



# Measurement in a Process Framework

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**Process and Methodology Seminar**

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# Agenda

**A process framework: CMMI**

**Measurement-related Process Areas**

**The Measurement and Analysis Process  
Area**

**Challenges for Process Maturity and  
Capability**



# “Process Improvement Improvement”

The CMMI Product Suite provides a foundation for *enterprise wide improvement* and adds:

- **New emphasis on products and services as well as process**
- **Emphasis on both process capability and organizational maturity**
- **Early emphasis on Measurement and Analysis**



# CMMI Is Integration and Improvement

CMMI supports process integration and product improvement.

CMMI integrates multiple disciplines into one process-improvement framework that eliminates inconsistencies and reduces duplication.

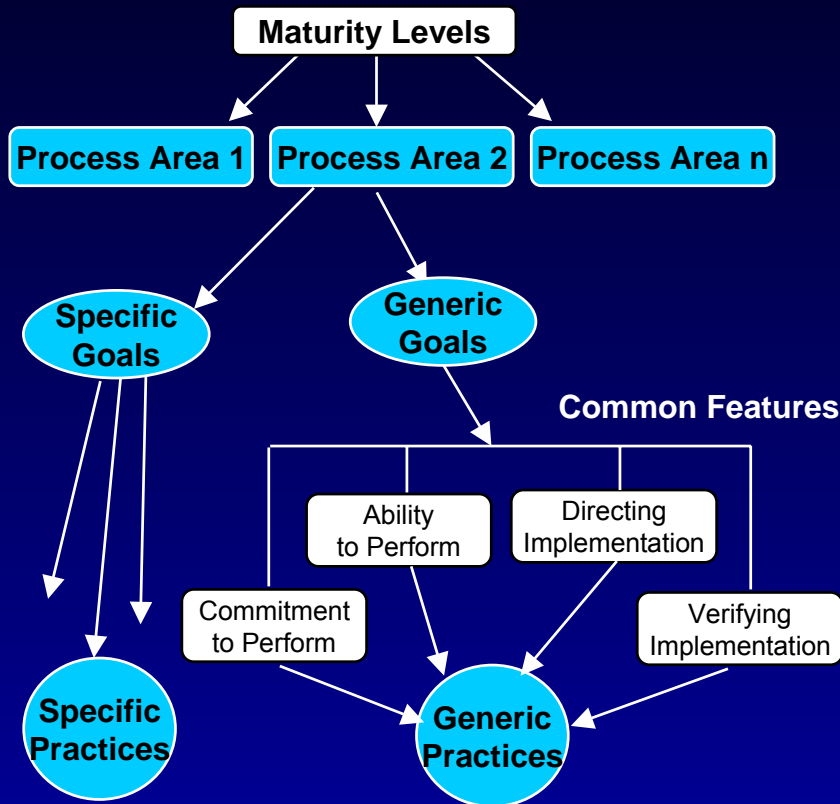
CMMI provides a framework for introducing new disciplines as needs arise and therefore reduces the cost of implementing model-based improvement.

CMMI is designed to minimize the impact on legacy process improvement efforts and investment.



