synergy an organization can**
  - **implement the CMMI and satisfy most ISO requirements**
  - **achieve CMMI maturity level**
  - **achieve ISO registration**
    - **must address requirements not covered by CMMI**

Case 1 - continued



- **"Granularity" of CMMI helps when developing an approach**
  - **we limit ourselves to process areas at the specific goal-level**
  - **generic practices can be implemented individually, usually across PAs**
- **SCAMPI is rigorous and detailed, resulting in an excellent process improvement road-map**

Establishing vs. Invoking GPs

- **Can divide Generic practices into two groups**
  - **Establishing, that institutionalize processes, e.g.:**
    - **GP 2.1, *Establish an Organizational Policy***
    - **GP 2.2, *Plan the Process***
    - **GP 2.3, *Provide Resources***
  - **Invoking, that implement processes, e.g.:**
    - **GP 2.5, *Train People***
    - **GP 2.6, *Manage Configurations***
    - **GP 2.7, *Identify and Involve Relevant Stakeholders***

Establishing vs. Invoking SPs

- **Most Specific Goals can be also categorized as**
  - **Establishing**
  - **Invoking**
- **Some SPs can, therefore, be similarly categorized**

Level 2 PA Example

SG	1							2							3		
SP	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3
REQM	Inv	Inv	Inv	Inv	Inv												
PP	Est	Est	Est	Est				Est	Est	Est	Est	Est	Est	Est	Inv	Inv	Inv
PMC	Inv	Inv	Inv	Inv	Inv	Inv	Inv	Inv	Inv	Inv							
SAM	Est	Inv	Inv					Inv	Inv	Inv	Inv						
MA	Est	Est	Est	Est				Inv	Inv	Inv	Inv						
PPQA	Inv	Inv						Inv	Inv								
CM	Est	Est	Est					Inv	Inv						Inv	Inv	

REQM Example

SG 1	Manage Requirements
SP 1.1-1	Obtain an Understanding of Requirements
SP 1.2-2	Obtain Commitment to Requirements
SP 1.3-1	Manage Requirements Changes
SP 1.4-2	Maintain Bidirectional Traceability of Requirements
SP 1.5-1	Identify Inconsistencies between Project Work and Requirements

All “invoking”

CM Example

Establishing

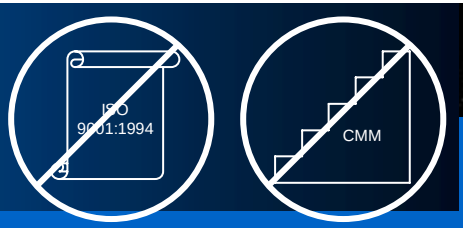
SG 1	***Establish Baselines***
SP 1.1-1	Identify Configuration Items
SP 1.2-1	Establish a Configuration Management System
SP 1.3-1	Create or Release Baselines
SG 2	***Track and Control Changes***
SP 2.1-1	Track Change Requests
SP 2.2-1	Control Configuration Items
SG 3	***Establish Integrity***
SP 3.1-1	Establish Configuration Management Records
SP 3.2-1	Perform Configuration Audits

Invoking

Case 1 - Steps

- ***Establishing Steps***
  - **Establish management responsibility**
    - **ISO: 5.1, 5.5.1, 8.2.2, 8.5.1**
    - **CMMI: Implement OPF, GP 2.4, GP 2.7**
    - ***Name management representative* (ISO 5.5.2)**
  - **Establish quality policy and specify quality objectives; communicate the policy**
    - **ISO: 5.3, 5.4.1, 5.5.3**
    - **CMMI: Implement GP 2.1, consider OPP SP 1.3**
    - ***Ensure that channels of communication are established***

Case 1 - Steps

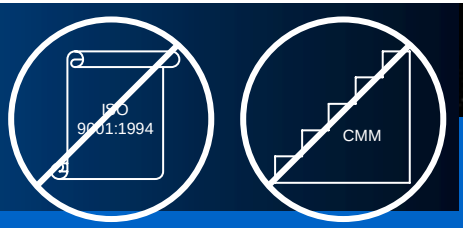


- ***Establishing Steps*** ***(continued)***
  - **Define and plan QMS**
    - **ISO: 4.1, 4.2.1, 4.2.2, 5.4.2**
    - **CMMI: Establish OPD, implement GP 2.2, GP 3.1 (may need to revisit ML 2 PAs in the Staged Representation)**
  - **Provide resources**
    - **ISO: 6.0**
    - **CMMI: Implement GP 2.3, GP 2.5, establish OT, may establish OEI SP 1.2 (for ISO 6.3 and 6.4)**

Case 1 - Steps

- ***Establishing Steps*** ***(continued)***
  - **Establish CM**
    - **ISO: 4.2.3, 4.2.4, 7.3.7, 7.5.3**
    - **CMMI: Establish CM PA (SG 1)**
    - ***Need: Procedure for defining the control of records (ISO 4.2.3)***
    - ***Need: Procedure for controlling identification, storage, protection of records (ISO 4.2.4)***

