The Rational Unified Process® and the Capability Maturity Model® – Integrated Systems/Software Engineering

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Acknowledgements

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• Jerry Perry
• Robert Woods

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• Philippe Kruchten
• Jim Smith
Topics

Goals and Purpose
CMMI Overview
RUP Overview
RUP to CMMI Mapping
Lessons Learned
What We’ve Heard

I’m trying to decide between using RUP and CMMI.

I’m using RUP, why would I want to look at the CMMI?

What’s the difference between CMMI and RUP?

I’m doing CMMI-based improvement, how can a tool like RUP help me?

How can I use RUP to develop ‘systems’, not just software?

CMMI is more a ‘waterfall’ development process, I need a more iterative approach.

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Our Approach

- **Plan**
  - Set comparison objectives
  - Select review team
  - Identify the RUP/CMMI authoritative source and constituent elements to be used in the comparison
  - Determine comparison information to capture

- Train review team on CMMI

- Determine how RUP supports CMMI

- Determine how CMMI supports RUP

- Report the results
  - Develop this tutorial
  - Develop a detailed Technical Report (~Aug 01)
Tutorial Goals

Explore commonalities between RUP and CMMI

Identify differences between RUP and CMMI

Recommend improvements in RUP and CMMI to strengthen both
Intended Audience

Organizations engaged in CMMI-based improvement considering using RUP

Organizations using RUP who are considering CMMI-based improvement

Appraisal teams using CMMI as a “yardstick” for organizations or projects using RUP
Topics

Goals and Purpose

CMMI Overview
RUP Overview
RUP to CMMI Mapping
Lessons Learned
What Is CMMI?

A framework of the key process elements for a system development

• structured collection of processes proven through experience

An integrated view of process improvement across multiple disciplines

• sets process improvement goals and priorities
• provides guidance for quality processes
• provides a yardstick for assessing current practices

Based on concepts and approaches pioneered by Crosby, Deming, Juran, Humphrey, et. al
Elements of an Effective Process -1

= CMMI Key Elements
Elements of an Effective Process -2

= CMMI Key Elements

= Your Project’s Additional Elements
Capability and Maturity

Process capability pertains to an individual process
• Knowing the process capabilities of a collection of processes has implications for organizational maturity

Organizational maturity pertains to a set of processes
• Being at a particular level of organizational maturity has process capability implications for multiple processes
CMMI Model Representations

Two approaches to process improvement

- process capability
- organizational maturity

CMMI models support each approach with a representation

- process capability approach ==> continuous representation
- organizational maturity approach ==> staged representation

Which representation to use is based on the purpose of the improvement task
CMMI Model Components

- Process Area 1
- Process Area 2
- Process Area n

Specific Goals

Specific Practices

Generic Goals

Generic Practices

Capability Levels
Continuous Representation Structure

Process

Process Area 1  Process Area 2  Process Area 3  Process Area n

Capability

Process performed well and continuously improved

Process not performed
# Capability Levels

A capability level is

- A well-defined evolutionary plateau describing the capability of any Process Area
- A layer in the foundation for continuous process improvement

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Optimizing</td>
</tr>
<tr>
<td>4</td>
<td>Quantitatively Managed</td>
</tr>
<tr>
<td>3</td>
<td>Defined</td>
</tr>
<tr>
<td>2</td>
<td>Managed</td>
</tr>
<tr>
<td>1</td>
<td>Performed</td>
</tr>
<tr>
<td>0</td>
<td>Incomplete</td>
</tr>
<tr>
<td>Category</td>
<td>Process Areas</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Process Management | Organizational Process Focus  
                        | Organizational Process Definition  
                        | Organizational Training  
                        | Organizational Process Performance  
                        | Organizational Innovation and Deployment |
| Project Management | Project Planning  
                        | Project Monitoring and Control  
                        | Supplier Agreement Management  
                        | Integrated Project Management 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  
                        | Causal Analysis and Resolution  
                        | Decision Analysis and Resolution |
Topics

Goals and Purpose
CMMI Overview
RUP Overview*
RUP to CMMI Mapping
Lessons Learned

What is RUP?

A software engineering process based on best practices in modern software development

- A disciplined approach to assigning and managing tasks and responsibilities in a development organization
- Focused on high-quality software that meets the needs of its end users within a predictable schedule and budget

A process framework that can be tailored to specific organization or project needs

A process product developed and marketed by Rational Software with an interactive knowledge base integrated with tools
Key Aspects of RUP

Risk-driven process
• Risk management integrated into the development process
• Iterations are planned based on high priority risks

Use-case driven development
• Use cases express requirements on the system’s functionality and model the business as context for the system
• Use cases are defined for the intended system and are used as the basis of the entire development process

Architecture-centric design activities
• Architecture is the primary artifact to conceptualize, construct, manage, and evolve the system
• Consists of multiple, coordinated views (or models) of the architecture
RUP Basic Principles

Develop Software Iteratively
• Driven by early risk identification and mitigation
• Each iteration results in an executable release

Manage Requirements
• Requirements inherently dynamic across the system’s life

Use Component-Based Architecture
• Architectures that are resilient to change are essential

Visually Model Software
• Promotes consistency and unambiguous communication of development information

Continuously Verify Software Quality
• Identify defects early, objective measure of project status

Control Changes to Software
• Create and release a tested baseline at the end of each iteration
RUP Architecture

RUP produces a **software generation**
- A generation extends from idea to retirement of a **single** version of the system

**Static Structure**
- Describes the process in terms of who is doing what, how, and when

**Dynamic Structure**
- Describes the process in terms of how the process rolls out over time
- Expressed in terms of iterations, phases, and milestones
Static Process Elements

Worker (who)
A role that defines the individuals or a team that should carry out the work

Activity (how)
Describes a piece of work a worker performs

Artifact (what)
A piece of information that is produced, modified, or used by an activity

Workflow (when)
Specifies when a set of related activities is performed, by which workers, producing some artifact, which provides some observable value to the project
RUP Workflows - 1

Project Management
• Plan an iterative process
• Decide duration and content of an iteration

Business Modeling
• Understand the organization structure and dynamics in which a system is to be deployed

Requirements
• Capture and manage requirements
• Design a user interface focused on users needs and goals

Analysis and Design
• Translate requirements into a specification that describes how to implement the system
RUP Workflows - 2

Implementation

- Create, assemble, and integrate components and subsystem into an executable system

Test

- Assess product quality

Configuration and Change Management

- Track and maintain the integrity of evolving project assets

Environment

- Support the development organization with processes and tools

Deployment

- Turn the finished software product over to its users
Additional Static Elements

Guidelines
• Rules, recommendations, techniques, or heuristics to support activities and artifacts

Templates
• Models of artifacts that can be used to create the artifact
• Usually associated with a tool

Concepts
• Discussions on particular concepts (e.g., iteration, risk) associated with the process

Tool mentors
• Show how to perform a set of process steps using a specific tool
Dynamic Element: Iterations

Each iteration results in an executable release
Dynamic Elements: Phases and Milestones

- **Inception**
  - Define scope of project

- **Elaboration**
  - Plan project, specify features, baseline architecture

- **Construction**
  - Build product

- **Transition**
  - Transition product to end user community
Static and Dynamic Process Structure

Core Workflows
- Business Modeling
- Requirements
- Analysis & Design
- Implementation
- Test & Assessment
- Deployment

Supporting Workflows
- Configur. & Change Mgmt
- Project Management
- Environment

Phases
- Inception
- Elaboration
- Construction
- Transition

Preliminary Iteration(s)  Iter. #1  Iter. #2  Iter. #n  Iter. #n+1  Iter. #n+2  Iter. #m  Iter. #m+1
System Evolution

• Four phases form one development cycle and produce a generation of the system

• Significant user enhancement, business or mission changes, or technology changes trigger a new generation
Topics

Goals and Purpose
CMMI Overview
RUP Overview

RUP to CMMI Mapping

• Project Management
• Engineering
• Support
• Process Management
• Generic Practices

Lessons Learned
Comparing Static Representations

RUP-CMMI Mapping

Static
- RUP
- CMMI
- External Constraints
- Project Needs

Dynamic
- Organization Needs
- Organizational Standard Processes
- Project Processes

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Caveats

We are not assessing the Rational Unified Process

A project or organization is expected to tailor RUP to meet specific project needs

We are not comparing the results of tailoring either RUP or CMMI for an actual project or organization

Tailoring decisions could augment or deteriorate the results of our comparison

These comparisons are subjective: reasonable people may come to different conclusions
Sources for Our Comparison

Rational Unified Process, version 2000.02.10
- all process elements (workflows, workflow details, activities, artifacts, guidelines, templates)

- all Process Areas
- Specific Goals within each Process Area
- Specific Practices within each goal
- Generic Practices
Capturing our Results

RUP to CMMI

- **HIGH**: reviewers found a high degree of synergy between CMMI practices and RUP
- **MEDIUM**: reviewers were able to find some support for the CMMI practice
- **LOW**: reviewers had to stretch what we saw in RUP to support the CMMI practice, there were no mechanisms to support the practice, or the practice was outside the scope of RUP

CMMI to RUP

- To be provided in a technical report (approximately ~Aug 01)
Topics

Goals and Purpose
CMMI Overview
RUP Overview
RUP to CMMI Mapping
  • Project Management
  • Engineering
  • Support
  • Process Management
  • Generic Practices
Lessons Learned
CMMI Basic Project Management

- **PMC**
  - **What To Monitor**: Status, issues, results of process and product evaluations; measures and analyses
  - **Corrective action**
  - **Replan**
  - **What To Build**
  - **Commitments**
  - **Measurement needs**

