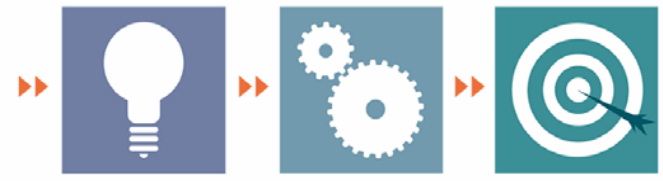


RATIONAL USER CONFERENCE 2003



FROM **ideas** TO **results**

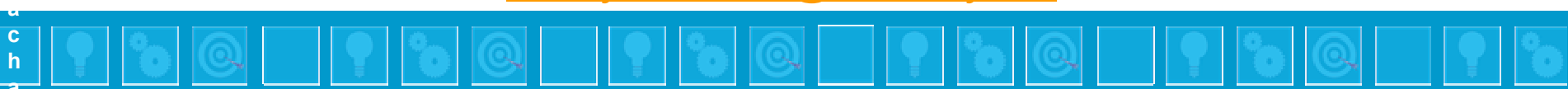
Practical Measurement in the Rational Unified Process

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U.S. Army TACOM-ARDEC*

Cheryl.Jones5@us.army.mil



Agenda

- ▶ Why Measure?
- ▶ Attributes of a Successful Measurement Program
- ▶ Standards and Methodologies
- ▶ Capability Maturity Model Integration (CMMI)
- ▶ Measurement Process – Practical Software and System Measurement
- ▶ RUP Overview
- ▶ Proposed PSM Plug-in for RUP
- ▶ RUP Phases and Information Categories
- ▶ Measures within PSM/RUP
- ▶ Summary



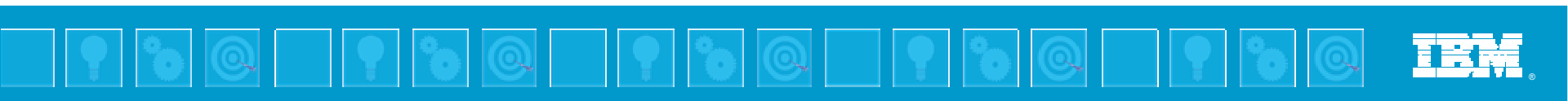
Why do we measure?

- ▶ Communicate effectively
- ▶ Identify and correct problems early
- ▶ Make informed trade-offs
- ▶ Track specific project objectives
- ▶ Manage risks
- ▶ Defend and justify decisions

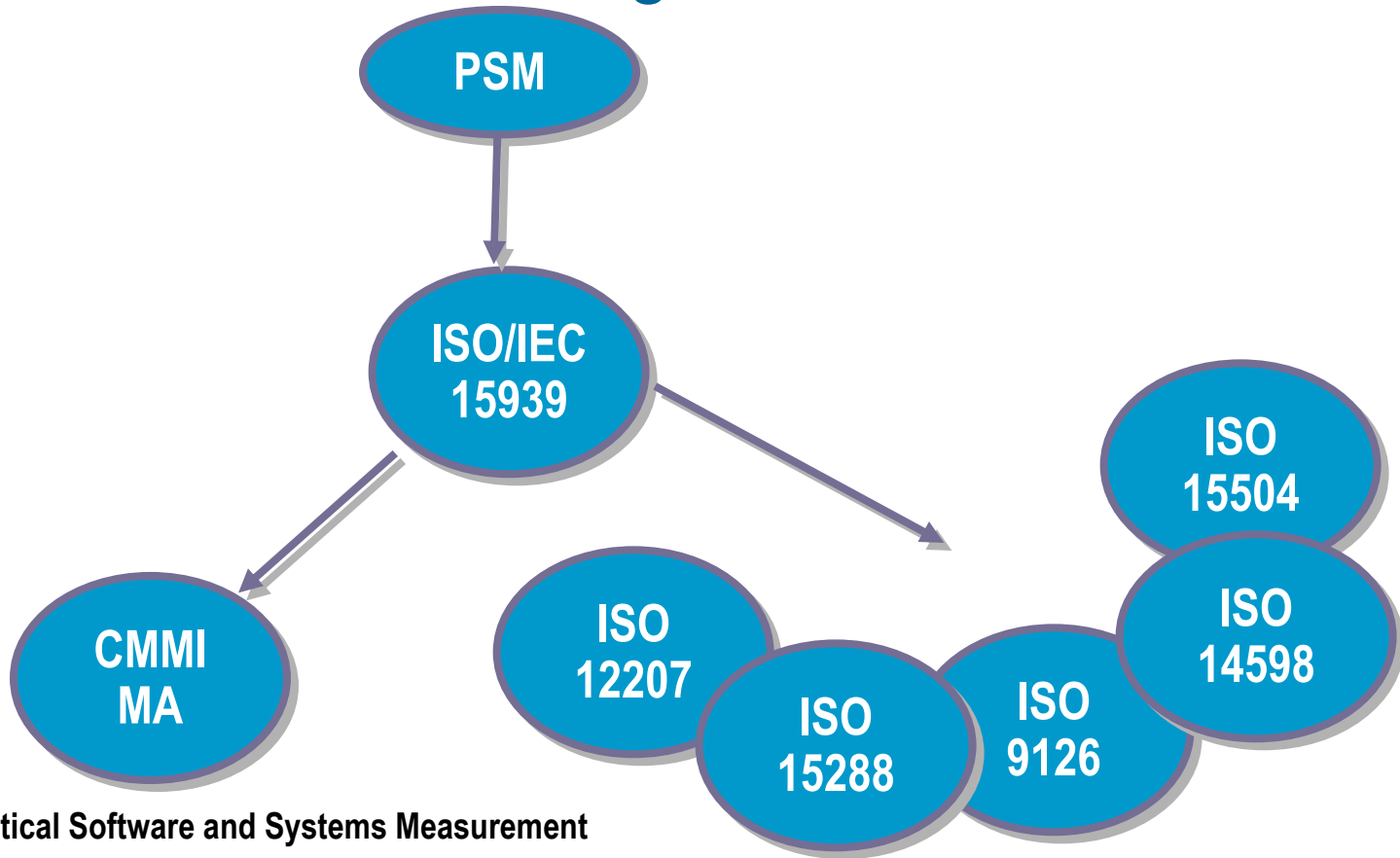


Attributes of a Successful Measurement Program

- ▶ Organizational commitment
- ▶ Organization uses the results
- ▶ Measurement process is well planned
- ▶ Measurement collection is automated
- ▶ Measures are objective and unambiguously defined
- ▶ Measurement process is continuously improved
- ▶ Results are communicated



Standards and Methodologies



PSM - Practical Software and Systems Measurement

ISO/IEC 15939 – Software Measurement Process

CMMI – Capability Maturity Model Integration – M & A

ISO 12207 – Software Life Cycle Process

ISO 15288 – System Life Cycle Process

ISO 14598 - Software Product Evaluation

ISO 15504 – Software Process Assessment

ISO 9126 – Software Product Quality

Capability Maturity Model Integration (CMMI)

- ▶ Models containing the essential elements of effective processes
 - CMMI is not a process!
- ▶ Provides guidance for improving processes and ability to manage development, acquisition and maintenance
- ▶ Assess at different levels of process maturity or capability
- ▶ Two Models
 - Staged Representation
 - Continuous Representation



CMMI Staged Representation

▶ Assess process maturity

Maturity Levels:

Level 1 Initial

Level 2 Managed

Level 3 Defined

Level 4 Quantitatively
Managed

Level 5 Optimizing

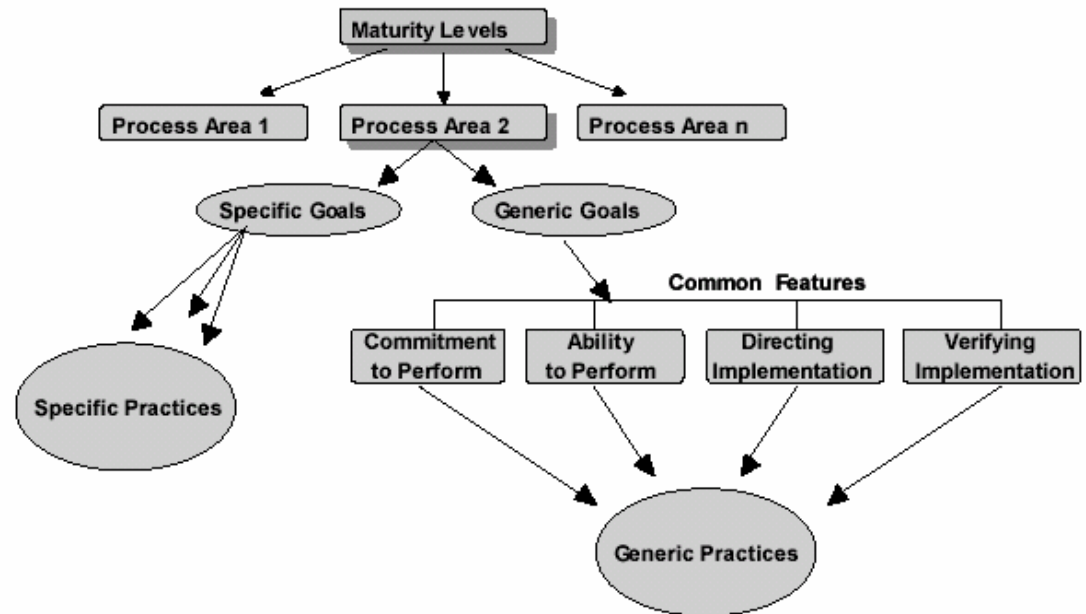


Figure 1: CMMI Model Components [FM103.HDA101.T104]

CMMI Continuous Representation

▶ Assess process capability

Capability Levels:

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

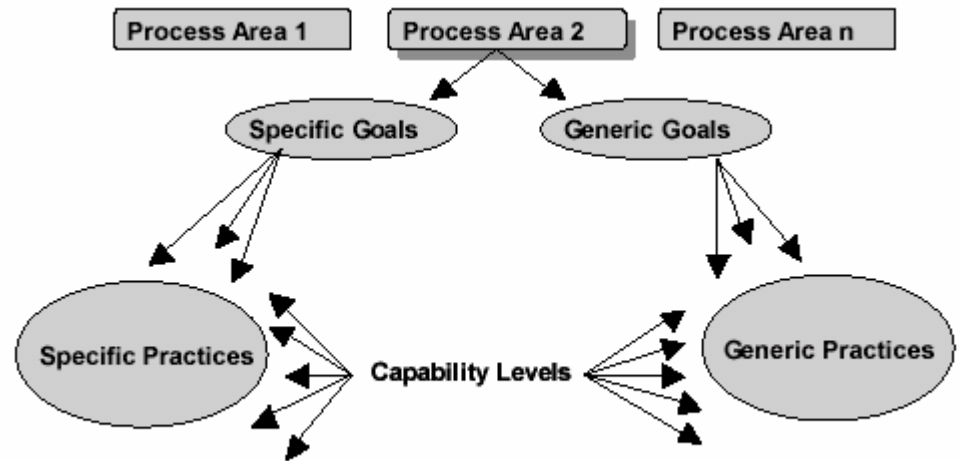
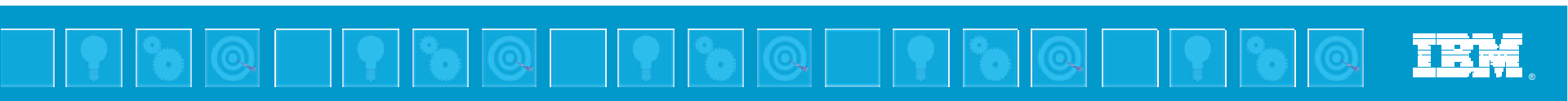


Figure 1: CMMI Model Components [FM103.HDA101.T103]

CMMI Level 2 (Staged) Key Process Areas

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



CMMI

Measurement & Analysis Process Area

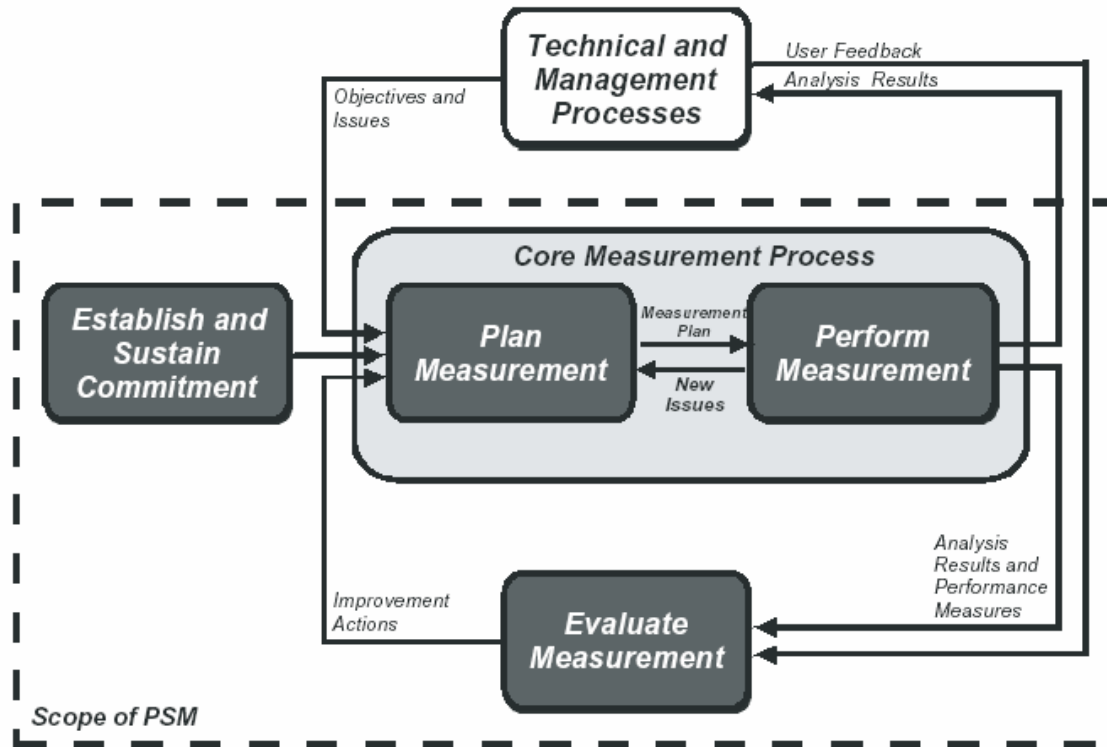
- ▶ Specific Goal 1: Measurement objectives and practices are aligned with identified information needs
- ▶ Specific Goal 2: Measurement results that address identified needs and objectives are provided

