


A Global Overview of The Structure

CMMI for Development V.1.2

Module 2

Agenda

- Overview of CMMI
- General Structure of CMMI
- CMMI Model Representations
- Generic Goals and Practices
- CMMI by PAs and Groups

Definition of CMMI

- **Process model**
  - a structured collection of practices
  - that describe the characteristics of effective processes

Definition of CMMI

- **CMMI**
  - An organized set of industry best practices for
    - Systems Engineering (SE)
    - Software Engineering (SW)
    - Hardware Engineering (HE)
  - With an addition for
    - Integrated Product and Process Development (IPPD)
  - Developed by the Carnegie Mellon SEI with broad external participation and review

Definition of CMMI

- **CMMI**
  - emphasizes the development of processes
    - to improve product development and customer services in organizations
  - provides a framework from which to organize and prioritize process improvement activities
    - product, business, people, technology
  - supports the coordination of multi-disciplined activities
    - that may be required to successfully build a product

Definition of CMMI

- **CMMI**
  - emphasizes the alignment of process improvement efforts objectives with organizational business objectives

Definition of CMMI

- **CMMI Architecture**
  - contains components to construct models and their appropriate training and appraisal materials
  - **CMMI Framework**
    - a managed structure that organizes CMMI components
      - **model**
      - **appraisal**
      - **training**
    - with rules and methods for generating models, their apprisal methods and thier training materials

Definition of CMMI

- **CMMI Framework**
  - **CMMI Model**
    - CMMI Model Foundation
      - selected sessions of the front matter
      - all generic goals and generic practices
      - core process areas (16)
      - core glossary
    - Shared CMMI Material
    - Constellation-Specific Material

Definition of CMMI

- **CMMI Constellation**
  - a collection of CMMI components for an area of interest that includes
    - a model,
    - training materials,
    - appraisal-related documents
  - Three planned constellations supported by the V.1.2 Model Framework:
    - **development (CMMI-DEV)**
    - **services (CMMI-SVC)**
    - **acquisition (CMMI-ACQ)**

Definition of CMMI

- **CMMI for Development (CMMI-DEV)**
  - covers the development and maintenance activities applied to both products and services
    - CMMI for Development
    - CMMI for Development + IPPD
  - **IPPD**
    - **Integrated Product and Process Development**
    - currently, the only one addition
    - **Addition**
      - used to expand constellations for specific additional content

CMMI Model Disciplines

- **CMMI Amplification**
  - a note or example that is relevant to a particular **discipline**
- **Disciplines, explicitly included in CMMI**
  - Systems Engineering (SE)
  - Software Engineering (SW)
  - Hardware Engineering (HE)
- Other disciplines can also benefit

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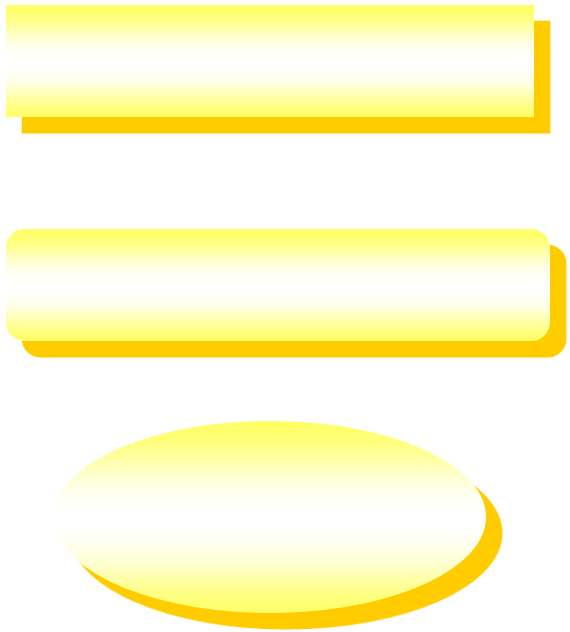
General structure of CMMI

- **Classification of components**
  - Required
  - Expected
  - Informative



General structure of CMMI

Describe what an organization must achieve to satisfy a PA

This achievement must be visibly implemented in an organization process

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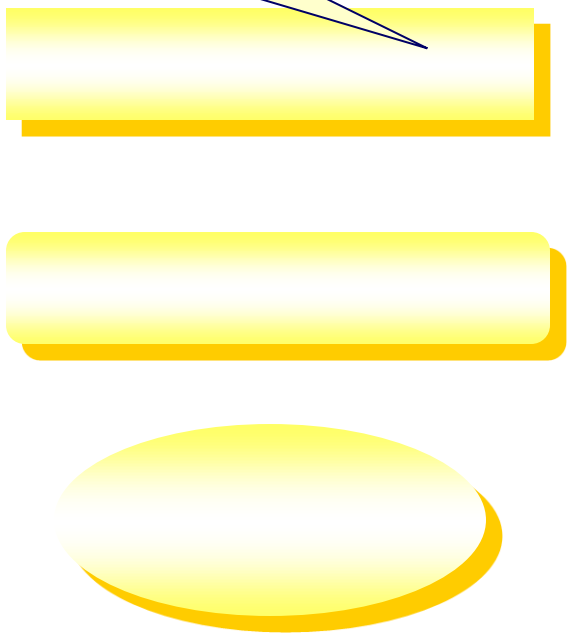
– Required

– Expected

– Informative



General structure of CMMI

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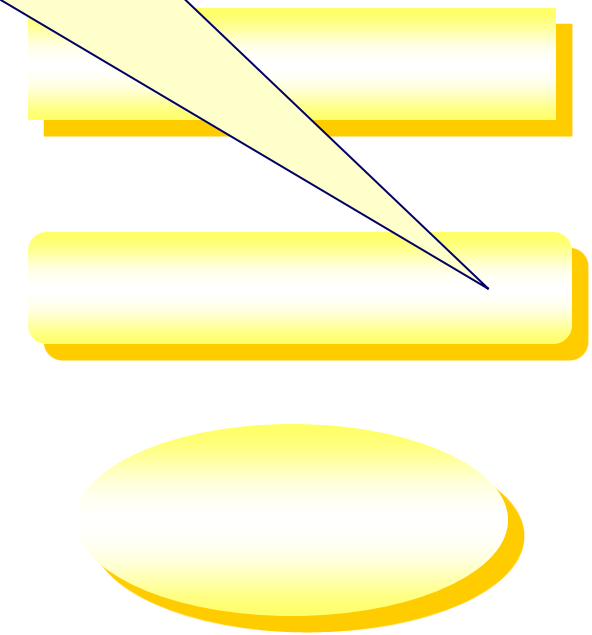
Describe what an organization will typically implement to achieve a required component

A guide for those who implement improvements or perform appraisals

– Required

– Expected

– Informative



General structure of CMMI

Provide details that help organizations get started in thinking about how to approach the required and expected components

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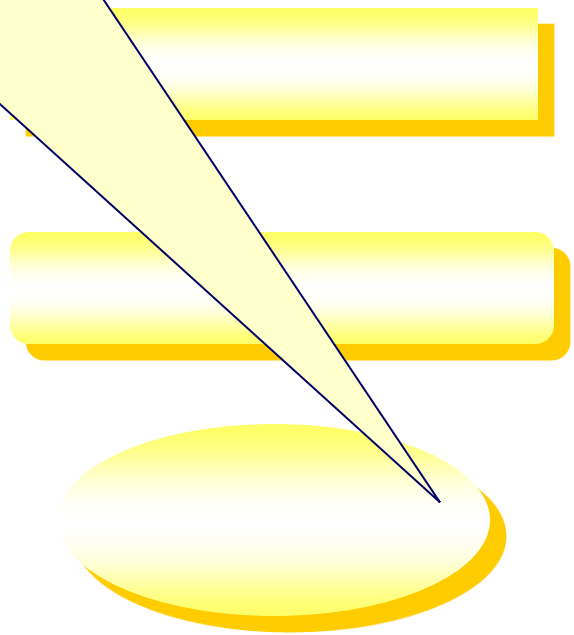
- Required
- Expected
- Informative



General structure of CMMI

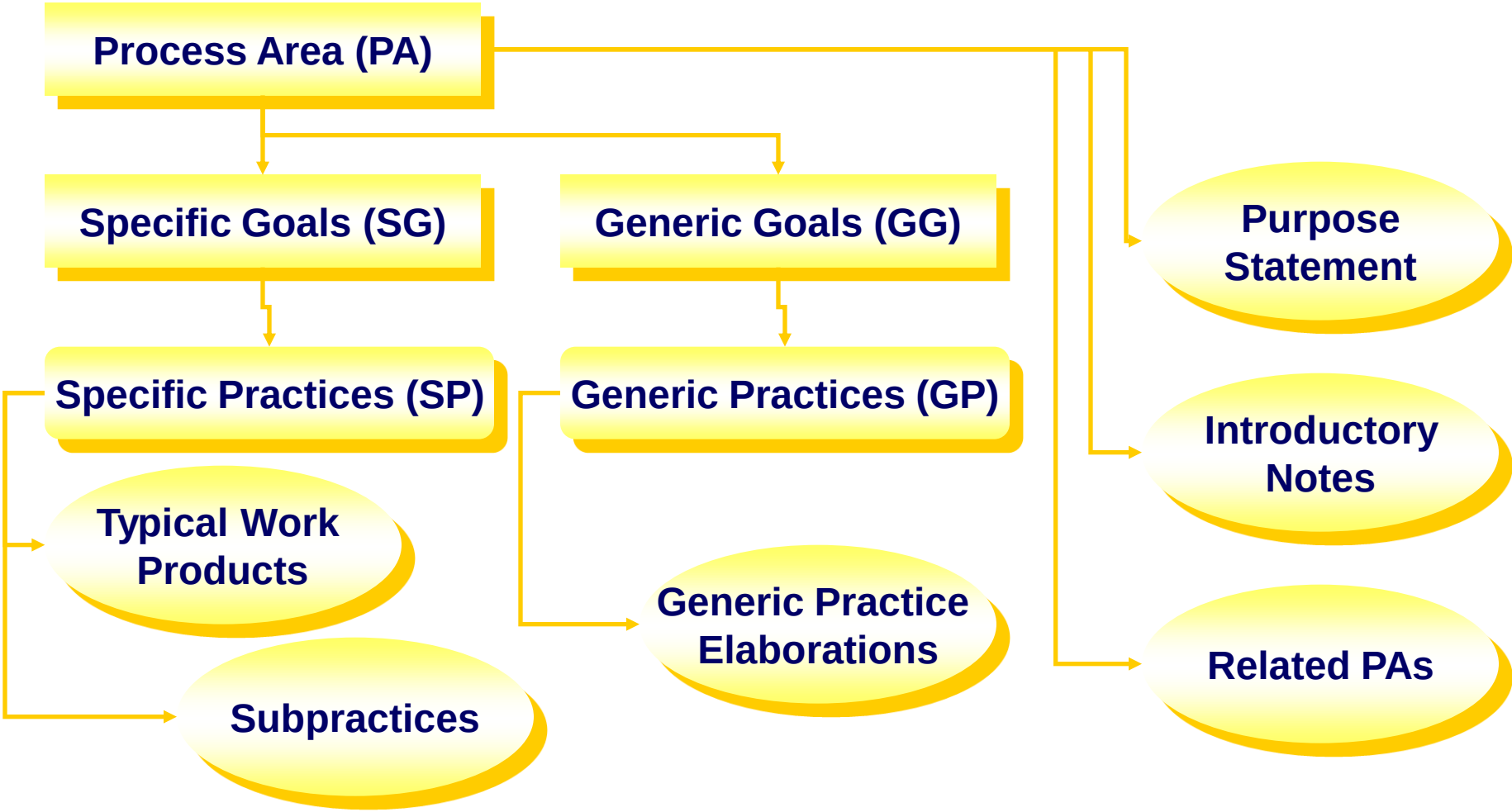
- CMMI consists of
  - 22 Process Areas
  - Supporting informative components

General structure of CMMI

- **Process Area (PA)**
  - cluster of related practices in an area
  - when performed collectively, satisfy a set of goals
    - considered important for making significant improvement
- **Supporting informative components**
  - provide further information to help apply concepts to practice

General structure of CMMI

- **General structure of PA**



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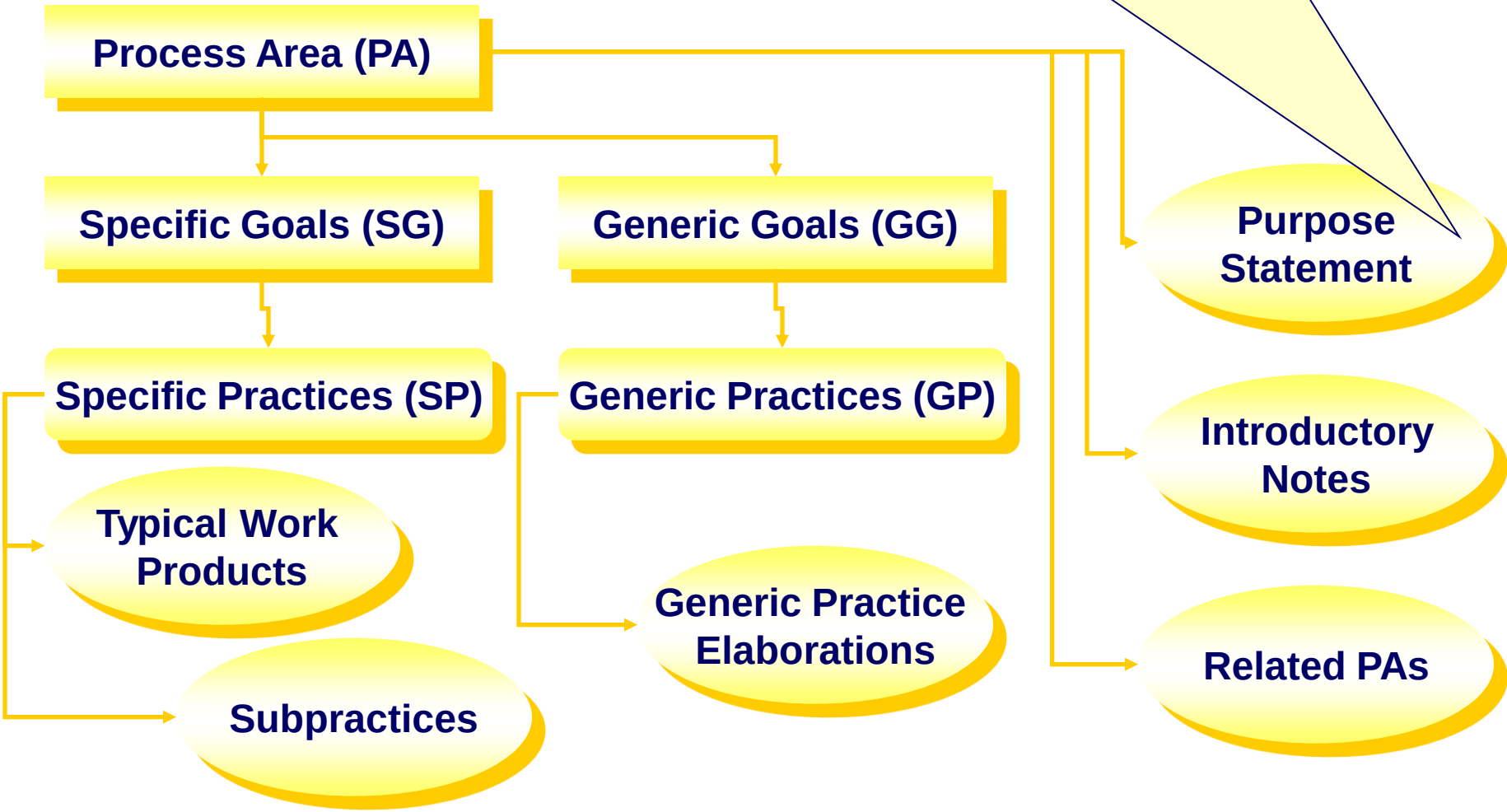
Describes the purpose of the PA



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Describes the major concepts covered in the PA

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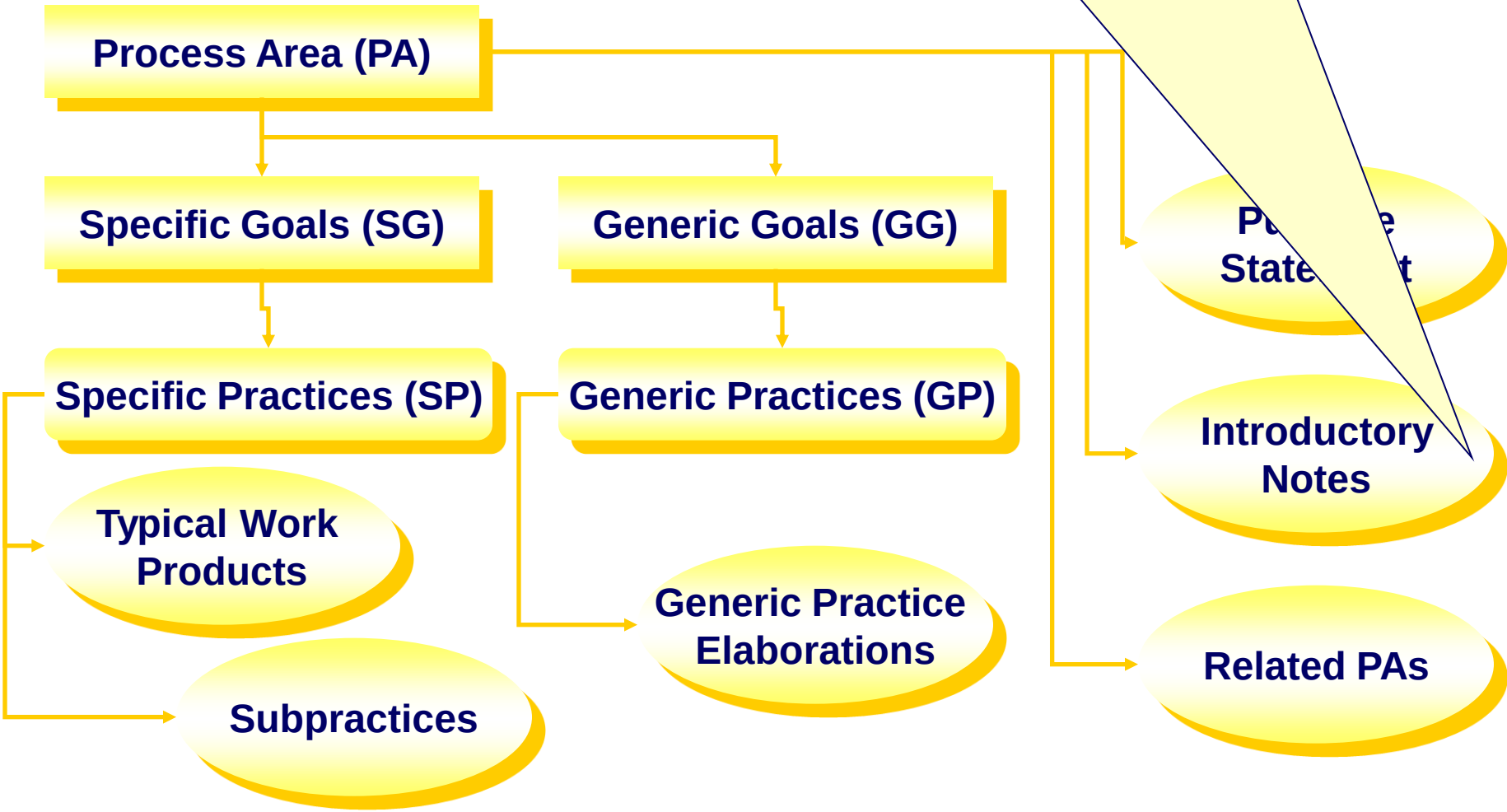

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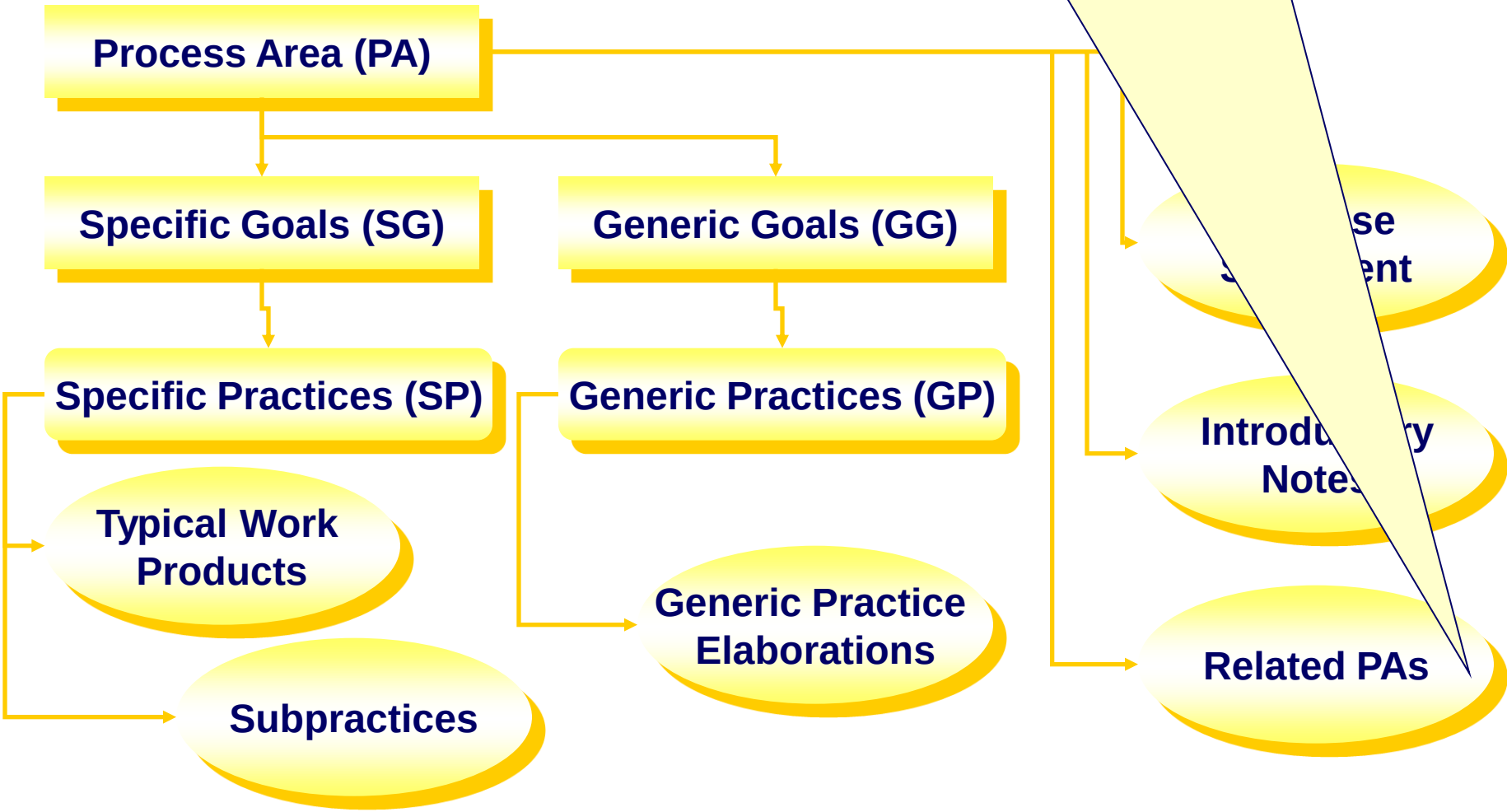
Lists references to related PAs