- **PP**
  - **What To Do**
  - **What To Build**
  - **Commitments**
  - **Measurement needs**

- **SAM**
  - **Supplier agreement**
  - **Supplier**
  - **Plans**

- **Engineering and Support process areas**

- **Product component requirements**
  - Technical issues
  - Completed product components
  - Acceptance reviews and tests

- **Corrective action**
## Project Planning: Overview

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>Establish and maintain plans that define project activities.</td>
</tr>
<tr>
<td><strong>Workflow</strong></td>
<td>Project Management, Environment</td>
</tr>
<tr>
<td><strong>Synergy</strong></td>
<td>• RUP provides adequate support mechanisms</td>
</tr>
<tr>
<td></td>
<td>• RUP does not provide assistance in sizing non-software project attributes (e.g., labor, machinery, materials)</td>
</tr>
</tbody>
</table>
## Project Planning: Mapping -1

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SG 1: Establish Estimates</strong>&lt;br&gt;Estimates of project planning parameters are established and maintained.</td>
<td><strong>Workflow:</strong> Project Management&lt;br&gt;<strong>WD:</strong> Conceive New Project&lt;br&gt;<strong>WD:</strong> Develop Software Development Plan</td>
</tr>
<tr>
<td><strong>SG 2: Develop a Project Plan</strong>&lt;br&gt;A project plan is established and maintained as the basis for managing the project.</td>
<td><strong>Workflow:</strong> Project Management&lt;br&gt;<strong>WD:</strong> Conceive New Project&lt;br&gt;<strong>WD:</strong> Develop Software Development Plan&lt;br&gt;<strong>Workflow:</strong> Environment&lt;br&gt;<strong>WD:</strong> Prepare Environment for Project&lt;br&gt;<strong>WD:</strong> Prepare Environment for an Iteration</td>
</tr>
</tbody>
</table>
Project Planning: Mapping -2

**CMMI**

SG 3: Obtain Commitment to the Plan

Commitments to the project plan are established and maintained.

**RUP**

Workflow: Project Management
WD: Develop Software Development Plan
# Project Planning: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish Estimates</td>
<td>• Estimate the Scope of the Project (H)</td>
</tr>
<tr>
<td></td>
<td>• Establish Estimates of Project Attributes (M)</td>
</tr>
<tr>
<td></td>
<td>• Define Project Life Cycle (H)</td>
</tr>
<tr>
<td></td>
<td>• Determine Estimates of Effort and Cost (H)</td>
</tr>
<tr>
<td>Develop a Project Plan</td>
<td>• Establish the Budget and Schedule (H)</td>
</tr>
<tr>
<td></td>
<td>• Identify Project Risks (H)</td>
</tr>
<tr>
<td></td>
<td>• Plan for Data Management (M)</td>
</tr>
<tr>
<td></td>
<td>• Plan for Project Resources (M)</td>
</tr>
<tr>
<td></td>
<td>• Plan for Needed Knowledge and Skills (H)</td>
</tr>
<tr>
<td></td>
<td>• Plan Stakeholder Involvement (H)</td>
</tr>
<tr>
<td></td>
<td>• Establish the Project Plan (H)</td>
</tr>
<tr>
<td>Obtain Commitment to</td>
<td>• Review Subordinate Plans (H)</td>
</tr>
<tr>
<td>the Plan</td>
<td>• Reconcile Work and Resource Levels (M)</td>
</tr>
<tr>
<td></td>
<td>• Obtain Plan Commitment (H)</td>
</tr>
</tbody>
</table>
Project Planning: Detail Example

SP1.2-1: Establish and document estimates of the attributes of the work products and tasks.

RUP Elements:
Workflow: Project Management
   Workflow Detail: Develop Software Development Plan
      Activity: Plan Phases and Iterations

Comments: RUP provides guidance on sizing a software effort. Sizing by analogy and sizing by analysis is discussed. RUP does not provide assistance in sizing non-software project attributes (i.e. labor, machinery, materials, and methods that will be required by the project).

Degree of Synergy: Medium
**Project Monitor and Control: Overview**

### CMMI

**Purpose**
Provide understanding into the project’s progress so that appropriate corrective actions can be taken when the project’s performance deviates significantly from the plan.

### RUP

**Workflow**
Project Management

**Synergy**
- RUP provides strong mechanisms to help monitor a project
- Project’s using RUP should make sure data management is explicitly addressed
## Project Monitor and Control: Mapping

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SG 1: Monitor Project Against Plan</strong></td>
<td><strong>Workflow:</strong> Project Management</td>
</tr>
<tr>
<td>Actual performance and progress of the project is monitored against the project plan.</td>
<td><strong>WD:</strong> Monitor and Control Project</td>
</tr>
<tr>
<td><strong>Workflow:</strong> Project Management</td>
<td><strong>Workflow:</strong> Configuration Management</td>
</tr>
<tr>
<td><strong>WD:</strong> Monitor and Control Project</td>
<td><strong>WD:</strong> Monitor and Control Project</td>
</tr>
</tbody>
</table>

| **SG 2: Manage Corrective Action to Closure** | **Workflow:** Project Management |
| Corrective actions are managed to closure when the project's performance or results deviate significantly from the plan. | **WD:** Monitor and Control Project |
# Project Monitor and Control: Synergy

<table>
<thead>
<tr>
<th><strong>Specific Goal</strong></th>
<th><strong>Specific Practice</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor Project Against Plans</td>
<td>• Monitor Project Planning Parameters (H)</td>
</tr>
<tr>
<td></td>
<td>• Monitor Commitments (M)</td>
</tr>
<tr>
<td></td>
<td>• Monitor Project Risks (H)</td>
</tr>
<tr>
<td></td>
<td>• Monitor Data Management (M)</td>
</tr>
<tr>
<td></td>
<td>• Monitor Stakeholder Interactions (H)</td>
</tr>
<tr>
<td></td>
<td>• Conduct Progress Reviews (H)</td>
</tr>
<tr>
<td></td>
<td>• Conduct Milestone Reviews (H)</td>
</tr>
<tr>
<td>Manage Corrective Actions to Closure</td>
<td>• Analyze Issues (H)</td>
</tr>
<tr>
<td></td>
<td>• Take Corrective Actions (H)</td>
</tr>
<tr>
<td></td>
<td>• Manage Corrective Actions (H)</td>
</tr>
</tbody>
</table>
Project Monitor and Control: Detail Example

SP1.4-1 Monitor the management of project data.

RUP Components:
Workflow: Configuration Management

Comments: Although not required, managing project data could be called out in the Configuration Management Plan.

Degree of Synergy: Medium
CMMI Basic Project Management

- **PMC**
  - What To Monitor
  - Corrective action
  - Replan
  - Status, issues, results of progress and milestone reviews
  - Plans

- **PP**
  - What To Build
  - What To Do
  - Commitments
  - Measurement needs

- **SAM**
  - Supplier agreement
  - Product component requirements
  - Technical issues
  - Completed product components
  - Acceptance reviews and tests

- **Engineering and Support process areas**
  - Status, issues, results of process and product evaluations; measures and analyses

- **Supplier**
## Supplier Agreement Management: Overview

<table>
<thead>
<tr>
<th></th>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>Manage the acquisition of products and services from suppliers external to the project for which there exists a formal agreement.</td>
<td><strong>Workflow</strong> none&lt;br&gt;&lt;br&gt;<strong>Synergy</strong>&lt;br&gt;• RUP does not explicitly deal with managing work from external suppliers to the project&lt;br&gt;• RUP’s QA Plan, CM Plan, and Software Development Plan have sections labeled for supplier and subcontractor control</td>
</tr>
</tbody>
</table>
## Supplier Agreement Management: Mapping

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SG 1: Establish Supplier Agreements</strong></td>
<td><strong>Workflow:</strong> none</td>
</tr>
<tr>
<td>Agreements with the suppliers are</td>
<td><strong>Outside of the scope of RUP</strong></td>
</tr>
<tr>
<td>established and maintained.</td>
<td></td>
</tr>
</tbody>
</table>

| **SG 2: Satisfy Supplier Agreements**     | **Workflow:** none                       |
| Agreements with the suppliers are         | **Outside of the scope of RUP**         |
| satisfied by both the project and the     |                                         |
| supplier                                  |                                         |
## Supplier Agreement Management: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish Supplier Agreements</td>
<td>• Analyze Needs and Requirements Determined by the Project (L)</td>
</tr>
<tr>
<td></td>
<td>• Select Suppliers (L)</td>
</tr>
<tr>
<td></td>
<td>• Establish Supplier Agreements (L)</td>
</tr>
<tr>
<td>Satisfy Supplier Agreements</td>
<td>• Acquire COTS Products (L)</td>
</tr>
<tr>
<td></td>
<td>• Execute the Supplier Agreement (L)</td>
</tr>
<tr>
<td></td>
<td>• Conduct Acceptance Testing (L)</td>
</tr>
<tr>
<td></td>
<td>• Transition Products (L)</td>
</tr>
</tbody>
</table>
CMMI Advanced Project Management

Process Performance
Objectives, Baselines, Models

Statistical Mgmt Data

Organization’s Std. Processes and Supporting Assets

Lessons Learned, Planning and Performance Data

Product Architecture for Structuring Teams

Engineering and Support process areas

Project’s Defined Process
Coordination, commitments, issues to resolve

Identified risks

Quantitative objectives; sub-processes to statistically manage

Risk exposure due to unstable processes

Risk Taxonomies & Parameters
Risk Status
Risk Mitigation Plans
Corrective Action

Basic Project Management process areas

QPM

RSKM
Integrated Project Management: Overview

CMMI

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

RUP

Workflow
Project Management, Environment

Synergy
• RUP encourages developing integrated plans
• RUP supports tailoring for project unique needs through the development case artifact
## Integrated Project Management: Mapping

### CMMI

**SG 1: Use the Project’s Defined Process**

The project is conducted using a defined process that is tailored from the organization's set of standard processes.