Project Monitoring & Control Process Area

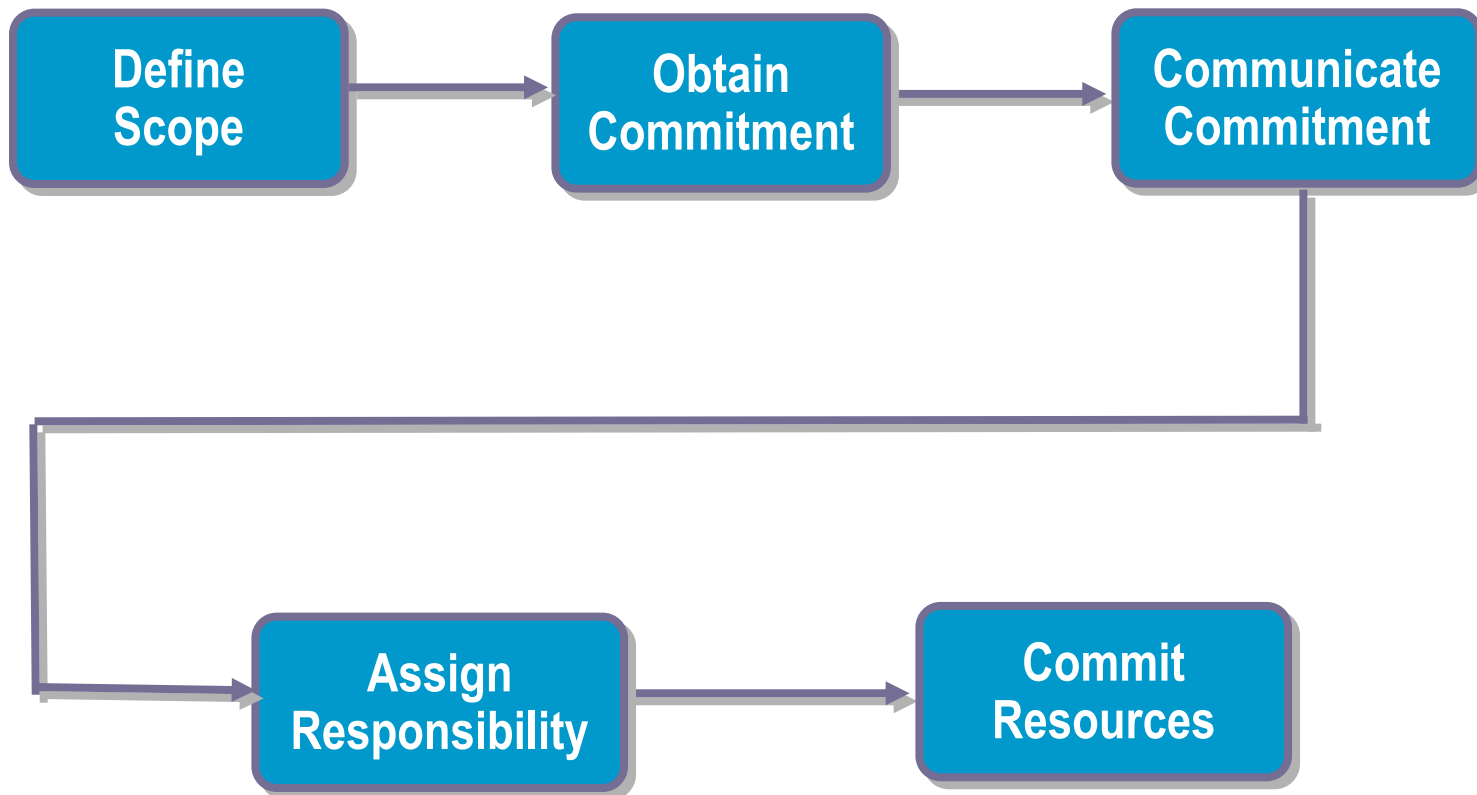
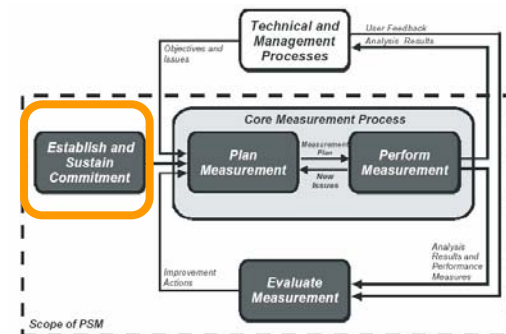
- ▶ Specific Goal 1 Actual performance and progress are monitored against the project plan



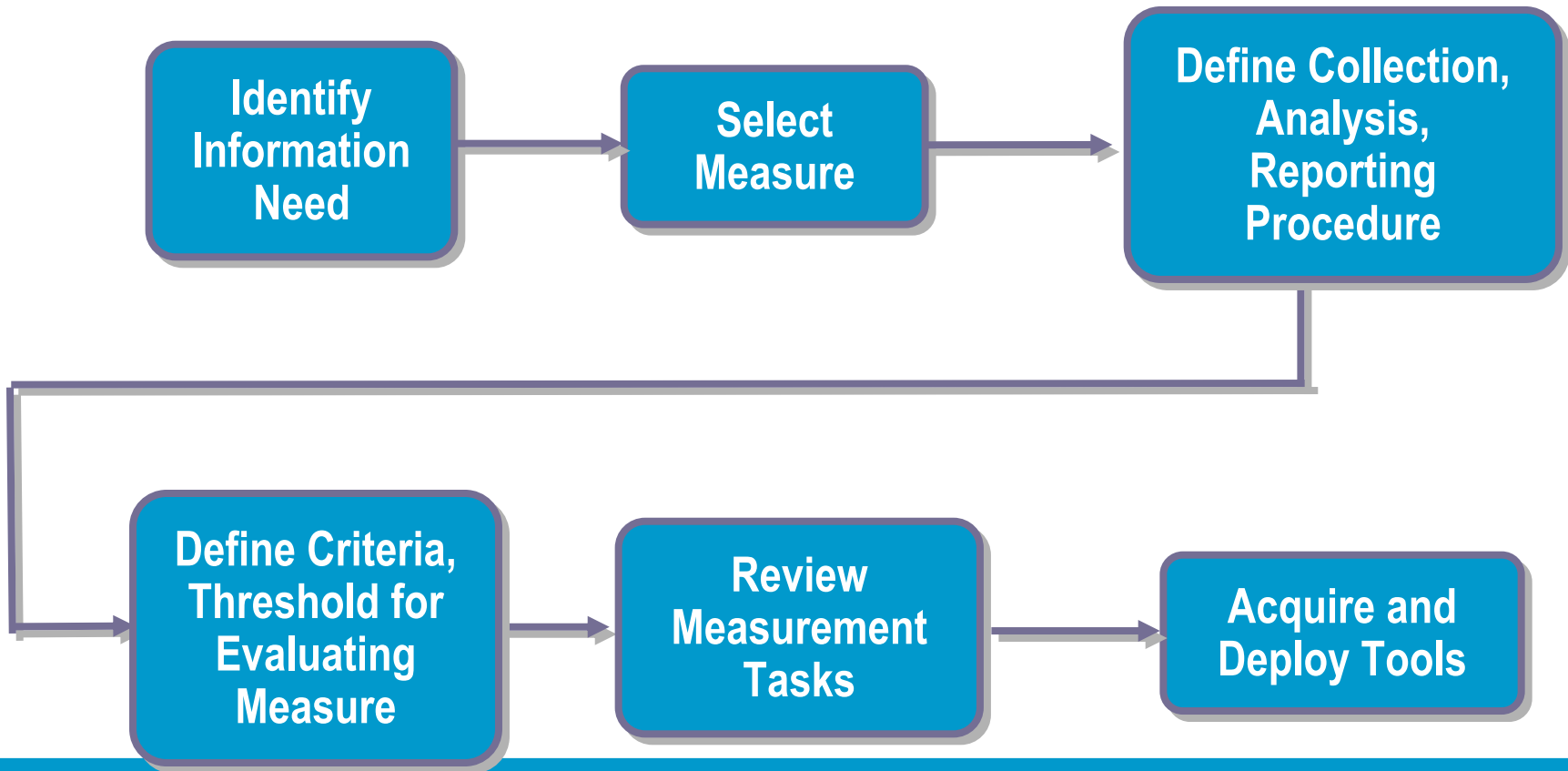
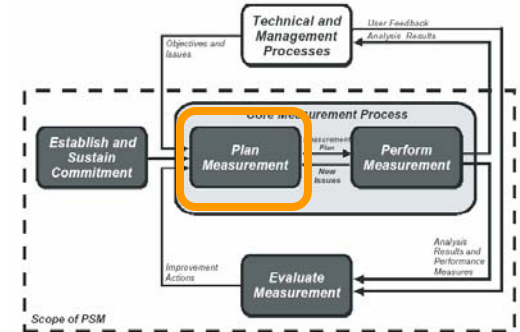
PSM Measurement Process Model



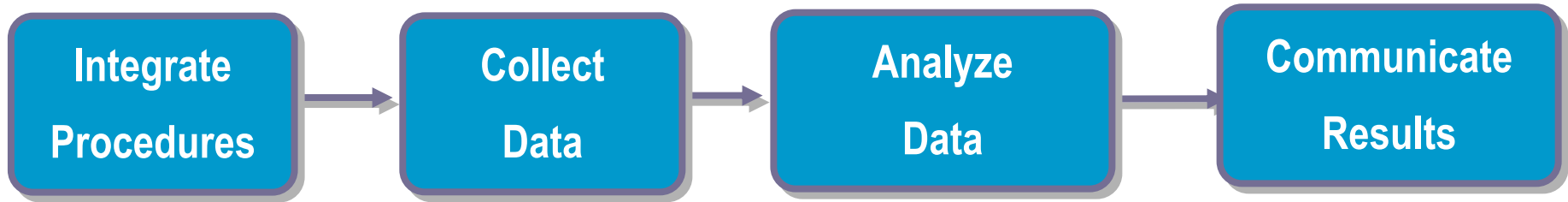
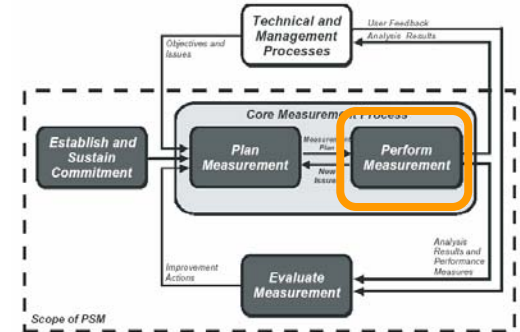
Establish and Sustain Commitment