# CMMI Model Structure

## Staged

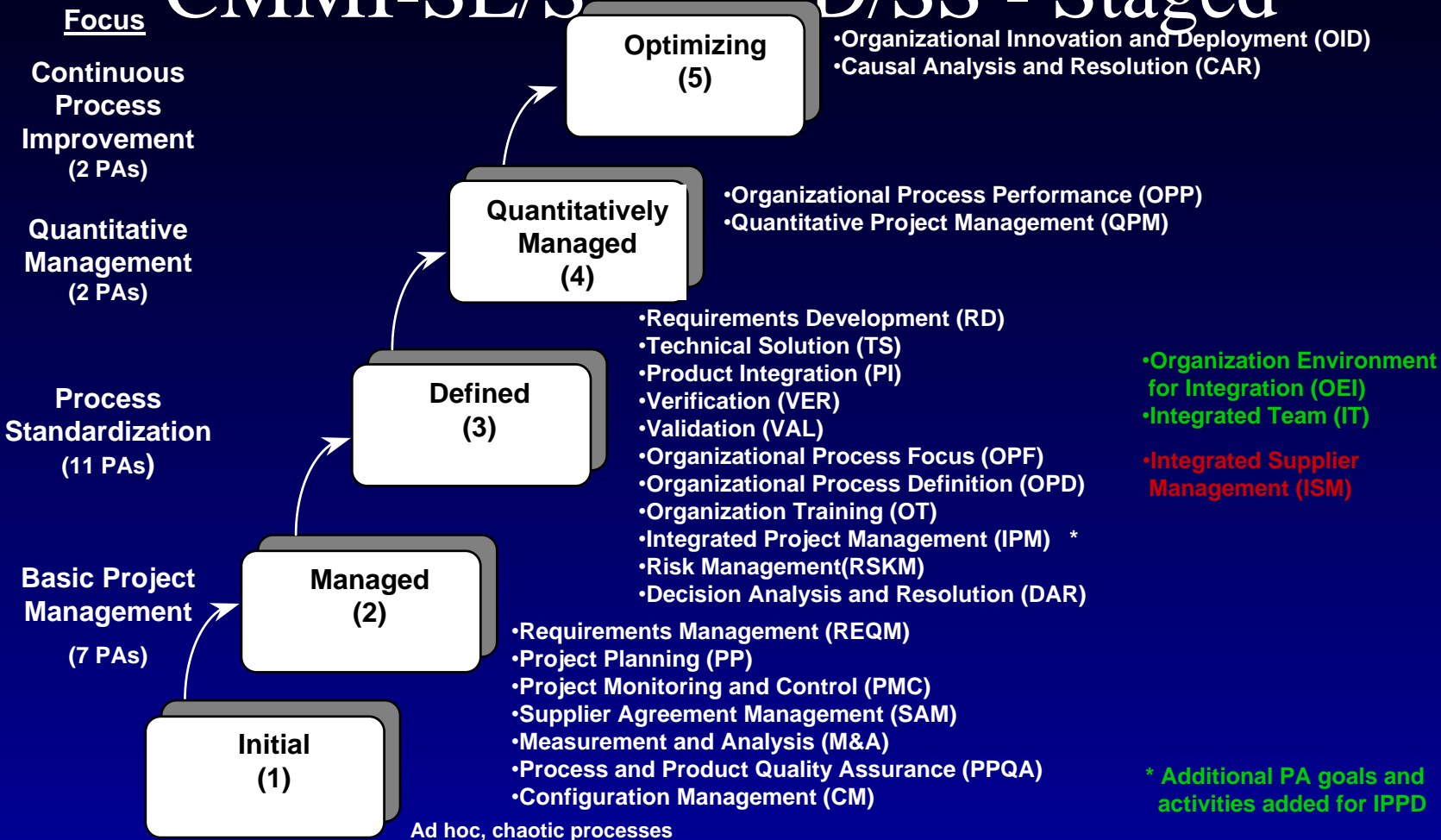


## Continuous





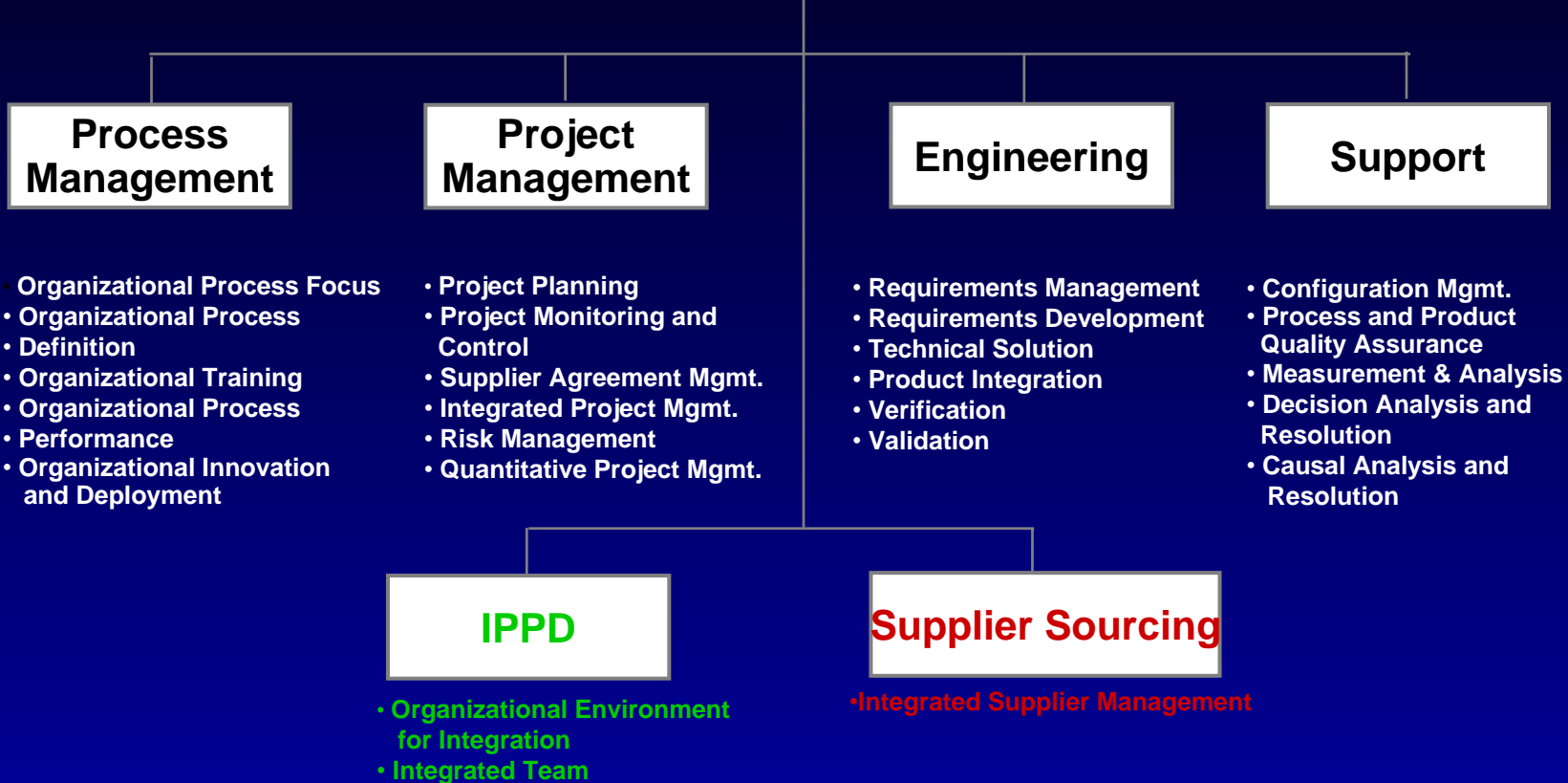
# CMMI-SE/SW/TPPD/SS - Staged





# CMMI-SE/SW/PPD/SS - Continuous

## CMMI





# Process Capability Levels

**5 Optimizing**

**4 Quantitatively Managed**

**3 Defined**

**2 Managed**

**1 Performed**

**0 Incomplete**







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# Measurement-related Process Areas

## Project Management

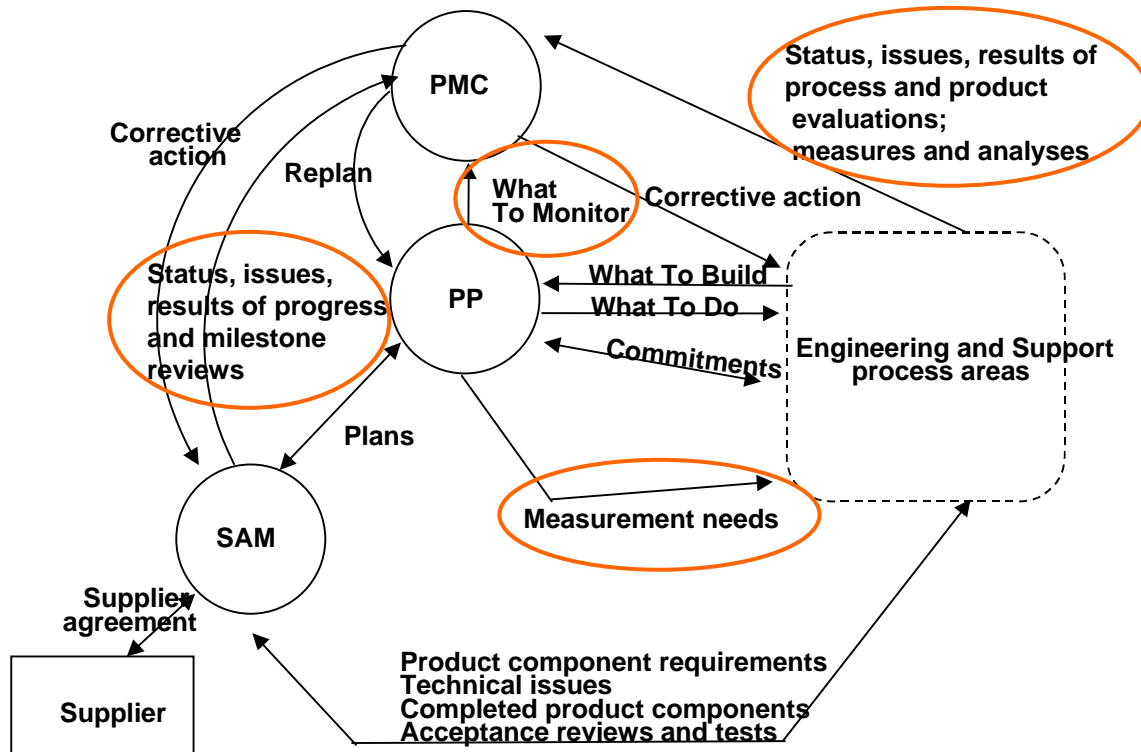
- Project Planning, Project Monitoring and Control, Software Acquisition Management
- Integrated Project Management, Risk Management, Quantitative Project Management