### RUP

**Workflow:** Environment  
**WD:** Prepare Environment for Project/Iteration  
**Workflow:** Project Management  
**WD:** Develop Software Development Plan  
**WD:** Monitor and Control Project

---

**SG 2: Coordinate and Collaborate with Relevant Stakeholders**

Coordination and Collaboration of the project with relevant stakeholders is conducted.

**Workflow:** Project Management  
**WD:** Close-out Phase
## Integrated Project Management: Synergy

<table>
<thead>
<tr>
<th><strong>Specific Goal</strong></th>
<th><strong>Specific Practice</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Use the Project’s Defined Process</td>
<td>• Establish the Project’s Defined Process (M)</td>
</tr>
<tr>
<td></td>
<td>• Use Organizational Assets for Planning Project Activities (M)</td>
</tr>
<tr>
<td></td>
<td>• Integrate Plans (M)</td>
</tr>
<tr>
<td></td>
<td>• Manage the Project Using the Integrated Plans (H)</td>
</tr>
<tr>
<td></td>
<td>• Contribute to the Organization’s Process Assets (H)</td>
</tr>
<tr>
<td>Coordinate and Collaborate with Relevant Stakeholders</td>
<td>• Manage Stakeholder Involvement (H)</td>
</tr>
<tr>
<td></td>
<td>• Manage Dependencies (L)</td>
</tr>
<tr>
<td></td>
<td>• Resolve Coordination Issues (H)</td>
</tr>
</tbody>
</table>
Integrated Project Management: Detail Example

SP1.1-1 Establish and maintain the project's defined process.

RUP Components:
Workflow: Environment
Workflow Detail: Prepare Environment for Project/Iteration

Comments: Using RUP, a project would assess the current software development organization and select the processes and tools to support the project. This is less formal than having an “organizational standard process” comprised of a suite of lifecycles and processes to choose from complete with tailoring guidelines.

Degree of Synergy: Medium
CMMI Advanced Project Management

- Process Performance Objectives, Baselines, Models
- Statistical Mgmt Data
- Organization’s Std. Processes and Supporting Assets
- Lessons Learned, Planning and Performance Data
- Project’s Defined Process
- Coordination, commitments, issues to resolve
- Identified risks
- Quantitative objectives; subprocesses to statistically manage
- Risk exposure due to unstable processes
- Risk Taxonomies & Parameters
- Risk Status
- Risk Mitigation Plans
- Corrective Action
- Basic Project Management process areas
- Product Architecture for Structuring Teams
- Engineering and Support process areas
- Process Management process areas
Risk Management: Overview

CMMI

Purpose
Identify potential problems before they occur, so that risk-handling activities may be planned and invoked as needed across the life cycle to mitigate adverse impacts on achieving objectives.

RUP

Workflow
Project Management

Synergy
- RUP is a risk driven development process
- Activities are performed to mitigate the highest risks and tackle the hardest jobs first
## Risk Management: Mapping

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SG 1: Prepare for Risk Management</strong>&lt;br&gt;Preparation for Risk Management is conducted.</td>
<td><strong>Workflow:</strong> Project Management&lt;br&gt;<strong>WD:</strong> Develop Software Development Plan</td>
</tr>
<tr>
<td><strong>SG 2: Identify and Analyze Risks</strong>&lt;br&gt;Risks are identified and analyzed to determine their relative importance.</td>
<td><strong>Workflow:</strong> Project Management&lt;br&gt;<strong>WD:</strong> Conceive New Project</td>
</tr>
<tr>
<td><strong>SG 3: Mitigate Risks</strong>&lt;br&gt;Risks are handled and mitigated, where appropriate, to reduce adverse impacts on achieving objectives.</td>
<td><strong>Workflow:</strong> Project Management&lt;br&gt;<strong>WD:</strong> Conceive New Project</td>
</tr>
</tbody>
</table>
## Risk Management: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare for Risk Management</td>
<td>• Determine Risk Sources and Categories (H)</td>
</tr>
<tr>
<td></td>
<td>• Define Risk Parameters (M)</td>
</tr>
<tr>
<td></td>
<td>• Establish a Risk Management Strategy (M)</td>
</tr>
<tr>
<td>Analyze Risks</td>
<td>• Identify Risks (H)</td>
</tr>
<tr>
<td></td>
<td>• Evaluate, Classify, and Prioritize Risks (H)</td>
</tr>
<tr>
<td>Mitigate Risks</td>
<td>• Develop Risk Mitigation Plans (H)</td>
</tr>
<tr>
<td></td>
<td>• Implement Risk Mitigation Plans (H)</td>
</tr>
</tbody>
</table>
Risk Management: Detail Example

SP2.1-1 Identify and document the risks.

RUP Components:
Workflow: Project Management
   Workflow Detail: Conceive New Project
   Activity: Identify and Assess Risks

Comments: RUP calls for identifying risks. The resulting artifact, the Risk List, documents the identified risks.

Degree of Synergy: High
CMMI Advanced Project Management

Process Performance Objectives, Baselines, Models

Risk exposure due to unstable processes

Organization’s Std. Processes and Supporting Assets

Quantitative objectives; subprocesses to statistically manage

IPM

Lessons Learned, Planning and Performance Data

Identified risks

Engineering and Support process areas

Project’s Defined Process

Risk Taxonomies & Parameters

Risk Status

Risk Mitigation Plans

Corrective Action

Product Architecture for Structuring Teams

Basic Project Management process areas

Statistical Mgmt Data

Project’s Defined Process

Coordination, commitments, issues to resolve

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RU/CMMI Tutorial - ESEPG
Quantitative Project Management: Overview

CMMI

Purpose
Quantitatively manage the project’s defined process to achieve the project’s established quality and process performance objectives.

RUP

Workflow
Environment

Synergy
• Quantitatively managing the project’s processes is outside the scope of RUP
• RUP provides some guidance on measures pertinent to RUP
Quantitative Project Management: Mapping

CMMI

SG 1: Quantitatively Manage the Project
The project is quantitatively managed using quality and process performance objectives.

SG 2: Statistically Manage Subprocess Performance
The performance of selected subprocesses within the project’s defined process is statistically managed.

RUP

Workflow: Environment
WD: Prepare Environment for Project

Workflow: none
## Quantitative Project Management: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitatively Manage the Project</td>
<td>• Establish the Project’s Objectives (L)</td>
</tr>
<tr>
<td></td>
<td>• Compose the Defined Process (M)</td>
</tr>
<tr>
<td></td>
<td>• Select the Subprocesses to be Managed (L)</td>
</tr>
<tr>
<td></td>
<td>• Manage Project Performance (L)</td>
</tr>
<tr>
<td>Statistically Manage Subprocess</td>
<td>• Select Measures and Analytic Techniques (L)</td>
</tr>
<tr>
<td>Performance</td>
<td>• Apply Statistical Methods to Understand Variation (L)</td>
</tr>
<tr>
<td></td>
<td>• Monitor Performance of the Selected Subprocesses (L)</td>
</tr>
<tr>
<td></td>
<td>• Record Statistical Management Data (L)</td>
</tr>
</tbody>
</table>
Quantitative Project Management: Detail Example

SP1.2-1 Select the processes and process elements that comprise the project’s defined process based on historical stability and capability data.

RUP Components:
Workflow: Environment
  Workflow Detail: Prepare Environment for Project
  Guidelines: Process Discriminates

Comments: While selection of processes and process elements aren’t selected based on historical stability (meaning statistically understood), RUP provides guidelines to help projects select processes based on characteristics.

Degree of Synergy: Medium
Topics

Goals and Purpose

CMMI Overview

RUP Overview

RUP to CMMI Mapping
  • Project Management
  • Engineering
  • Support
  • Process Management
  • Generic Practices

Lessons Learned
CMMI Engineering Process Areas

- **REQM**: Requirements
  - Customer needs
  - Product and product component requirements

- **RD**: Requirements Definition
  - Alternative solutions
  - Requirements
  - Product components, verification and validation reports

- **TS**: Requirements Specification
  - Product components

- **PI**: Product Integration
  - Product

- **Ver**: Verification
  - Work products, validation reports

- **Val**: Validation
  - Customer
## Requirements Management: Overview

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td><strong>Workflow</strong></td>
</tr>
<tr>
<td>Manage the requirements of the project’s product and product components and to identify inconsistencies between those requirements and the project’s plans and work products.</td>
<td>Requirements</td>
</tr>
</tbody>
</table>

• RUP integrates the tracking (or change management) of requirements with capturing and analyzing requirements.
Requirements Management: Mapping

**CMMI**

**SG 1: Manage Requirements**
Requirements are managed and inconsistencies with project plans and work products are identified.

**RUP**

**Workflow:** Requirements
**WD:** Understand Stakeholder Needs
**WD:** Manage the Scope of the System
**WD:** Manage Changing Requirements

**Workflow:** Analysis and Design
**WD:** Analyze Behavior
**WD:** Design Components
**WD:** Design Database
**WD:** Design Real-time
## Requirements Management: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manage Requirements</td>
<td>• Obtain an Understanding of Requirements (H)</td>
</tr>
<tr>
<td></td>
<td>• Obtain Commitment to Requirements (Level 2) (H)</td>
</tr>
<tr>
<td></td>
<td>• Manage Requirement Changes (H)</td>
</tr>
<tr>
<td></td>
<td>• Maintain Bi-Directional Traceability of Requirements (Level 2) (H)</td>
</tr>
<tr>
<td></td>
<td>• Identify Inconsistencies between Project Work and Requirements (H)</td>
</tr>
</tbody>
</table>
Requirements Management: Detail Example

SP1.2-2: Obtain commitment to the requirements from the project participants.