Reflects the high-level relationships among the PAs



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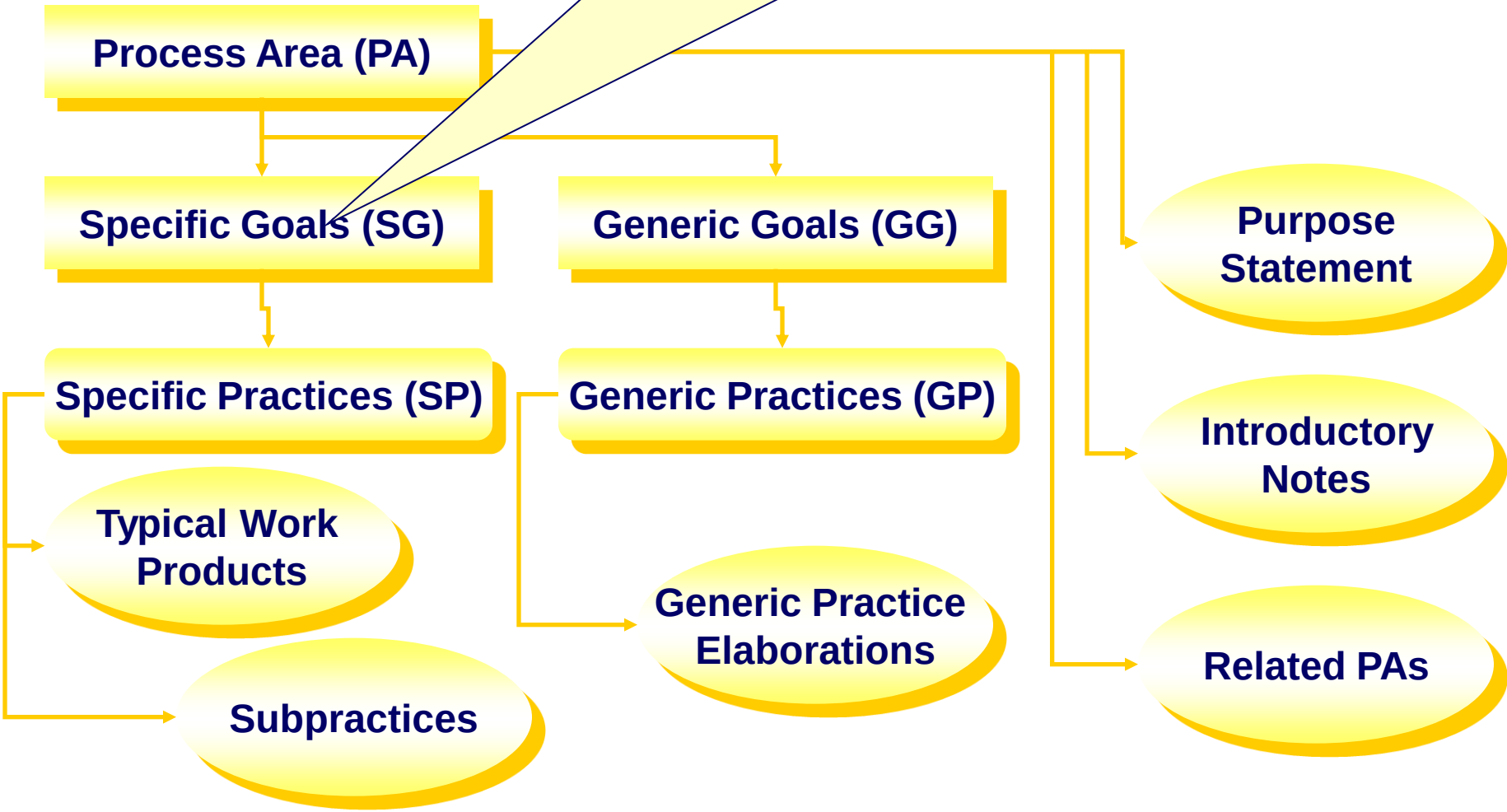
Apply to a PA

Describe some of the unique characteristics, that must be present to satisfy the PA



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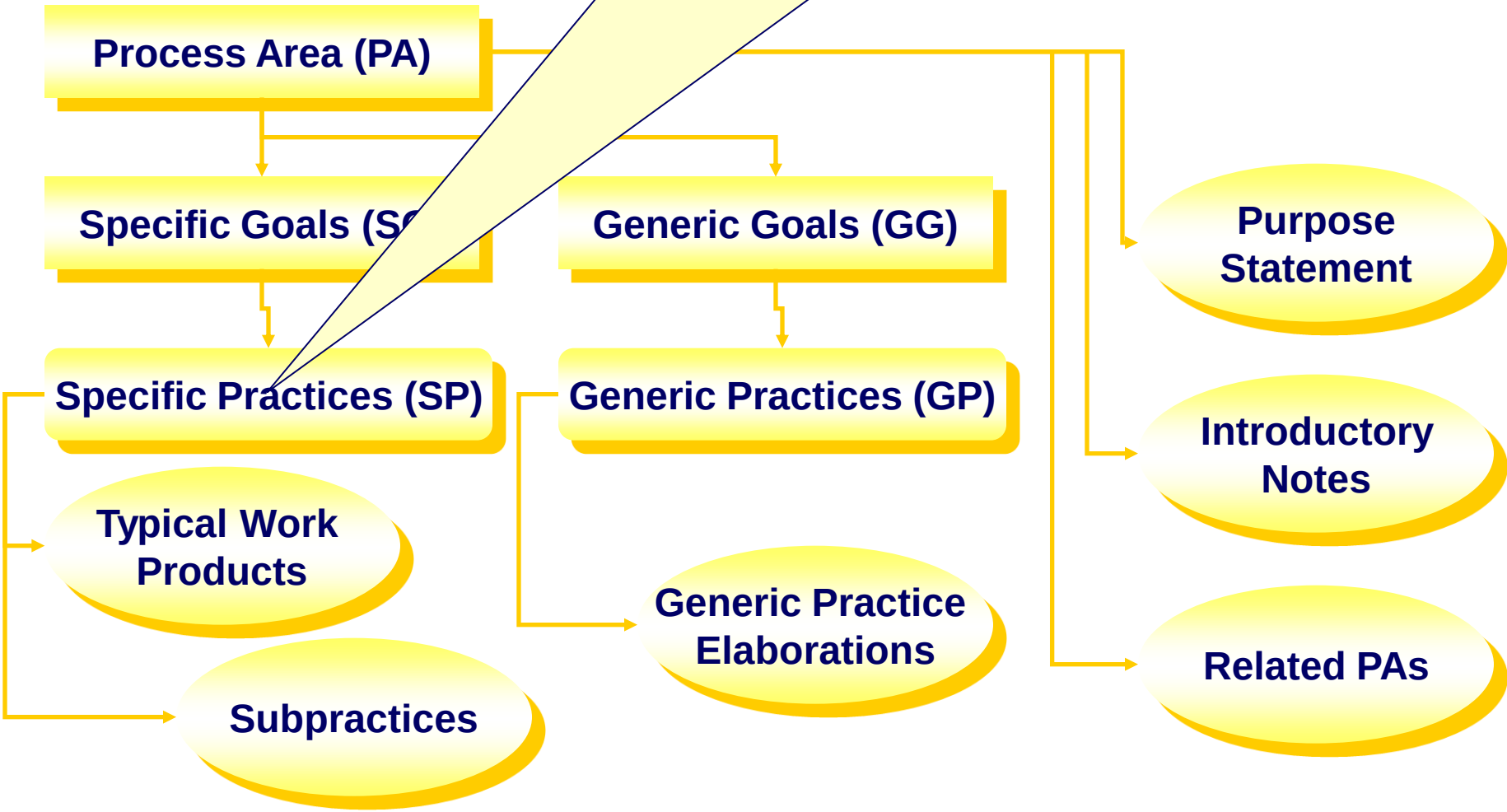
Describe the activities expected to result in achievement of the SGs of a PA



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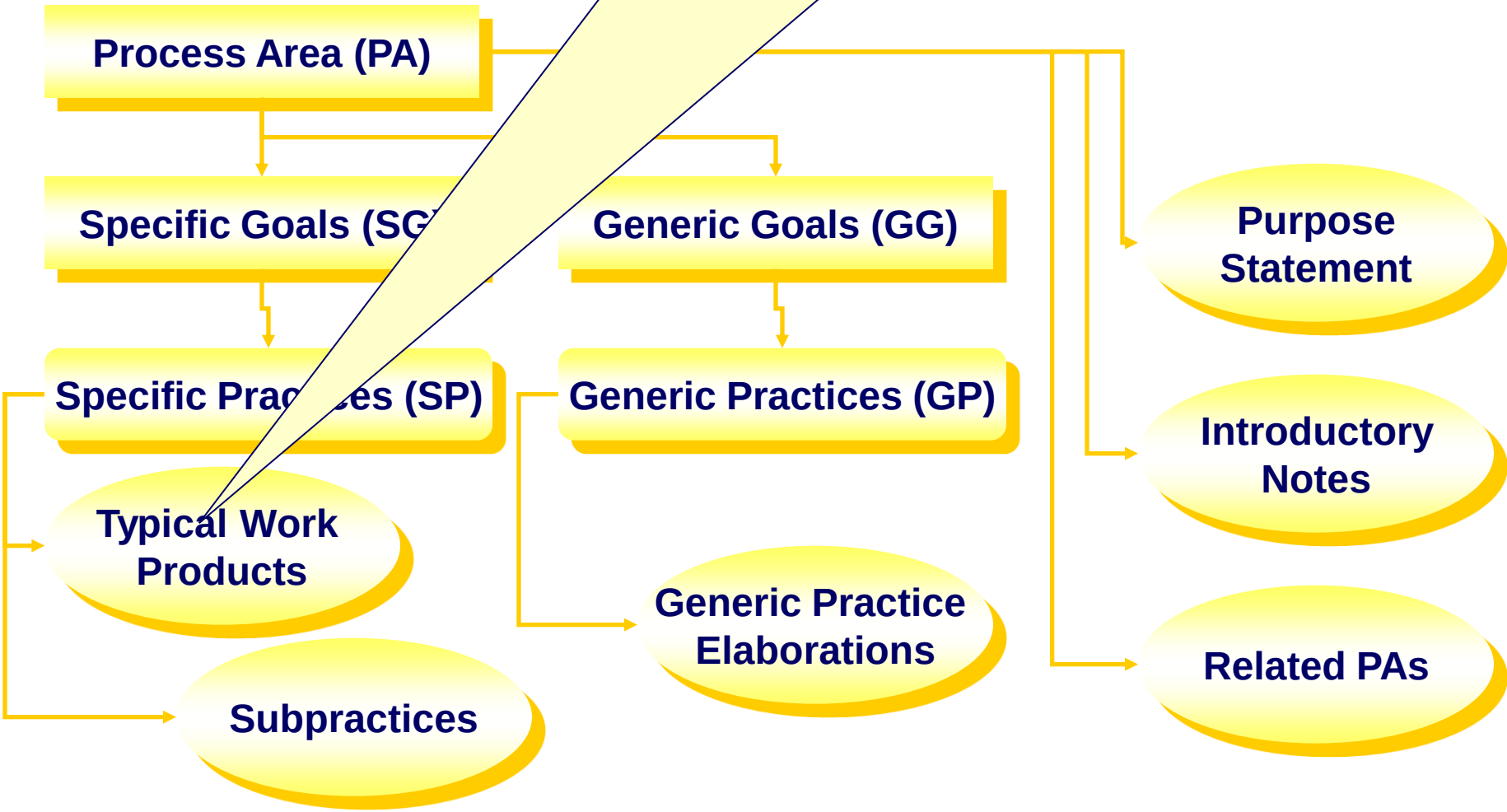
List sample outputs from a SP

Not necessarily complete lists



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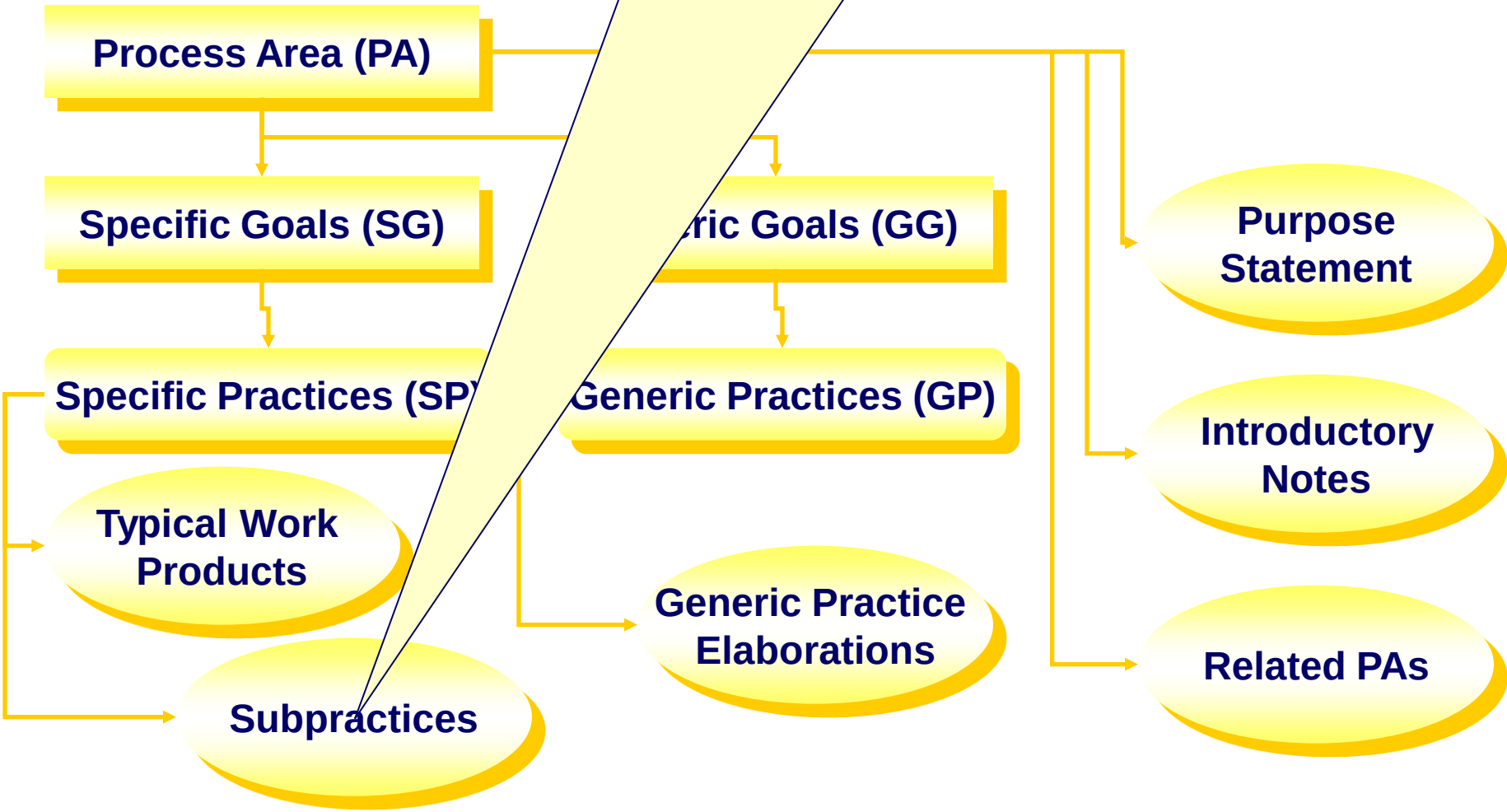
- **General stru**

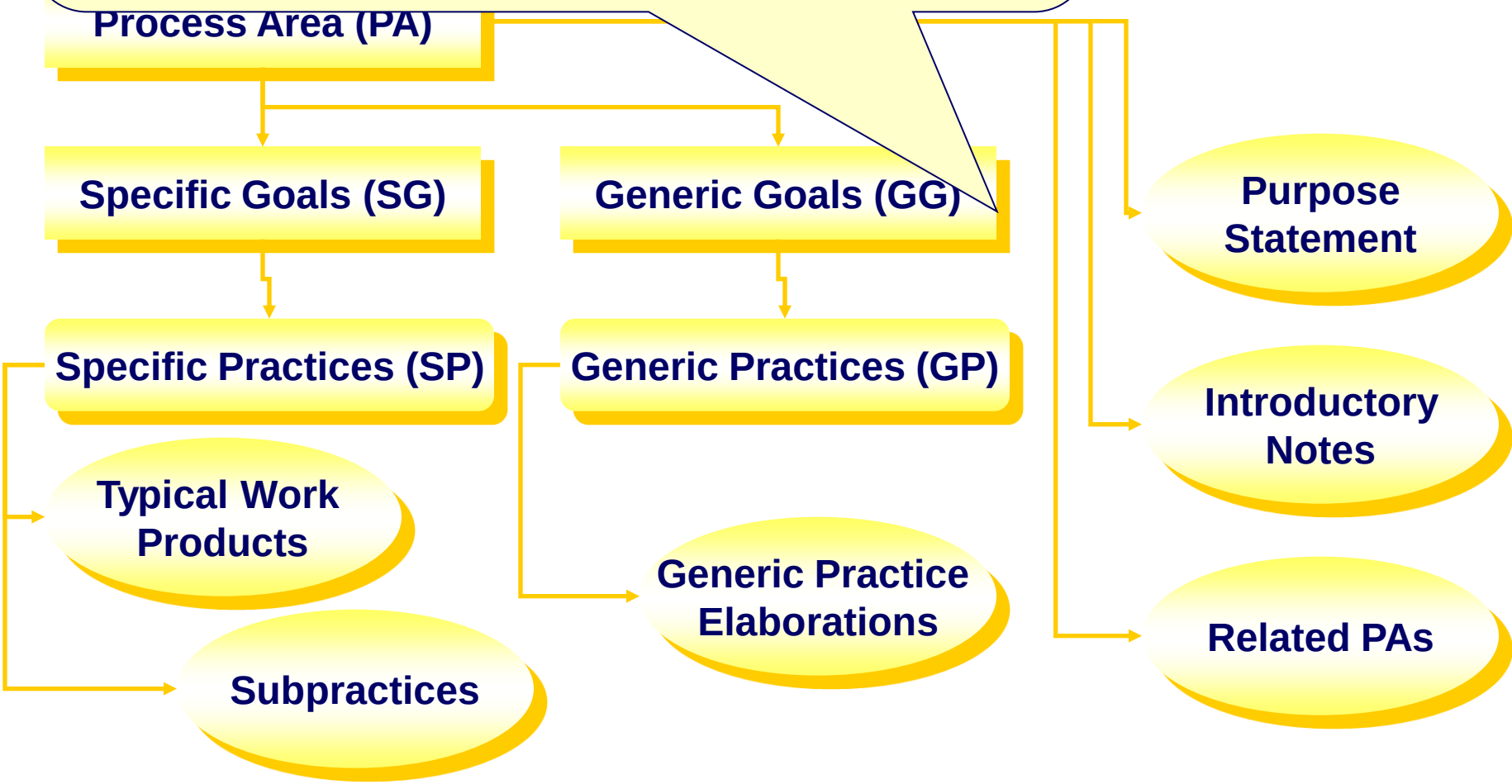
Detailed descriptions that provide guidance for interpreting and implementing a SP



Describe the characteristics that must be present to institutionalize the processes that implement a PA

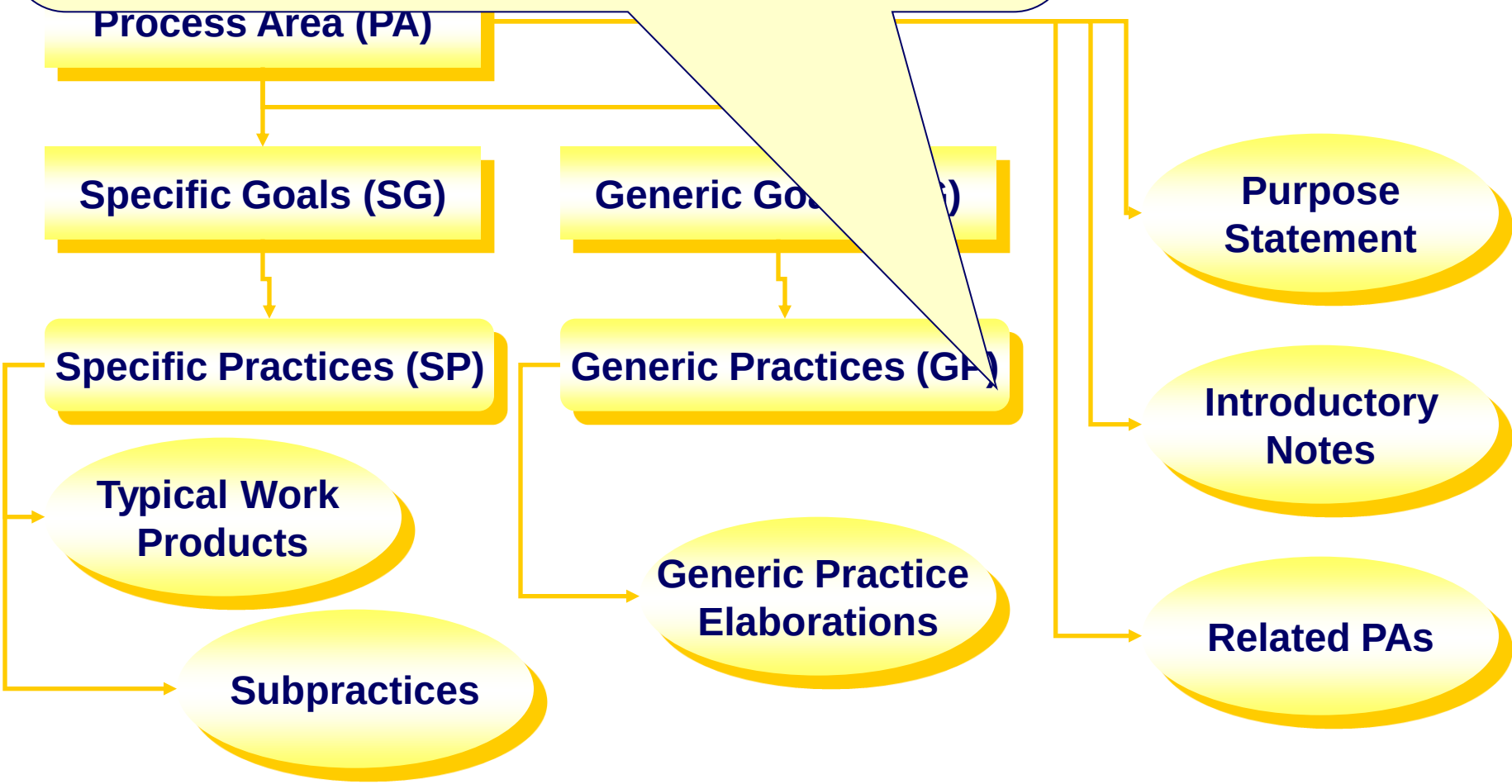
The same GGs appear in multiple PAs

Signify improved control in planing and implementing the processes associated with the PA

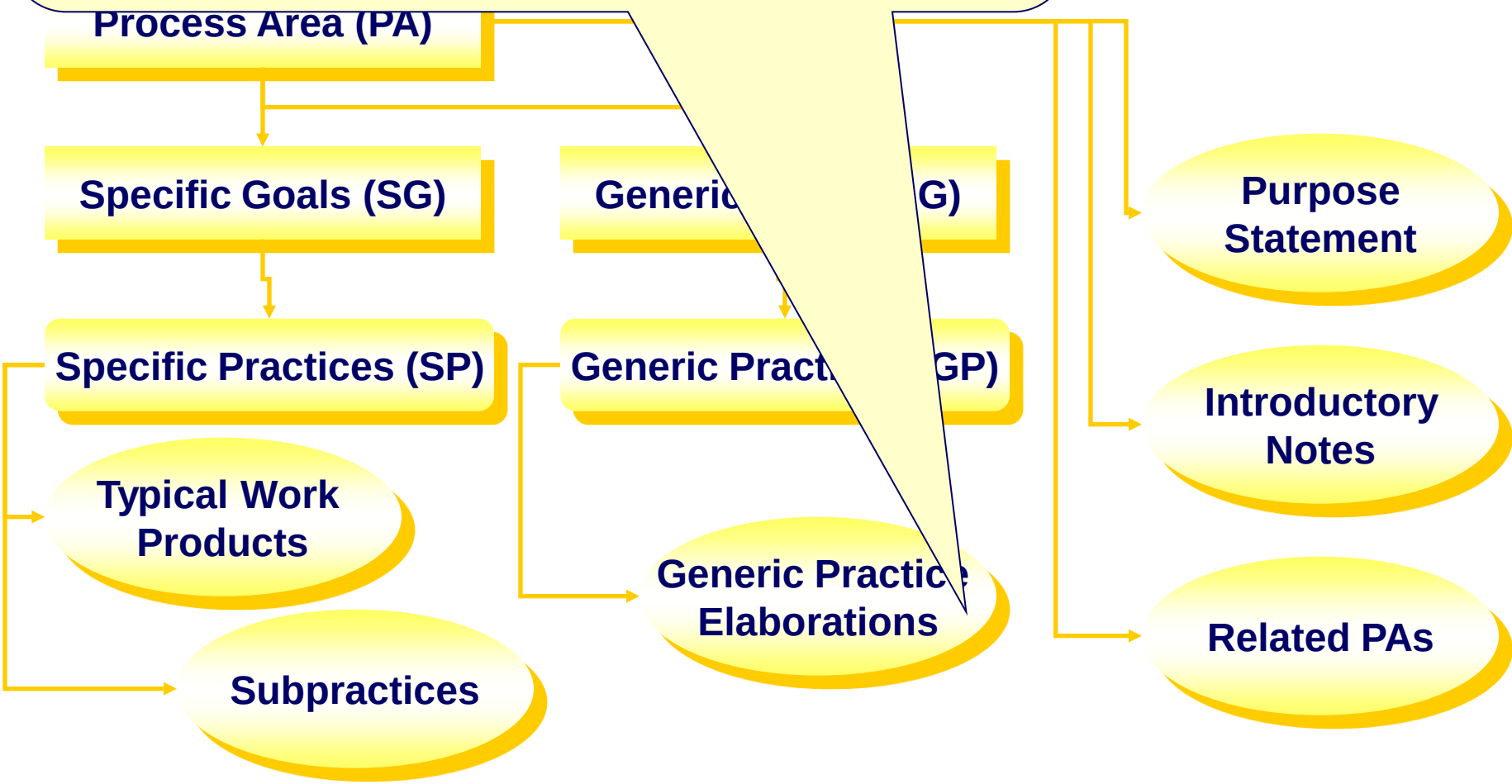


Activities that ensure that the processes associated with the PA will be effective, repeatable, and lasting