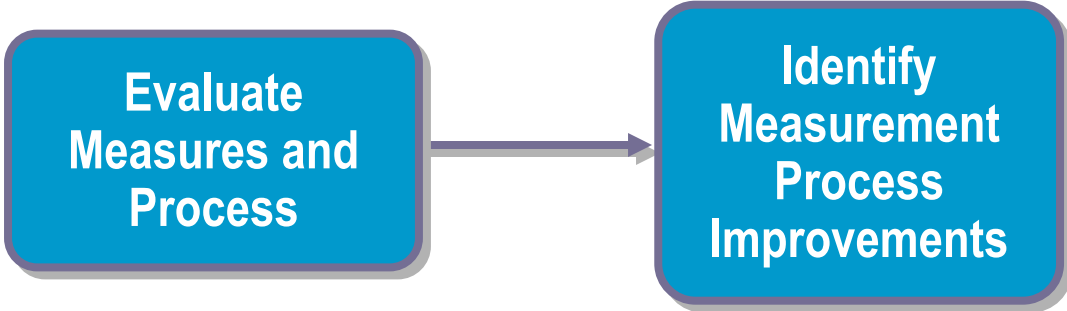
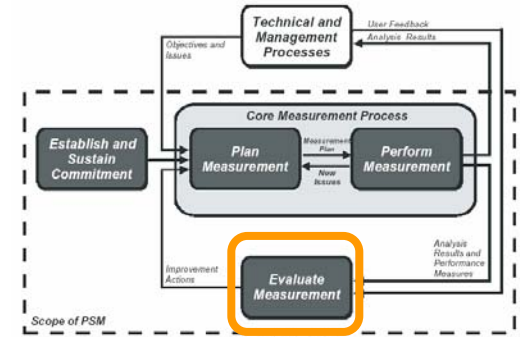
Plan the Measurement Process



Perform the Measurement Process



Evaluate Measurement



Six Best Practices

Best Practices

Process Made Practical

Develop Iteratively
Manage Requirements

Use Component
Architectures

Model Visually (UML)

Continuously Verify Quality
Manage Change



The Rational Unified Process

RUP is an industry-wide process platform that provides you with software development knowledge, guidelines, templates, and examples for every member of your team.

Rational Unified Process: Overview

Phases

Disciplines	Inception	Elaboration	Construction	Transition
Business Modeling	High activity	Low activity	Low activity	Low activity
Requirements	High activity	High activity	Low activity	Low activity
Analysis & Design	Low activity	High activity	High activity	Low activity
Implementation	Low activity	Low activity	High activity	High activity
Test	Low activity	Low activity	Low activity	High activity
Deployment	Low activity	Low activity	Low activity	High activity
Configuration & Change Mgmt	Low activity	Low activity	Low activity	Low activity
Project Management	Low activity	Low activity	Low activity	Low activity
Environment	Low activity	Low activity	Low activity	Low activity

Iterations

Initial | Elab #1 | Elab #2 | Const #1 | Const #2 | Const #N | Tran #1 | Tran #2

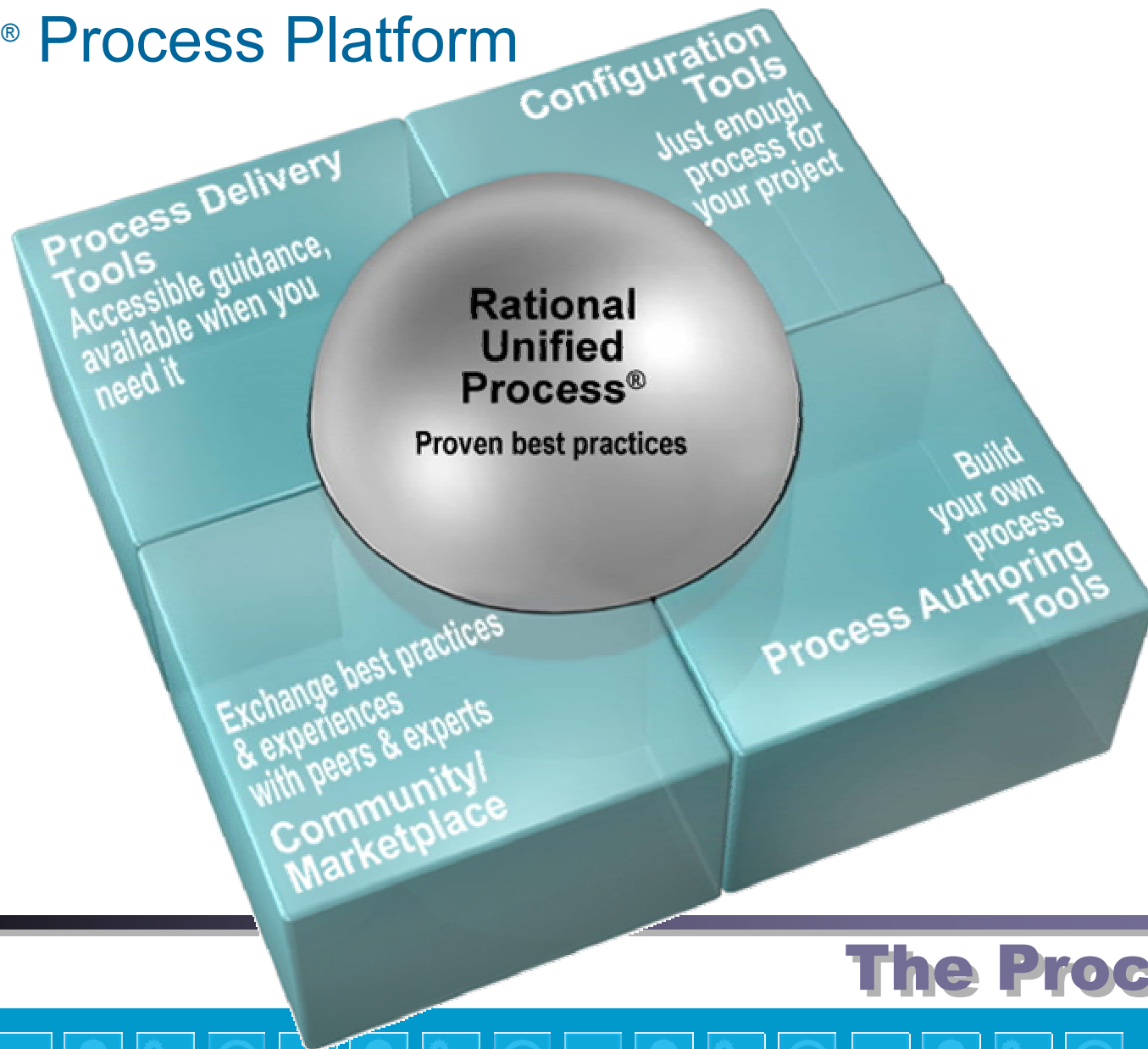
Click on an area of the screen for more information.

The Rational Unified Process® or RUP® product is a software engineering process. It provides a disciplined approach to assigning tasks and responsibilities within a development organization. Its goal is to ensure the production of high-quality software that meets the needs of its end users within a predictable schedule and budget.