Case 1 - Steps

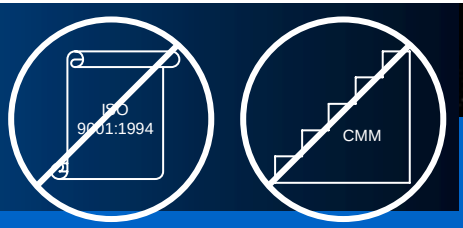


- ***Establishing Steps*** ***(continued)***
  - **Establish quality assurance**
    - **ISO: 8.2.2**
    - **CMMI: Implement PPQA PA, Establish VER and VAL PAs; revisit OPF**
    - ***Need: Procedure defining responsibilities and requirements for planning and conducting audits and process for selecting auditors (ISO 8.2.2)***

Case 1 - Steps

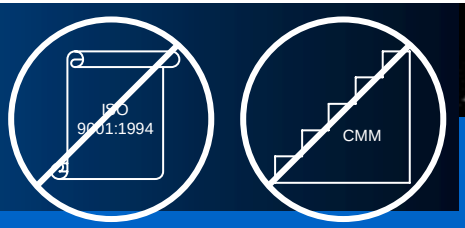
- ***Establishing Steps*** ***(continued)***
  - **Establish measurement and analysis function**
    - **ISO: 8.1, 8.2.1, 8.2.3, 8.2.4, 8.4**
    - **CMMI: Establish MA PA (SG 1); consider QPM SG 2 and CAR SG 1**
    - ***Need: determine how customer satisfaction will be addressed (ISO 8.2.1)***
  - **Plan product realization**
    - **ISO: 7.1**
    - **CMMI: establish PP, SAM, IPM; implement GP 3.1; revisit OPD**

Case 1 - Steps



- ***Performing Steps***
  - **Perform product realization**
    - **ISO: 5.2, 7.2.1, 7.2.2, 7.2.3, 7.3.1, 7.3.2, 7.3.3**
    - **CMMI: Implement RD, REQM, TS and PI**
    - ***Ensure customers are informed about product development and contractual matters and their feedback is addressed (ISO 7.2.3)***
  - **Perform verification and validation**
    - **ISO: 7.3.5, 7.3.6, 7.5.2**
    - **CMMI: Invoke VER and VAL PAs**

Case 1 - Steps



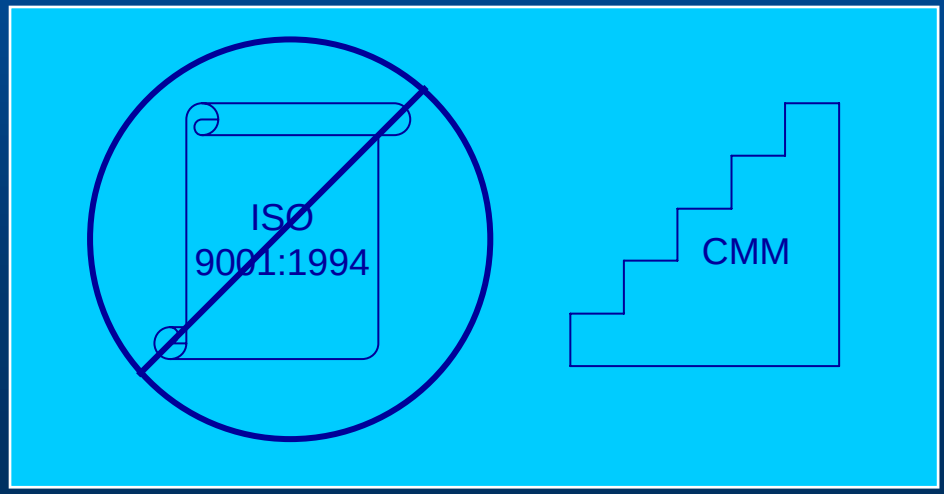
- ***Performing Steps*** ***(continued)***
  - **Implement purchasing**
    - **ISO: 7.4**
    - **CMMI: Invoke SAM PA**
  - **Perform measurement, tracking, reviewing and auditing**
    - **ISO 5.6, 7.3.4, 8.2.1, 8.2.3, 8.5.2, 8.5.3**
    - **CMMI: Invoke PMC, PPQA, CM, and MA PAs; implement CAR (as needed); revisit OPF and IPM; perform GP 2.6, GP 2.8, GP 2.9, GP 2.10, GP 3.2**
    - ***Need: procedure for corrective and preventive actions (ISO 8.5.2 & 8.5.3)***

Case 1 - Steps

- ***Performing Steps (continued)***
  - ***Need to address:***
    - ***control of production and service provision (ISO 7.5.1)***
    - ***handing of customer property (ISO 7.5.4)***
    - ***preservation of the product during internal processing (ISO 7.5.5)***
    - ***control of monitoring and measuring devices (ISO 7.6.1)***
    - ***handing of nonconforming products (ISO 8.3)***