The same GPs appear in multiple PAs



Appear after the GP to provide guidance on how the GP may be applied in the context of the PA



General structure of CMMI

- **22 PAs, in alphabetical order:**
  - CAR - Causal Analysis and Resolution
  - CM - Configuration Management
  - DAR - Decision Analysis and Resolution
  - IPM - Integrated Project Management
  - MA - Measurement and Analysis
  - OID - Organizational Innovation and Deployment
  - OPD - Organizational Process Definition
  - OPF - Organizational Process Focus
  - OPP - Organizational Process Performance
  - OT - Organizational Training

General structure of CMMI

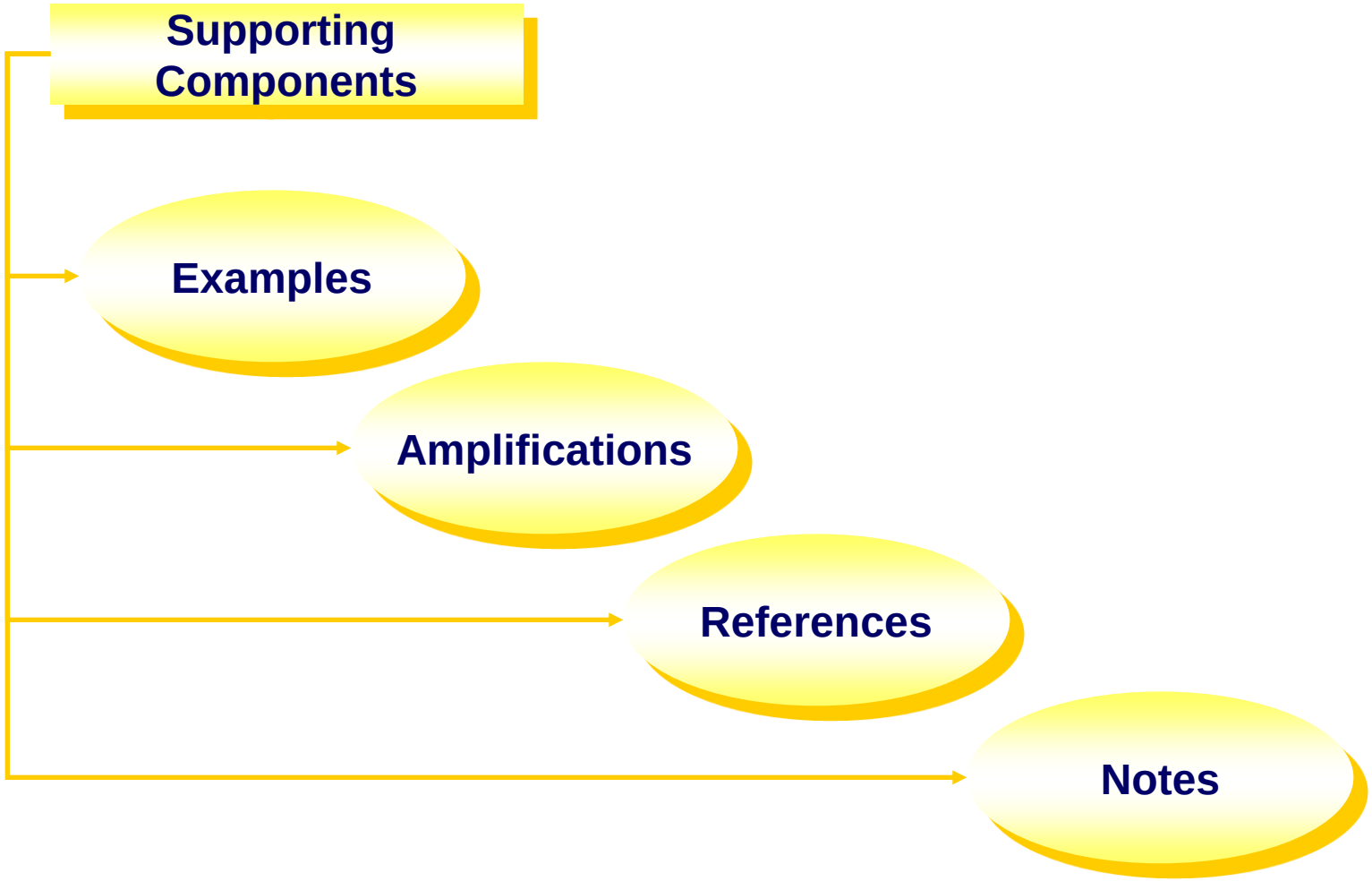
- **22 PAs, in alphabetical order:**
  - PI - Product Integration
  - PMC - Project Monitoring and Control
  - PP - Project Planning
  - PPQA - Process and Product Quality Assurance
  - QPM - Quantitative Project Management
  - RD - Requirements Development
  - REQM - Requirements Management
  - RSKM - Risk Management

General structure of CMMI

- **22 PAs, in alphabetical order:**
  - SAM - Supplier Agreement Management
  - TS - Technical Solution
  - VAL - Validation
  - VER - Verification

General structure of CMMI

- **Supporting informative components**



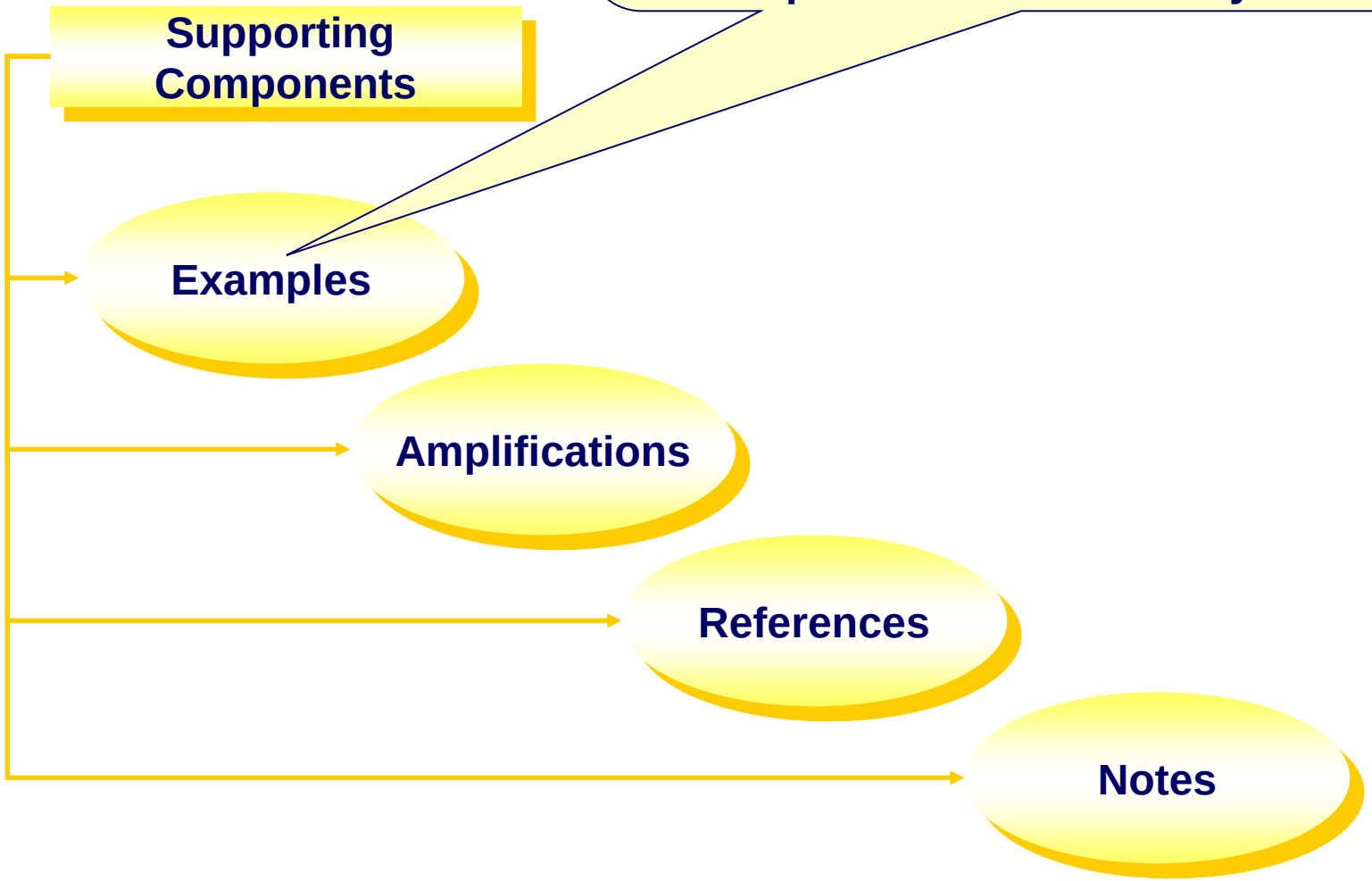
General

- **Supporting ir**

Acomponent comprising text

Often a list of items, usually in a box, that can accompany any other component

Provides one or more examples to clarify a concept or described activity



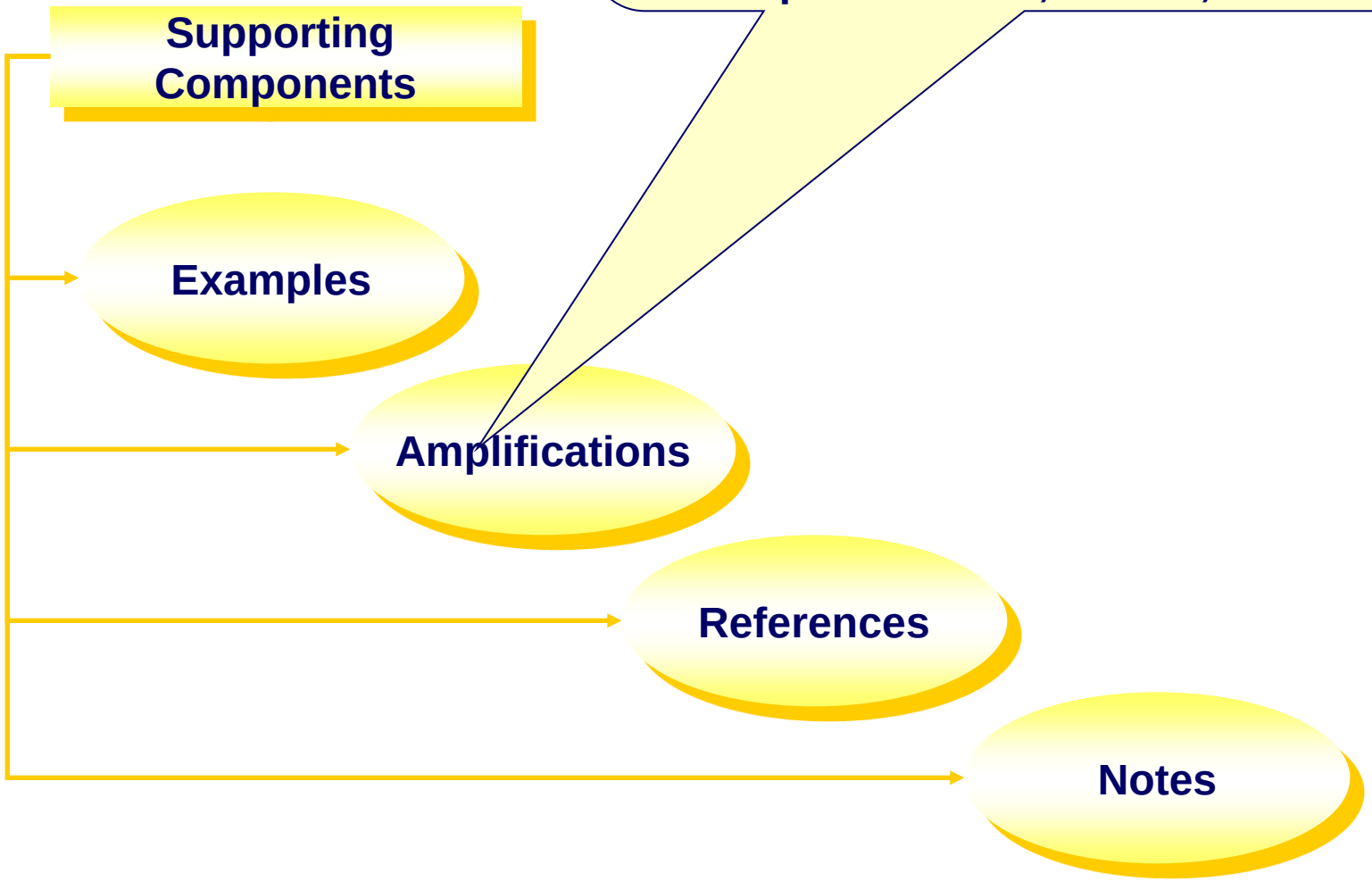
General

- **Supporting ir**

Provide guidance relevant to a particular discipline

Labeled with a heading that indicates which discipline it applies to

Examples: For SW, For SE, For HE

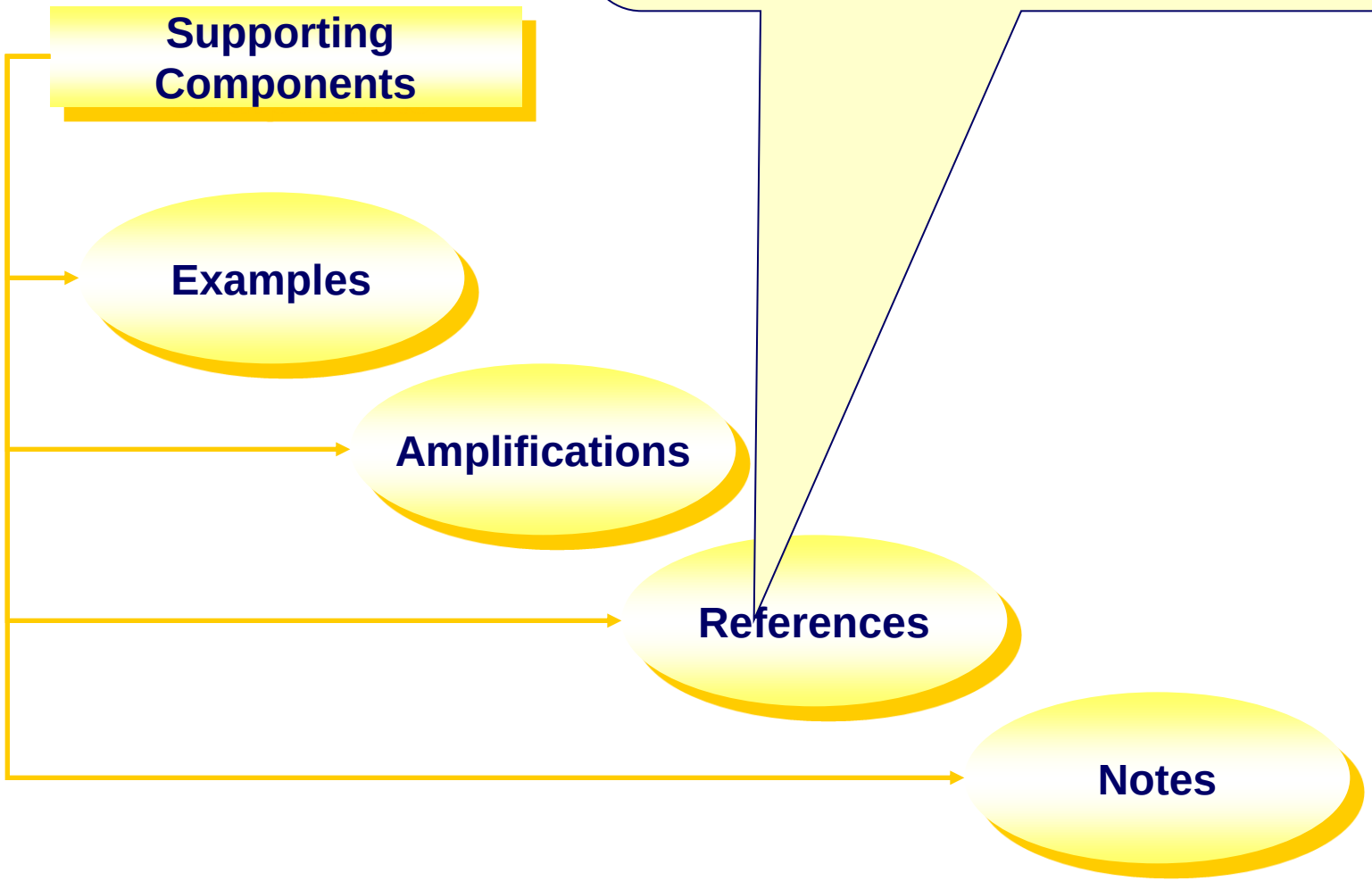


General

- **Supporting ir**

Pointers to additional or more detailed information in related PAs

Can accompany nearly any other model component

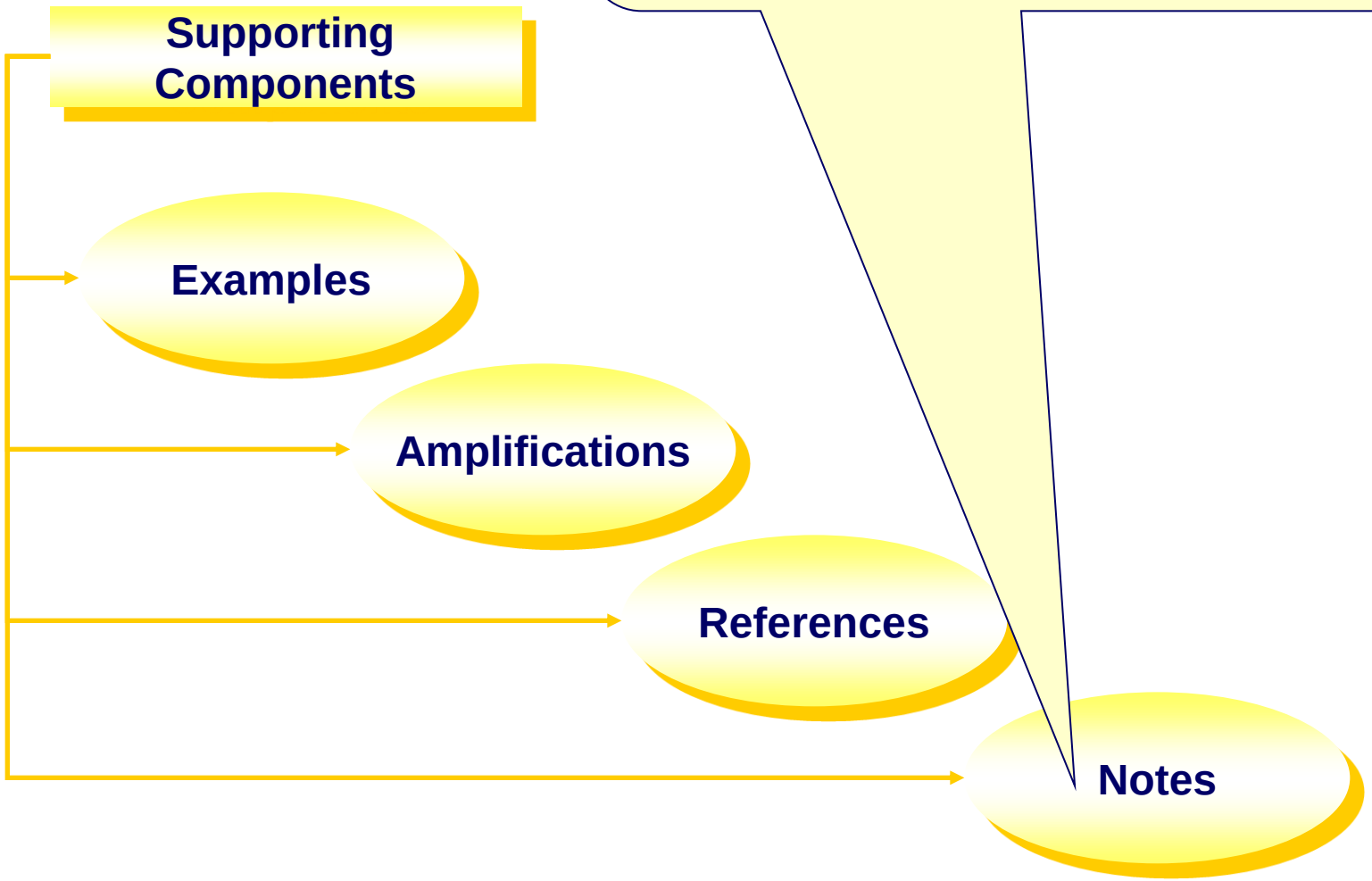


General

- **Supporting ir**

Provide details that help in understanding the core information of the model

Can be attached to any process area component



General structure of CMMI

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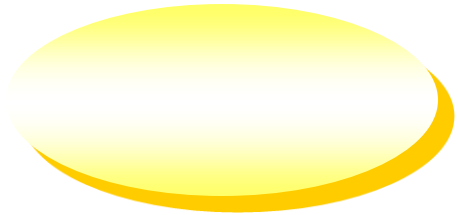
Generic Goals

Specific Goals

– Required

– Expected

– Informative



General structure of CMMI

Generic Practices

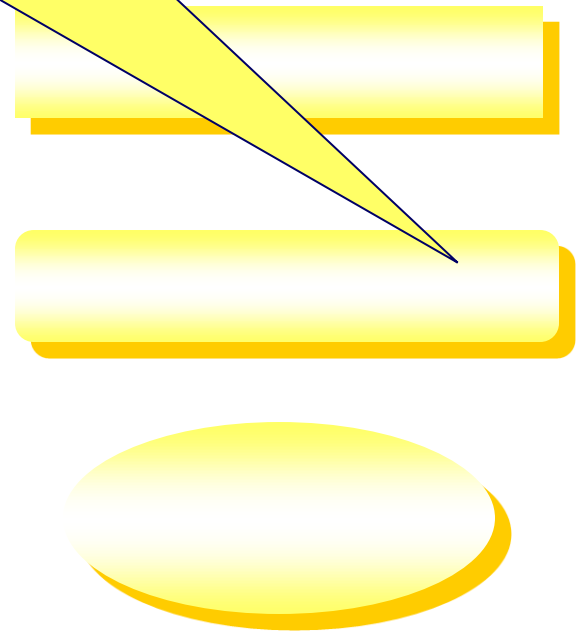
Specific Practices

nts

– Required

– Expected

– Informative



General structure of CMMI

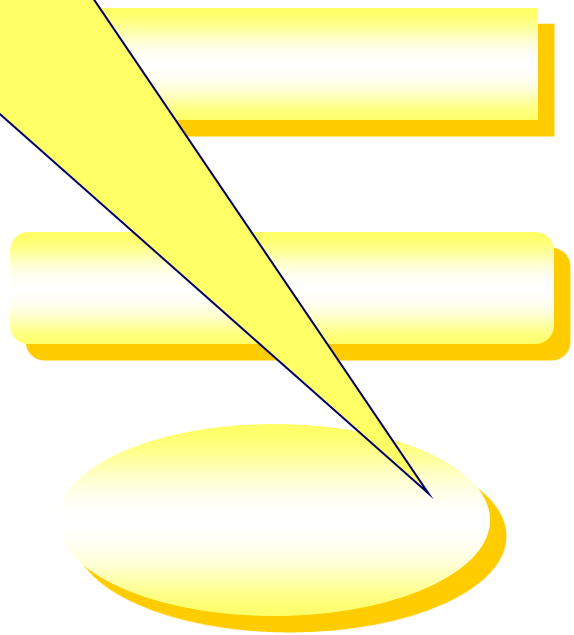
Purpose Statement
Introductory Notes
Related Process Areas
Generic Practice Elaborations
Examples, Notes, References, Amplifications
Subpractices
Typical Work Products

nts

– Required

– Expected

– Informative



General structure of CMMI

- **Numbering Scheme (Identification)**
  - Specific Goals: SG n
  - Specific Practices: SP n.m
  - Generic Goals: GG n
  - Generic Practices: GP n.m