The preceding figure illustrates the overall architecture of the RUP, which has two dimensions:

- The horizontal axis represents time and shows the lifecycle aspects of the process as it unfolds. This first

The RUP® Process Platform



The Process

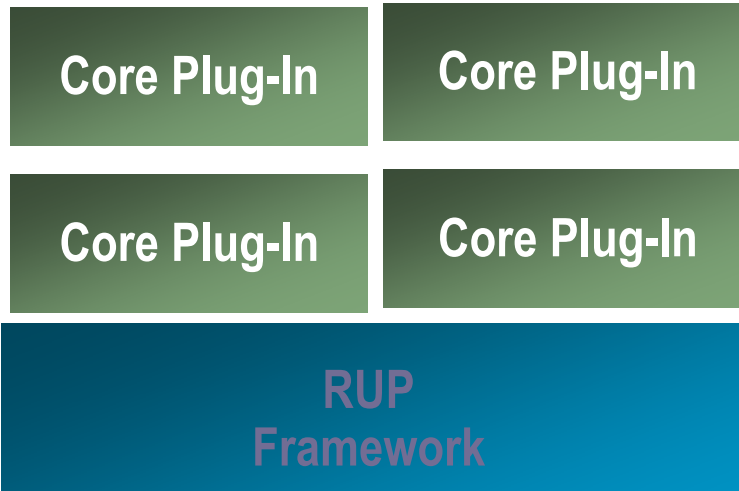


Configuration Tools: *Right-Size the Process Platform*

Partners

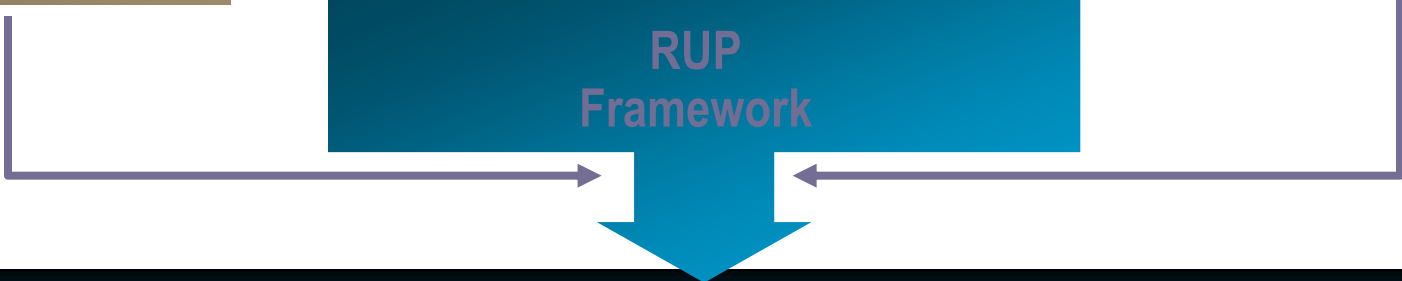
- Technology Plug-In
- Tool Plug-In
- Domain Plug-In