RUP Elements:
Workflow: Requirements
  Workflow Detail: Manage the Scope of the System
  Activity: Prioritize Use Cases

Comments: RUP employs use cases to plan and package the work to be done. The architect comes up with a first cut at a list of prioritized use cases. The project team is involved in revising the prioritized list based on project risks, availability of resources, and stakeholder needs.

Degree of Synergy: High
CMMI Engineering Process Areas

- **REQM**: Requirements

- **RD**: Product and product component requirements
  - Alternative solutions
  - Requirements

- **TS**: Product components
  - Product components, work products, verification and validation reports

- **PI**: Product
  - Customer needs

- **Ver**: Customer needs
  - Work products, validation reports

- **Val**: Customer
## Requirements Development: Overview

### CMMI

**Purpose**
Produce and analyze customer, product, and product component requirements.

### RUP

**Workflows**
Requirements, Configuration and Change Management, Analysis and Design, Implementation, Test

**Synergy**
- RUP provides good support mechanisms
- RUP “features” equivalent to customer requirements
- Interfaces treated as one kind of requirement
- Prototyping key approach for requirements (incl. interfaces) validation
SG 1: Develop Customer Requirements
Stakeholder needs, expectations, constraints, and interfaces are collected and translated into customer requirements.

SG 2: Develop Product Requirements
Customer requirements are refined and elaborated to develop product and product component requirements for the product life cycle.

Workflow: Requirements
WD: Understand Stakeholder Needs
WD: Analyze the Problem
WD: Define the System
Workflow: Configuration and Change Management
WD: Manage Change Requests

Workflow: Requirements
WD: Refine the System Definition
WD: Develop Software Development Plan
Workflow: Analysis and Design
WD: Analyze Behavior
SG 3: Analyze and Validate Requirements
The requirements are analyzed and validated, and a definition of required functionality is developed.

Workflow: Requirements
Guidelines: Use-case Storyboard
WD: Analyze the Problem, Understand Stakeholder Needs, Define the System, Manage the Scope of the System, Refine the System Definition, Manage Changing Requirements
Workflow: Analysis and Design
WD: Define a Candidate Architecture
Workflows: Implementation, Test (to create and assess prototypes)
## Requirements Development: Synergy -1

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop Customer Requirements</td>
<td>• Collect Stakeholder Needs (H)</td>
</tr>
<tr>
<td></td>
<td>• Elicit Needs (Level 2) (H)</td>
</tr>
<tr>
<td></td>
<td>• Transform Stakeholder Needs, Expectations, Constraints, and Interfaces into Customer Requirements (H)</td>
</tr>
<tr>
<td>Develop Product Requirements</td>
<td>• Establish Product and Product Component Requirements (H)</td>
</tr>
<tr>
<td></td>
<td>• Allocate Product Component Requirements (M)</td>
</tr>
<tr>
<td></td>
<td>• Identify Interface Requirements (H)</td>
</tr>
</tbody>
</table>
## Requirements Development: Synergy -2

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze and Validate Requirements</td>
<td>• Establish Operational Concepts and Scenarios (H)</td>
</tr>
<tr>
<td></td>
<td>• Establish a Definition of Required Functionality (H)</td>
</tr>
<tr>
<td></td>
<td>• Analyze Requirements (H)</td>
</tr>
<tr>
<td></td>
<td>• Evaluate Product Cost, Schedule and Risk (Level 3) (H)</td>
</tr>
<tr>
<td></td>
<td>• Validate Requirements (H)</td>
</tr>
<tr>
<td></td>
<td>• Validate Requirements with Comprehensive Methods (Level 2) (H)</td>
</tr>
</tbody>
</table>
Requirements Development: Detail Example

SP2.2-1: Allocate the requirements for each product component.

RUP Elements:
Workflow: Analysis and Design
   Workflow Detail: Analyze Behavior
   Activity: Use-case Analysis, Identify Design Elements

Comments: RUP transforms the behavioral descriptions from the use cases into a set of design elements for the product using an object-oriented approach for analysis and design. RUP does not refer to this set of activities as “requirements flowdown”.
CMMI stipulates that higher-level functionality that becomes the responsibility of 2+ product components must be partitioned for unique component allocation. This can lead to a functional design, which RUP explicitly avoids.

Degree of Synergy: Medium
CMMI Engineering Process Areas

- **REQM (Requirements)**
  - Customer needs
  - Product and product component requirements
  - Requirements

- **RD (Requirements Definition)**
  - Alternative solutions
  - Requirements

- **TS (Requirements Analysis)**
  - Product components
  - Product components, work products, verification and validation reports

- **PI (Product and Process Integration)**
  - Product

- **Ver (Verification)**
  - Product components, verification and validation reports

- **Val (Validation)**
  - Requirements

Customer

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# Technical Solution: Overview

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>Develop, design, and implement solutions to requirements. Solutions, designs and implementations encompass products, product components, and product related processes either singly or in combinations as appropriate.</td>
</tr>
<tr>
<td><strong>Workflows</strong></td>
<td>Analysis and Design, Implementation, Deployment, Project Management</td>
</tr>
<tr>
<td><strong>Synergy</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• RUP addresses the central goals of forming, designing, and implementing engineered solutions</td>
</tr>
<tr>
<td></td>
<td>• RUP provides greater guidance on architecture development and validation than CMMI</td>
</tr>
<tr>
<td></td>
<td>• RUP does not explicitly cover consideration of design alternatives except at the architectural level</td>
</tr>
<tr>
<td></td>
<td>• RUP does not explicitly cover the use of selection criteria for product solutions or components</td>
</tr>
</tbody>
</table>
# Technical Solution: Mapping -1

## CMMI

**SG 1: Select Product Component Solutions**
Product or product component solutions, including applicable product related processes, are selected from alternative solutions.

**SG 2: Develop the Design**
Product or product component designs are developed.

## RUP

**Workflow:** Project Management
**WD:** Conceive New Project
**Artifact:** Business Case

**Workflow:** Analysis and Design
**WD:** Define a Candidate Architecture
**WD:** Refine the Architecture

**Workflow:** Analysis & Design
(all workflow details, activities, guidelines, artifacts)
SG 3: Implement the Product Design
Product components, and associated support documentation, are implemented from their designs.

Workflow: Implementation
WD: Implement Component Artifact: Programming Guidelines
Workflow: Deployment
WD: Develop Support Materials
## Technical Solution: Synergy -1

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Product Component Solutions</td>
<td>• Develop Alternative Solutions and Selection Criteria (M)</td>
</tr>
<tr>
<td></td>
<td>• Develop Detailed Alternative Solutions and Selection Criteria (Level 2) (L)</td>
</tr>
<tr>
<td></td>
<td>• Evolve Operational Concepts and Scenarios (Level 2) (H)</td>
</tr>
<tr>
<td></td>
<td>• Select Product Component Solutions (M)</td>
</tr>
</tbody>
</table>
## Technical Solution: Synergy -2

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Develop the Design</strong></td>
<td>• Use Effective Design Methods (H)</td>
</tr>
<tr>
<td></td>
<td>• Develop a Technical Data Package (H)</td>
</tr>
<tr>
<td></td>
<td>• Establish a Complete Technical Data Package (Level 3) (H)</td>
</tr>
<tr>
<td></td>
<td>• Establish Interface Descriptions (H)</td>
</tr>
<tr>
<td></td>
<td>• Design Comprehensive Interface (Level 3) (H)</td>
</tr>
<tr>
<td></td>
<td>• Perform Make, Buy, or Reuse Analyses (Level 3) (L)</td>
</tr>
<tr>
<td><strong>Implement the Product Design</strong></td>
<td>• Implement the Design (H)</td>
</tr>
<tr>
<td></td>
<td>• Establish Product Support Documentation (H)</td>
</tr>
</tbody>
</table>
Technical Solution: Detail Example

SP1.1-1: Develop alternative solutions and establish selection criteria.

RUP Elements:
Workflow: Project Management
   Artifact: Business Case
Workflow: Analysis and Design
   Workflow Details: Define a Candidate Architecture, Refine the Architecture

Comments: The Business Case describes at least two approaches to realizing the system Vision, and analyze these in terms of capability, risk impact, schedule, and economic outcomes. Project options might include differing contractual bases, differing project lifecycles, differing mixes of 'make' and 'buy', and so on. During the Project Approval Review, one of the offered choices is selected. RUP provides references to sources for risk and decision analysis techniques but does not explicitly establish criteria. While RUP is very architecture focused, it does not provide guidance on product component selection.

Degree of Synergy: Medium
CMMI Engineering Process Areas

- Requirements (REQM)
  - Customer needs
  - Requirements
  - Product and product component requirements

- Requirement Development (RD)
  - Alternative solutions
  - Requirements
  - Product components
  - Product component requirements

- Technical Solutions (TS)
  - Alternative solutions
  - Requirements
  - Product components
  - Work products, verification and validation reports

- Integration (PI)
  - Product
  - Customer

- Verification (Ver)
  - Product components, verification and validation reports

- Validation (Val)
  - Product components, verification and validation reports
  - Customer needs
Product Integration: Overview

**CMMI**

**Purpose**
Assemble the product from the product components, ensure that the product, as integrated, functions properly and deliver the product.