Agenda

- Overview of CMMI
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- CMMI Model Representations
- Generic Goals and Practices
- CMMI by PAs and Groups

CMMI Model Representations

- **Representations**
  - two different approaches in implementing CMMI
  - **Continuous**
    - PAs are organized by categories
  - **Staged**
    - PAs are organized by maturity levels

CMMI Model Representations

- **Continuous representation**
  - Categories of PAs
    - Process Management
    - Project Management
    - Engineering
    - Support

CMMI Model Representations

Category	Process Areas
Process Management	Organizational Process Focus Organizational Process Definition + IPPD Organizational Training Organizational Process Performance Organizational Innovation and Deployment
Project Management	Project Planning Project Monitoring and Control Supplier Agreement Management Integrated Project Management + IPPD Risk Management Quantitative Project Management
Engineering	Requirements Management Requirements Development Technical Solution Product Integration Verification Validation
Support	Configuration Management Process and Product Quality Assurance Measurement and Analysis Decision Analysis and Resolution Causal Analysis and Resolution

CMMI Model Representations

- **Continuous representation**
  - Capability levels (CL)

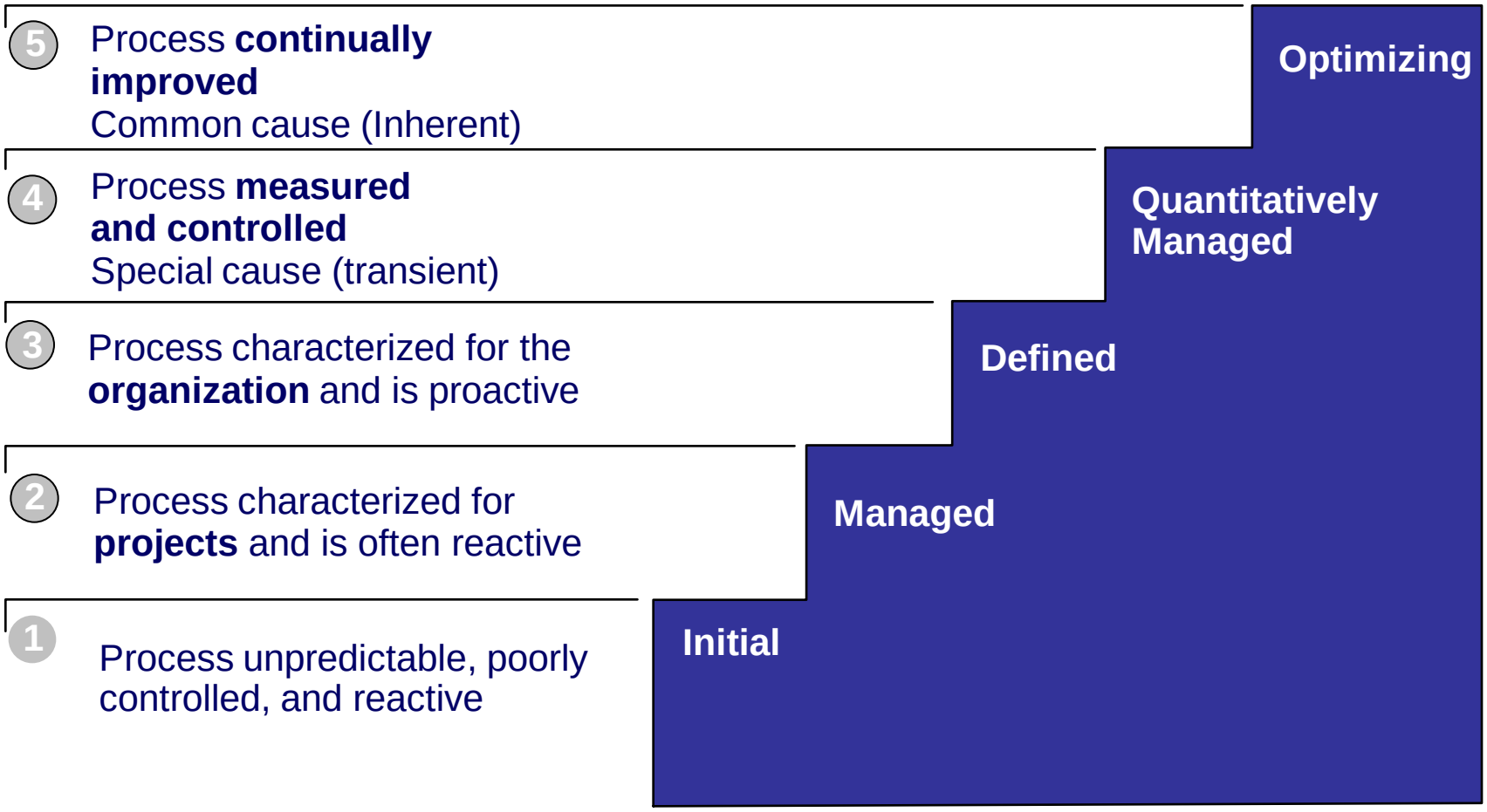
Level	Capability
CL 5	Optimizing
CL 4	Quantitatively Managed
CL 3	Defined
CL 2	Managed
CL 1	Performed
CL 0	Incomplete

CMMI Model Representations

- **Staged representation**
  - Maturity levels (MLs) of PAs
    - ML 1. Initial
      - .
    - ML 2. Managed
      - basic project management
    - ML 3. Defined
      - process standardization
    - ML 4. Quantitatively Managed
      - quantitative management
    - ML 5. Optimizing
      - continuous process improvement

CMMI Model Representations

- **Staged representation**

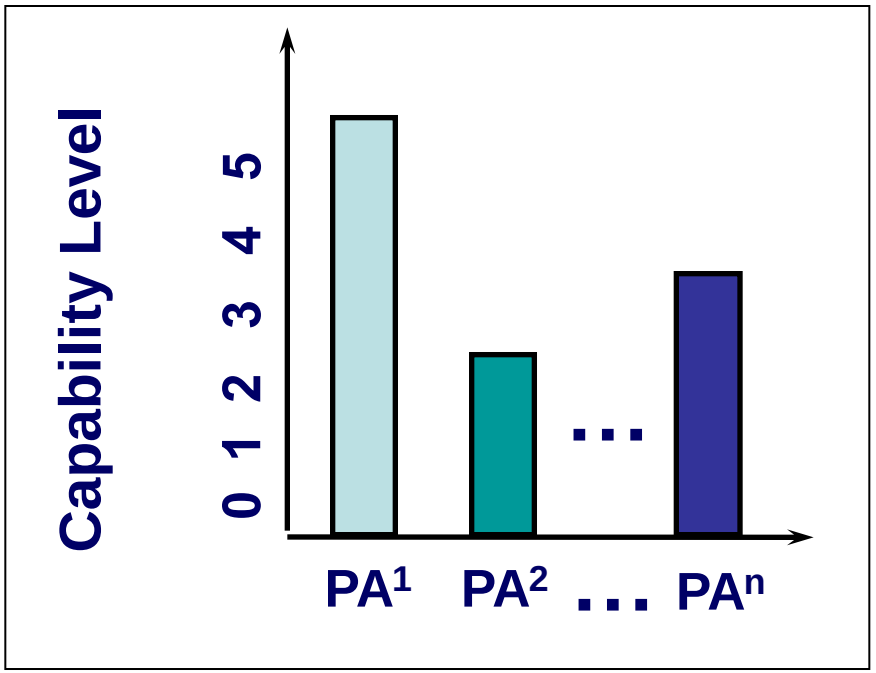


CMMI Model Representations

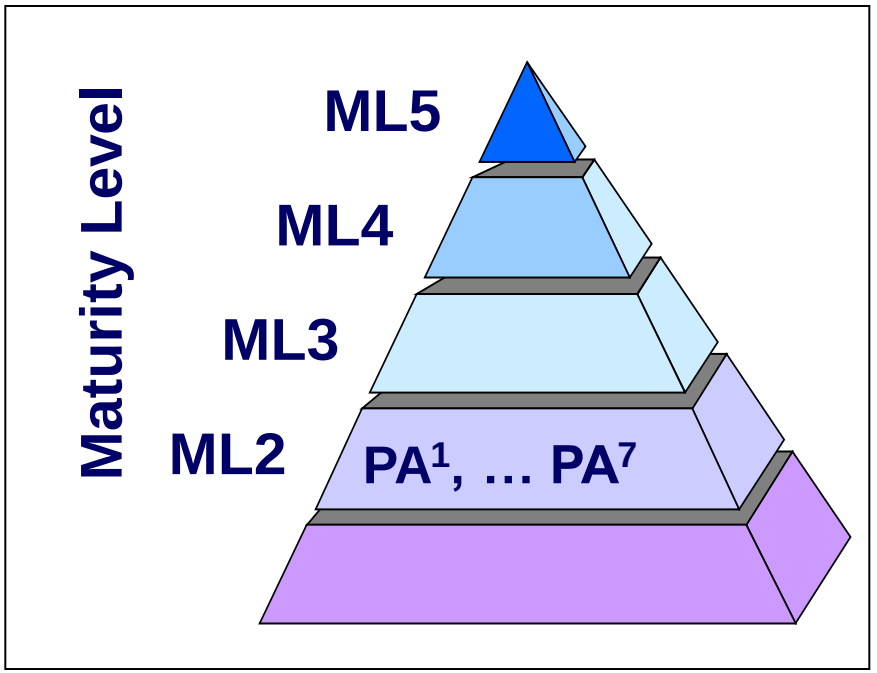
Level	Process Areas
5 Optimizing	Organizational Innovation and Deployment Causal Analysis and Resolution
4 Quantitatively Managed	Organizational Process Performance Quantitative Project Management
3 Defined	Requirements Development Technical Solution Product Integration Verification Validation Organizational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

CMMI Model Representations

Continuous

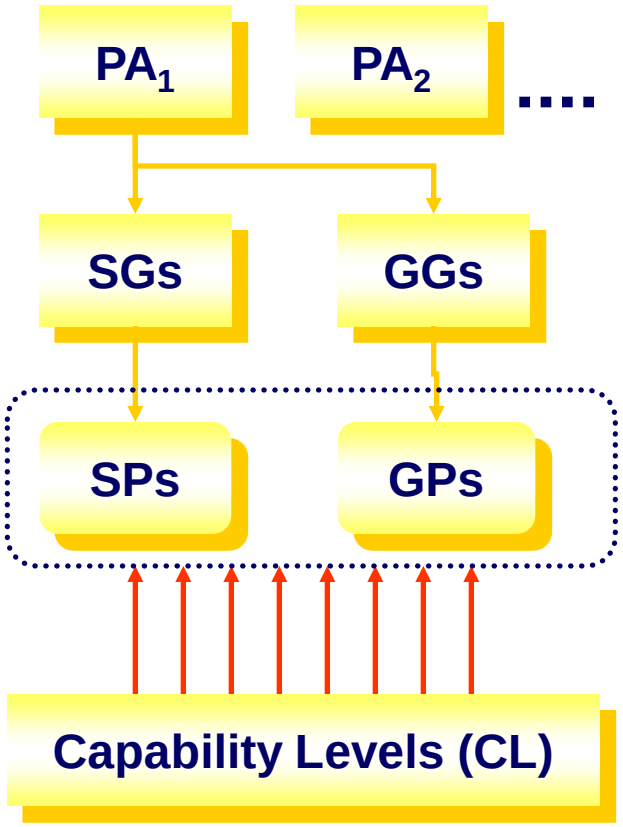


Staged

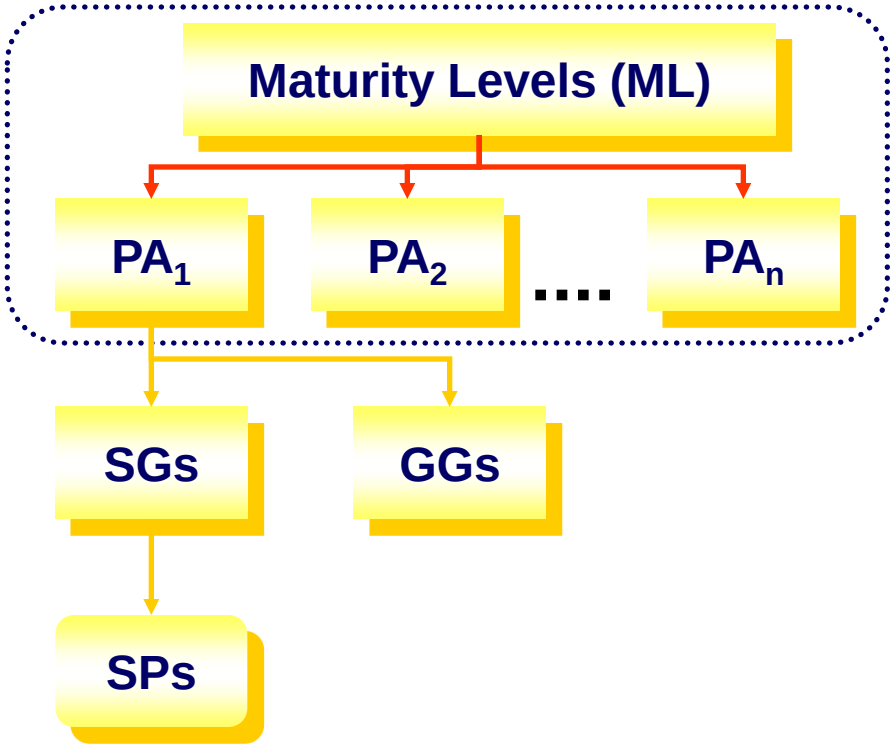


CMMI Model Representations

Continuous



Staged



Common Features

Agenda

- Overview of CMMI
- General Structure of CMMI
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- Generic Goals and Practices
- CMMI by PAs and Groups

Generic Goals and Practices

- **Process Institutionalization**
  - Means that the process is ingrained in the way the work is performed
  - The organization builds an infrastructure
    - that contains effective, usable, and consistently applied processes
    - the organizational culture conveys the process
    - management nurtures the culture
    - culture is conveyed through role models and recognition
    - processes endure after the people who originally defined them have gone

Generic Goals and Practices

- **Role of Generic Goals and Practices**
  - Contribute to process institutionalization
  - GGs and GPs provide for commitment and consistency
    - troughout processes and activities in an organization
  - GGs define the degree of institutionalization

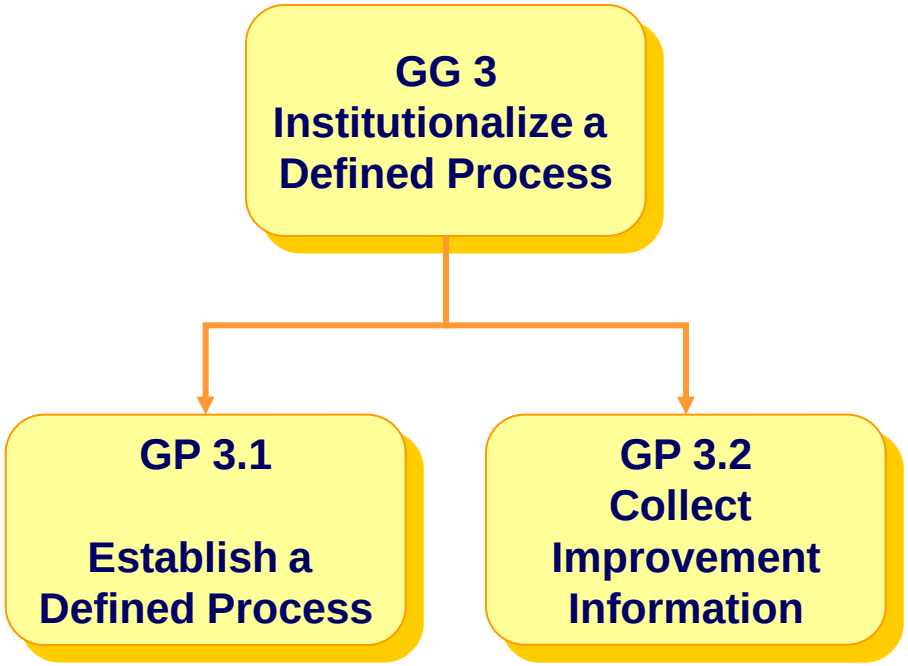
Generic Goals and Practices

GGs	Name of A GG	Progression of Processes	Contin. rep.	Staged rep.
GG 1	Achieve Specific Goals	Performed Process	CL 1	
GG 2	Institutionalize a Managed Process	Managed Process	CL 2	ML 2 – 5
GG 3	Institutionalize a Defined Process	Defined Process	CL 3	ML 3 – 5
GG 4	Institutionalize a Quantitatively Managed Process	Quantitatively Managed process	CL 4	
GG 5	Institutionalize an Optimizing Process	Optimizing Process	CL 5	

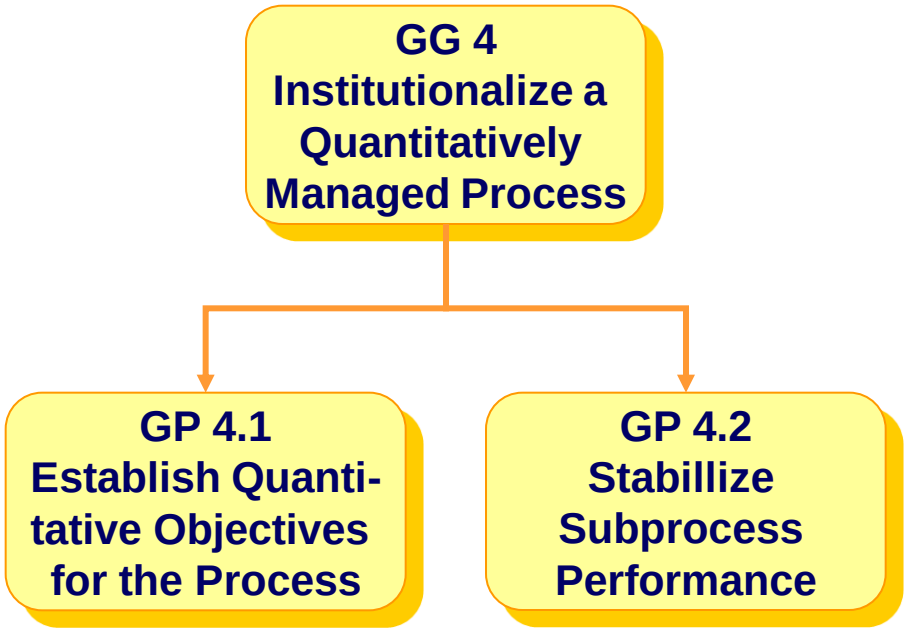
Generic Goals and Practices

Generic Goals and Practices

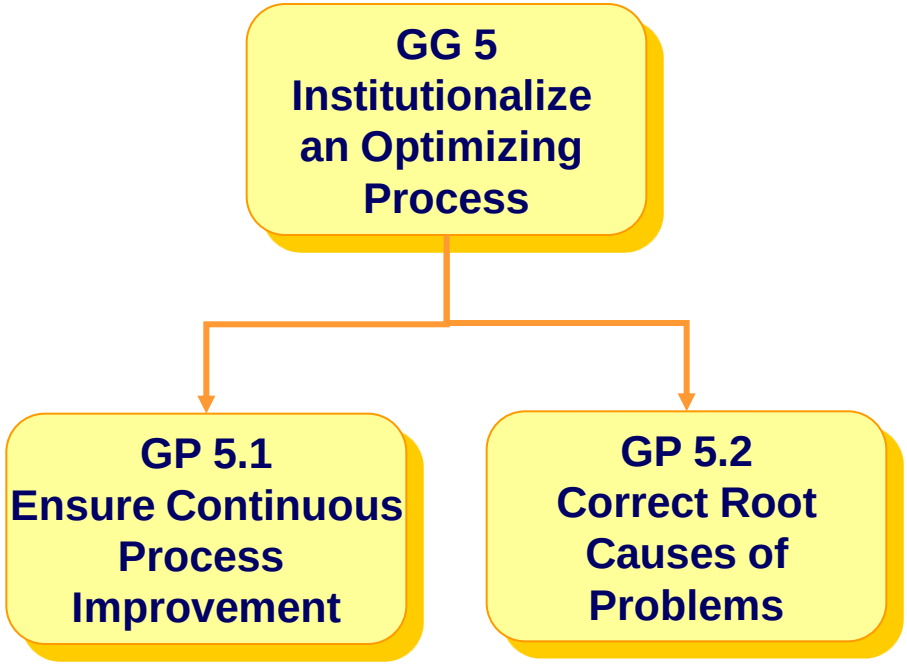
Generic Goals and Practices



Generic Goals and Practices



Generic Goals and Practices



Generic Goals and Practices

- **Staged Representation - Requirements**

MLs	Description	Requirements
ML 1	Ad hoc and chaotic processes	
ML 2	Adhere to policy; Follow documented plans and processes; Apply adequate resources; Assign responsibility and authority; Train people; Apply CM; Monitor, control, and evaluate the processes; Identify and involve stakeholders; Review with management	GP 2.1 – 2.10 All ML 2 PAs
ML 3	Tailor the project's process from organization's standard processes; Understand processes qualitatively; Ensure that processes contributes to organization assets	GP 2.1 – 3.2 All ML 2 – ML 3 PAs
ML 4	Measure process performance; Stabilize process and control charts; Deal with causes of special variations	GP 2.1 – 3.2 All ML 2 – ML 4 PAs
ML 5	Prevent defects; Proactively improve; Insert and deploy innovative technology	GP 2.1 – 3.2 All ML 2 – ML 5 PAs

Generic Goals and Practices

- **Continuous Represent. – Req. for a PA**

CLs	Description	Requirements
CL 0	Not performed, incomplete	A few GPs or SPs implemented
CL 1	Perform the work	GP 1.1, PA SPs
CL 2	Adhere to policy; Follow documented plans and processes; Apply adequate resources; Assign responsibility and authority; Train people; Apply CM; Monitor, control, and evaluate the processes; Identify and involve stakeholders; Review with management	GP 1.1 – GP 2.10 PA SPs
CL 3	Project's process is tailored from organization's standard processes; Understand processes qualitatively; Process contributes to organization assets	GP 1.1 – GP 3.2 PA SPs
CL 4	Measure process performance; Stabilize process and control charts; Deal with causes of special variations	GP 1.1 – GP 4.2 PA SPs
CL 5	Prevent defects; Proactively improve; Insert and deploy innovative technology	GP 1.1 – 5.2 PA SPs