## Process Management

## Engineering

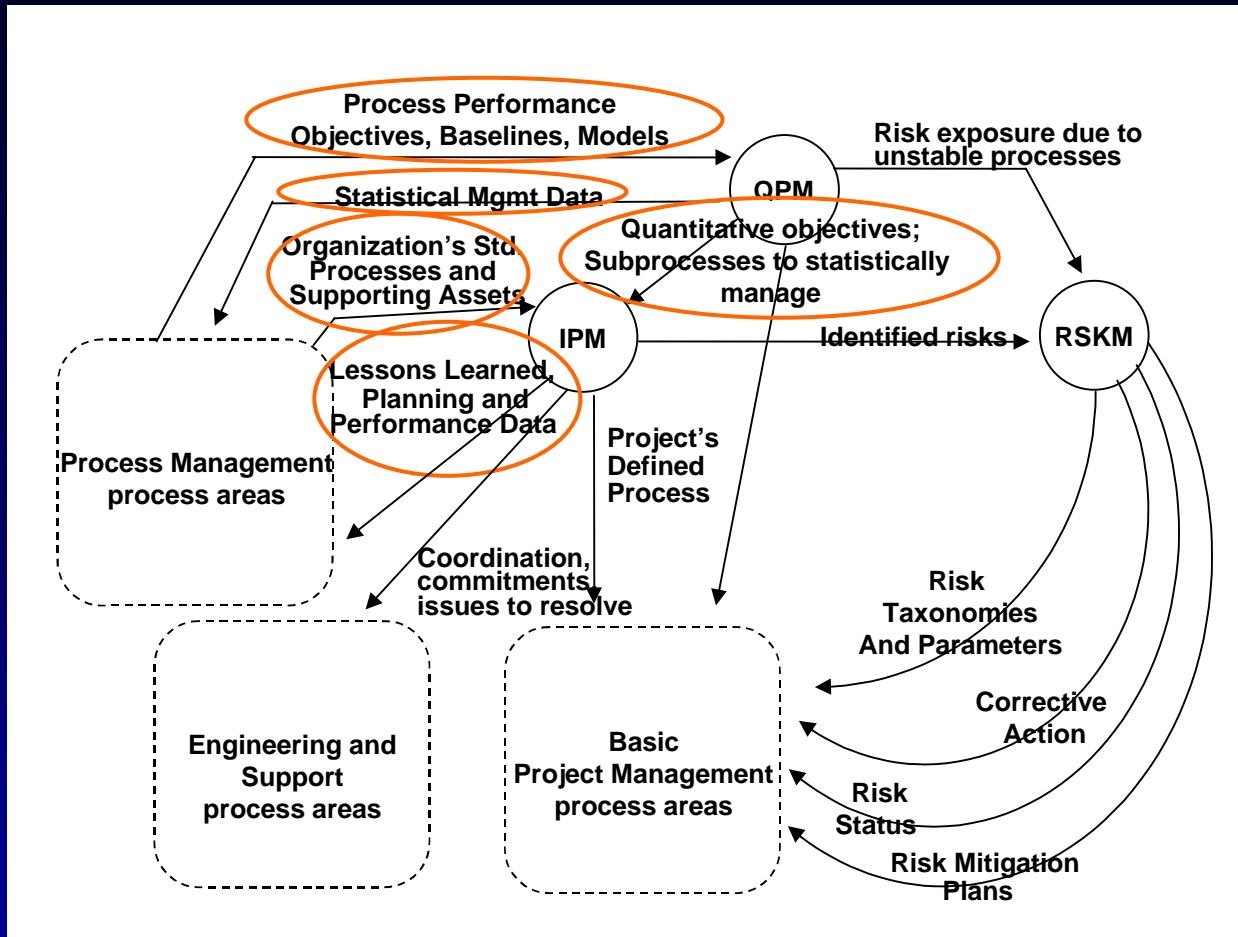


# Basic Project Management PA's





# Advanced Project Management PA's





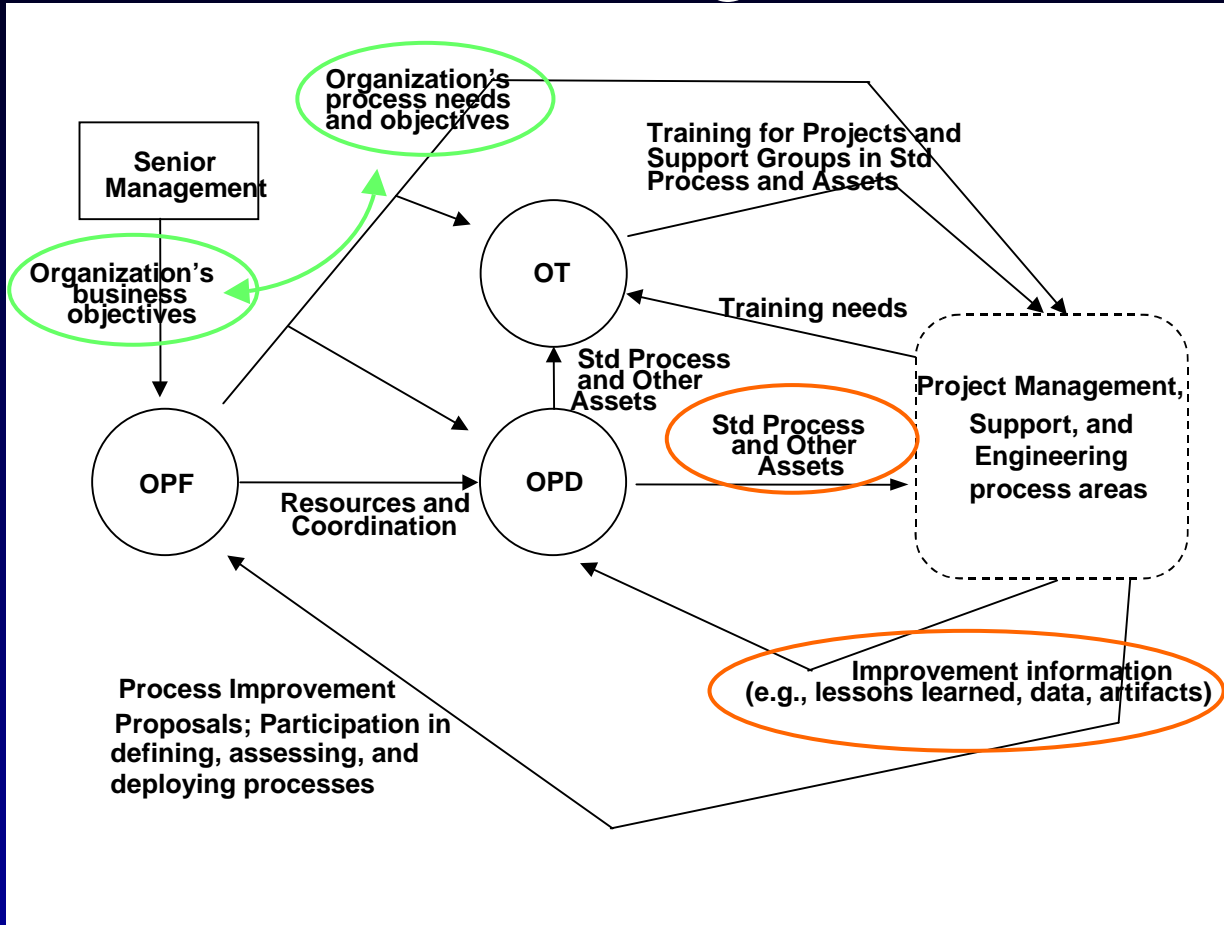
# Measurement-related Process Areas

## Process Management

- Organization Process Focus, Organization Process Definition Organization Training
- Organization Process Performance, Organization Innovation and Deployment