**RUP**

**Workflows**
Implementation, Test, Deployment, Change & Configuration Management, Analysis & Design

**Synergy**
- RUP supports the general intent of product integration
- RUP does not single interfaces out for special treatment but does treat them as first class elements of any design and integration
Product Integration: Mapping -1

CMMI

SG 1: Prepare for Product Integration
The strategy for conducting product integration is established and maintained.

SG 2: Ensure Interface Compatibility
The product component interfaces, both internal and external, are compatible.

RUP

Workflow: Implementation
WD: Plan the Integration
Artifact: Integration Build Plan

Workflow: Change and Configuration Management
WD: Create Project CM Environment
Activity: Create Integration Workspace

Workflow: Analysis and Design
Artifact: Design Model
Workflow: Implementation
WD: Structure the Implementation Model, Integrate each Subsystem, Integrate the System
Workflow: Test
WD: Execute Integration Tests, Execute System Test
SG 3: Assemble Product Components and Deliver the Product

Verified product components are assembled and the integrated, verified, and validated product is delivered.

**CMMI**

**RUP**

**Workflow:** Implementation
- WD: Implement Component
- Activity: Perform Unit Tests
- WD: Integrate Each Subsystem
- WD: Integrate the System

**Workflow:** Test
- WD: Execute Test in Integration Test Stage

**Workflow:** Deployment
- WD: Product Deployment Unit
- WD: Package Product
- WD: Provide Access to Download Site
## Product Integration: Synergy -1

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare for Product Integration</td>
<td>• Establish a Product Integration Strategy (H)</td>
</tr>
<tr>
<td></td>
<td>• Establish the Product Integration Environment (Level 2) (H)</td>
</tr>
<tr>
<td></td>
<td>• Define Detailed Product Integration Procedures (Level 3) (H)</td>
</tr>
<tr>
<td>Ensure Interface Compatibility</td>
<td>• Review Interface Descriptions for Completeness (H)</td>
</tr>
<tr>
<td></td>
<td>• Manage Interfaces (H)</td>
</tr>
</tbody>
</table>
### Product Integration: Synergy -2

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assemble Product Components and Deliver the Product</td>
<td>• Confirm Readiness of Product (H)</td>
</tr>
<tr>
<td></td>
<td>• Components for Integration (H)</td>
</tr>
<tr>
<td></td>
<td>• Assemble Product Components (H)</td>
</tr>
<tr>
<td></td>
<td>• Checkout Assembled Product Components (H)</td>
</tr>
<tr>
<td></td>
<td>• Package and Deliver the Product or Product Components (H)</td>
</tr>
</tbody>
</table>
Product Integration: Detail Example

**SP2.1-1:** Review interface descriptions for coverage and completeness.

**RUP Elements:**
Workflow: Analysis and Design
   Artifact: Design Model
Workflow: Implementation
   Workflow Details: Structure the Implementation Model, Integrate each Subsystem, Integrate the System
Workflow: Test
   Workflow Details: Execute Integration Tests, Execute System Test

**Comments:** Interfaces are a critical part of the architecture and design in RUP. The primary review mechanism is building architectural prototypes and integrating and testing the executables in each iteration such that the interfaces are exercised in a more realistic setting.

**Degree of Synergy:** High
CMMI Engineering Process Areas

- **REQM (Requirements)**: Customer needs → Requirements
- **RD (Requirements Development)**: Customer needs → Alternative solutions
- **TS (Requirements Analysis)**: Alternate solutions → Requirements; Requirements → Product components
- **PI (Requirements Planning and Organization)**: Product components → Product
- **Ver (Verification)**: Product components, work products, verification and validation reports → Customer
- **Val (Validation)**: Customer → Work products, verification and validation reports → Customer

The diagram illustrates the flow of information and activities between the different processes, emphasizing the importance of requirements management and the iterative nature of product development and validation.
Verification: Overview

CMMI

Purpose
Assure that selected work products meet their specified requirements.

RUP

Workflows
Test, Environment, Implementation

Synergy
• RUP provides good support for verification practices
• Verification occurs with each iteration
# Verification: Mapping

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SG 1: Prepare for Verification</strong> &lt;br&gt;Preparation for verification is conducted.</td>
<td><strong>Workflow:</strong> Test  &lt;br&gt;<strong>WD:</strong> Plan Test  &lt;br&gt;<strong>WD:</strong> Design Test  &lt;br&gt;<strong>Workflow:</strong> Environment  &lt;br&gt;<strong>WD:</strong> Support Environment</td>
</tr>
<tr>
<td><strong>SG 2: Perform Peer Reviews</strong> &lt;br&gt;Peer reviews are performed on selected work products.</td>
<td><strong>Work Guideline:</strong> Reviews (applies to all work products in all workflows)</td>
</tr>
<tr>
<td><strong>SG 3: Verify Selected Work Products</strong> &lt;br&gt;Selected work products are verified against their specified requirements.</td>
<td><strong>Workflow:</strong> Test  &lt;br&gt;<strong>WD:</strong> Execute Integration Test  &lt;br&gt;<strong>WD:</strong> Execute System Test  &lt;br&gt;<strong>WD:</strong> Evaluate Test  &lt;br&gt;<strong>Workflow:</strong> Implementation  &lt;br&gt;<strong>WD:</strong> Implement Component</td>
</tr>
</tbody>
</table>
## Verification: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare for Verification</td>
<td>• Establish a Verification Strategy (H)</td>
</tr>
<tr>
<td></td>
<td>• Establish the Verification Environment (Level 2) (H)</td>
</tr>
<tr>
<td></td>
<td>• Establish Detailed Verification Plans (Level 3) (H)</td>
</tr>
<tr>
<td>Perform Peer Reviews</td>
<td>• Prepare for Peer Reviews (H)</td>
</tr>
<tr>
<td></td>
<td>• Conduct Peer Reviews (H)</td>
</tr>
<tr>
<td></td>
<td>• Analyze Peer Review Data (Level 2) (H)</td>
</tr>
<tr>
<td>Verify Selected Work Products</td>
<td>• Perform Verification (H)</td>
</tr>
<tr>
<td></td>
<td>• Analyze Verification Results and Identify Corrective Actions (Level 2) (H)</td>
</tr>
<tr>
<td></td>
<td>• Perform Re-Verification (H)</td>
</tr>
</tbody>
</table>
Verification: Detail Example

SP3.3-1: Perform re-verification of corrected work products and ensure that work products have not been negatively impacted.

RUP Elements:
Workflow: Test
  Workflow Detail: Execute Tests
  Activity: Execute Tests in Integration Test Stage
  Activity: Execute Tests in System Test Stage
  Activity: Fix a Defect

Comments: In iterative development, regression testing occurs with each iteration. If bugs fix are needed, another iteration is performed with its own test activities. For each iteration a new version of the test model is developed that contains old tests (as regression tests), and new tests that take new functionality into account.

Degree of Synergy: High
Validation: Overview

**CMMI**

**Purpose**
Demonstrate that a product or product component fulfills its intended use when placed in its intended environment.

**RUP**

**Workflows**
Project Management, Deployment

**Synergy**
- RUP begins validation early with use case reviews with the users and continues with each iteration’s executable evaluated in a pre-release setting with selected users.
- Product acceptance is defined as part of the project plan.
Validation: Mapping

CMMI

SG 1: Prepare for Validation
Preparation for validation is conducted.

SG 2: Validate Product or Product Components
The product or product components are validated to ensure that they are suitable for use in their intended operating environment.

RUP

Workflow: Project Management
WD: Develop Product Acceptance Plan

Workflow: Deployment
WD: Beta Test Product

Workflow: Project Management
WD: Close-out Project
Artifact: Product Acceptance Plan
Workflow: Deployment
WD: Beta Test Product
**Validation: Synergy**

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare for Validation</td>
<td>• Establish a Validation Strategy (H)</td>
</tr>
<tr>
<td></td>
<td>• Establish the Validation Environment (Level 2) (H)</td>
</tr>
<tr>
<td></td>
<td>• Define Detailed Validation Procedures (Level 3) (H)</td>
</tr>
<tr>
<td>Validate Product or Product Components</td>
<td>• Perform Validation (H)</td>
</tr>
<tr>
<td></td>
<td>• Capture and Analyze Validation Results (H)</td>
</tr>
</tbody>
</table>
Validation: Detail Example

SP1.1-1: Establish and maintain a validation strategy.

RUP Elements:
Workflow: Deployment
  Workflow Detail: Beta Test Product
  Activity: Manage Beta Test
Workflow: Project Management
  Workflow Detail: Develop Product Acceptance Plan

Comments: Inherent to RUP is the continual validation of each iteration’s executable by actual users in order to identify defects or disconnects as early as possible. The product acceptance plan is co-developed with the users.

Degree of Synergy: High
Topics

Goals and Purpose
CMMI Overview
RUP Overview
RUP to CMMI Mapping
  - Project Management
  - Engineering
  - Support
  - Process Management
  - Generic Practices
Lessons Learned
CMMI Basic Support Process Areas

MA

Measurements, analyses
Information needs

All process areas

CM
Configuration items; change requests
Baselines; audit reports

PPQA
Quality and noncompliance issues
Processes and work products; standards and procedures
# Configuration Management: Overview

## CMMI

**Purpose**

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

## RUP

**Workflow**

Configuration and Change Management

**Synergy**

- RUP provides good support mechanisms
Configuration Management: Mapping -1

CMMI

SG 1: Establish Baselines
Baselines of identified work products are established and maintained.