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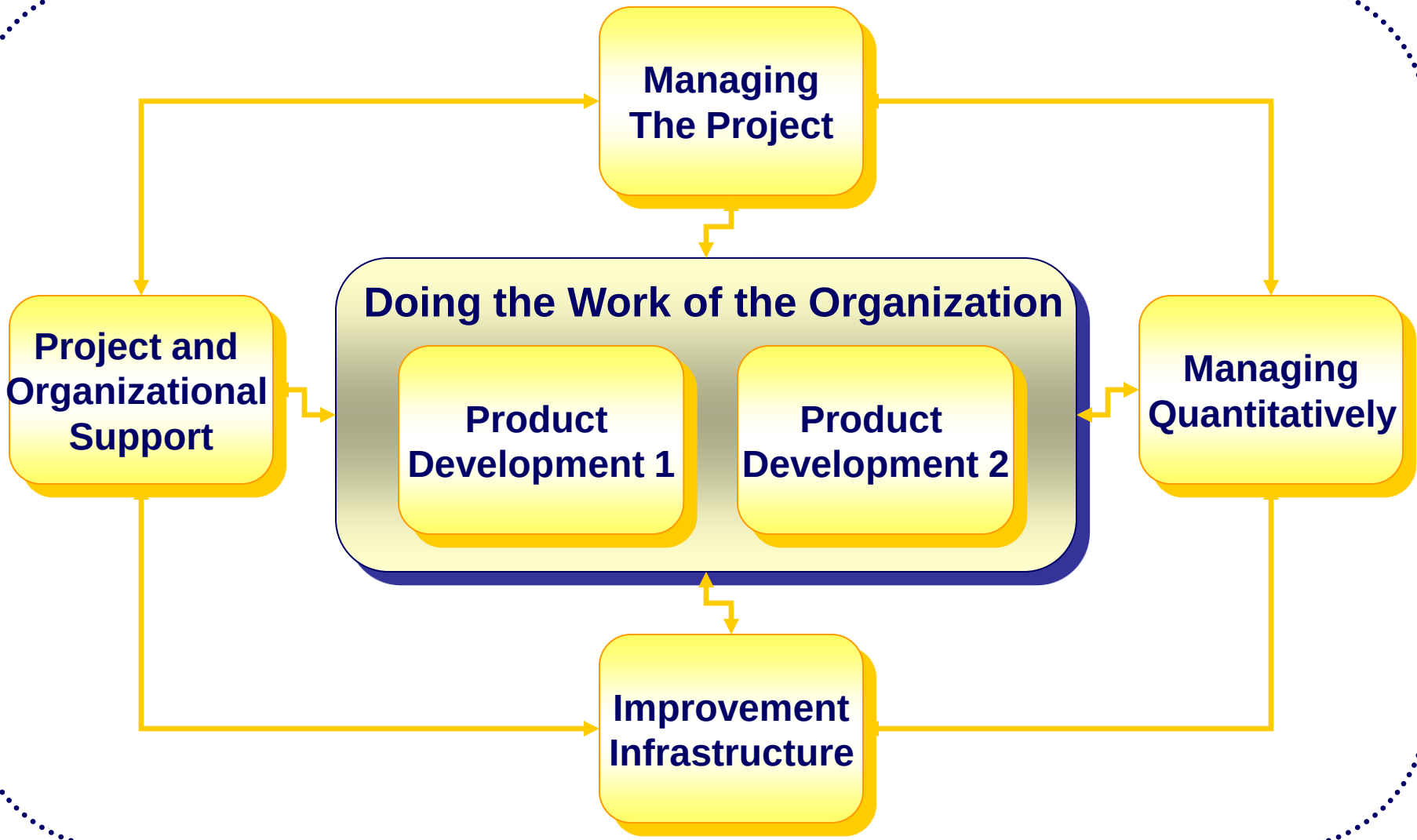
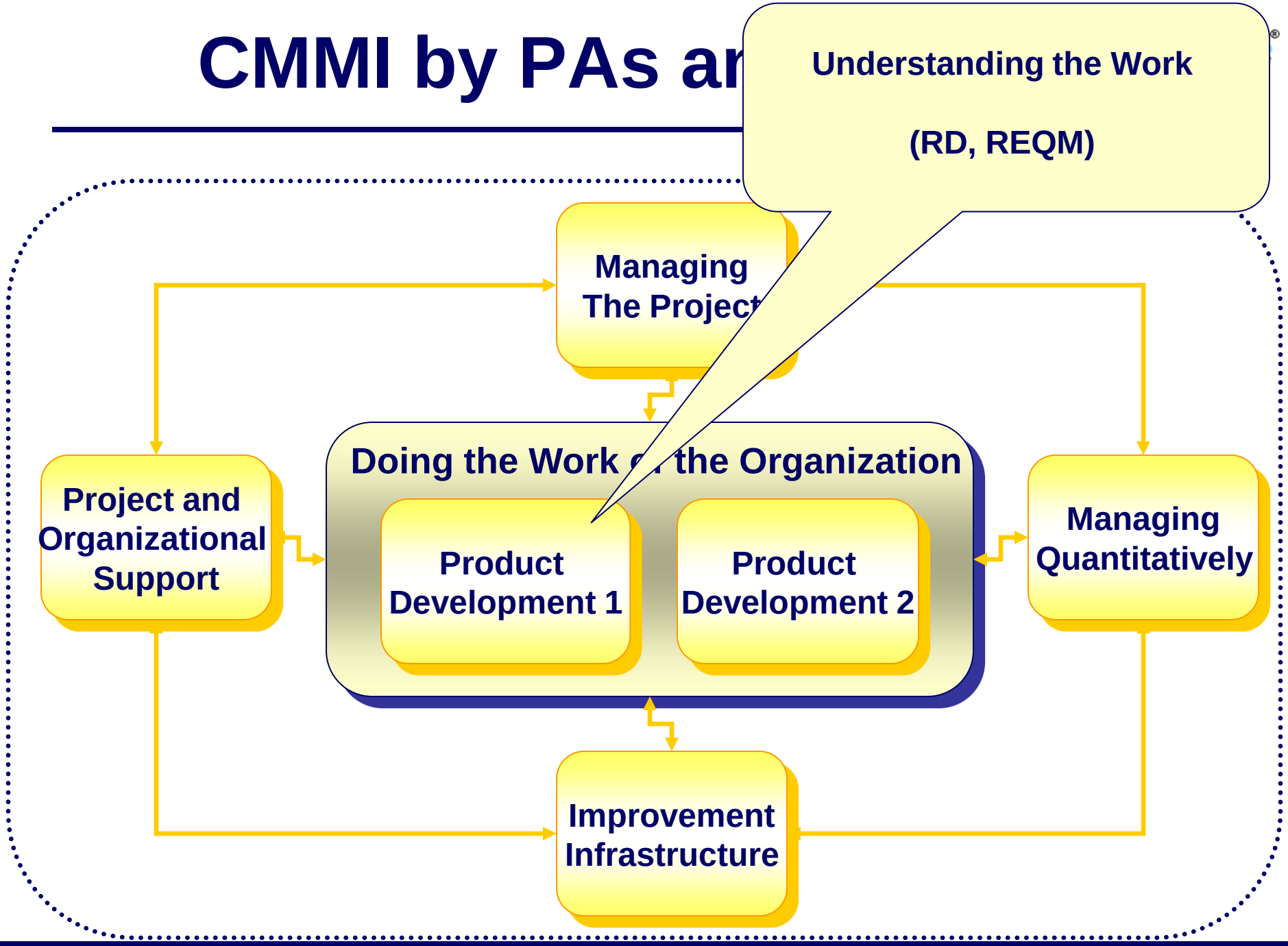
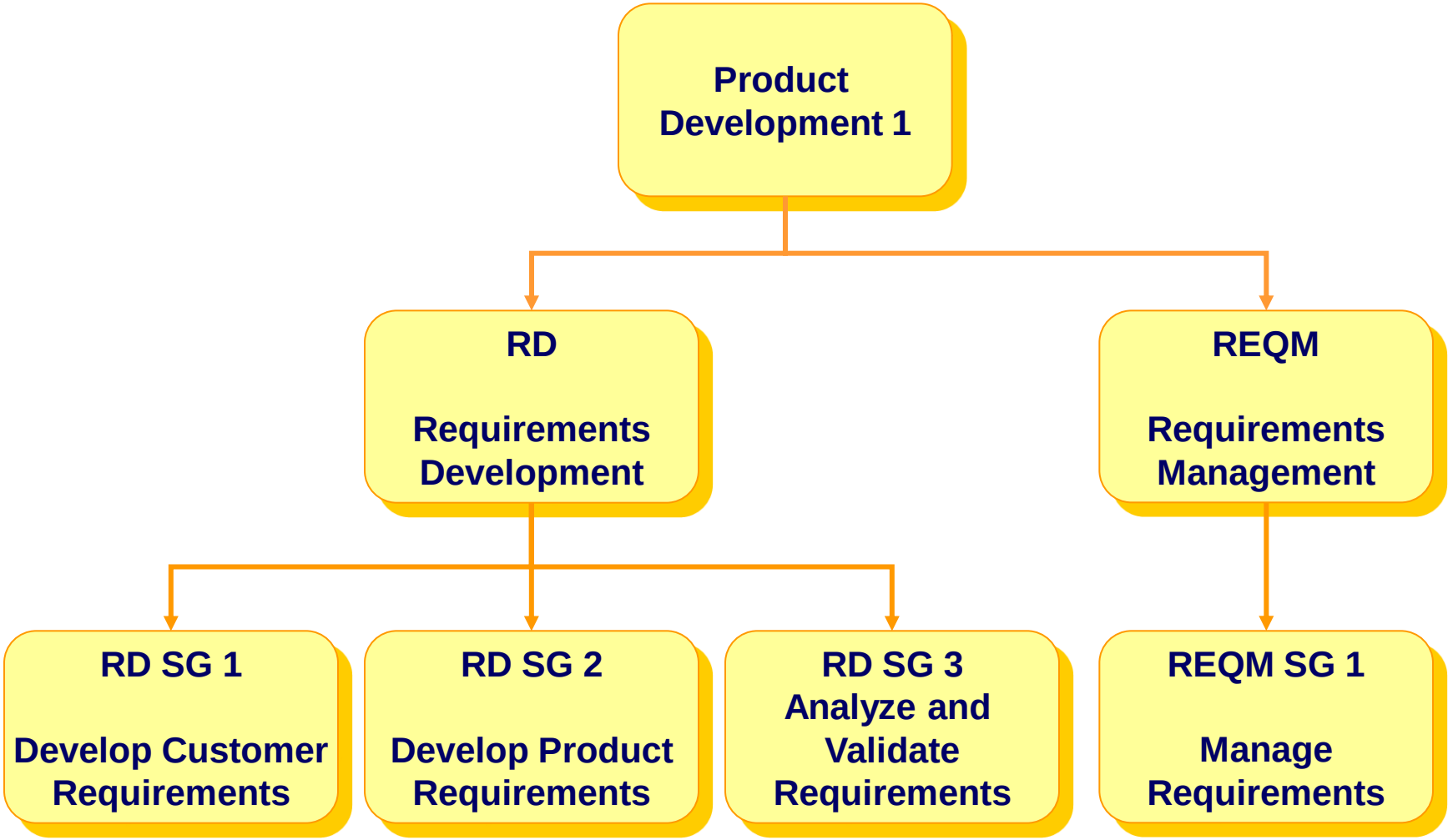


CMMI by PAs ar



CMMI by PAs and Groups



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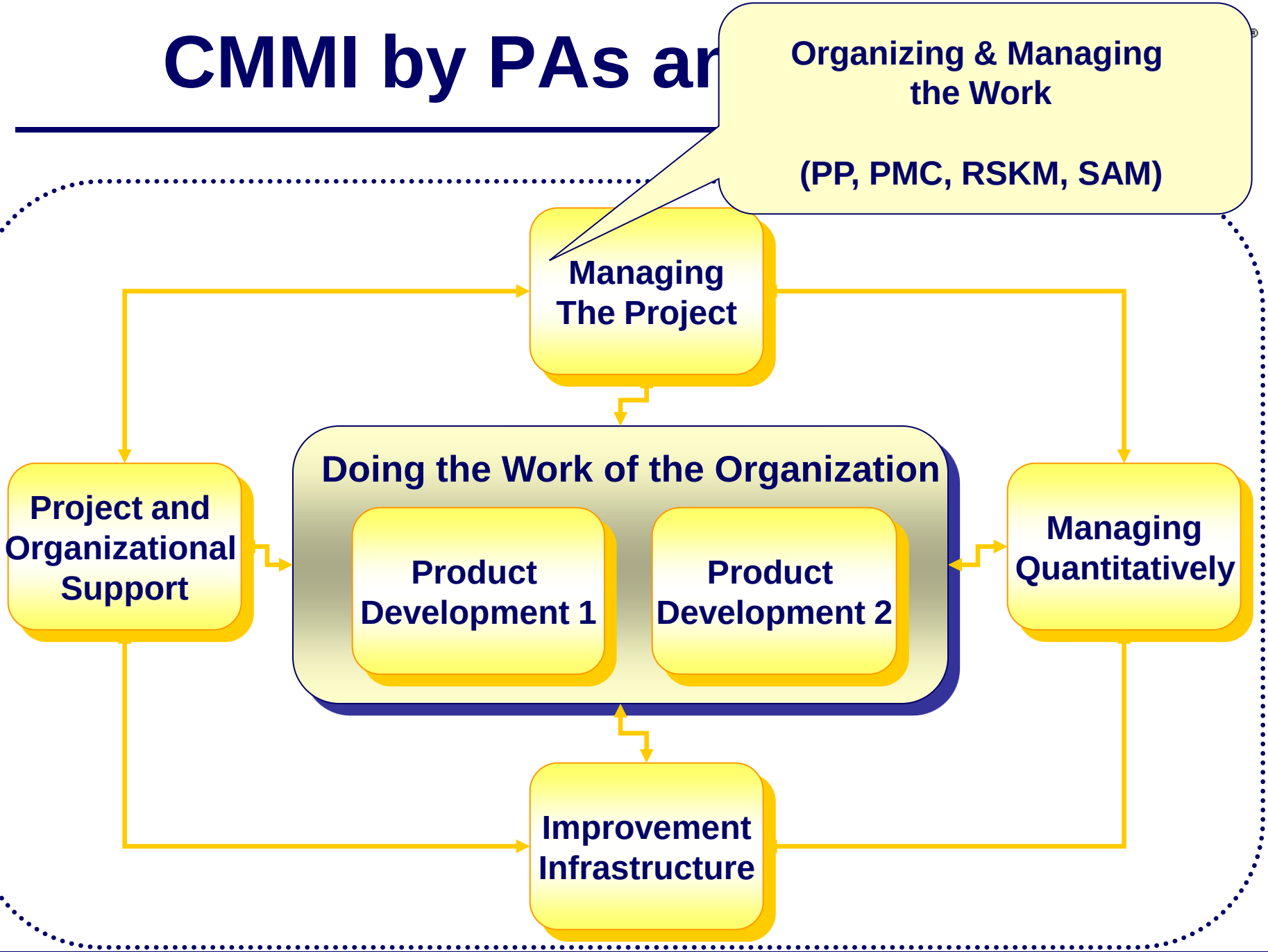
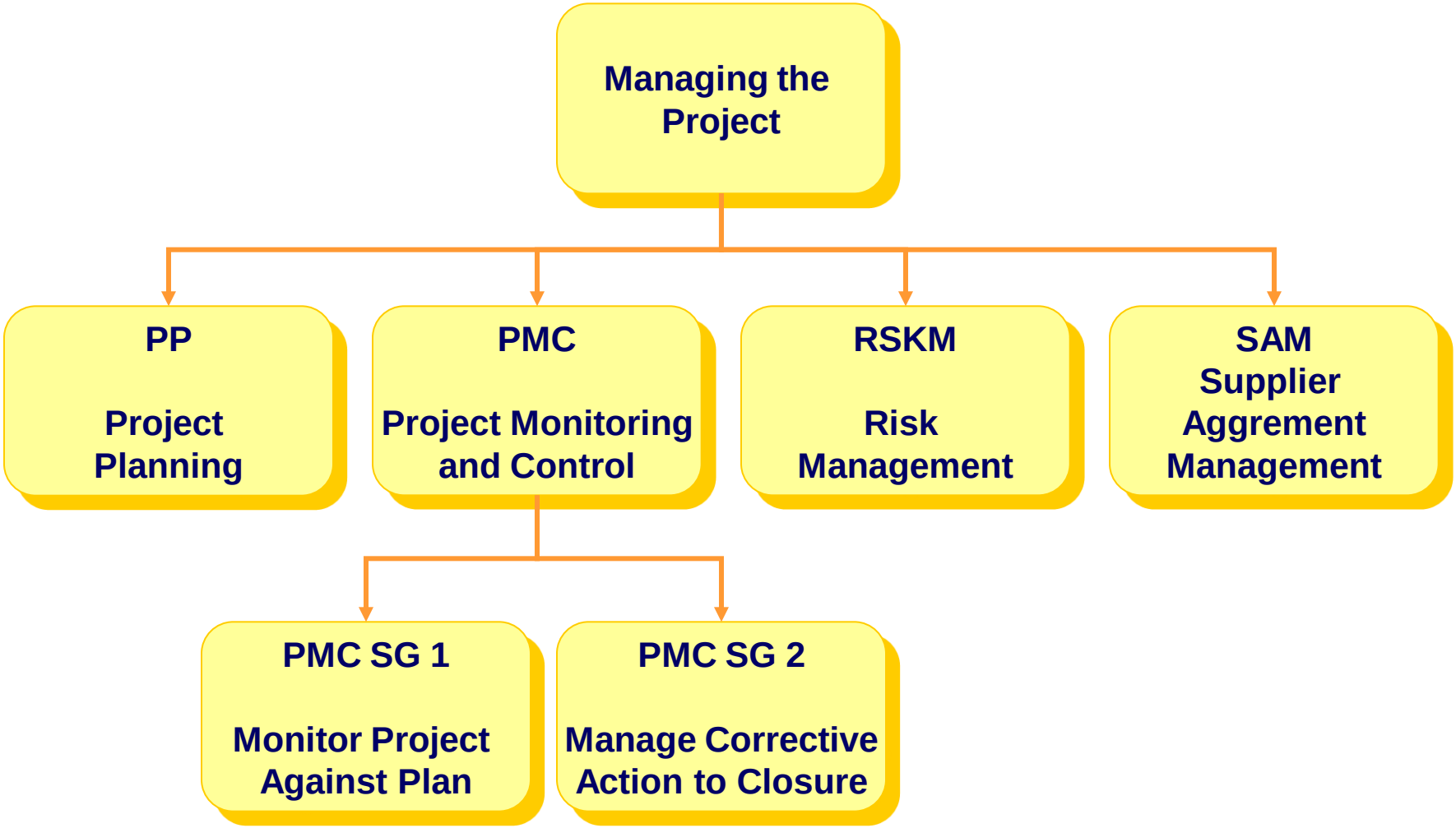
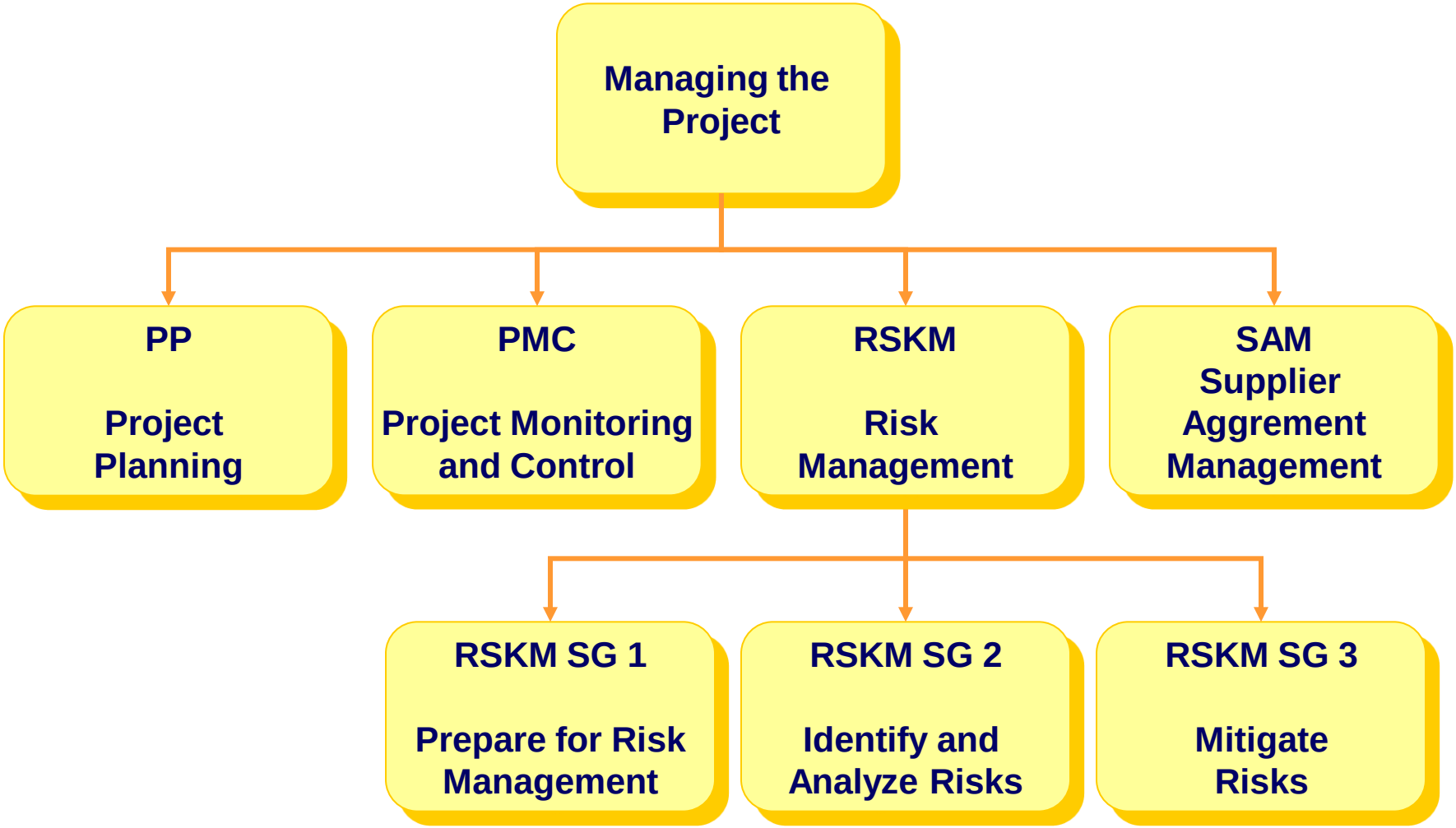