Core RUP



Customers

- Project Plug-In
- Company Plug-In

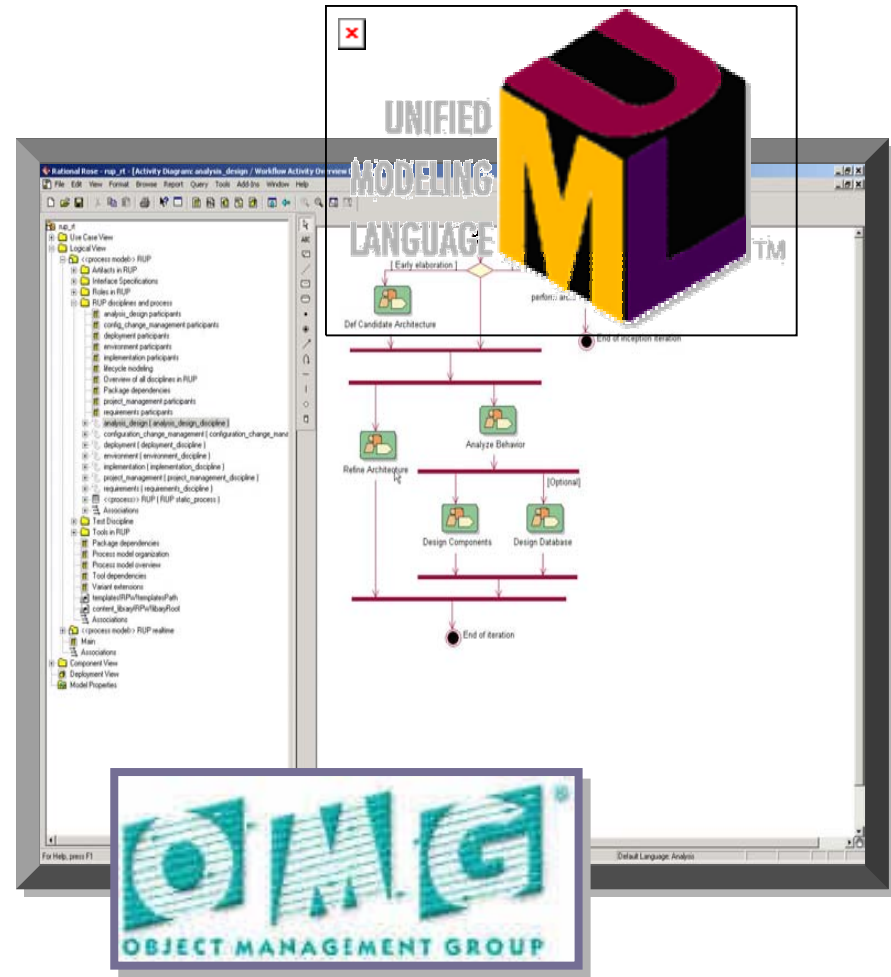


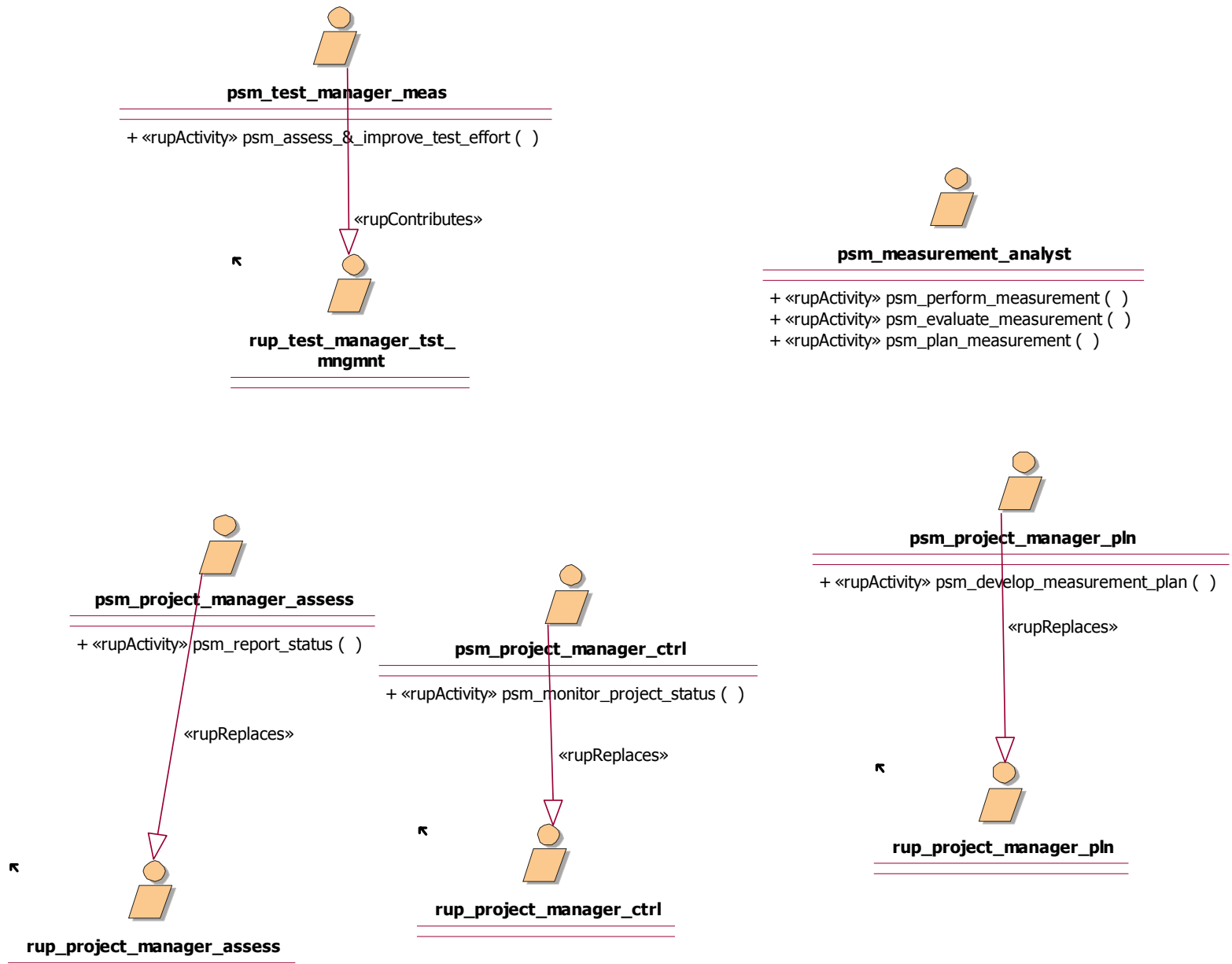
RUP Configurations

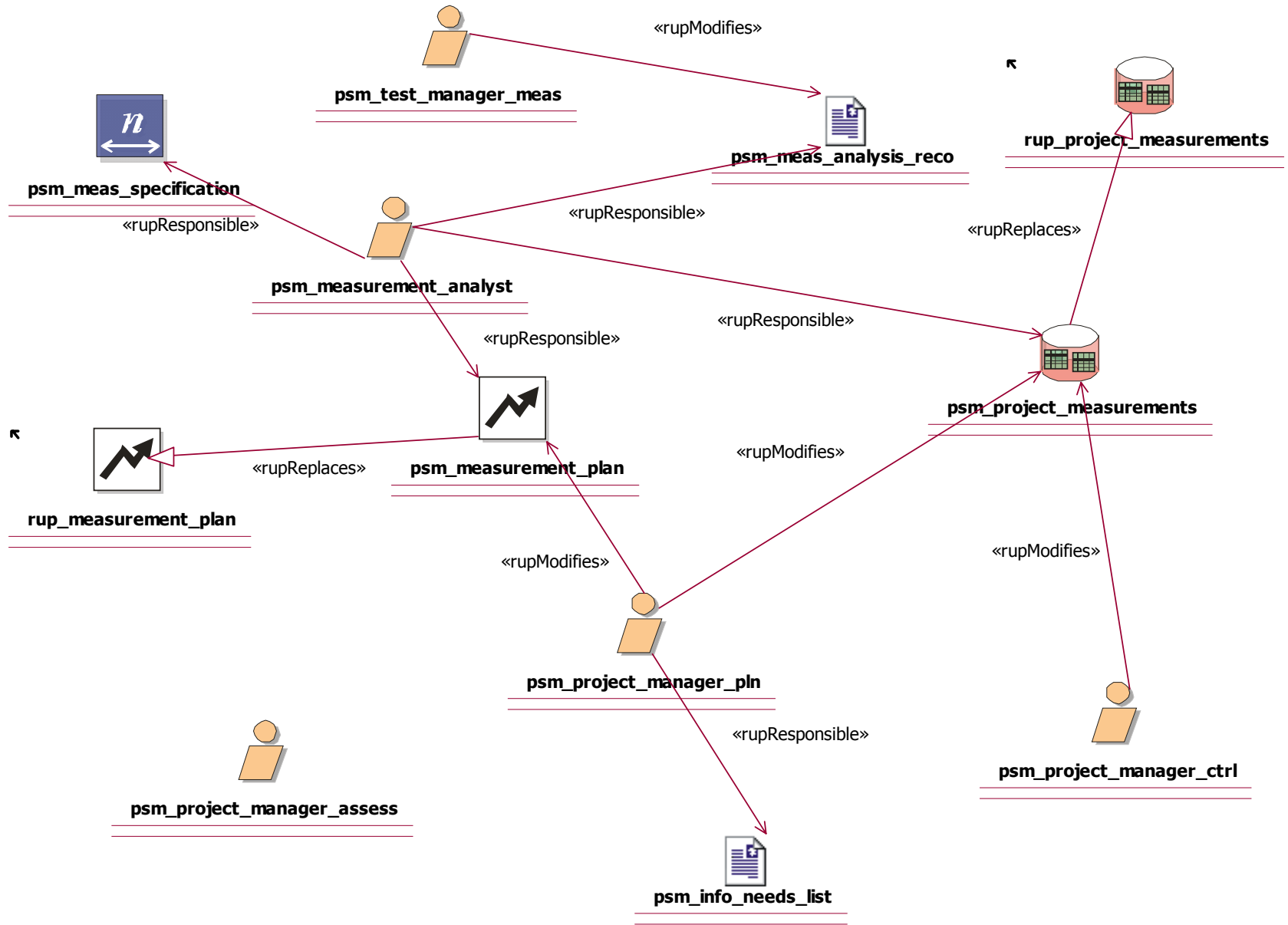
For a complete list of available Plug-Ins, see www.rational.com/products/rup

Customization Tools: *Rational Process Workbench*

- ▶ Drag & drop functionality allows easy creation of Plug-Ins
- ▶ Open and extensible: Based on OMG SPEM (Software Process Engineering Meta Model)
- ▶ Automatically generates and packages Plug-Ins







Configuration Tools: *RUP Builder*

- ▶ Enables project managers to selectively “right-size” their project’s process
- ▶ Visually configure process
- ▶ Check consistency among Plug-Ins
- ▶ Generate new PSM RUP Configuration

The screenshot shows the RUP Builder interface with the following components:

- Process Plug-In Choices:** A tree view where 'RUP' is expanded. Under 'RUP', 'Formal_Resources', 'Informal_Resources', and 'PSM' are checked. Under 'PSM', 'rup_dotnet_plugin', 'rup_j2ee_plugin', and 'rup_ux_modeling_plugin' are unchecked.
- Selectable Process Components:** A tree view where 'RUP' is expanded. Under 'RUP', 'Formal Resources', 'Informal Resources', and 'PSM' are expanded. Under 'PSM', 'Measurements' is checked. Under 'Measurements', 'Measurement Analyst' is expanded, showing several sub-components like 'psm_project_manager_pln', 'Measurement Plan', 'Information Needs List', 'Measurement Analysis and Recommendations', 'psm_project_manager_assess', 'psm_project_manager_ctrl', 'psm_test_manager_meas', and 'Measurement Specification'.

Callouts and annotations:

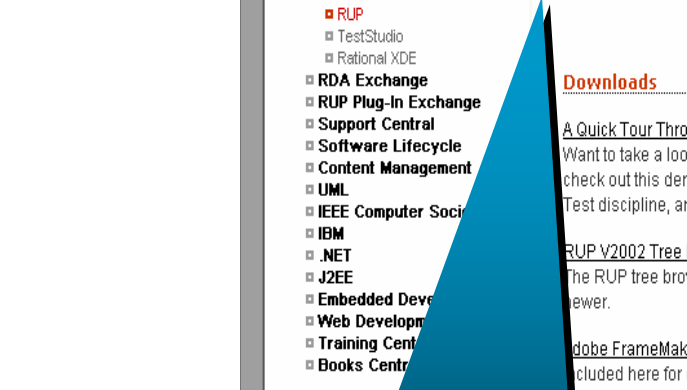
- Top Right:** A dark green callout box says "Add new Plug-Ins on Demand".
- Right Side:** A dark green callout box says "Right Size" via checkbox".
- Bottom Center:** A dark green callout box says "Create Your Own Process Configurations".
- Bottom:** A text box says "For more process plugins go to: [RUP Plug-In Exchange](#)".



Community/Marketplace: *Rational Developer Network*

RUP Plug-In Exchange allows uploading and downloading of Plug-Ins

The screenshot shows the Rational Developer Network website interface. At the top, there's a navigation bar with 'Development Resources', 'Discussions', and 'My Workspace'. Below that, the 'Current Location' is 'Development Resources > Rational Tools > RUP'. A search bar is on the left with a 'Go' button. The main content area is titled 'RUP' and features a 'Welcome' message. There are several sections: 'Ask Dr. Process' with a link to 'Can I use the RUP for a three-person project?', 'Downloads' with links to 'A Quick Tour Through RUP v2002 Test Discipline Viewlet', 'RUP V2002 Tree Browser Patch for Netscape 6.2 and Above', and 'Adobe FrameMaker Templates for RUP version 2002'. On the right, there are sections for 'RUP Knowledge Center: Your Home Page for RUP Product Support', 'Please spend a minute completing our survey about software maintenance and distribution.', 'Recommended Sites' with a link to 'More RUP and Process Information on the Web', and 'Training' with links to 'Rational Unified Process Fundamentals', 'Implementing Rational Unified Process', and 'PRJ110: Principles of Rational Unified Process'. A left-hand navigation menu lists various resources like 'Rational Tools', 'RDA Exchange', 'RUP Plug-In Exchange', 'Support Central', etc.