RUP

Workflow: Configuration and Change Management
WD: Plan Project Configuration & Change Control
WD: Change & Deliver Configuration Items
WD: Manage Baselines & Releases

SG 2: Track and Control Changes
Changes to the work products under configuration management are tracked and controlled.

Workflow: Configuration and Change Management
WD: Manage Change Requests
Configuration Management: Mapping -2

CMMI

SG 3: Establish Integrity
Integrity of baselines is established and maintained.

RUP

Workflow: Configuration and Change Management
WD: Monitor and Report Configuration Status
## Configuration Management: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish Baselines</td>
<td>• Identify Configuration Items (H)</td>
</tr>
<tr>
<td></td>
<td>• Establish a Configuration Management System (H)</td>
</tr>
<tr>
<td></td>
<td>• Create or Release Baselines (H)</td>
</tr>
<tr>
<td></td>
<td>• Track Changes (H)</td>
</tr>
<tr>
<td></td>
<td>• Control Changes (H)</td>
</tr>
<tr>
<td>Track and Control Changes</td>
<td>• Establish Configuration Management Records (H)</td>
</tr>
<tr>
<td></td>
<td>• Perform Configuration Audits (H)</td>
</tr>
<tr>
<td>Establish Integrity</td>
<td>• Establish Configuration Management Records (H)</td>
</tr>
<tr>
<td></td>
<td>• Perform Configuration Audits (H)</td>
</tr>
</tbody>
</table>
Configuration Management: Detail Example

SP1.3-1: Create or release baselines for internal use and for delivery to the customer.

RUP Elements:
Workflow: Configuration and Change Management
Workflow Detail: Change and Deliver Configuration Items
Workflow Detail: Manage Baselines and Releases

Comments: RUP provides for the creation of internal as well as external baselines (i.e., deployment unit = an executable collection of components, documents (end-user support material and release notes) and installation artifacts).

Degree of Synergy: High
CMMI Basic Support Process Areas

MA

- Measurements, analyses
- Information needs

CM

- Configuration items; change requests
- Baselines; audit reports

All process areas

PPQA

- Quality and noncompliance issues
- Processes and work products; standards and procedures
Process and Product Quality Assurance: Overview

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

CMMI

RUP

Workflow
Project Management

Synergy
• RUP implements process and product quality throughout all workflows, phases, and iterations
• RUP Activity, Artifacts, Guidelines, Checkpoints, and Templates “encode” what should be evaluated
Process and Product Quality Assurance: Mapping

**CMMI**

SG 1: Objectively Evaluate Processes and Work Products
Adherence of the performed process and associated work products and services to applicable process descriptions, standards and procedures is objectively evaluated.

SG 2: Provide Objective Insight
Noncompliance issues are objectively tracked and communicated, and resolution is ensured.

**RUP**

Workflow: Project Management
Artifact: Quality Assurance Plan
WD: Monitor and Control Project
Activity: Assess Iteration
Artifact: Review Record (reviews and checkpoints in each workflow)

Workflow: Project Management
Artifact: Problem Resolution Plan
WD: Monitor and Control Project
Activity: Handle Exceptions and Problems
Artifact: Review Record (reviews and checkpoints in each workflow)
# Process and Product Quality Assurance: Synergy

<table>
<thead>
<tr>
<th><strong>Specific Goal</strong></th>
<th><strong>Specific Practice</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectively Evaluate Processes and Work Products</td>
<td>• Objectively Evaluate Processes (H)</td>
</tr>
<tr>
<td></td>
<td>• Objectively Evaluate Work Products and Services (H)</td>
</tr>
<tr>
<td>Provide Objective Insight</td>
<td>• Communicate and Ensure Resolution of Noncompliance Issues (H)</td>
</tr>
<tr>
<td></td>
<td>• Establish Records (H)</td>
</tr>
</tbody>
</table>
Process and Product Quality Assurance: Detail Example

SP2.1-1: Communicate quality issues and ensure resolution of noncompliance issues with the staff and managers.

RUP Elements:
Workflow: Project Management
  Workflow Detail: Monitor and Control Project
  Activity: Handle Exceptions and Problems

Comments: Following the Problem Resolution Plan, problem management procedures are triggered in Activity: Handle Exceptions & Problems based on problems identified in a Status Assessment, raising of Change Requests to track defects, anomalies discovered during reviews, or through non-conformances raised during process audits and reviews.

Degree of Synergy: High
CMMI Basic Support Process Areas

MA
- Measurements, analyses
- Information needs

CM
- Configuration items; change requests

All process areas
- Processes and work products; standards and procedures
- Baselines; audit reports

PPQA
- Quality and noncompliance issues
## Measurement and Analysis: Overview

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td><strong>Workflow</strong></td>
</tr>
<tr>
<td>Develop and sustain a measurement capability that is used to support management information needs.</td>
<td>Project Management</td>
</tr>
<tr>
<td><strong>Synergy</strong></td>
<td><strong>Synergy</strong></td>
</tr>
<tr>
<td>- RUP provides good support mechanisms including extensive guidelines on candidate measures of project, process, and product</td>
<td>- RUP provides good support mechanisms including extensive guidelines on candidate measures of project, process, and product</td>
</tr>
<tr>
<td>- RUP does not explicitly address the communication of measurement results to data providers</td>
<td>- RUP does not explicitly address the communication of measurement results to data providers</td>
</tr>
</tbody>
</table>
Measurement and Analysis: Mapping

**CMMI**

**SG 1: Align Measurement and Analysis Activities**
Measurement objectives and practices are aligned with identified information needs and objectives.

**SG 2: Provide Measurement Results**
Measurement results that address identified information needs and objectives are provided.

**RUP**

**Workflow:** Project Management
**WD:** Develop Software Development Plan
**Activity:** Develop Measurement Plan
**Guidelines:** Metrics

**Workflow:** Project Management
**WD:** Monitor and Control the Project
**Activity:** Monitor Project Status
**Activity:** Report Status
# Measurement and Analysis: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Align Measurement and Analysis Activities</strong></td>
<td>• Establish Measurement Objectives (H)</td>
</tr>
<tr>
<td></td>
<td>• Specify Measures (H)</td>
</tr>
<tr>
<td></td>
<td>• Specify Data Collection and Storage Procedures (H)</td>
</tr>
<tr>
<td></td>
<td>• Specify Analysis Procedures (H)</td>
</tr>
<tr>
<td><strong>Provide Measurement Results</strong></td>
<td>• Collect Measurement Data (H)</td>
</tr>
<tr>
<td></td>
<td>• Analyze Measurement Data (H)</td>
</tr>
<tr>
<td></td>
<td>• Store Data and Results (H)</td>
</tr>
<tr>
<td></td>
<td>• Communicate Results (H)</td>
</tr>
</tbody>
</table>
Measurement and Analysis: Detail Example

SP2.4-1: Report results of measurement and analysis activities to all affected stakeholders.

RUP Elements:
Workflow: Project Management
  Workflow Detail: Monitor and Control the Project
  Activity: Report Status
  Artifact: Status Assessment

Comments: Artifact: Status Assessment is drawn from the Project Measurements in Activity: Monitor Project Status. Status Assessment is used to ensure that expectations (i.e., Project Review Authority, project manager, and team leads in the functional areas) are synchronized and consistent. Data providers are not explicitly identified as receivers of measurement data.

Degree of Synergy: High
CMMI Advanced Support Process Areas

- CAR: Process improvement proposals
- Process improvement proposals lead to Defects and other problems
- Process Management Process Areas
- Process Management Process Areas
- All process areas
- Selected issues
- Structured decisions
- DAR
# Decision Analysis and Resolution: Overview

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td><strong>Workflow</strong></td>
</tr>
<tr>
<td>Make decisions using a structured approach that evaluates identified alternatives against established criteria.</td>
<td>none</td>
</tr>
<tr>
<td><strong>Synergy</strong></td>
<td><strong>Synergy</strong></td>
</tr>
<tr>
<td>• Decision analysis and resolution processes are outside the scope of RUP</td>
<td></td>
</tr>
</tbody>
</table>
## Decision Analysis and Resolution: Mapping

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
</table>
| **SG 1: Evaluate Alternatives**<br>Decisions are based on an evaluation of alternatives using established criteria. | **Workflow:** none  
Outside the scope of RUP |
| **SG 2: Provide Measurement Results**<br>Measurement results that address identified information needs and objectives are provided. | **Workflow:** none  
Outside the scope of RUP |
## Decision Analysis and Resolution: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate Alternatives</td>
<td>• Establish and Use Guidelines for Decision Analysis (L)</td>
</tr>
<tr>
<td></td>
<td>• Select Evaluation Technique (L)</td>
</tr>
<tr>
<td></td>
<td>• Establish Evaluation Criteria (L)</td>
</tr>
<tr>
<td></td>
<td>• Identify Proposed Alternatives (L)</td>
</tr>
<tr>
<td></td>
<td>• Evaluate Alternative Solutions (L)</td>
</tr>
<tr>
<td></td>
<td>• Select Solutions (L)</td>
</tr>
</tbody>
</table>
CMMI Advanced Support Process Areas

- CAR: Process improvement proposals
- Defects and other problems

- Process Management Process Areas
- Process Management Process Areas

- All process areas

- Selected issues

- Structured decisions

- DAR
### Causal Analysis and Resolution: Overview

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>Identify causes of defects and other problems and take action to prevent them from occurring in the future.</td>
</tr>
<tr>
<td><strong>Workflow</strong></td>
<td><strong>Project Management</strong></td>
</tr>
<tr>
<td><strong>Synergy</strong></td>
<td><strong>Workflow</strong></td>
</tr>
<tr>
<td>• In RUP, the iteration assessment supplies a natural point in each iteration to integrate causal analysis and resolution.</td>
<td></td>
</tr>
<tr>
<td>• Projects would need to develop their own quantitatively-based causal analysis techniques.</td>
<td></td>
</tr>
</tbody>
</table>
Causal Analysis and Resolution: Mapping

**CMMI**

SG 1: Determine Causes of Defects
Root causes of defects and other problems are systematically determined.