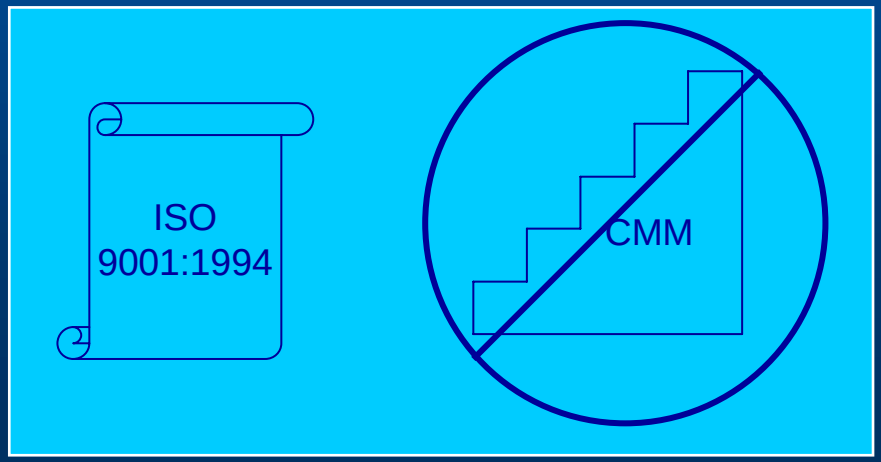
Case 2 - Transition with prior CMMI experience

- **Differences from Case 1**
  - **Process improvement initiative exists**
  - **Transition from CMM to CMMI**
    - **CMM ML 2 to CMMI ML 2**
    - **CMM ML 3 to CMMI ML 3**



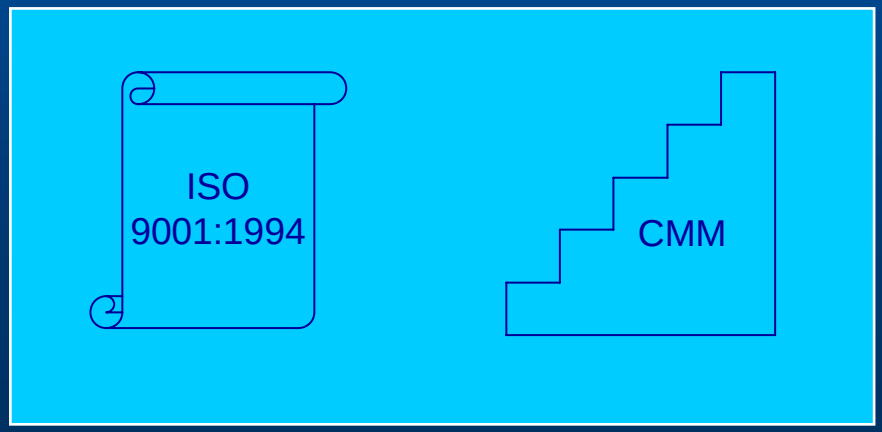
Case 3 - Transition with prior ISO experience

- **Differences from Case 1**
  - **This is an ISO-centered approach**
  - **Organization needs guidance for transitioning from legacy ISO 9001:1994 to ISO 9001:2000**
  - **May consult ISO 9000-3 when available**
  - **Similar to Case 1 as far as CMMI is concerned**



Case 4 - Transition with prior ISO and CMM experience

- **Differences from Case 1**
  - **Most advanced organizations**
  - **Depending on CMM ML, Case 2 or 3 approaches can be used**



Process Improvement Planning

Planning completes IDEAL Establishing Phase:
- Run process improvement as a project

- **Gap Analysis/Appraisal** → **Requirements**
- **Transitioning steps** → **Life cycle steps**

***Need*: resources, training, schedule, control, periodic evaluation**

Sample PIP Outline

1 Introduction

- 1.1 Purpose of this PIP
- 1.2 Corporate goals
- 1.3 Scope

2 Goals

- 2.1 Process Improvement Objectives
- 2.2 Success Criteria
- 2.3 Constraints
- 2.4 Risks

3 Process Improvement Participants

- 3.1 Management
- 3.2 Engineering Process Group
- 3.3 Projects

4 Process Improvement Implementation

- 4.1 PI Tasks
- 4.2 PI Management
  - 4.2.1 Tracking
  - 4.2.2 Measurement
  - 4.2.3 Risk Management
  - 4.2.4 Configuration Management
  - 4.2.5 Quality Methods
  - 4.2.6 Training
- 4.3 Schedule
- 4.4 Resources

A - Acting Phase

- **Implement the Process Improvement Plan**
  - **monitor progress**
    - **process action teams**
      - **deliverables**
    - **implementation pilots**
    - **periodic informal gap analyses**
  - **report results**
    - **progress visibility**

L - Learning Phase

- **Repeat IDEAL process from Diagnosing phase onwards**
  - **adjust improvement approach**
    - **modify / delete / add transitioning steps**
    - **create additional PATs (?)**
    - **change piloting (more/less)**
  - **re-evaluate process improvement goals**
  - **re-evaluate resource availability, schedule, management approach, etc.**

Tutorial Summary

- **Process improvement approach requires**
  - **Problem solving process**
  - **Framework(s)**
- **ISO 9001:2000 and CMMI are synergistic**
  - **Used effectively as a "framework"**
  - **We used CMMI to interpret ISO**
- **Process improvement approach depends on the organization's readiness, culture, maturity**
  - **Transitioning from the legacy frameworks**

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