RUP Knowledge Center and Discussion Forum Provide Targeted Content and Community

Additional Role – Measurement Analyst

The screenshot shows the Rational Unified Process (RUP) interface. At the top, the title bar reads "Rational Unified Process®" and includes navigation links for "Glossary", "Index", "Feedback", and "About". Below the title bar is a search bar and a "Print" button. The left sidebar contains a navigation tree with categories like "Where Am I", "Tree Sets", and "Analyst", "Developer", "Team", "Tester", "Manager", "Production and Support", "Doug's RUP", and "Getting Started". The main content area is titled "Measurements > Measurement Analyst" and features the heading "Role: Measurement Analyst" with a subtext "[Begin describing the Measurement Analyst role responsibilities / purpose here]".

Topics

- [Description](#)
- [Related Information](#)
- [Staffing](#)
- [Further Reading](#)

Diagram:

The diagram illustrates the responsibilities of the Measurement Analyst role. It consists of three main yellow boxes:

- Top Box:** "Responsible For" (indicated by an upward arrow). It contains three document icons labeled "Measurement Analysis and Recommendations", "Measurement Specification", and "Measurement Plan".
- Middle Box:** "Measurement Analyst" (indicated by a person icon). It contains three chevron icons labeled "Evaluate Measurements", "Perform Measurement", and "Plan Measurement".
- Bottom Box:** "Modifies" (indicated by a downward arrow). It contains one document icon labeled "Project Measurements".

Arrows indicate the flow of responsibility: the Measurement Analyst role is responsible for the top box, and the top box modifies the bottom box.

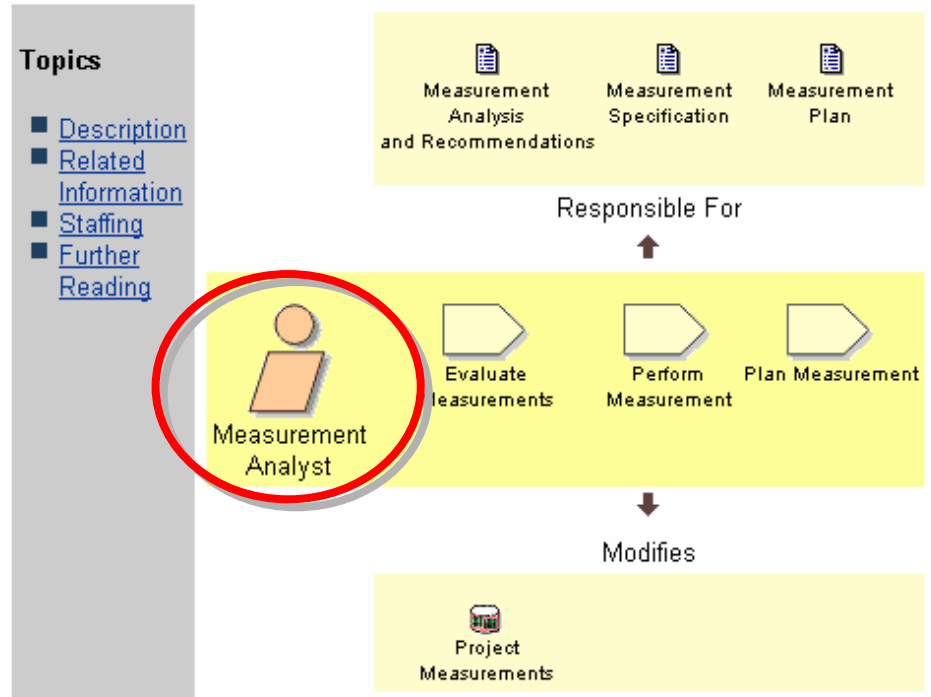
Measurement Analyst Activities

 Measurements >  Measurement Analyst

Role: Measurement Analyst

[Begin describing the Measurement Analyst role responsibilities / purpose here]

- ▶ Plan Measurement
- ▶ Perform Measurement
- ▶ Evaluate Measurements



Project Manager Discipline

Rational Unified Process®

Glossary | Index | Feedback | About

Search | Print

Where Am I | Tree Sets

Analyst | Developer | **Dougs RUP**

Production and Support | Team | Tester

Getting Started | Manager

Project Manager

Role: Project Manager

The Project Manager role plans, manages and allocates resources, shapes priorities, coordinates interactions with customers and users, and keeps the project team focused. The Project Manager also establishes a set of practices that ensure the integrity and quality of project artifacts.

Topics

- Description
- Related Information
- Staffing
- Further Reading

Responsible For

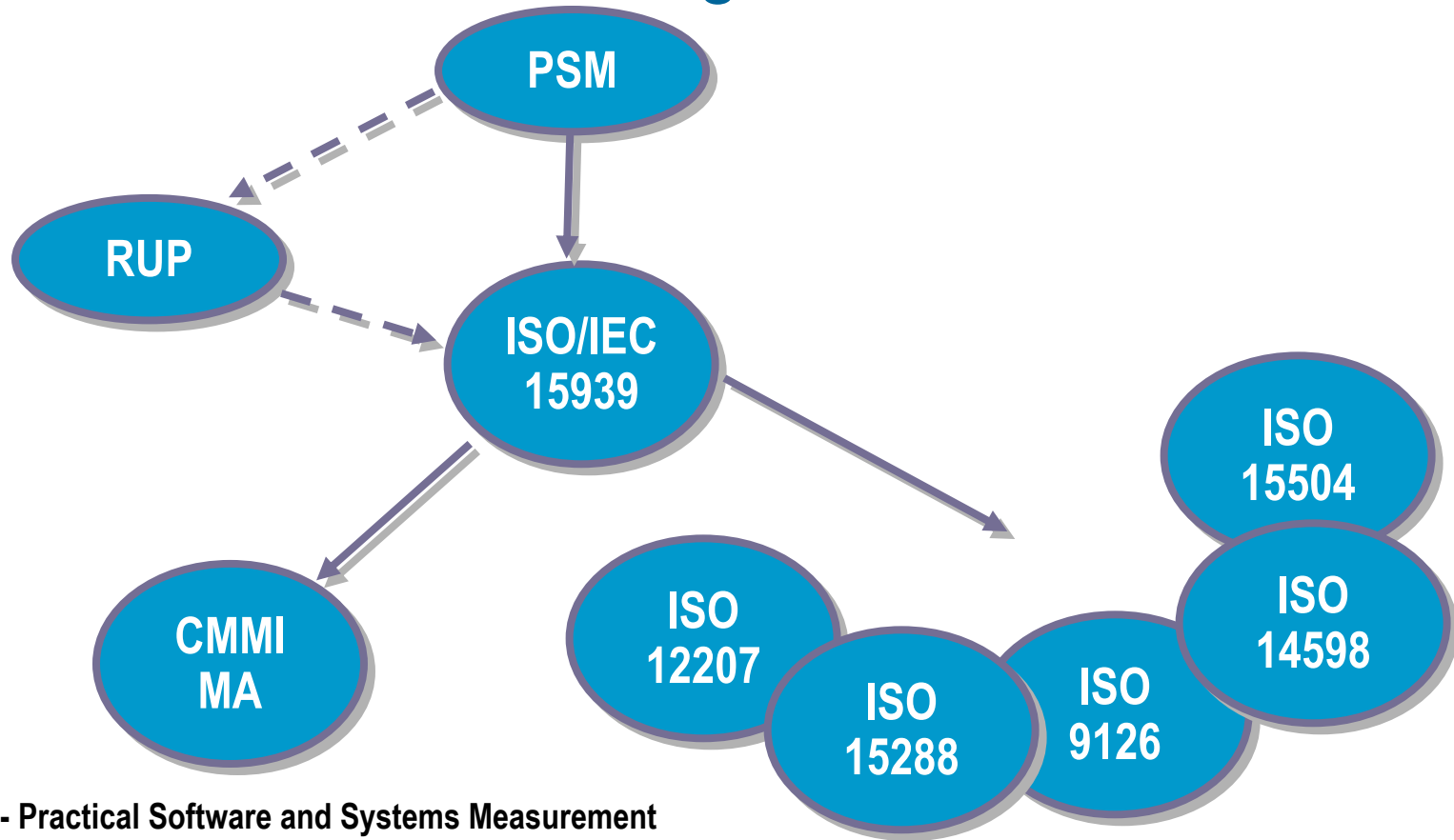
Product Acceptance Plan	Problem Resolution Plan	Measurement Plan	Project Measurements	Issues List	Work Order	Information Needs List	
Business Case	Iteration Plan	Software Development Plan	Risk List	Status Assessment	Iteration Assessment	Risk Management Plan	Quality Assurance Plan