SG 2: Address Causes of Defects
Root causes of defects and other problems are systematically addressed to prevent their future occurrence.

**RUP**

Workflow: Project Management
WD: Manage Iteration
Activity: Assess Iteration
Artifact: Iteration Assessment

Workflow: Project Management
WD: Plan for Next Iteration
Activity: Develop Iteration Plan
Artifact: Development Case
Workflow: Test
Activity: Execute System Tests
# Causal Analysis and Resolution: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine Causes of Defects</td>
<td>• Select Data for Analysis (M)</td>
</tr>
<tr>
<td></td>
<td>• Analyze Causes (L)</td>
</tr>
<tr>
<td>Address Causes of Defects</td>
<td>• Implement the Action Proposals (M)</td>
</tr>
<tr>
<td></td>
<td>• Evaluate the Effect of Changes (M)</td>
</tr>
<tr>
<td></td>
<td>• Record Data (L)</td>
</tr>
</tbody>
</table>
Causal Analysis and Resolution: Detail Example

SP1.2-1: Perform causal analysis of selected defects and other problems and propose actions to address them.

RUP Elements:
Workflow: Project Management
   Workflow Detail: Manage Iteration
   Activity: Assess Iteration, Artifact: Iteration Assessment

Comments: In RUP, each iteration ends with an assessment of the iteration’s objectives, risks, and defects that is used to modify the project or improve the process. Artifact: Iteration Assessment captures the result of an iteration, the degree to which the evaluation criteria was met, lessons learned, and changes to be done. While RUP provides an appropriate context for causal analysis, this CMMI practice assumes a statistical basis for the selection of defects and problems to address and the use of causal analysis techniques to analyze the defects. These aspects would need to be added to the iteration assessment, planning the next iteration, updating the development case, and specifying specific product and process measures in the measurement plan.

Degree of Synergy: Low
Topics

Goals and Purpose
CMMI Overview
RUP Overview
RUP to CMMI Mapping
  • Project Management
  • Engineering
  • Support
  • Process Management
  • Generic Practices
Lessons Learned
CMMI Basic Process Management

Process Areas

- Senior Management
  - Organization's business objectives

- OPF
  - Resources and Coordination
  - Process Improvement Proposals; Participation in defining, assessing, and deploying processes

- OT
  - Training needs
  - Std Process and Other Assets
  - Training for Projects and Support Groups in Std Process and Assets

- OPD
  - Std Process and Other Assets

- Project Management, Support, and Engineering process areas
  - Improvement information (e.g., lessons learned, data, artifacts)
Organizational Process Focus: Overview

CMMI

Purpose
Establish and maintain an understanding of the organization's processes and process assets, and to identify, plan, and implement the organization's process improvement activities.

RUP

Workflow
Environment

Synergy
• RUP is primarily a project level tool
• Organizations wanting to use RUP for process management process areas may need to add workflows to address organizational process focus and definition issues
Organizational Process Focus: Mapping

**CMMI**

**SG 1: Determine Process Improvement Opportunities**

Strengths, weaknesses, and improvement opportunities for the organization's processes are identified periodically and as needed.

**SG 2: Plan and implement Process Improvement Activities**

Improvements are planned and implemented, process assets are deployed, and process-related experiences are incorporated into the organization’s process assets.

**RUP**

**Workflow:** Environment

**WD:** Prepare Environment for Project

**Activity:** Development-Organization Assessment

**Workflow:** Environment

**WD:** Prepare Environment for Project

**Activity:** Development-Organization Assessment
## Organizational Process Focus: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine Process Improvement Opportunities</td>
<td>• Establish Organizational Process Needs (L)</td>
</tr>
<tr>
<td></td>
<td>• Assess the Organization’s Processes (H)</td>
</tr>
<tr>
<td></td>
<td>• Identify the Organization’s Process Improvements (H)</td>
</tr>
<tr>
<td>Plan and Implement Process Improvement Activities</td>
<td>• Establish Process Action Plans (M)</td>
</tr>
<tr>
<td></td>
<td>• Implement Process Action Plans (L)</td>
</tr>
<tr>
<td></td>
<td>• Deploy Process and Related Assets (L)</td>
</tr>
<tr>
<td></td>
<td>• Incorporate Process-Related Experiences into the Organization’s Process Assets (L)</td>
</tr>
</tbody>
</table>
Organizational Process Focus: Detail Example

**SP1.2-1**: Assess the processes of the organization periodically and as needed to maintain an understanding of their strengths and weaknesses.

**RUP Components:**
Workflow: Environment
   Workflow Detail: Prepare Environment for Project
   Activity: Development Organization Assessment

**Comments**: When preparing for a new project, RUP provides an activity to assess the organization’s processes

**Degree of Synergy**: High
CMMI Basic Process Management

Process Areas

Senior Management

Organization's process needs and objectives

Training for Projects and Support Groups in Std Process and Assets

OT

Training needs

Std Process and Other Assets

OPF

Resources and Coordination

OPD

Process Improvement Proposals; Participation in defining, assessing, and deploying processes

Improvement information (e.g., lessons learned, data, artifacts)

Project Management, Support, and Engineering process areas

Organization’s business objectives
### Organizational Process Definition: Overview

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td><strong>Workflow</strong>&lt;br&gt;Environment&lt;br&gt;<strong>Synergy</strong>&lt;br&gt;• Organizations could use RUP as the basis for their Organizational Standard Process&lt;br&gt;• Organizations would need to pay attention to Medium and Low synergy areas</td>
</tr>
</tbody>
</table>

Establish and maintain a usable set of organizational process assets.
# Organizational Process Definition: Mapping

<table>
<thead>
<tr>
<th><strong>CMMI</strong></th>
<th><strong>RUP</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SG 1: Create Organizational Process Assets</strong>&lt;br&gt;A set of organizational process assets is available.</td>
<td><strong>Workflow:</strong> Environment&lt;br&gt;<strong>WD:</strong> Develop Guidelines&lt;br&gt;<strong>Concept:</strong> Implementing a Process in an Organization&lt;br&gt;<strong>Concept:</strong> Process Configuration</td>
</tr>
<tr>
<td><strong>SG 2: Make Supporting Process Assets Available</strong>&lt;br&gt;Process assets that support the use of the organization’s set of standard processes are available.</td>
<td><strong>Concept:</strong> Process Configuration</td>
</tr>
</tbody>
</table>
## Organizational Process Definition: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create Organizational Process Assets</td>
<td>• Establish Standard Processes (M)</td>
</tr>
<tr>
<td></td>
<td>• Establish Life-Cycle Model Descriptions (M)</td>
</tr>
<tr>
<td></td>
<td>• Establish Tailoring Criteria and Guidelines (M)</td>
</tr>
<tr>
<td>Make Supporting Process Assets</td>
<td>• Establish An Organizational Measurement Repository (L)</td>
</tr>
<tr>
<td>Available</td>
<td>• Establish An Organizational-Process Asset Library (M)</td>
</tr>
</tbody>
</table>
Organizational Process Definition: Detail Example

SP1.2-1: Establish and maintain descriptions of the life-cycle process models approved for use in the organization.

RUP Components:
Concepts: Process Configuration

Comments: Supplementary information suggests that RUP can be the organization's standard process. Following RUP should allow organizations to describe many life cycle types. RUP suggests that there may be more than one organization-wide process, one for each different type of development.

Degree of Synergy: Medium
CMMI Basic Process Management

Process Areas

- **Senior Management**: Organization's process needs and objectives
- **OPF**: Organization's business objectives
- **OPD**: Resources and Coordination
- **OT**: Training for Projects and Support Groups in Std Process and Assets
- **Std Process and Other Assets**: Training needs
- **Proj Management, Support, and Engineering process areas**: Improvement information (e.g., lessons learned, data, artifacts)

- **Process Improvement Proposals; Participation in defining, assessing, and deploying processes**
## Organizational Training: Overview

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td><strong>Workflow</strong></td>
</tr>
<tr>
<td>Develop the skills and knowledge of people so they can perform their roles effectively and efficiently.</td>
<td>none</td>
</tr>
<tr>
<td><strong>Synergy</strong></td>
<td><strong>Synergy</strong></td>
</tr>
<tr>
<td>• Organizational training issues are outside the scope of RUP</td>
<td>• Organizational training issues are outside the scope of RUP</td>
</tr>
</tbody>
</table>
## Organizational Training: Mapping

### CMMI

**SG 1: Identify Training Needs and Make Training Available**

Training to support the organization’s management and technical roles is identified and made available.

### RUP

**Workflow:** none

*Outside of the scope of RUP*

### SG 2: Provide Necessary Training

Training necessary for individuals to perform their roles effectively is provided.