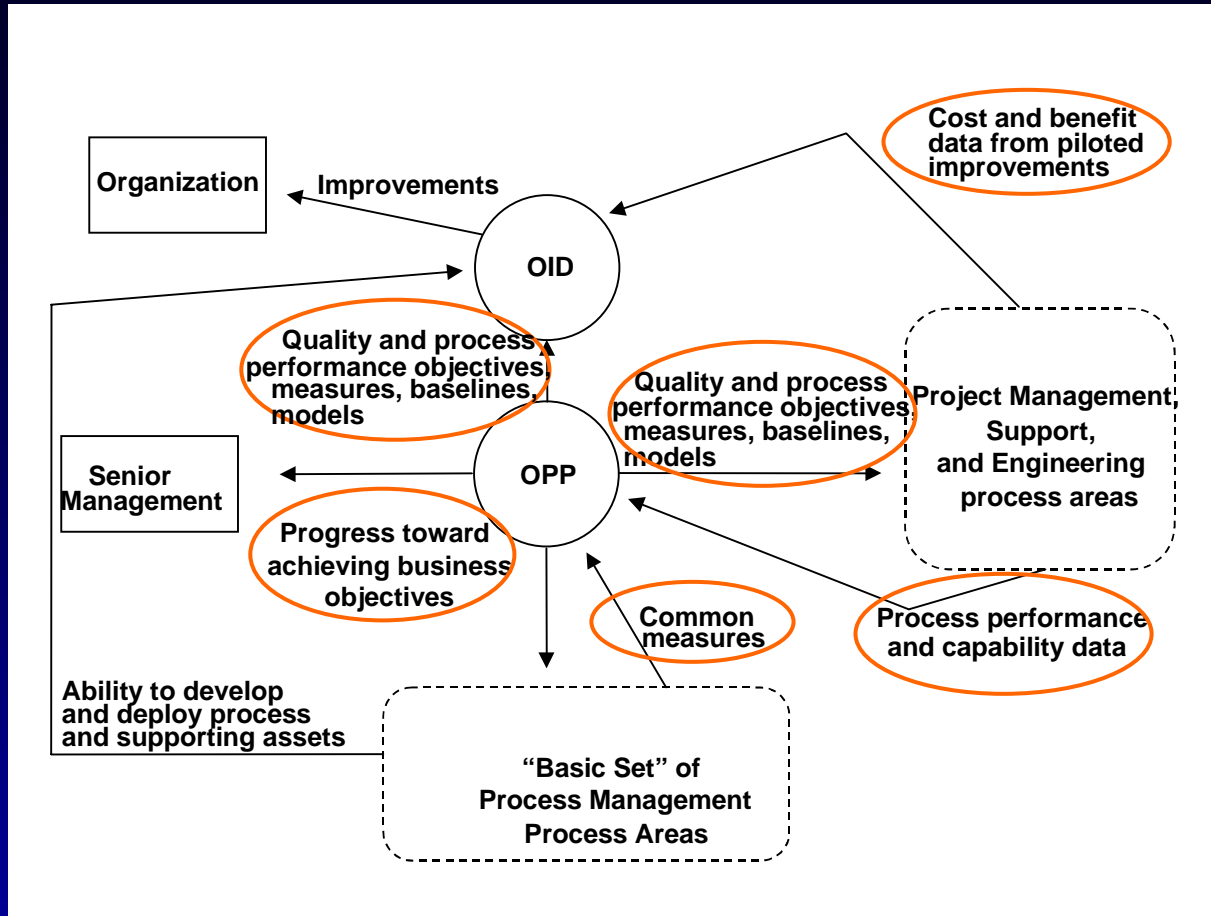


# Basic Process Management PA's





# Advanced Process Management PA's

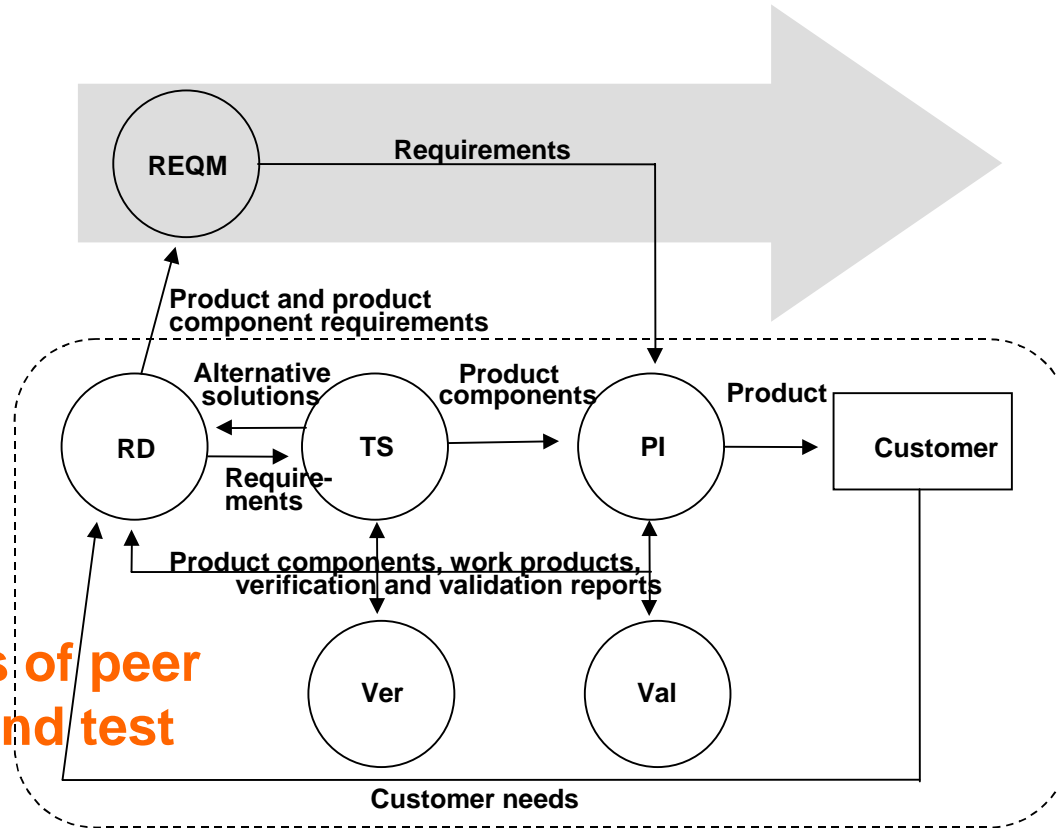








# Engineering Process Areas



Analysis of peer review and test data



SW-CMM v1.1 Common Features	CMMI Common Features
<b>Commitment to Perform</b>	<b>Commitment to Perform</b>
Establish an Organizational Policy	Establish an Organizational Policy
<b>Ability to Perform</b>	<b>Ability to Perform</b>
	Plan the Process
Provide Resources	Provide Resources
Assign Responsibility	Assign Responsibility
Train People	Train People
<b>Activities Performed</b>	<i>(Specific Practices)</i>
Plan the Process	
Perform the Process	
Monitor and Control the Process	
	<b>Directing Implementation</b>
	Identify & Involve Rel. Stakeholders
	Manage Configurations
	Monitor and Control the Process
	Collect Improvement Information
<b>Measurement &amp; Analysis</b>	<b>Expanded in the Measurement and Analysis PA</b>
Measure the Process	
Analyze the Measurements	
<b>Verifying Implementation</b>	<b>Verifying Implementation</b>
Review with Org. Management	Review Status w/ Higher-Level Mgt
Review with Project Management	
Objectively Verify Adherence	Objectively Evaluate Adherence