CMMI by PAs and Groups

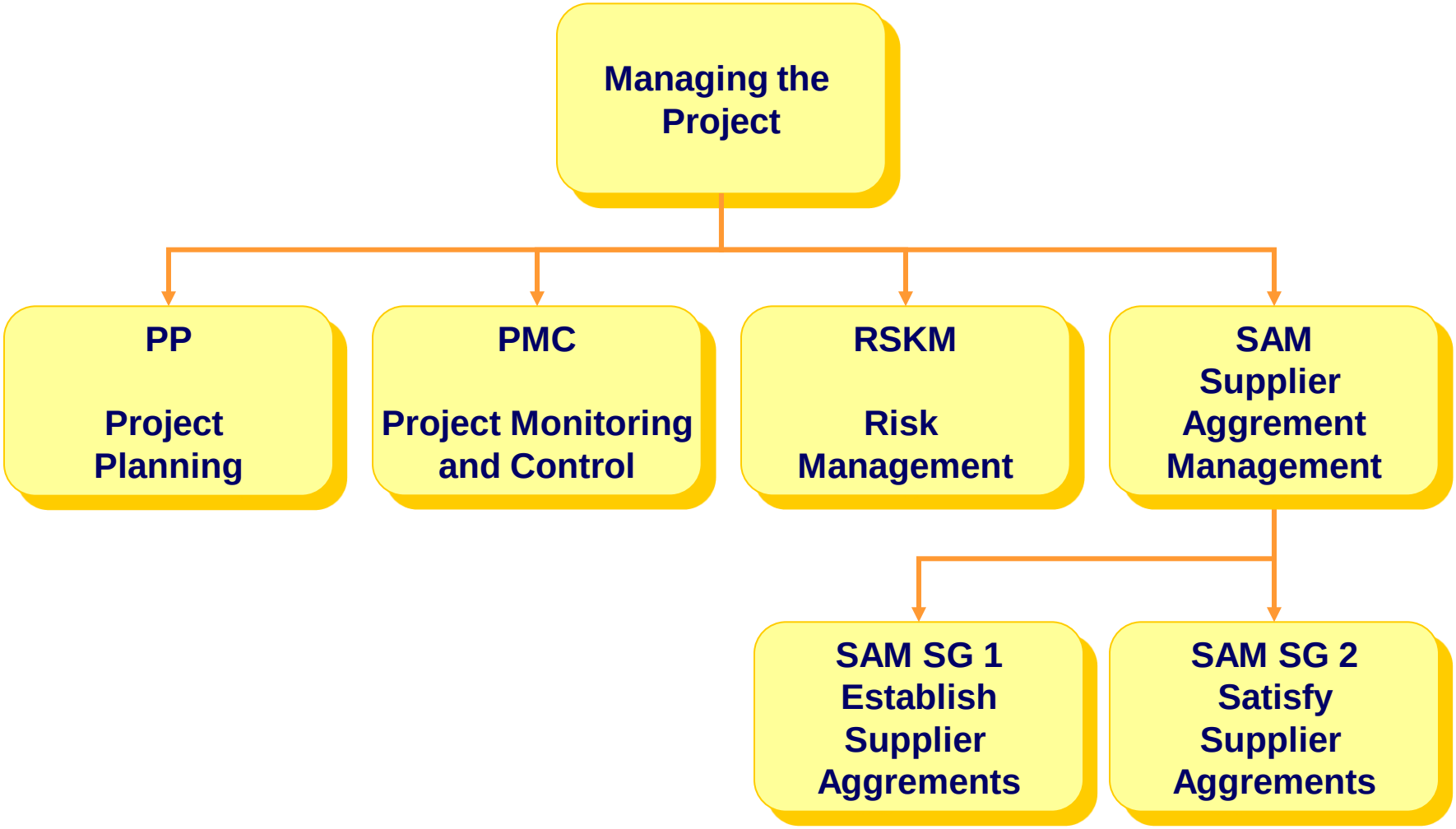
CMMI by PAs and Groups



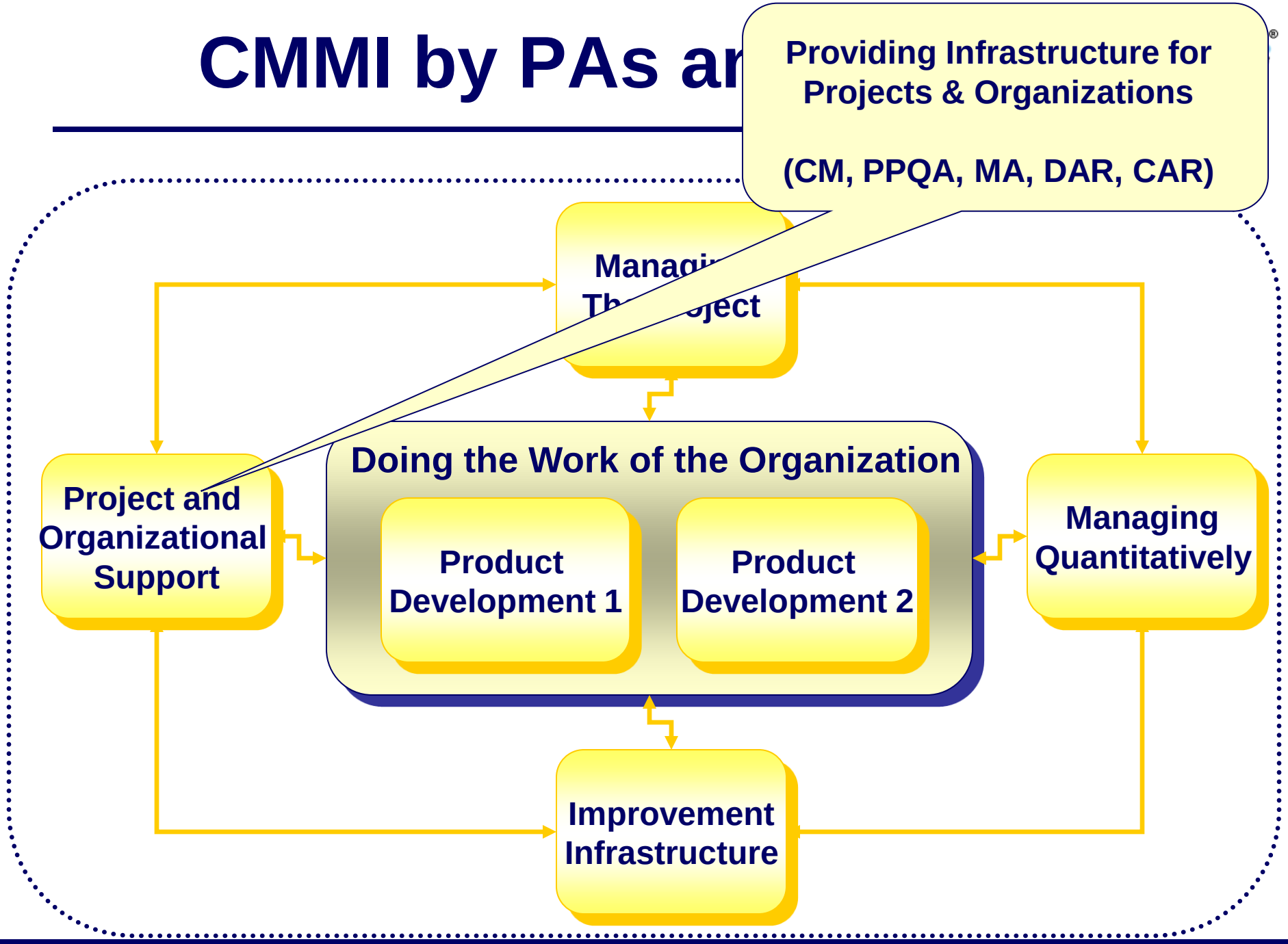
CMMI by PAs and Groups



CMMI by PAs and Groups



CMMI by PAs ar



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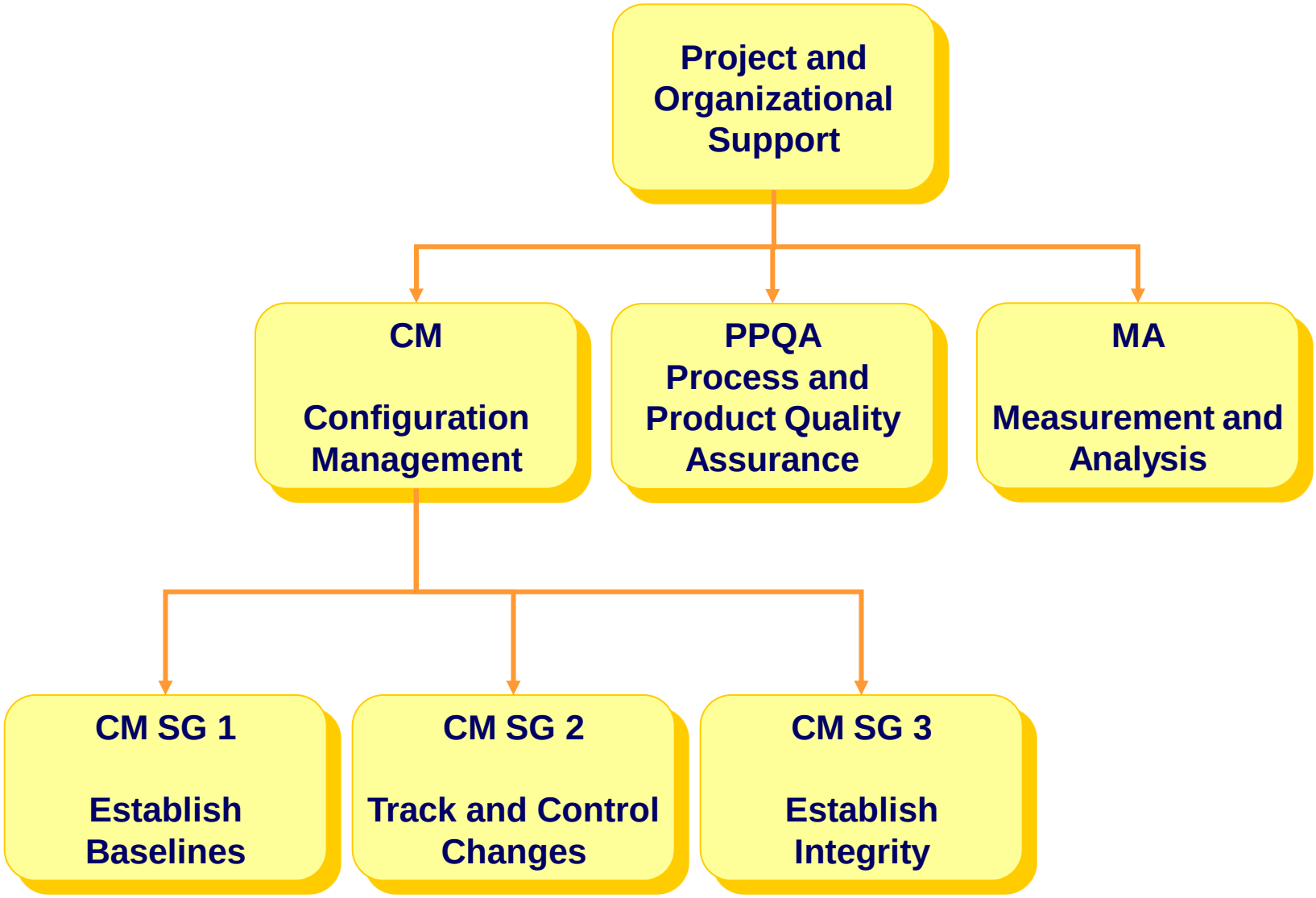

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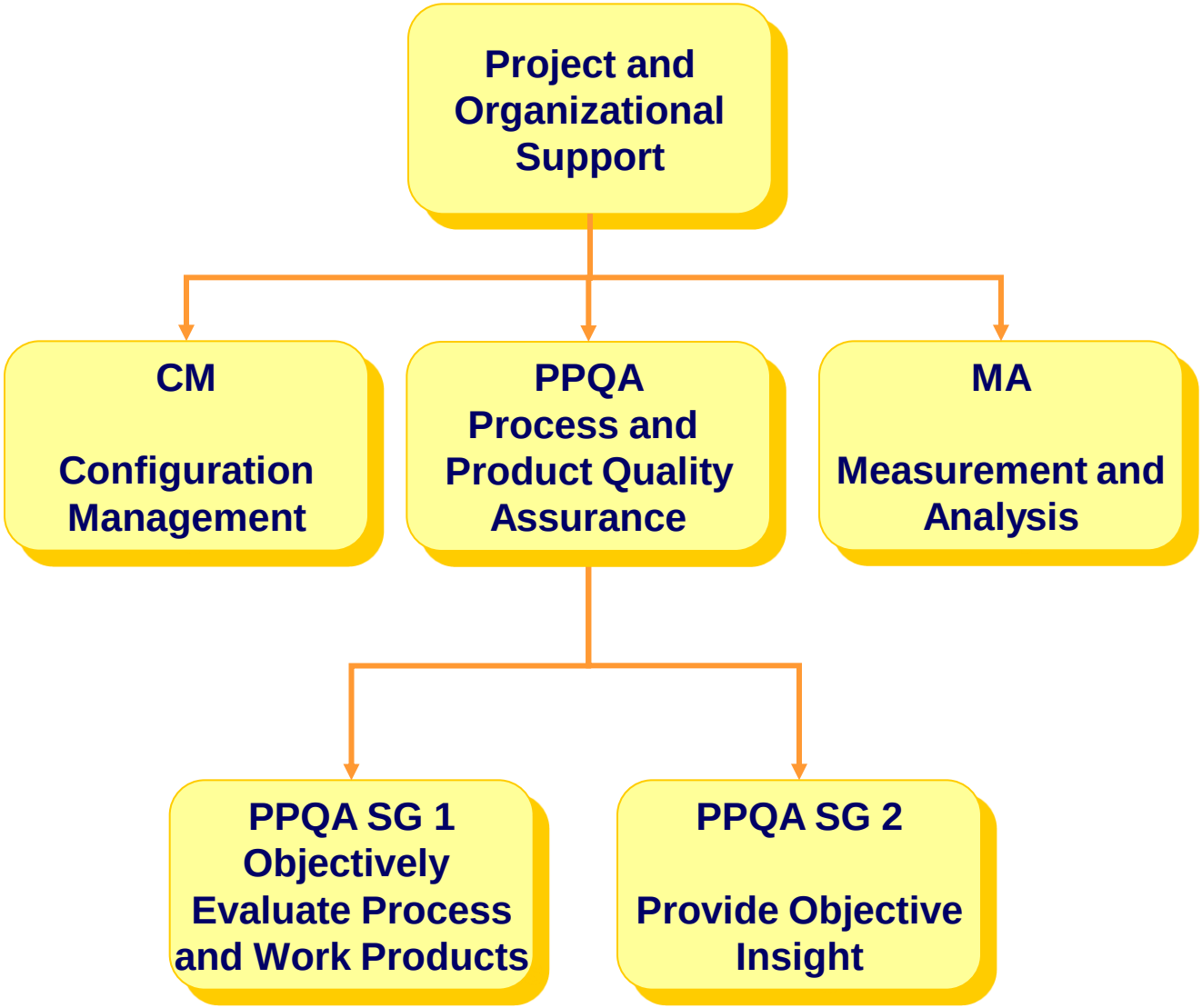

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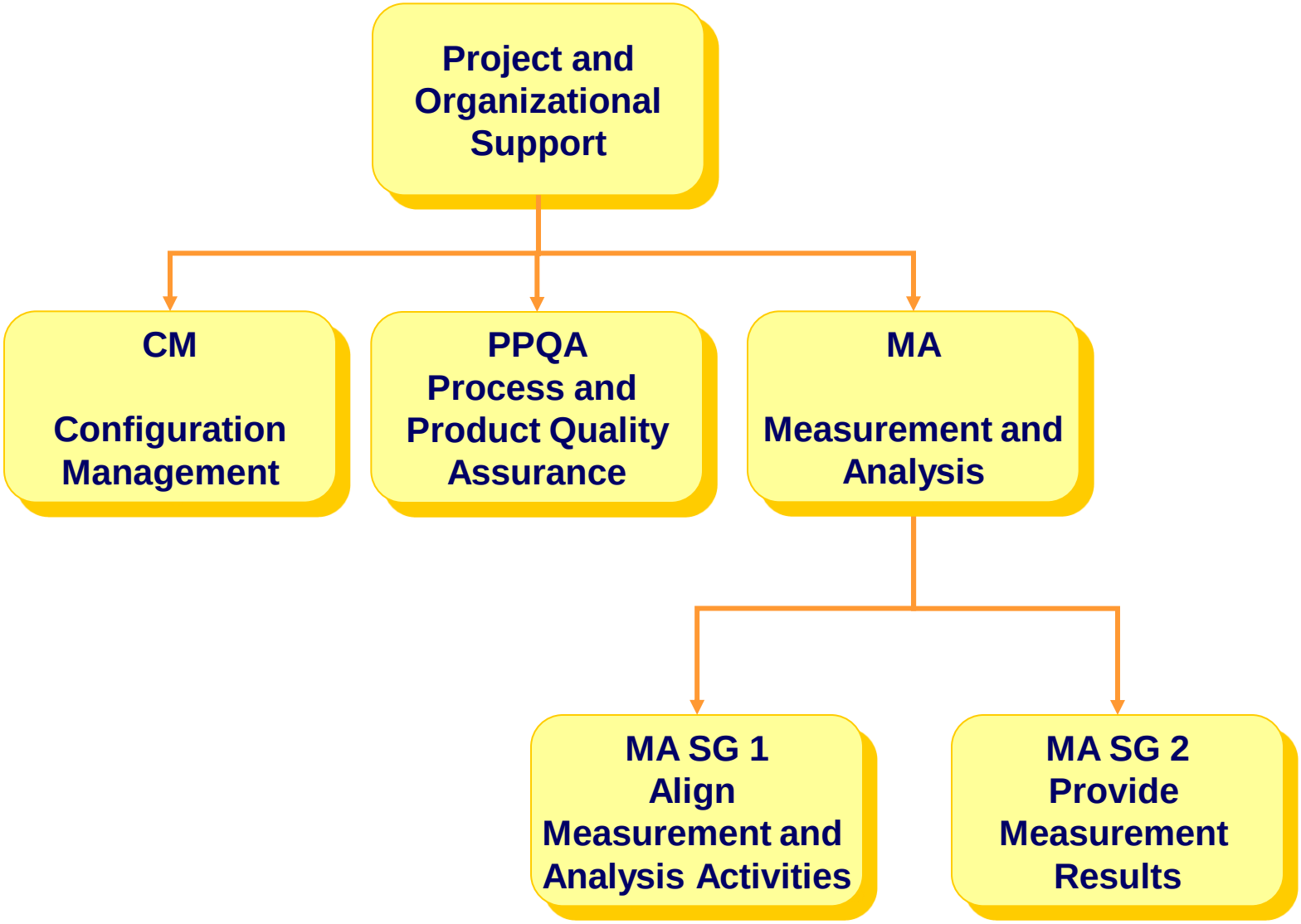

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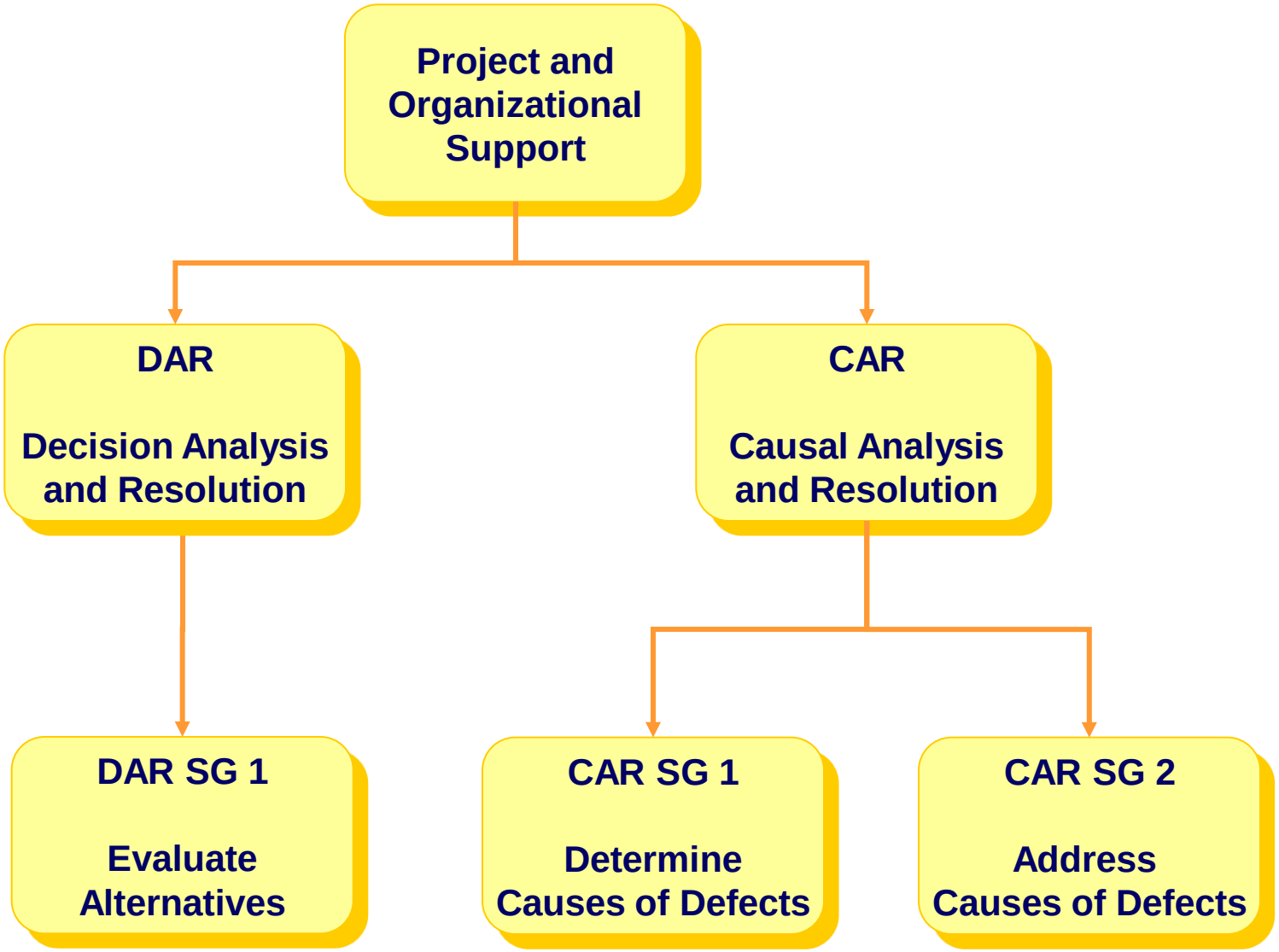
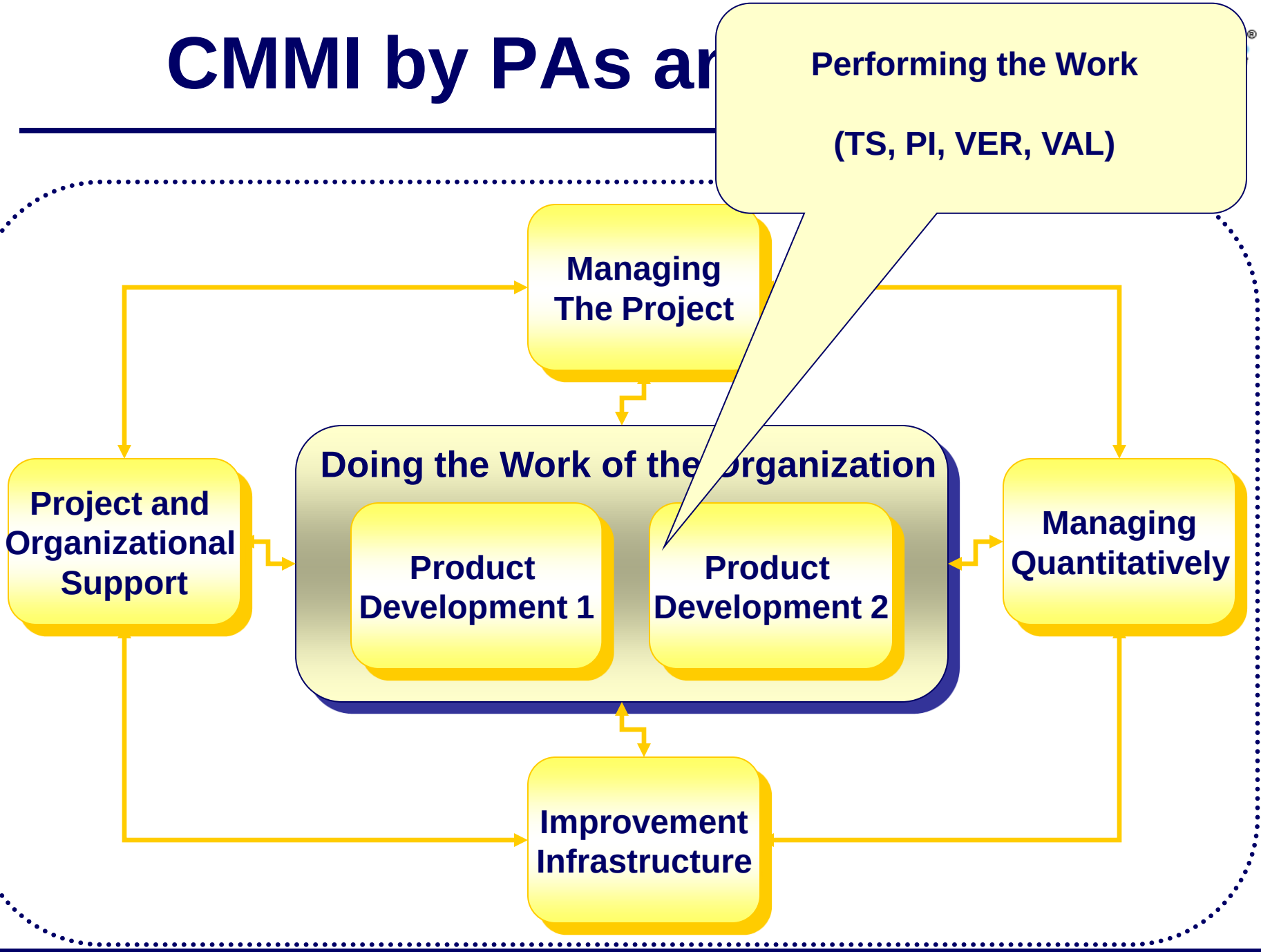


CMMI by PAs ar



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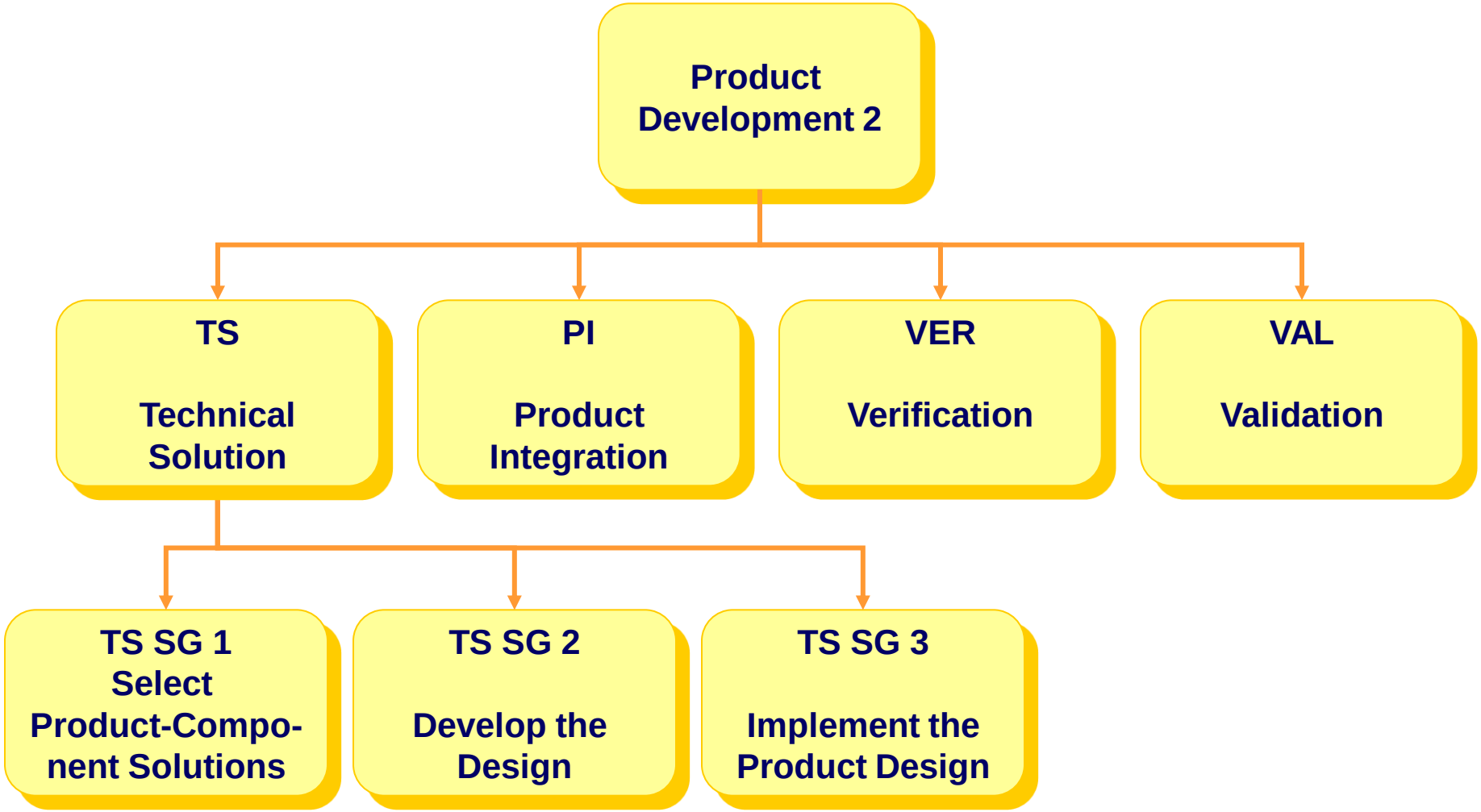