**Workflow:** none

*Outside of the scope of RUP*
## Organizational Training: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
</table>
| Identify Training Needs and Make Training Available | • Establish the Strategic Training Needs (L)  
• Determine which Training Needs are the Responsibility of the Organization (L)  
• Establish and Maintain Organizational Training Tactical Plan (L)  
• Establish and Maintain Training Capability (L) |
| Provide Necessary Training | • Deliver Training (L)  
• Establish Training Records (L)  
• Assess Training Effectiveness (L) |
CMMI Advanced Process Management

Process Areas

**Organization**
- Improvements
- Quality and process performance objectives, measures, baselines, models

**Senior Management**
- Ability to develop and deploy process and supporting assets
- Progress toward achieving business objectives

**OID**
- Cost and benefit data from piloted improvements
- Quality and process performance objectives, measures, baselines, models

**OPP**
- Common measures
- Process performance and capability data
- "Basic Set" of Process Management Process Areas

**Project Management, Support, and Engineering process areas**
- Process performance and capability data
## Organizational Process Performance: Overview

<table>
<thead>
<tr>
<th></th>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>Establish and maintain a quantitative understanding of the performance of the organization’s set of standard processes, and to provide the process performance data, baselines, and models to quantitatively manage the organization’s projects.</td>
<td>none</td>
</tr>
<tr>
<td><strong>Workflow</strong></td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td><strong>Synergy</strong></td>
<td>• Establishing a quantitative understanding of an organization’s set of processes is outside the scope of RUP</td>
<td>none</td>
</tr>
</tbody>
</table>
Organizational Process Performance: Mapping

<table>
<thead>
<tr>
<th>CMMI</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SG 1: Establish Performance Baselines and Models</strong>&lt;br&gt;Baselines and models that characterize the expected process performance of the organization's set of standard processes are established and maintained.</td>
<td><strong>Workflow:</strong> none&lt;br&gt;Outside of the scope of RUP</td>
</tr>
</tbody>
</table>
## Organizational Process Performance: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish Performance Baselines and Models</td>
<td>• Select Processes (L)</td>
</tr>
<tr>
<td></td>
<td>• Establish Process Performance Measures (L)</td>
</tr>
<tr>
<td></td>
<td>• Establish Quality and Process Performance Objectives (L)</td>
</tr>
<tr>
<td></td>
<td>• Establish Process Performance Baselines (L)</td>
</tr>
<tr>
<td></td>
<td>• Establish Process Performance Models (L)</td>
</tr>
</tbody>
</table>
CMMI Advanced Process Management

Process Areas

Organization

Improvements

OID

Cost and benefit
data from piloted improvements

Quality and process performance objectives, measures, baselines, models

Senior Management

Progress toward achieving business objectives

OPP

Quality and process performance objectives, measures, baselines, models

Project Management,
Support, and
Engineering process areas

Process performance and capability data

Common measures

“Basic Set” of Process Management Process Areas

Ability to develop and deploy process and supporting assets
<table>
<thead>
<tr>
<th><strong>Organizational Innovation and Deployment: Overview</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CMMI</strong></td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
</tr>
<tr>
<td>Select and deploy incremental and innovative improvements that measurably improve the organization’s processes and technologies. The improvements support the organization’s quality and process performance objectives as derived from the organization’s business objectives.</td>
</tr>
<tr>
<td><strong>RUP</strong></td>
</tr>
<tr>
<td><strong>Workflow</strong></td>
</tr>
<tr>
<td>none</td>
</tr>
<tr>
<td><strong>Synergy</strong></td>
</tr>
<tr>
<td>• Establishing measurable objectives for incremental and innovative process improvement is outside the scope of RUP</td>
</tr>
</tbody>
</table>
## Organizational Innovation and Deployment: Mapping

### CMMI

<table>
<thead>
<tr>
<th>SG 1: Select Improvements</th>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process and technology improvements that contribute to meeting quality and process performance objectives are selected.</td>
<td><strong>Workflow:</strong> none&lt;br&gt;Outside of the scope of RUP</td>
</tr>
</tbody>
</table>

### SG 2: Deploy Improvements

<table>
<thead>
<tr>
<th>RUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurable improvements to the organization’s processes and technologies are continually and systematically deployed.</td>
</tr>
</tbody>
</table>
### Organizational Innovation and Deployment: Synergy

<table>
<thead>
<tr>
<th>Specific Goal</th>
<th>Specific Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Select Improvements</strong></td>
<td>• Collect and Analyze Improvement Proposals (L)</td>
</tr>
<tr>
<td></td>
<td>• Identify Innovations (L)</td>
</tr>
<tr>
<td></td>
<td>• Pilot Improvements (L)</td>
</tr>
<tr>
<td></td>
<td>• Select Improvements for Deployment (L)</td>
</tr>
<tr>
<td><strong>Deploy Improvements</strong></td>
<td>• Plan the Deployment (L)</td>
</tr>
<tr>
<td></td>
<td>• Manage the Deployment (L)</td>
</tr>
<tr>
<td></td>
<td>• Measure Improvement Effects (L)</td>
</tr>
</tbody>
</table>
Topics

Goals and Purpose

CMMI Overview

RUP Overview

RUP to CMMI Mapping
  • Project Management
  • Engineering
  • Support
  • Process Management
  • Generic Practices

Lessons Learned

Conclusions
Continuous Representation Structure

- Generic Goals & Generic Practices
- Specific Goals & Specific Practices
The Capability Levels

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

<table>
<thead>
<tr>
<th>Generic Goal</th>
<th>Generic Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are none</td>
<td>• There are none</td>
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</table>
## Capability Level 1

<table>
<thead>
<tr>
<th>Generic Goal</th>
<th>Generic Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieve Specific Goals</td>
<td>• Identify Work Scope</td>
</tr>
<tr>
<td></td>
<td>• Perform Base Practices</td>
</tr>
<tr>
<td>Generic Goal</td>
<td>Generic Practices</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Institutionalize a Managed Process</td>
<td>• Establish and Maintain an Organizational Policy</td>
</tr>
<tr>
<td></td>
<td>• Plan the Process</td>
</tr>
<tr>
<td></td>
<td>• Provide Resources</td>
</tr>
<tr>
<td></td>
<td>• Assign Responsibility</td>
</tr>
<tr>
<td></td>
<td>• Train People</td>
</tr>
<tr>
<td></td>
<td>• Manage Configurations</td>
</tr>
<tr>
<td></td>
<td>• Identify and Involve Relevant Stakeholders</td>
</tr>
<tr>
<td></td>
<td>• Monitor and Control the Process</td>
</tr>
<tr>
<td></td>
<td>• Objectively Evaluate Adherence</td>
</tr>
<tr>
<td></td>
<td>• Review Status with Higher-Level Management</td>
</tr>
</tbody>
</table>
### Capability Level 3

<table>
<thead>
<tr>
<th>Generic Goal</th>
<th>Generic Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutionalize a Defined Process</td>
<td>• Establish a Defined Process</td>
</tr>
<tr>
<td></td>
<td>• Collect Improvement Information</td>
</tr>
</tbody>
</table>
## Capability Level 4

<table>
<thead>
<tr>
<th>Generic Goal</th>
<th>Generic Practices</th>
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</thead>
<tbody>
<tr>
<td>Institutionalize a Quantitatively Managed Process</td>
<td>• Establish Quality Objectives</td>
</tr>
<tr>
<td></td>
<td>• Stabilize Subprocess Performance</td>
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</tbody>
</table>
### Capability Level 5

<table>
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<tbody>
<tr>
<td>Institutionalize an Optimizing Process</td>
<td>• Ensure Continuous Process Improvement</td>
</tr>
<tr>
<td></td>
<td>• Correct Common Causes of Problems</td>
</tr>
</tbody>
</table>
Topics

Goals and Purpose
CMMI Overview
RUP Overview
RUP to CMMI Mapping
Lessons Learned
... On Planning the Comparison

- Determining the goals/objectives for the comparison before doing the comparison is key
- Comparison objectives, expected results, degree of rigor, and needed resources must be consistent to achieve reasonable results
- Determining the “level” on which to base the comparison must be part of setting the objectives and expected results
- Determining how comparison results will be captured before the review starts expedites the review
- Having all reviewers capture their findings in a similar manner is vital for later consolidation and reporting
… On Executing the Comparison

• Prototyping the level of comparison to see if you get the desired results before the review saves rework
  - Avoid comparisons below the Specific Practice level

• Determining the basic principles that drive both the CMMI and the target process are essential to any valid comparison

• Determining the lexicon of the target process is essential for a valid review
  - Vital to understand the intent of a CMMI specific practice but don’t expect an exact match of terminology
... On Resources Used in the Comparison

• Reviewers need to be familiar (but not necessarily experts) with CMMI and the target process

• Reviewers must include resources that have in-depth understanding of CMMI and the target process (not necessarily the same person)

• Reviewers need to have a common understanding
  - Comparison objectives and expected results
  - Level of comparison, “rating” scheme, form of findings capture
  - Lexicon and basic principles of the target process
  - Intent of CMMI process areas
CMMI Observations

CMMI provides good guidance on general systems development practices and institutionalization of process practices

CMMI could better address

• Architecture-related practices
• Recursive nature of the process elements in the engineering process areas
• “Waterfall” appearance of the engineering process areas
RUP Observations

RUP provides strong engineering, basic support, and basic project management practices

- Clear definition of roles and responsibilities
- Integration of engineering and project management activities
- Use of iterations to mitigate risks as early as possible
- Validation of requirements and solutions
- Focus on early architecture definition and validation

Organizations using RUP may have need to address

- Statistical process control
- Organizational process elements
- Subcontractor or vendor management practices
- Institutionalization of processes
Parting Thoughts

RUP is a software engineering process that is integrated with a suite of software development tools.

CMMI is a process framework that integrates systems and software engineering process elements and the organizational processes necessary to institutionalize them.

RUP and CMMI complement each other in achieving a mature software development organization.
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