# Measurement-Related GPs

**“Monitor and control the process against the plan and take appropriate corrective action.”  
(GP2.8)**

**“Collect work products, measures, measurement results, and improvement information derived from planning and performing the process to support the future use and improvement of the organization’s processes and process assets.” (GP3.2)**



# The Measurement Thread

Two uses of measurement: project management and process improvement

As the organization matures, the sophistication and uses of measurement increase



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**A process framework: CMMI**

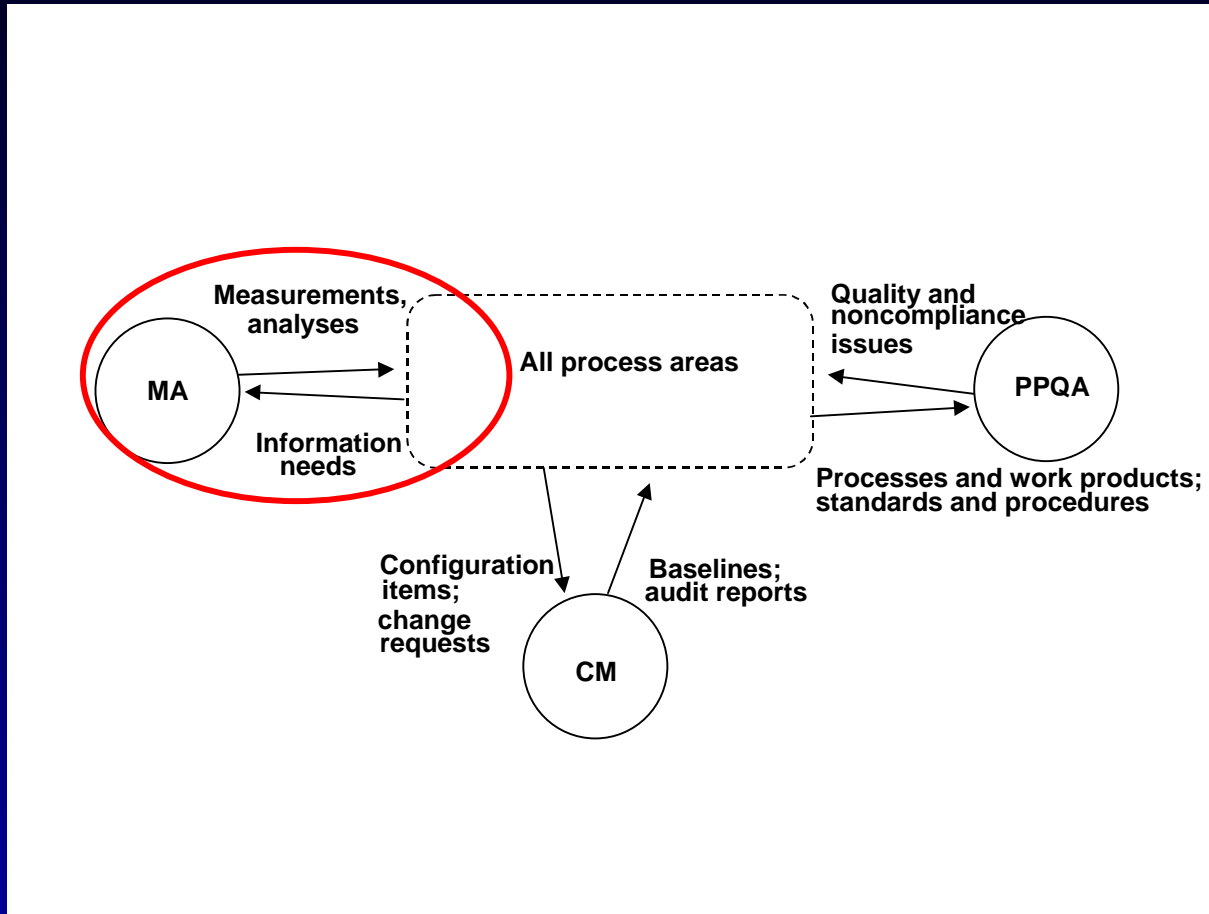
**Measurement-related Process Areas**

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# Support Process Areas





# Measurement and Analysis - Purpose

“The purpose of Measurement and Analysis is to **develop and sustain a measurement capability that is used to support management information needs.**”

“The Measurement and Analysis process area **supports all process areas** by providing practices that guide projects and organizations in aligning measurement needs and objectives with a measurement approach that will provide objective **results that can be used in making informed decisions**, and taking appropriate corrective actions.”



# Measurement the in CMM<sup>®</sup>-SW

“...practices that are necessary to determine status related to the process. Measurements included in this common feature are used to control and improve the process.”

Measurement practices found in Activities Performed as well.





# Measurement and Analysis Objectives

The integration of measurement and analysis activities into project processes supports the following:

- Objective planning and estimating
- Tracking actual performance against established plans and objectives
- Identifying and resolving process-related issues
- Providing a basis for incorporating measurement into additional processes in the future



# Measurement and Analysis Goals

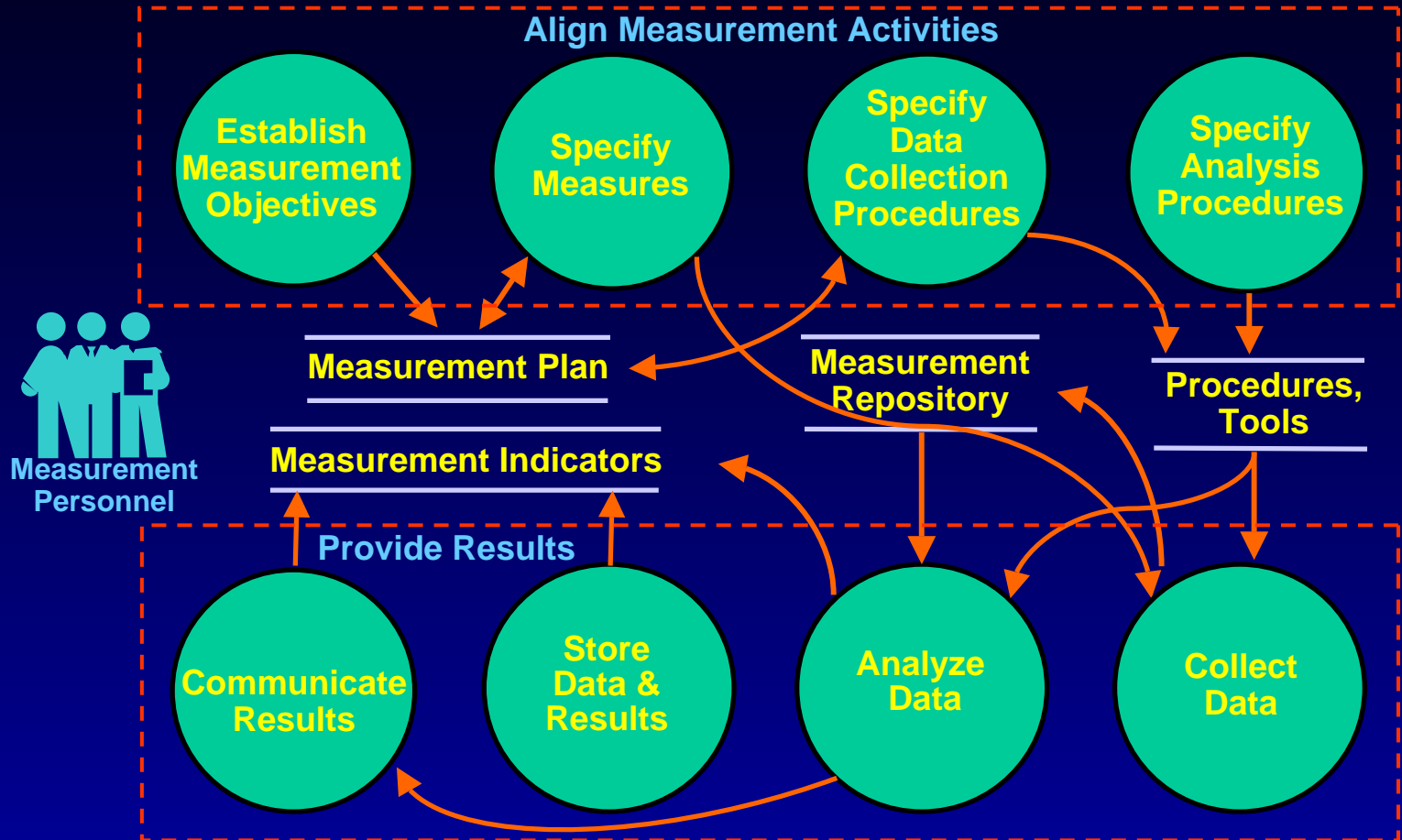
Align Measurement and Analysis Activities