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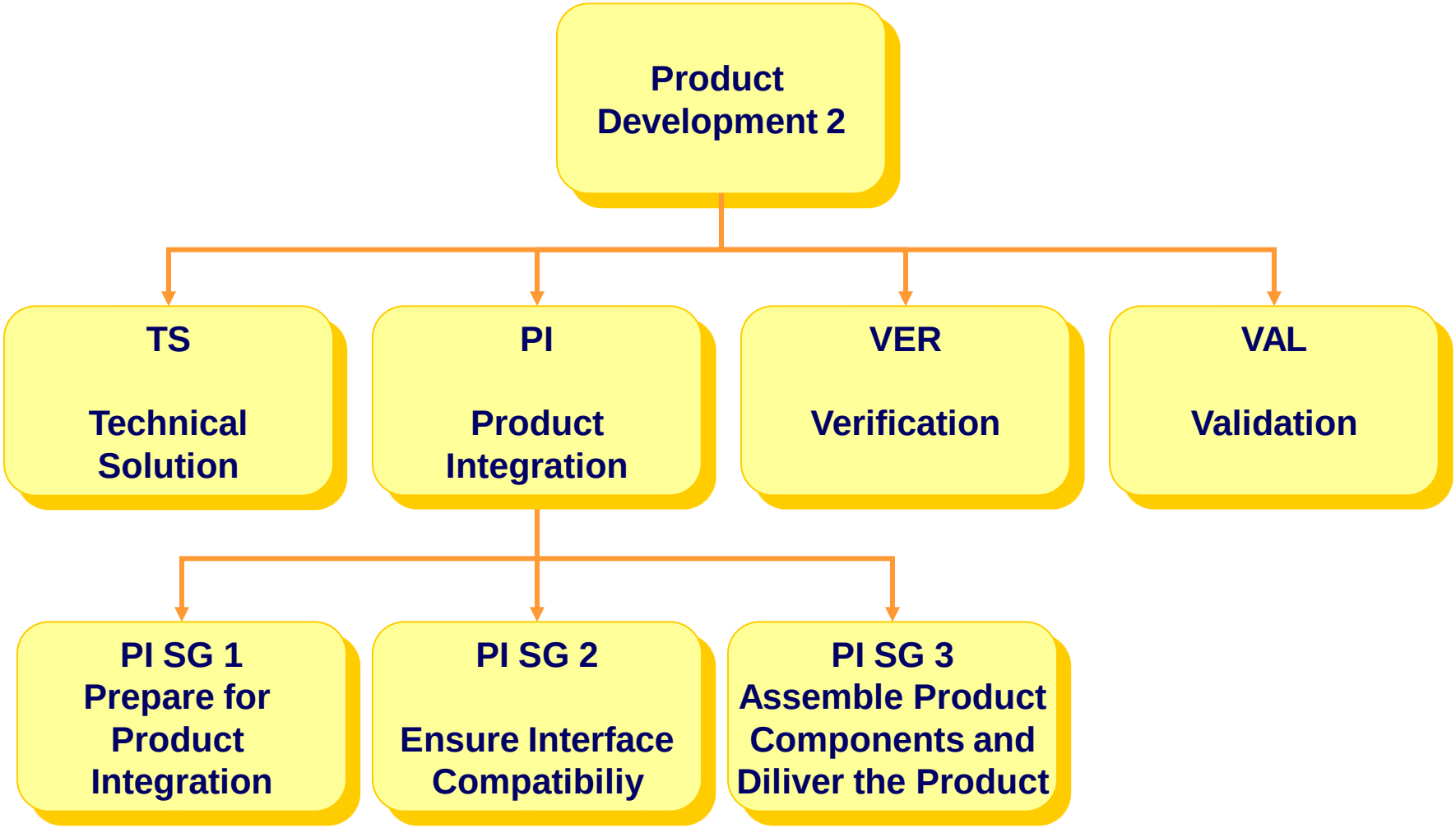

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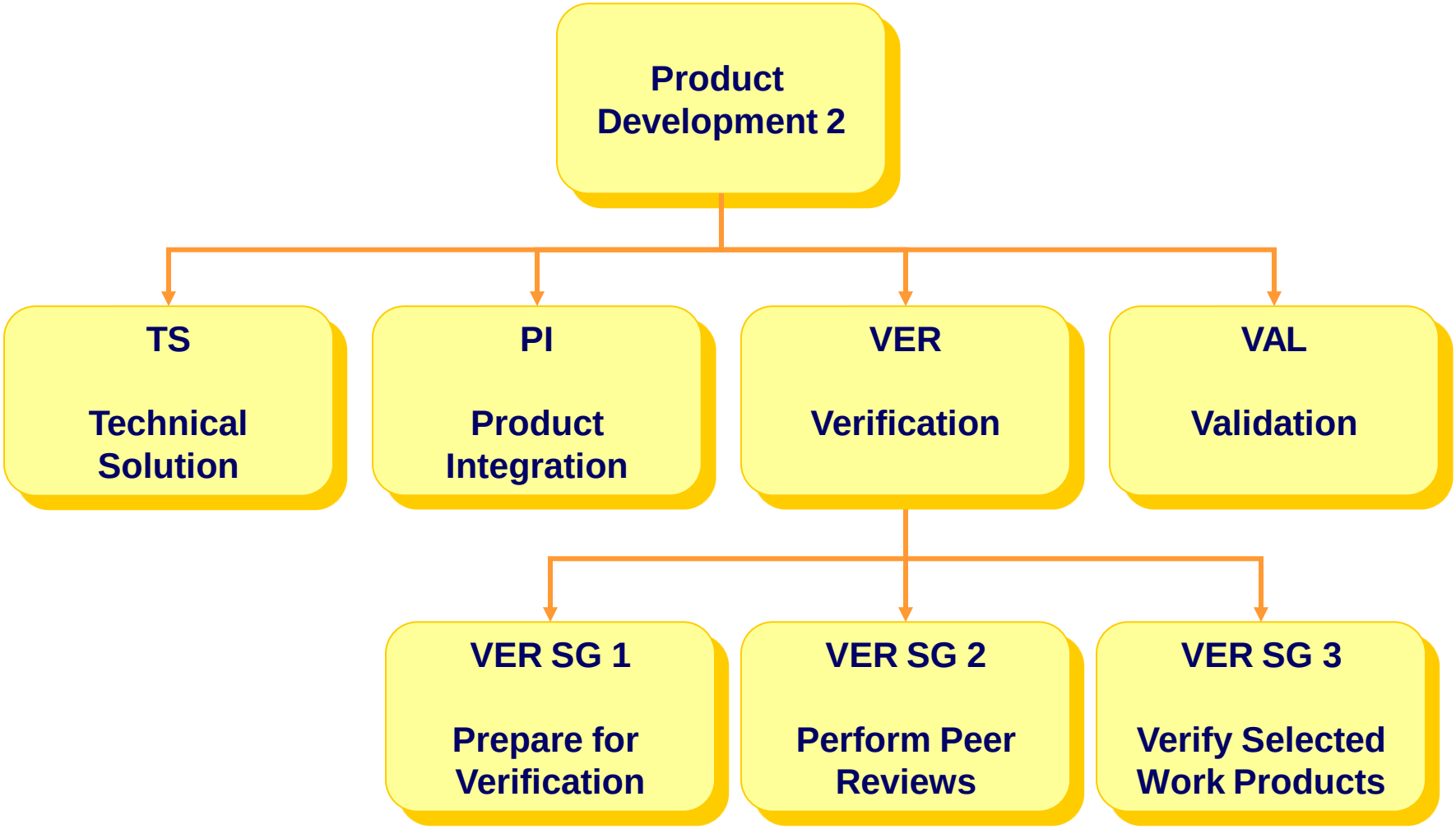
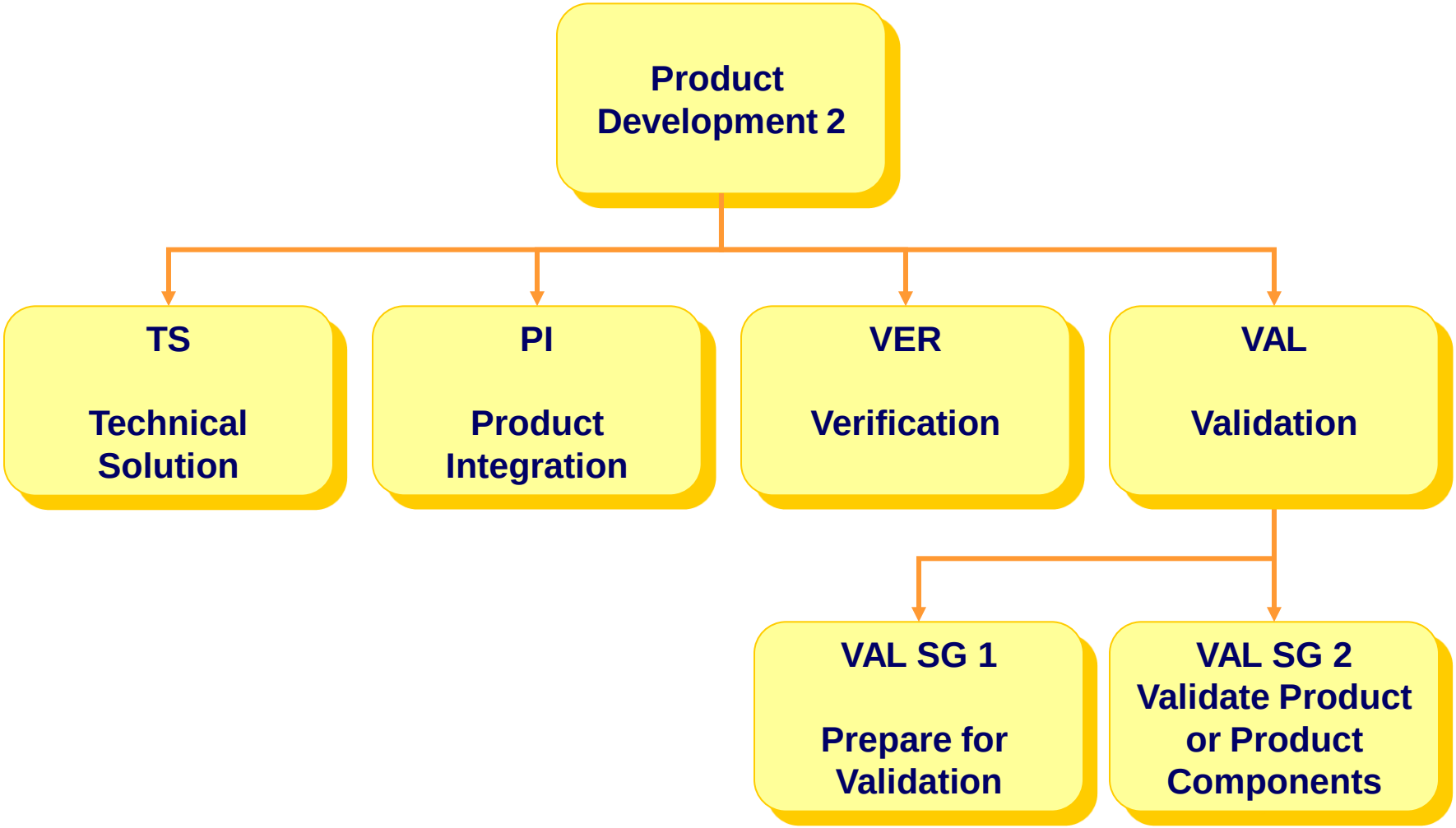
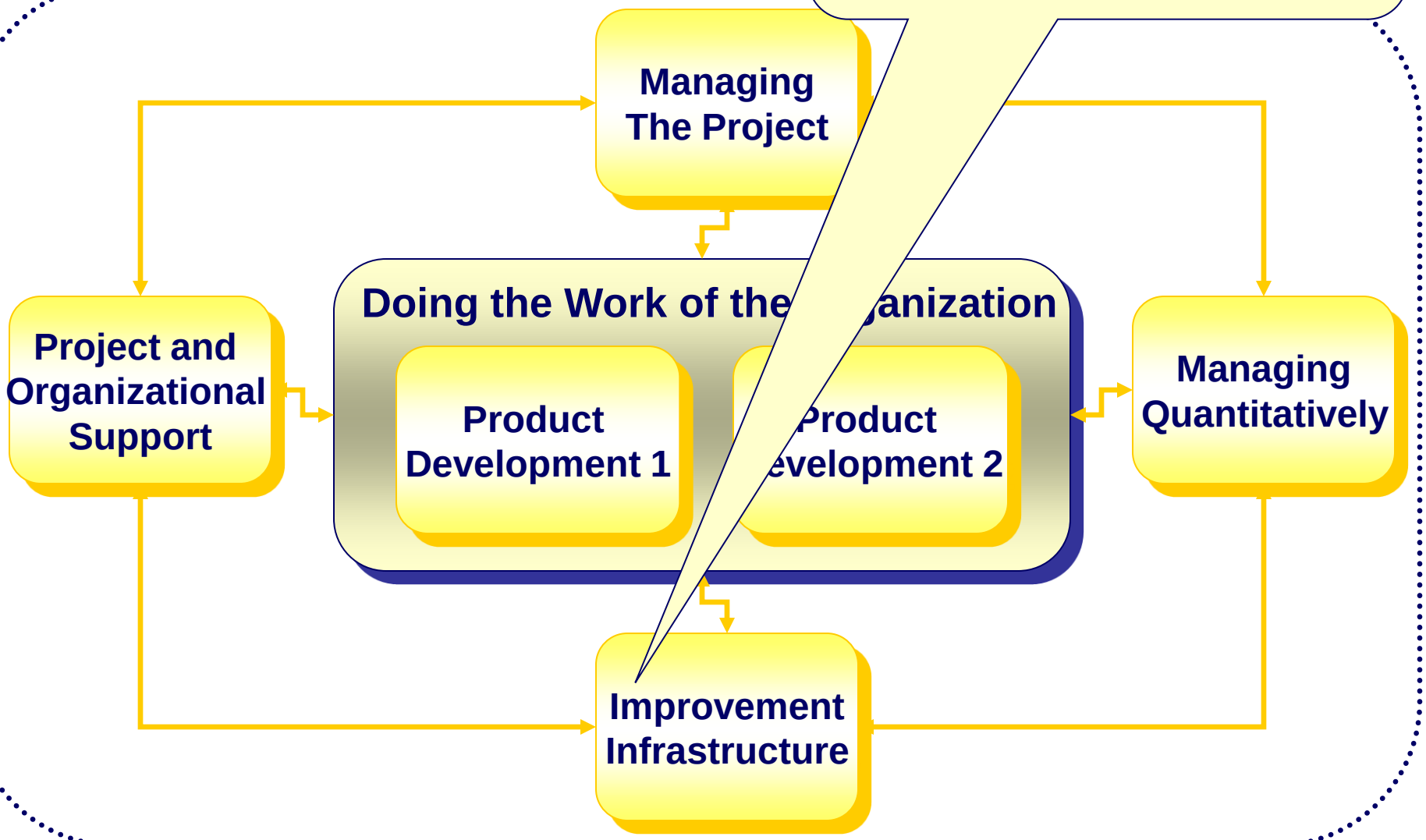


CMMI by PAs and Groups



CMMI by PAs ar



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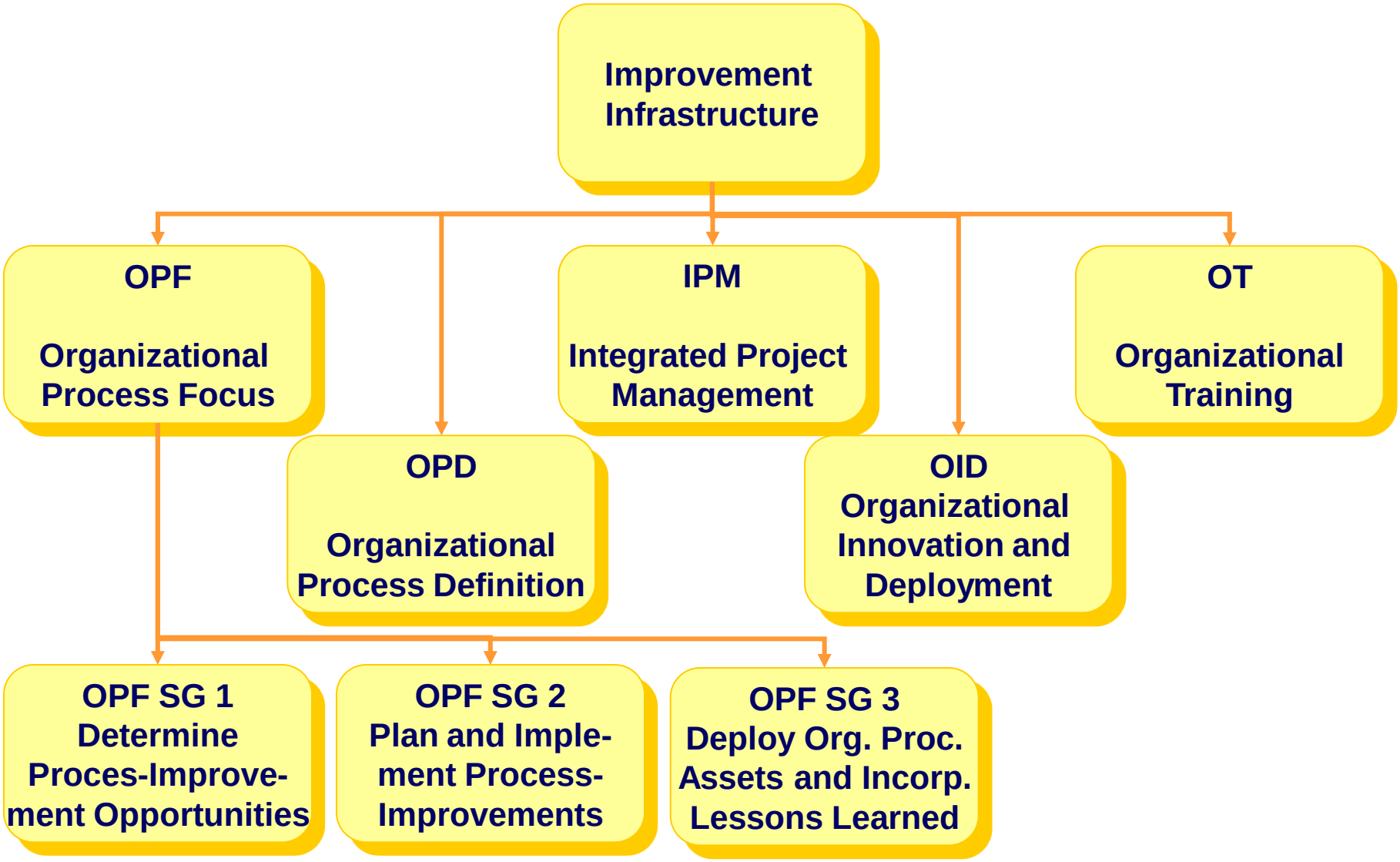

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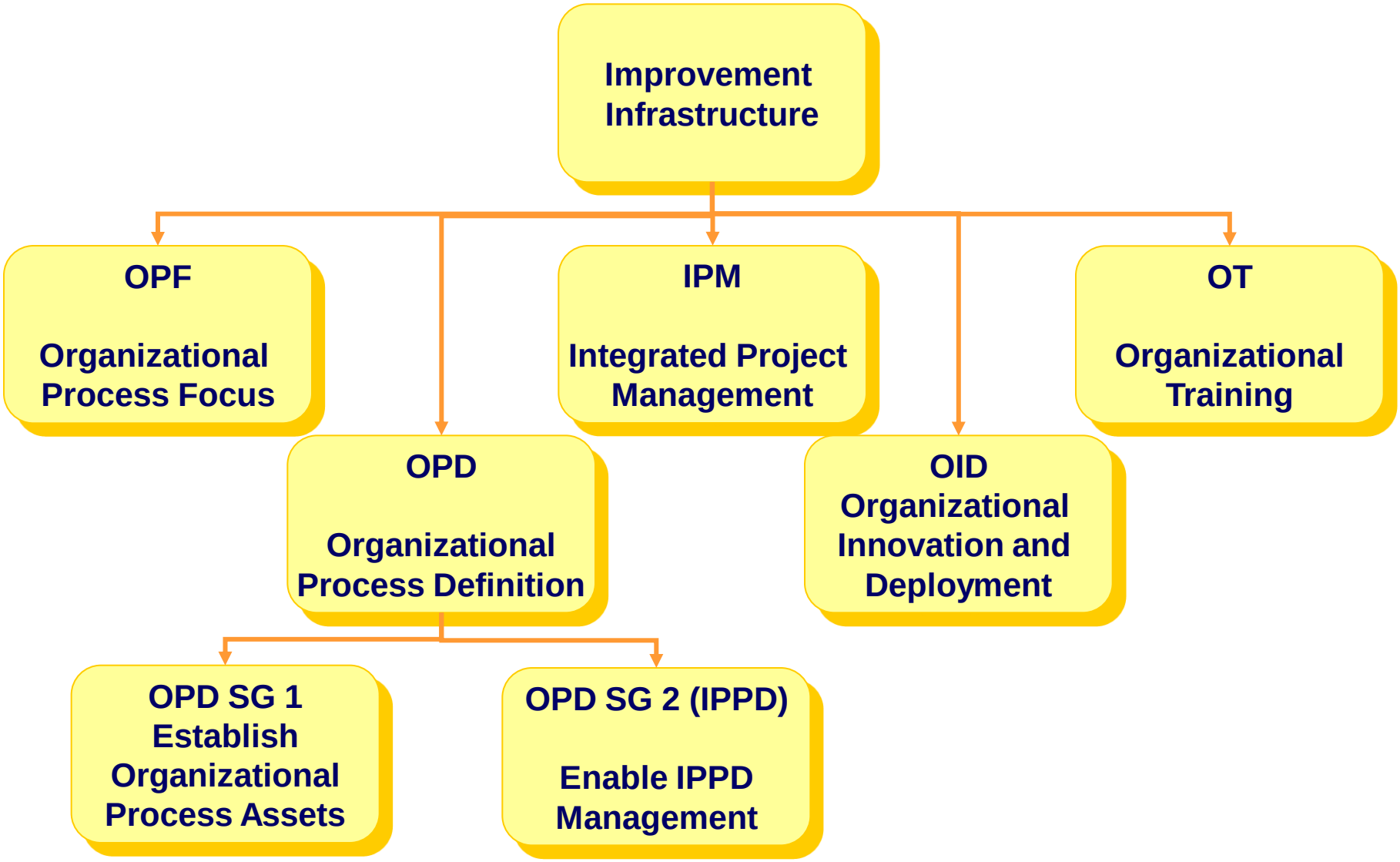