Project Manager

Monitor Project Status	Define Project Organization and Staffing	Initiate Project	Acquire Staff	Schedule and Assign Work	Initiate Iteration	Develop Measurement Plan	Report Status
Develop Problem Resolution Plan	Develop Risk Management Plan	Develop Product Acceptance Plan	Compile Software Development Plan	Develop Measurement Plan	Prepare for Project Close-Out	Prepare for Phase Close-Out	Handle Exceptions and Problems
Develop Business Case	Plan Phases and Iterations	Identify and Assess Risks	Develop Iteration Plan	Assess Iteration	Report Status	Define Monitoring & Control Processes	Develop Quality Assurance Plan

Applet RupPresenterApplet started | My Computer

Standards and Methodologies



PSM - Practical Software and Systems Measurement

ISO/IEC 15939 – Software Measurement Process

CMMI – Capability Maturity Model Integration – M & A

ISO 12207 – Software Life Cycle Process

ISO 15288 – System Life Cycle Process

ISO 14598 - Software Product Evaluation

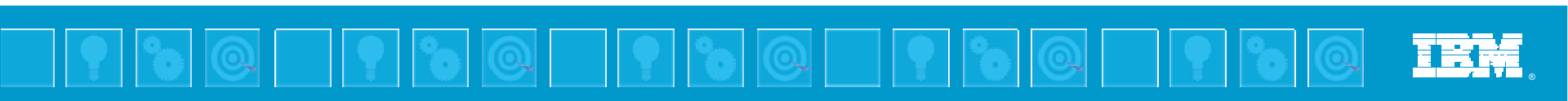
ISO 15504 – Software Process Assessment

ISO 9126 – Software Product Quality

RUP – Rational Unified Process

RUP Phases & Information Categories

- ▶ Schedule and Progress
- ▶ Resources and Cost
- ▶ Product Size and Stability
- ▶ Product Quality
- ▶ Process Performance
- ▶ Technology Effectiveness
- ▶ Customer Satisfaction



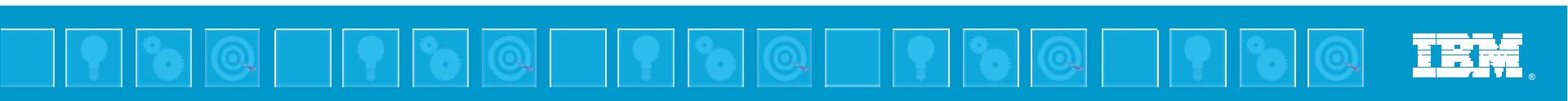
RUP Phases & Information Categories

RUP Phases	PSM Information Categories
Inception	<ul style="list-style-type: none"> ▶ Schedule and Progress ▶ Resources and Cost ▶ Process Performance
Elaboration	<ul style="list-style-type: none"> ▶ Schedule and Progress ▶ Resources and Cost ▶ Product Size and Stability ▶ Product Quality ▶ Process Performance ▶ Technology Effectiveness
Construction	<ul style="list-style-type: none"> ▶ Schedule and Progress ▶ Resources and Cost ▶ Product Size and Stability ▶ Product Quality ▶ Process Performance ▶ Technology Effectiveness ▶ Customer Satisfaction
Transition	<ul style="list-style-type: none"> ▶ Schedule and Progress ▶ Resources and Cost ▶ Product Quality ▶ Customer Satisfaction



Information Need May Vary During Lifecycle

- ▶ Pre-study/Inception
 - Monitoring requirements
- ▶ Feasibility/Elaboration
 - Examine architecturally critical requirements
 - Examine progress in requirement's level of detail
 - Use case progress
- ▶ Execution/Construction
 - Monitoring open defects
 - Status of change requests
 - Requirements churn
 - Test progress
 - Code churn
 - Tasks being completed on schedule (or earned value)
- ▶ Execution/Transition
 - Trend of open defects
 - Code churn
 - Number of tasks completed late
 - Customer reported defects



Information Needs/Sample Measures

Information Category	Information Category	Prospective Measures
Inception	Schedule and Progress	Task Completion Requirements Status Business Use-Case Model Status Use-Case Model Status Design Model Status
	Resources and Cost	Staff Level, Turnover Earned Value – BCWS, BCWP, ACWP, SPI, CPI, SV, CV
	Process Performance	Requirements-Design Traceability Requirements-Test Case Traceability Model Elements (e.g., Activity, Diagrams)
Elaboration	Schedule and Progress	Task Completion Requirements Status Requirements Tested Use-Case Model Status Design Model Status Units Designed, Coded, Tested Test Cases Attempted, Passed, Failed
	Resources and Cost	Staff Level, Turnover Earned Value – BCWS, BCWP, ACWP, SPI, CPI, SV, CV
	Product Size and Stability	Requirements Lines of Code Function Points Components Interfaces
	Product Quality	Defects
	Process Performance	Requirements/Model Traceability Requirements/Test Case Traceability
	Technology Effectiveness	Requirements Coverage

Information Needs/Sample Measures

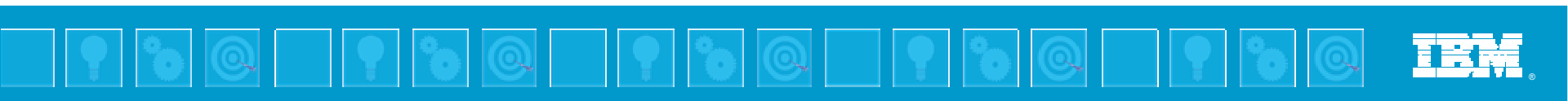
Information Category	Information Category	Prospective Measures
Construction	Schedule and Progress	Task Completion Change Requests Opened, Resolved Units Designed, Coded, Tested Test Cases Attempted, Passed, Failed
	Resources and Cost	Staff Level, Turnover Earned Value – BCWS, BCWP, ACWP, SPI, CPI, SV, CV
	Product Size and Stability	Requirements Lines of Code Function Points Components Interfaces
	Product Quality	Defects Age of Defects Cyclomatic Complexity Mean-Time-to-Failure
	Process Performance	Defects Contained Defects Escaping Scrap, Rework Effort Requirements/Model Traceability Requirements/Test Case Traceability Change Request/Test Case Traceability
	Technology Effectiveness Customer Satisfaction	Requirements Coverage Customer Reported Defects
Transition	Schedule and Progress	Task Completion Change Requests Opened, Resolved Test Case Progress
	Resources and Cost	Earned Value – BCWS, BCWP, ACWP, SPI, CPI, SV, CV
	Product Quality	Defects
	Customer Satisfaction	Customer Reported Defects

Demo



Next Steps

- ▶ Formalize PSM Plug-In
- ▶ Make it available on IBM Rational Developer Network
 - <http://www.rational.net>
 - Free to IBM Rational users!
- ▶ Solicit RUP users who practice PSM to use the plug-in



References

- ▶ Doug Ishigaki, Cheryl Jones, “Practical Measurement in the Rational Unified Process”, the Rational Edge, January 2003 Edition.
 - <http://www.therationaledge.com>
- ▶ McGarry, John, Card, David, Jones, Cheryl, Layman, Beth, Clark, Elizabeth, Dean, Joseph, Hall, Fred. *Practical Software Measurement: Objective Information for Decision Makers*. Boston, MA: Addison-Wesley, 2002.
 - The PSM book
 - <http://www.psmc.com>
- ▶ ISO/IEC 15939:2002, “Software Engineering – Software Measurement Process.” Geneva, Switzerland, 2002.
- ▶ “Capability Maturity Model Integration, Version 1.1”, CMU/SEI-2002-TR-001, CMU/SEI-2002-TR-002
 - <http://www.sei.cmu.edu>
- ▶ Kruchten, Philippe. *The Rational Unified Process: An Introduction*. Boston, MA: Addison-Wesley, 2000.
- ▶ Royce, Walker E. *Software Project Management: A Unified Framework*. Boston, MA: Addison-Wesley, 1998.



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FROM ideas TO results

QUESTIONS



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FROM ideas TO results

Thank You

Doug Ishigaki, IBM

John Riedener, U.S. Army & PSM

Cheryl Jones, U.S. Army & PSM

Bjorn Gustafsson, IBM