Provide Measurement Results

Institutionalize a Managed Process



# The Level 2 Process Area





# Activities for Goal 3

Institutionalize a Managed Process

**Establish an Organizational Policy**

**Plan the Process**

**Provide Resources**

**Assign Responsibility**

**Train People**

**Manage Configurations**

**Identify and Involve Relevant Stakeholders**

**Monitor and Control the Process**

**Objectively Evaluate Adherence**

**Review Status with Higher-Level Management**



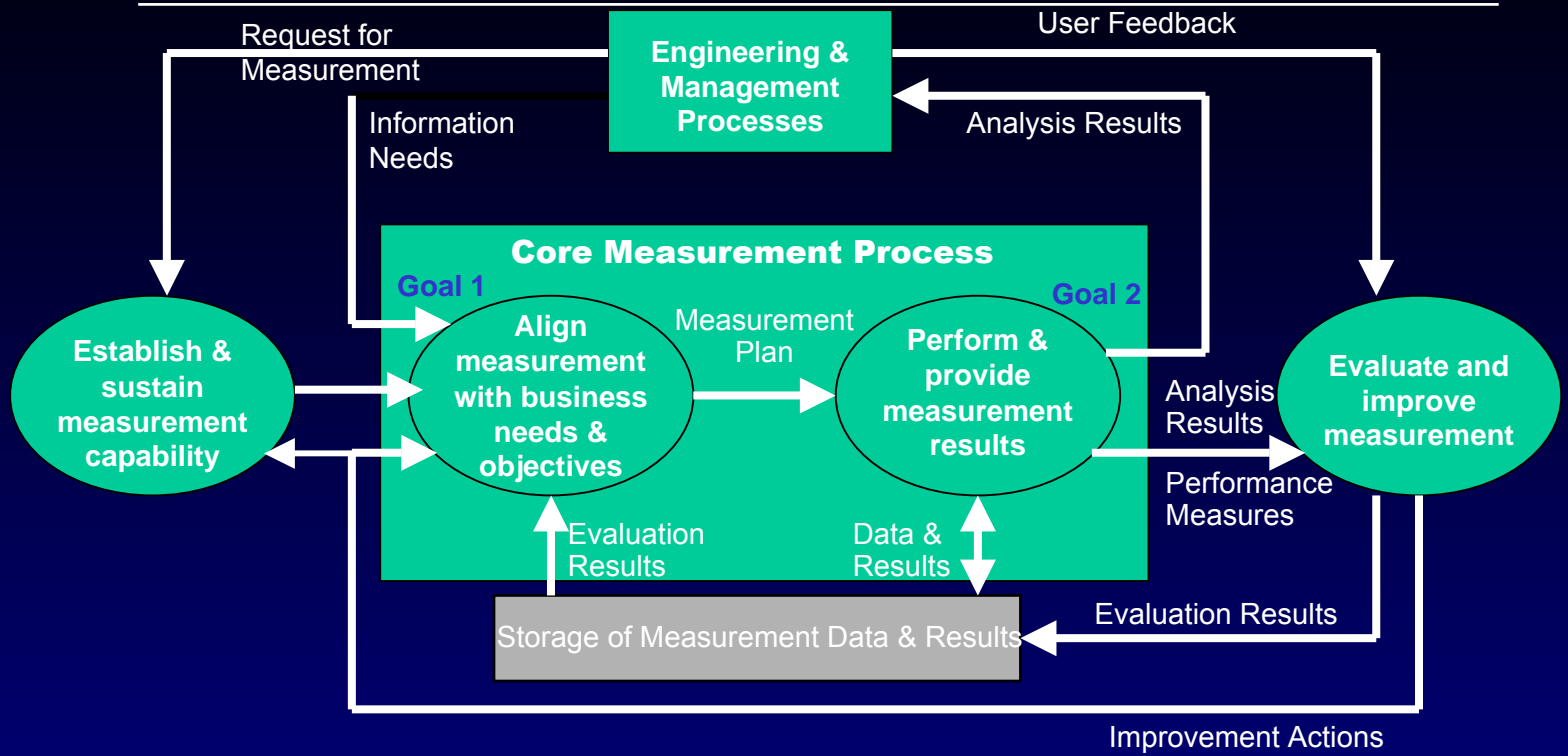
# ISO 15939- Software Measurement Process

Defines a process applicable to all software-related engineering and management disciplines.

The process is flexible, tailorable, and adaptable to the needs of different users.



# Mapping to ISO 15939 - 1



## Align with Needs & Objectives

- SP 1.1 Establish measurement objectives
- SP 1.2 Specify measures
- SP 1.3 Specify data collection & storage procedures
- SP 1.4 Specify analysis procedures