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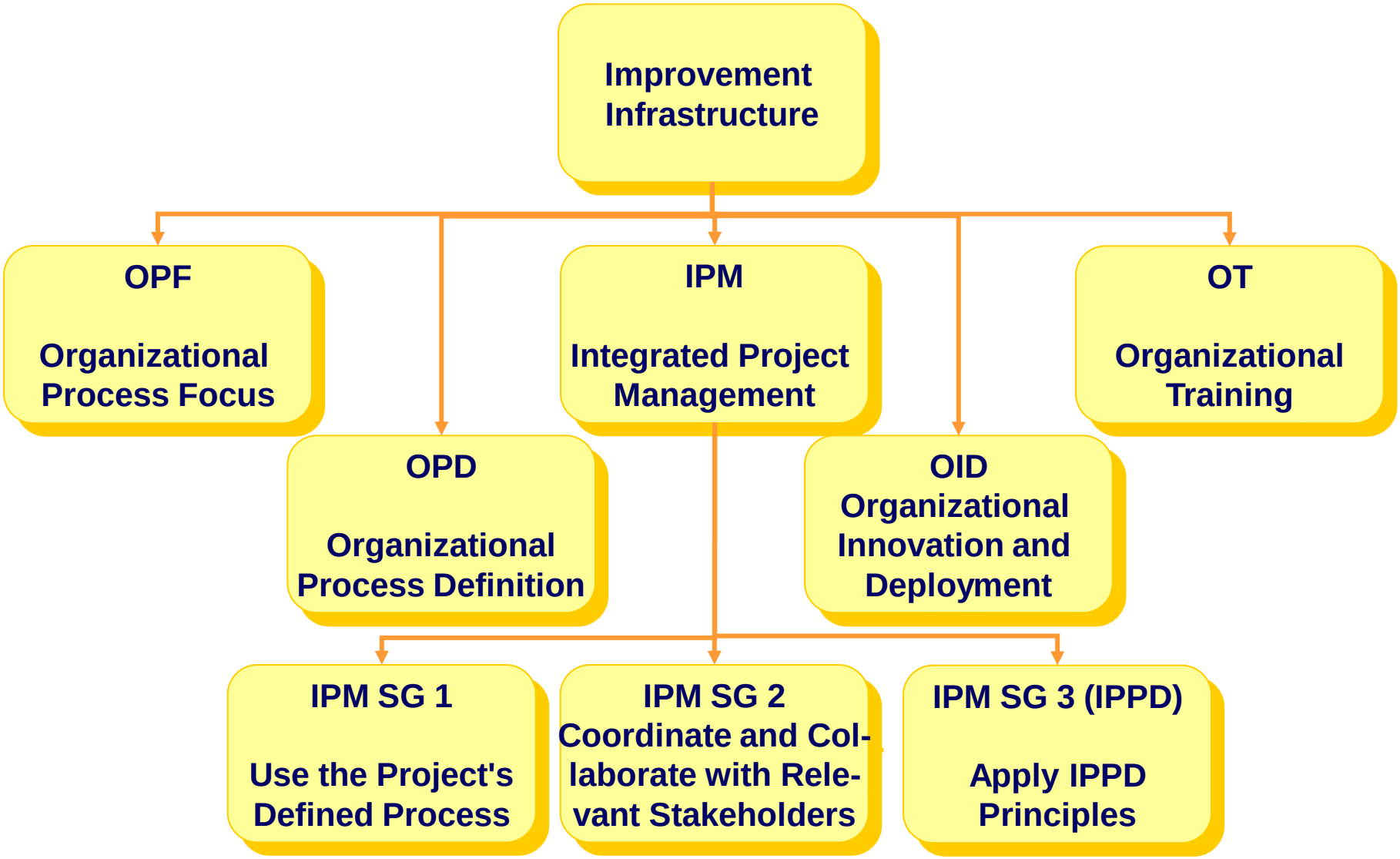
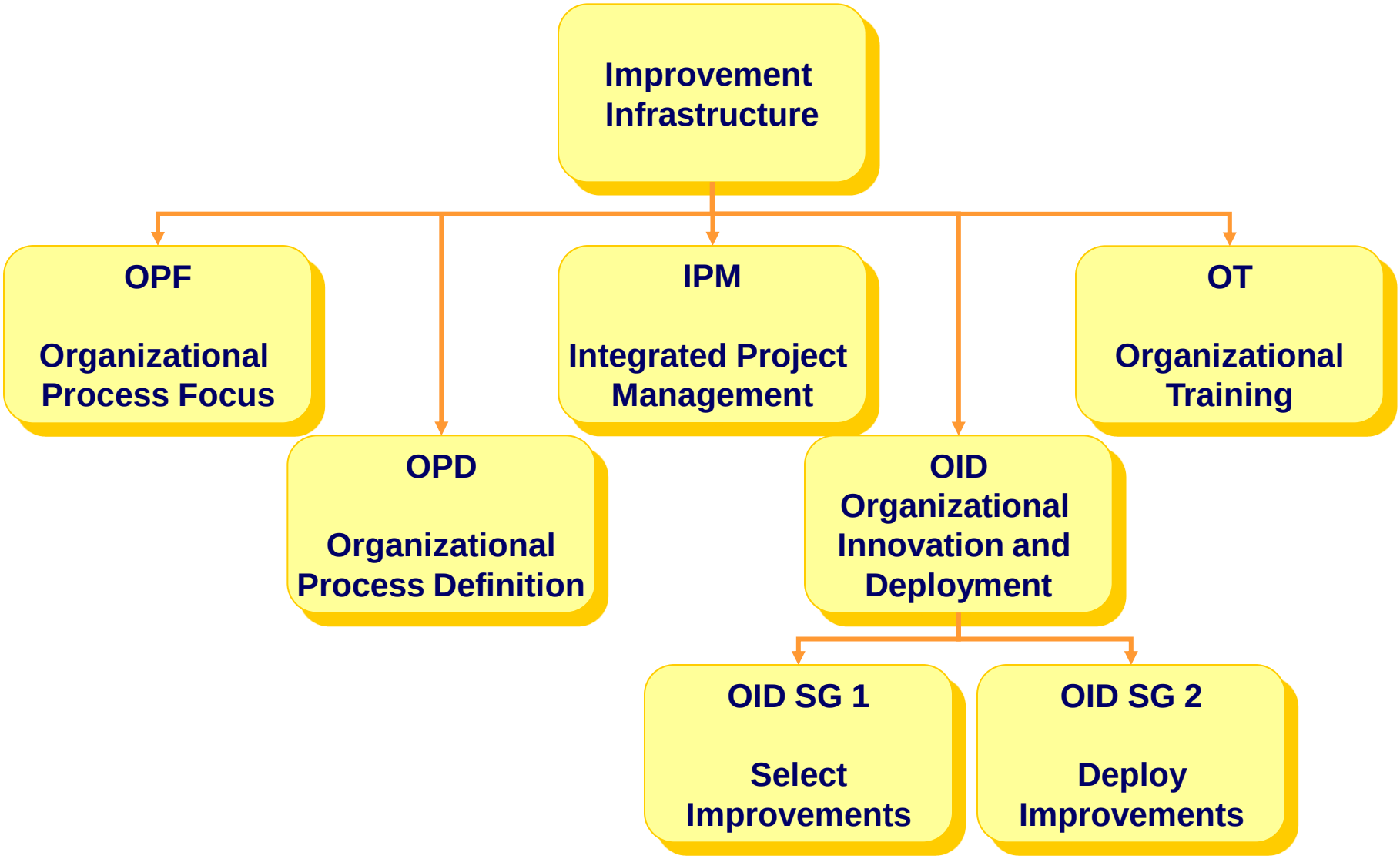


CMMI by PAs and Groups



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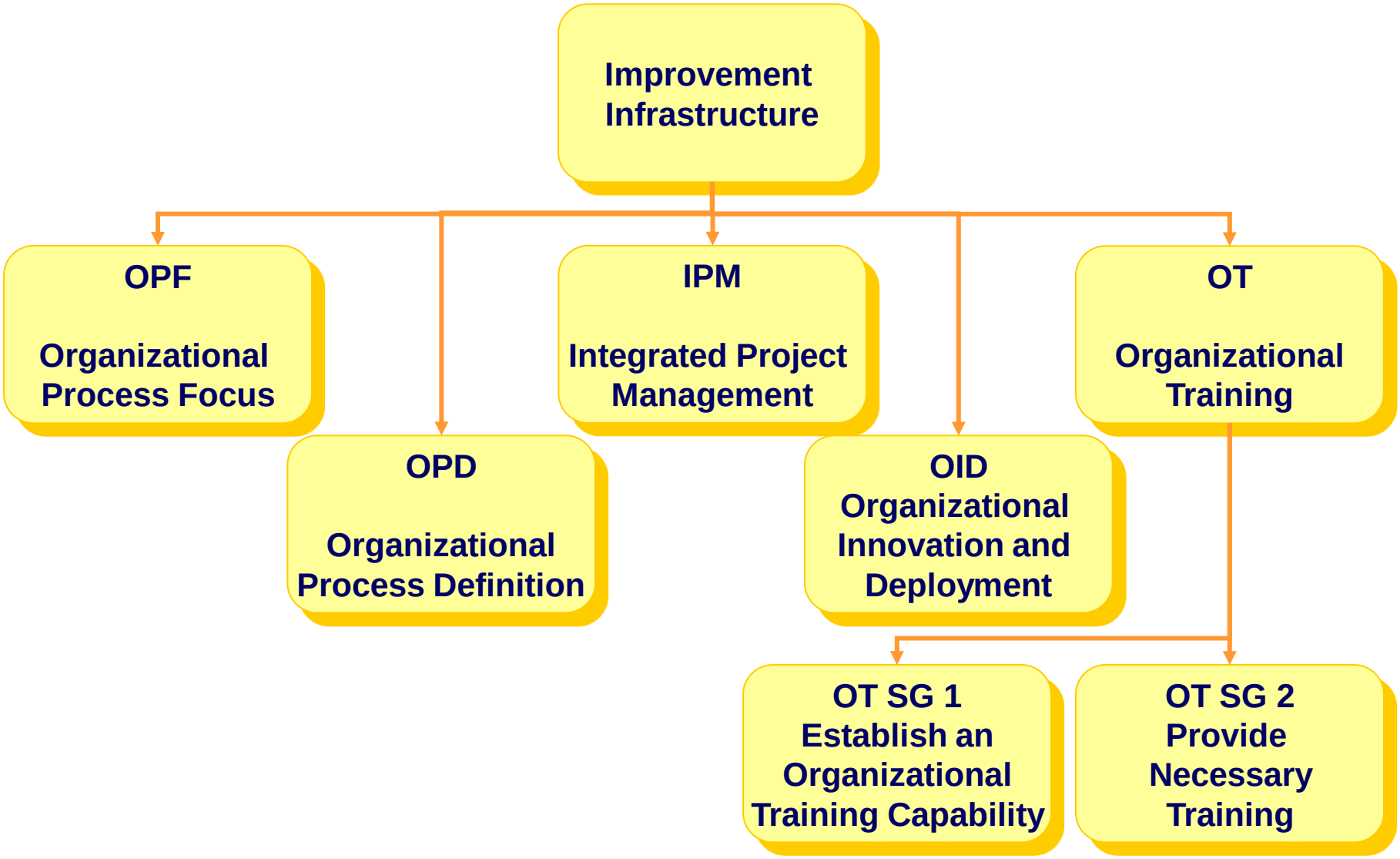
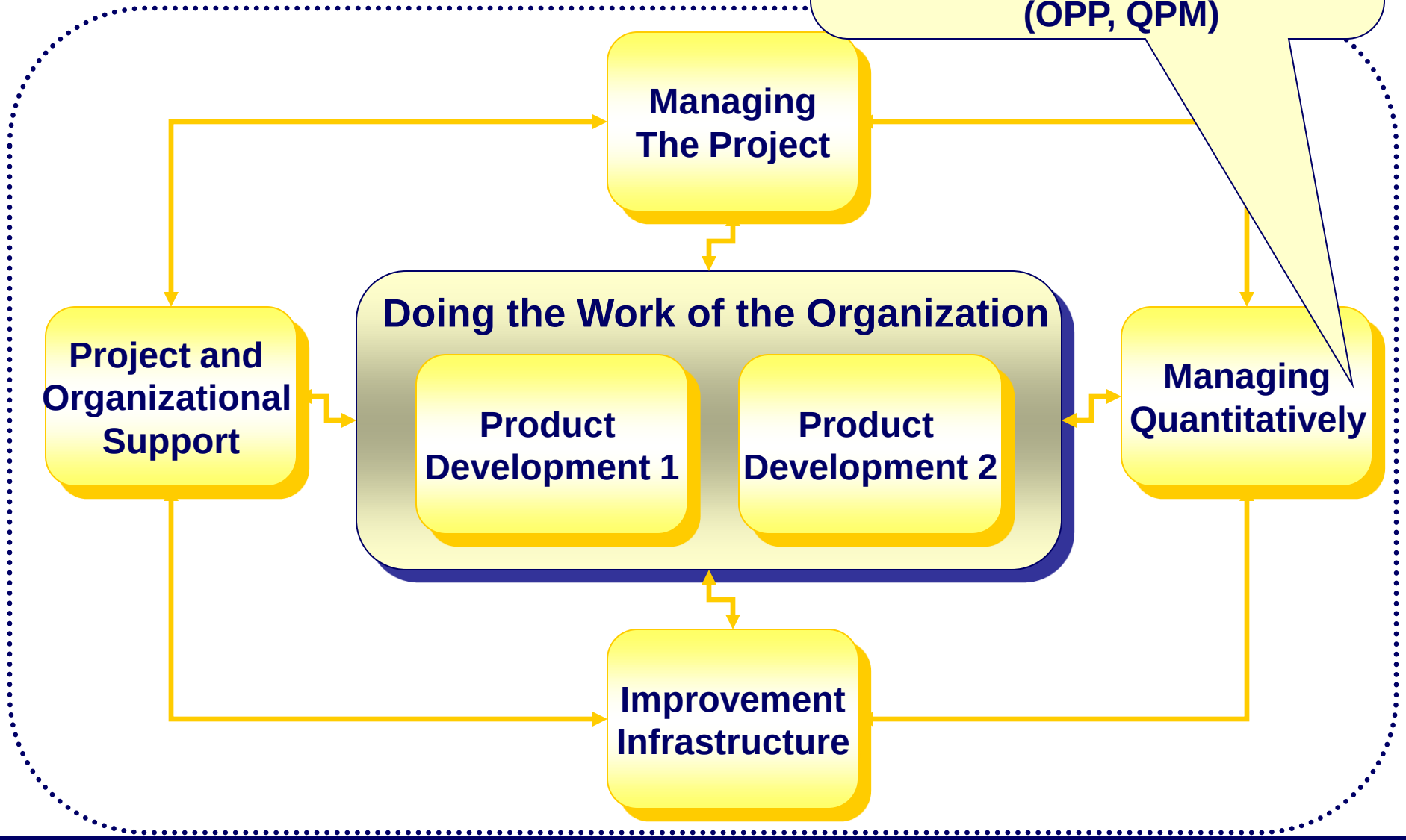


CMMI by PAs ar



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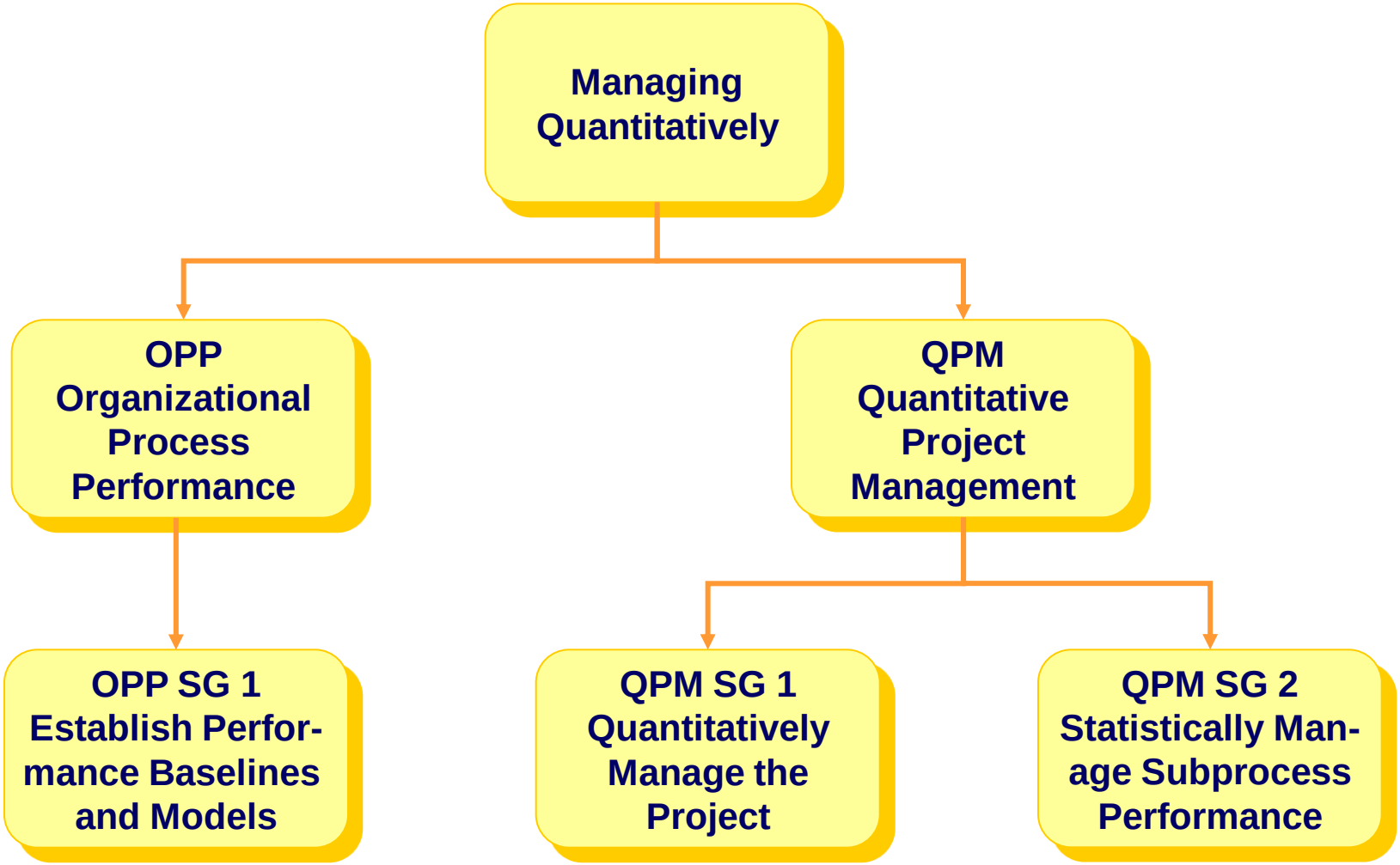

Maturity Levels vs. PA Categories

MLx	Process management	Project management	Engineering	Support
ML5	OID			CAR
ML4	OPP	QPM		
ML3	OPF OPD+IPPD OT	IPM+IPPD RSKM	RD TS PI VAL VER	DAR
ML2		PP PMC SAM	REQM	CM MA PPQA
ML1				

Module 03 / Engineering
- Requirements Engineering (REQM, RD)
- Building the Product (TS, PI)
- Quality in Engineering (VAL, VER)

Agenda

	management	t agement	Engineering	Support
ML5	OID			CAR
ML4	OPP	QPM		
ML3	OPF OPD+IPPD OT	IPM+IPPD RSKM	RD TS PI VAL VER	DAR
ML2		PP PMC SAM	REQM	CM MA PPQA
ML1				

Module 04 / Basic Project Management
- Project Planning (PP)
- Project Montoring and Control (PMC)
- Supplier Aggrement Management (SAM)

Agenda

	manageme	nagement	Engineering	Support
ML5	OID			CAR
ML4	OPP	QPM		
ML3	OPF OPD+IPPD OT	IPM+IPPD RSKM	RD TS PI VAL VER	DAR
ML2		PP PMC SAM	REQM	CM MA PPQA
ML1				

Module 05 / Basic Support
- Configuration Management (CM)
- Measurement and Analysis (MA)
- Process and Product Quality Ass. (PPQA)

Agenda

			Engineering	Support
ML5	OID			CAR
ML4	OPP	QPM		
ML3	OPF OPD+IPPD OT	IPM+IPPD RSKM	RD TS VAL VER	DAR
ML2		PP PMC SAM	REQM	CM MA PPQA
ML1				

Course

Module 06 / Organizational Support
- Organizational Process Definition (OPD)
- Organizational Process Focus (OPF)
- Organizational Training (OT)
- OPD + IPPD Principles

MLx	Process management	Project management		Support
ML5	OID			CAR
ML4	OPP	QPM		
ML3	OPF OPD+IPPD OT	IPM+IPPD RSKM	RD TS PI VAL VER	DAR
ML2		PP PMC SAM	REQM	CM MA PPQA
ML1				

Module 07 / Advanced Project Manag.
- Risk Management (RSKM)
- Integrated Project Management (IPM)
- IPM + IPPD Principles

Agenda

	management	nagement	Engineering	Support
ML5	OID			CAR
ML4	OPP	QPM		
ML3	OPF OPD+IPPD OT	IPM+IPPD RSKM	RD TS PI VAL VER	DAR
ML2		PP PMC SAM	REQM	CM MA PPQA
ML1				

Module 08 / Progressive Support
- Decision Analysis and Resolution (DAR)
- Causal Analysis and Resolution (CAR)

Agenda

	management		Engineering	Support
ML5	OID			CAR
ML4	OPP	QPM		
ML3	OPF OPD+IPPD OT	IPM+IPPD RSKM	RD TS PI VAL VER	DAR
ML2		PP PMC SAM	REQM	CM MA PPQA
ML1				

Course

Module 09 / Quantitative Management
- Organizational Process Performance (OPP)
- Quantitative Project Management (QPM)
- Organizational Innovation and Depl. (OID)

MLx	Process management	Projec management		Support
ML5	OID			CAR
ML4	OPP	QPM		
ML3	OPF OPD+IPPD OT	IPM+IPPD RSKM	RD TS PI VAL VER	DAR
ML2		PP PMC SAM	REQM	CM MA PPQA
ML1				

Course

Module 10 / Generic Goals and Pract.
- Generic Goals GGs 1-5
- Generic Practices GPs
- Relationships between PAs

MLx	Process management	Project management	Engineering	Support
ML5	OID			CAR
ML4	OPP	QPM		
ML3	OPF OPD+IPPD OT	IPM+IPPD RSKM	RD TS PI VAL VER	DAR
ML2		PP PMC SAM	REQM	CM MA PPQA
ML1				

Summary

- Overview of CMMI
- General Str… of CMMI
- CMMI
- Generi
- CMMI by PAs and Groups

Process Model
CMMI
CMMI Architecture
CMMI Additions and Disciplines

Summary

- Overview of CMMI
- General Structure of CMMI
- CMMI Mode[illegible]resentations
- Generi[illegible]
- CMMI [illegible]

Classification of Components
Process Area
CMMI Process Areas
General Structure of Process Areas
Supporting Informative Components

Summary

- Overview of CMMI
- General Structure of CMMI
- CMMI Model Representations
- Generic Goals and Practices
- CMMI Process Areas

Continuous Representation
CL1-CL5
Staged Representation
ML1-ML5

Summary

- Overview of CMMI
- General Structure of CMMI
- CMMI Model Representations
- Generic Goals and Practices
- CMMI by PA and Groups

Process Institutionalization
Generic Goals
Generic Practices

Summary

- Overview of CMMI
- General Structure of CMMI
- CMMI Model Representations
- Generic Goals and Practices
- CMMI by PAs and Groups

Project and Organizational Support
Managing The Project
Product Development 1, Product Development 2
Managing Quantitatively
Improvement Infrastructure

References

- CMMI® (Capability Maturity Model Integration) for Development Version 1.2, (CMU/SEI-2006-TR-008), Carnegie Mellon Software Engineering Institute, USA, August 2006
- Introduction to CMMI for Development Version 1.2,Training Workbook, Carnegie Mellon Software Engineering Institute, USA, 2006

Questions

Review Questions - 1

1. What is a process?
2. What is a process model?
3. Is the CMMI a process or a process model?
4. The CMMI specifies (check all that apply)
   - __ What to do
   - __ How to do it
   - __ Who does it
   - __ When they do it
5. The CMMI has the _____ representation and the _____ representation.
6. The CMMI is composed of 22 _____.

Review Questions - 2

7. Each process area has the following components in it's structure
   - _____
   - _____
   - _____
   - _____
   - _____
   - _____
   - _____
   - _____
   - _____
   - _____
   - _____
8. And the following supporting components:
   - _____
   - _____
   - _____
   - _____

THE END

A Global Overview of The Structure

CMMI for Development V.1.2

Module 2