## Perform & Provide Results

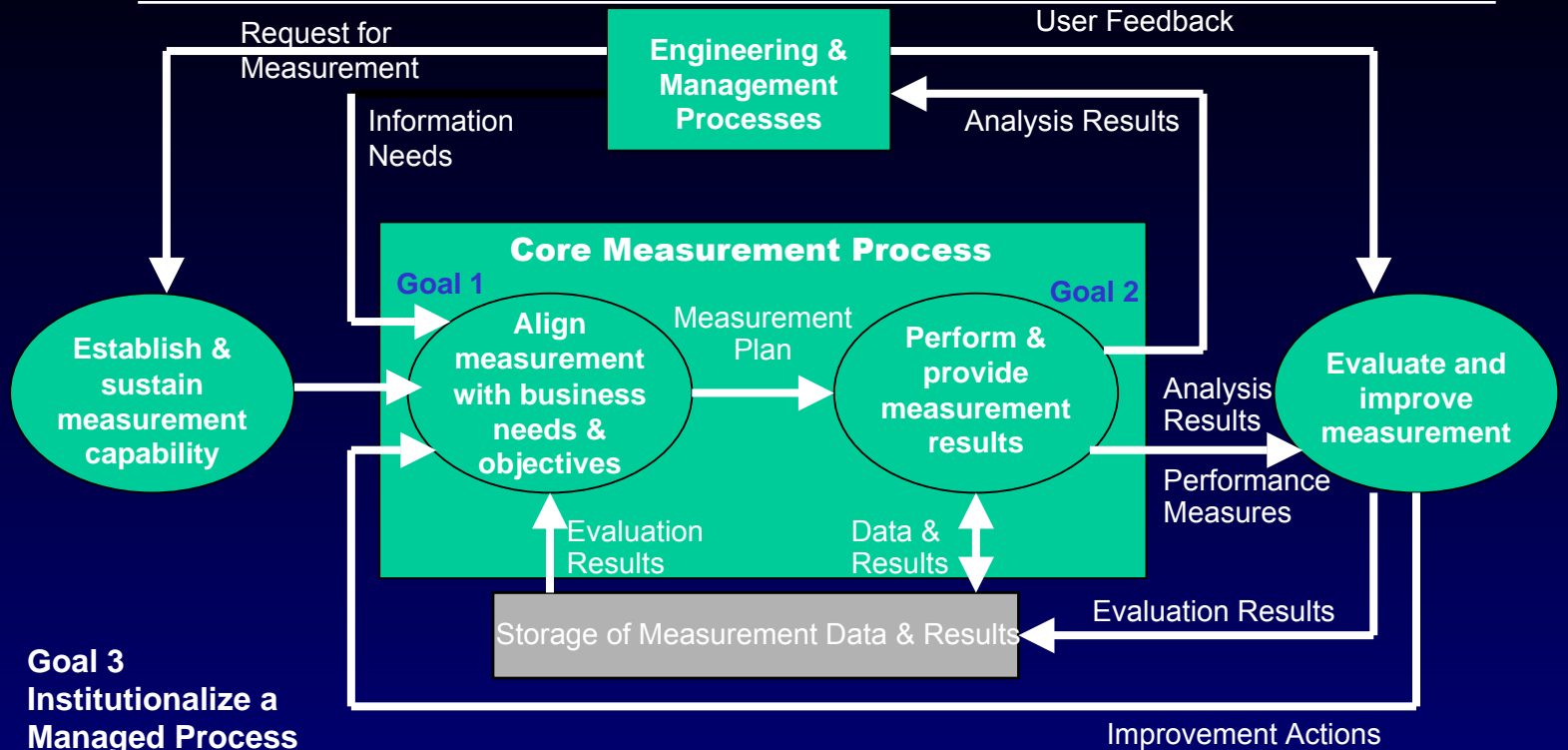
- SP 2.1 Collect measurement data
- SP 2.2 Analyze measurement data
- SP 2.3 Store data & results
- SP 2.4 Communicate results

## M&A Specific Goals:

1. Measurement objectives and practices are aligned with identified information needs and objectives
2. Measurement results that address identified information needs and objectives are provided



# Mapping to ISO 15939 - 2



## Establish & Sustain Process

- GP 2.1 Establish organizational policy
- GP 2.3 Provide resources
- GP 2.4 Assign responsibility
- GP 2.5 Train people

## Align with Needs & Objectives

- GP 2.2 Plan the process
- GP 2.7 Identify and involve relevant stakeholders

## Perform & Provide Results

- GP 2.6 Manage configurations

## Evaluate & Improve

- GP 2.8 Monitor & control
- GP 2.9 Objectively evaluate adherence
- GP 2.10 Review status with higher-level management



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# CMMI-SE/SW v1.1 Compared to CMM-SW v1.1

**Organizations using SW-CMM v1.1 should be able to transition to CMMI by focusing on the following changes:**

- **Measurement and Analysis at L2**
- **Risk Management & Decision Analysis and Resolution at L3**
- **Expansion of Software Product Engineering**
- **Refocus of Measurement and Analysis CF to Directing Implementation CF**

**Most SW-CMM v2 Draft C updates have been incorporated.**



# Challenges for SW-CMM Organizations

Consistent measurement process or  
approach

Integration of measurement into processes

Institutionalization of Measurement and  
Analysis



# Consistent Measurement Process

Practices describe a process for measurement

- No consistent guidance for how to do this in CMM-SW
- Guidance addresses both measurement as associated with ‘activities performed’ and other common features



# Explicit References to Use of Measurement

“Calls” to measurement from other  
process areas

Requires integration into the process for  
data generation and information use

Plan for measurement as part of process  
definition



# Institutionalized Measurement Process

As a process area, Measurement and  
Analysis must be institutionalized

Includes evaluating how well it is working

May be difficult given how it touches all  
other process areas



# What you can do.....NOW

Review and document your existing measurement and analysis activities and procedures

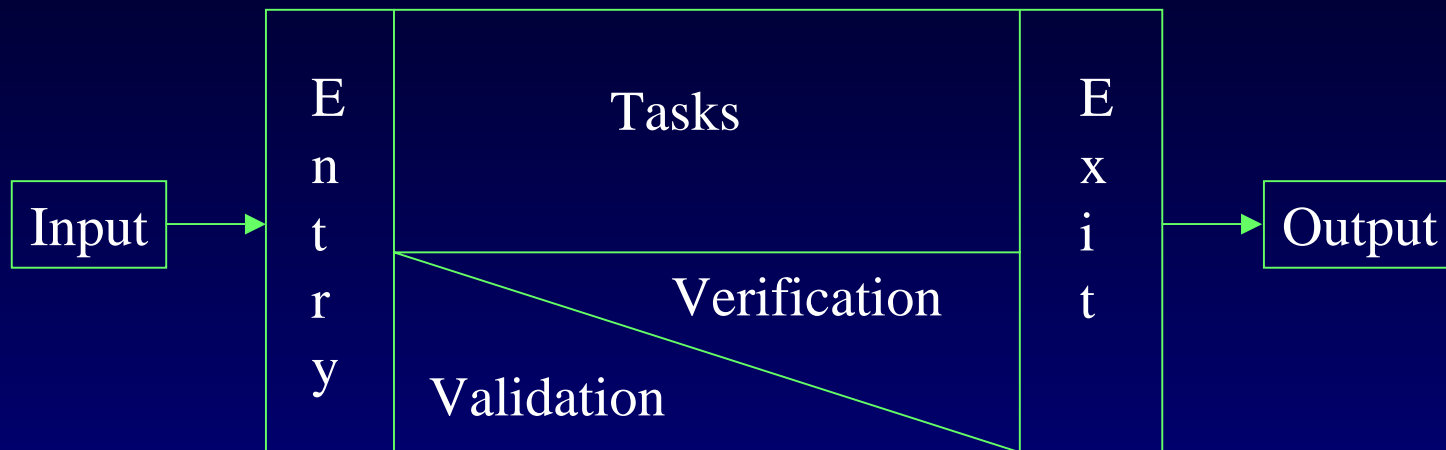
Evaluate the value of your existing measurement and analysis activities

Integrate Measurement and Analysis into your processes and train it

Establish an organizational infrastructure to support measurement and analysis



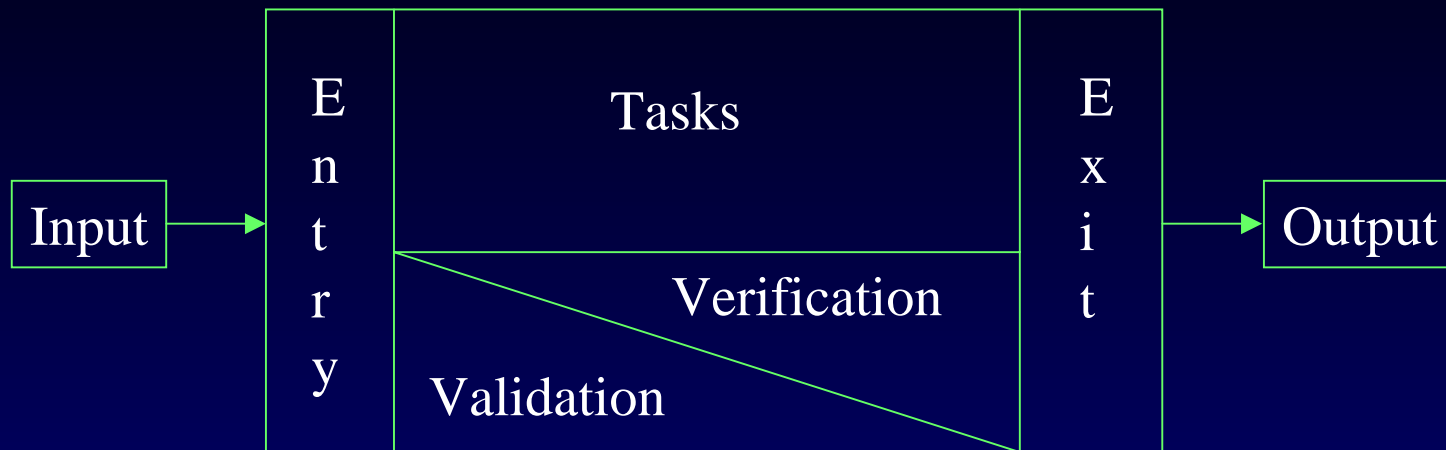
# Integrating Measurement and Analysis into Processes



**Where are the data generated and how?  
Who needs to use the information and when?**



# ETVX Derived Measures



## Cycle time

- Time to perform tasks
- Time from assessing entry criteria to meeting exit criteria

## Efficiency

- $\text{Output} / (\text{Input} + \text{Tasks} + \text{V\&V})$

## Effectiveness

- $1 - (\# \text{outputs fail exit} / \text{total outputs})$

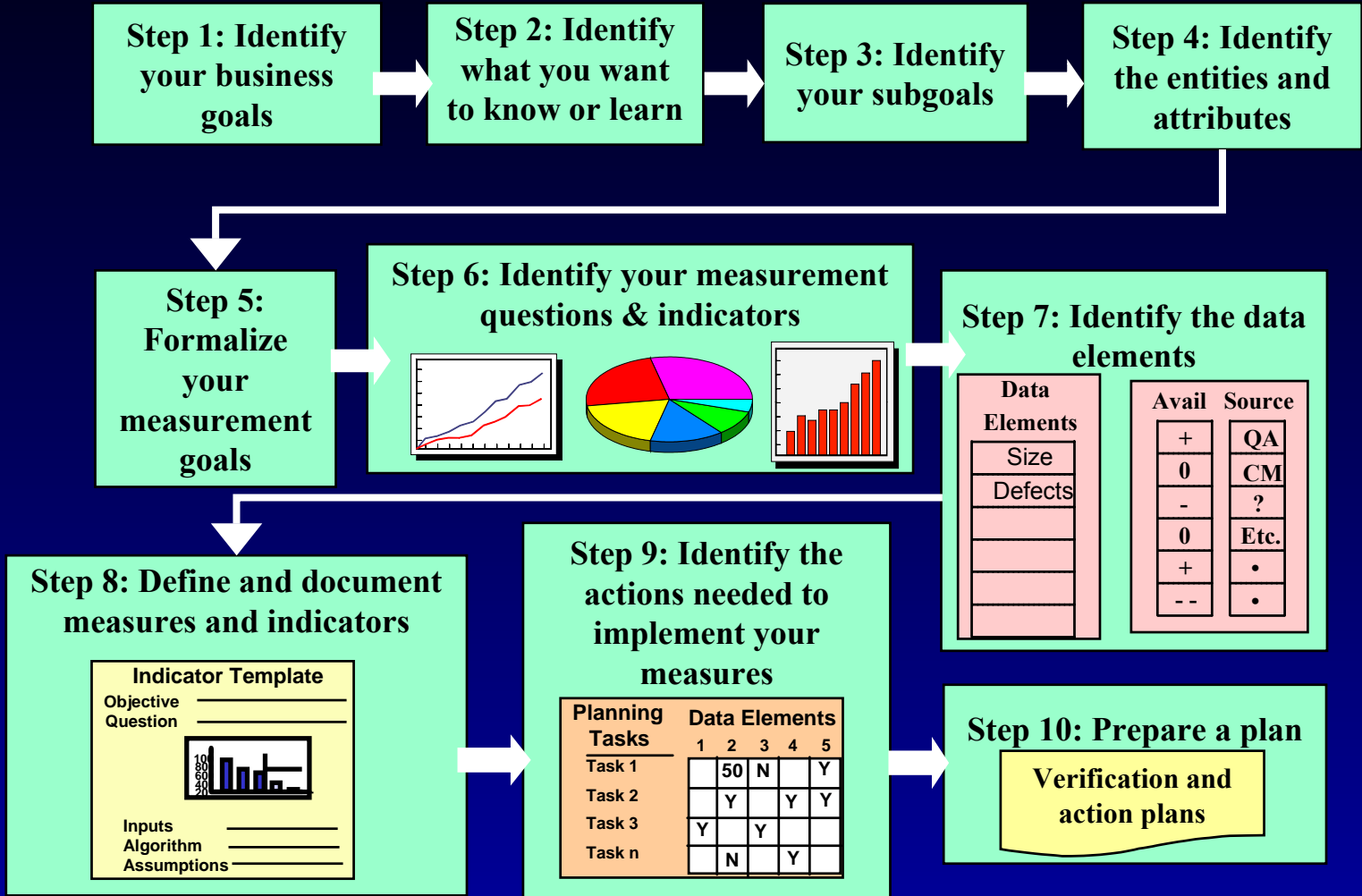
## Input Quality

- $\text{Input meeting entry} / \text{Total Input}$





# Goal-Driven Software Measurement



# Mapping of M&A Practices to Indicator Template

INDICATOR TEMPLATE

Measurement Goal # \_\_\_\_\_:

Objective \_\_\_\_\_

Questions \_\_\_\_\_

Visual Display

Bar Color	Value
Green	80
Green	60
Green	50
Red	30
Black	10

Input(s) \_\_\_\_\_

Data Elements \_\_\_\_\_

Responsibility for Reporting \_\_\_\_\_

Form(s) \_\_\_\_\_

Algorithm \_\_\_\_\_

Assumptions \_\_\_\_\_

Interpretation \_\_\_\_\_

X-reference \_\_\_\_\_

Probing Questions \_\_\_\_\_

Evolution \_\_\_\_\_

Establish Measurement Objectives

Specify Measures

Specify Data Collection Procedures

Collect Data

Specify Analysis Procedures

Analyze Data

Store Data & Results

Communicate Results



# In the End.....

Much better preparation at lower levels of maturity for achieving the higher levels





# For More Information

## Go to the SEI Website

- <http://www.sei.cmu.edu/sema>
- <http://www.sei.cmu.edu/cmami>

## Contact SEI Customer Relations

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