Defining Lean Service and Maintenance Processes

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"I have made this letter longer than usual because I lack the time to make it shorter"

Blaise Pascal

Presentation Objectives

Provide motivation and principles for lean, maintenance, and service.

Describe Service/Maintenance in terms of "projects" and CMMI®.

Describe successful CMMI Tailoring for Service/Maintenance Organizations.

Answer any of your questions.

CMMI is a registered trademark in the US Copyright and Patent Office by Carnegie Melon University.

Agenda

Introduction

Motivation and Background

Tailoring Project Management

Tailoring CM

Tailoring Engineering

Miscellaneous Tailoring

Questions and Answers

Lean Problems

Most organizations have too much waste (e.g., non-value added).

Most processes have too many "non-value added" steps.

How can organizations focus on "value added" and remove waste?

How can organizations measure value and waste?

Lean is a recent quality approach to help organizations focus on "value" and remove "non-value".

What is Lean?

Lean has its roots in quality and manufacturing, and is a recent popular movement in quality.

"Lean Production" is the name for the Toyota Lean Production System.

The following are major lean references (books):
- **"The Machine That Changed The World"**
- **"Learning to See"**
- **"The Toyota Way"**
- **"The Toyota Product Development System"**
- **"Lean Thinking"**

Some Lean Principles - (1)

Establish customer defined value (i.e., identify the "value stream"). Process = "value".

Continuously eliminate non-value added activities (e.g., waste, rework, defects).

Use leadership and standardization to create a lean culture.

Align your organization through visual communication.

Create an optimized process flow (e.g., "Flow", "Pull", "Just-In-Time", "Leveled").

Some Lean Principles - (2)

Use lean metrics to manage the value stream.

Front-Load the process for maximum design space.

Build a learning organization to achieve lean and continuous improvement.

Adapt technology to fit your people and processes.

Strive for perfection through continuous improvement.

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Some Service/Maint. Successes

HP Success Story
- **Lean CMMI® L3 Process 25% of the size of HP India Process**
- **Very Small Projects (0.25-0.5 FTE projects)**
- **Includes website development**
- **Includes maintenance/service**
- **See References [Kellum 2006]**

Raytheon/NASA JPL Success Story
- **Documented in SEI Report**
- **Tailored all CMMI L3 practices in report**
- **Only one customer (JPL) - Simple model**
- **See References**

Numerous CMM Success Stories
- **More and more CMMI service/maintenance success stories emerging**

Draft CMMI® for Service
- **Has not been released by SEI**

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Project Management PAs

Project Planning (PP - L2)

Project Monitoring and Control (PMC - L2)

Integrated Project Management (IPM - L3)
  – **Tailoring**
  – **Advanced Project Management**

Risk Management (RSKM - L3)

Supplier Agreement Management (SAM - L2)

• Reference: "CMMI[SM] for Systems Engineering and Software Engineering,", CMMI-SE/SW Staged Version, Version 1.1

Project Planning Goals

SG 1: Estimates of project planning parameters are established and maintained.

SG 2: A project plan is established and maintained as the basis for managing the project.

SG 3: Commitments to the project plan are established and maintained.

• Reference: "CMMI[SM] for Systems Engineering and Software Engineering,", CMMI-SE/SW Staged Version, Version 1.1

Commitment Metrics

COMMITs	Size	Effort	Cost	Schedule	Defects
1. 2. 3. . . . N					
N+1 ...					

Plate Full

Backlog

Service/Maint. Principles

The CMMI is "project" oriented. In a Service/ Maintenance organization, there may not even be a "project".

The term "Project" may not work in your organization ("Project" definition: Start Date/End Date). This can be a major problem when interpreting the CMMI for Service/Maintenance.

Most of the time, there are a collection of activities that can be grouped together:
- Releases/Bundles
- Tasks/Service Requests
- Change Requests/Problem Reports
- Annual Plans (e.g., service, maintenance)

Example Service/Maint. Plans

Possible Equivalents to CMMI Project Plans:

- **Release Plan (e.g., Annual, Quarterly, Monthly)**

- **Task Plan (e.g., for a customer under a PO)**

- **Service Request**

- **Service Level Agreement (SLA)**

- **Annual CM Plan**
  – **Change Requests(CRs)/Problem Reports (PRs)**

- **Annual Plans (e.g., service, maintenance)**
  – **Can have releases, CRs/PRs, Service Requests, Tasks**

Service/Maint. PM Tailoring

Don't change your business to match CMMI. Improve your business to meet CMMI Goals.

Use Lean Templates that implement CMMI requirements (combine items).

Put many of the CMMI requirements that don't change across tasks in annual plans (e.g., Scope, Data, Training, Risks, CM, etc.) The things that do change (e.g., estimates, schedule, etc.), make lean and tailor to tasks.

Schedules can be very different (e.g., more focused on releases/CM than milestones). Tracking can be done periodically (e.g., monthly), and meetings may be combined.

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The Customer and CM

Why perform CM?

If effective CM is not performed, the risk of shipping the wrong version to a customer is too high. For example, a version delivered to a customer might …

- **Have defects**
- **Have untested changes**
- **Not be reproducible**

CM is all about "Product Integrity":

- **Knowing exactly what customers have**
- **Knowing the exact status of products, versions, baselines, configuration items (e.g., exactly what is in which version)**
- **Knowing how to reproduce every product, version, component, configuration item, etc.**

CM Principles

Configuration Identification:
- What are configuration items, and what configuration does your customer have?

Configuration Control:
- How do I control changes made to the configuration?

Configuration Status Accounting:
- What is the current status of the configuration?

Configuration Auditing:
- Does the configuration have product integrity?

• Reference: "Configuration Management" Training; Copyright © by Process Assets, LLC (PAL).

CMMI CM Goals

SG 1: Baselines of identified work products are established

SG 2: Changes to work products under configuration management are tracked and controlled

SG 3: Integrity of baselines is established and maintained

• Reference: *CMMI_SM for Systems Engineering and Software Engineering, CMMI-SE/SW Staged Version*, Version 1.1
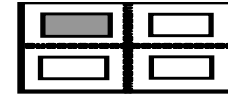
NASA JPL MGSS CM Process

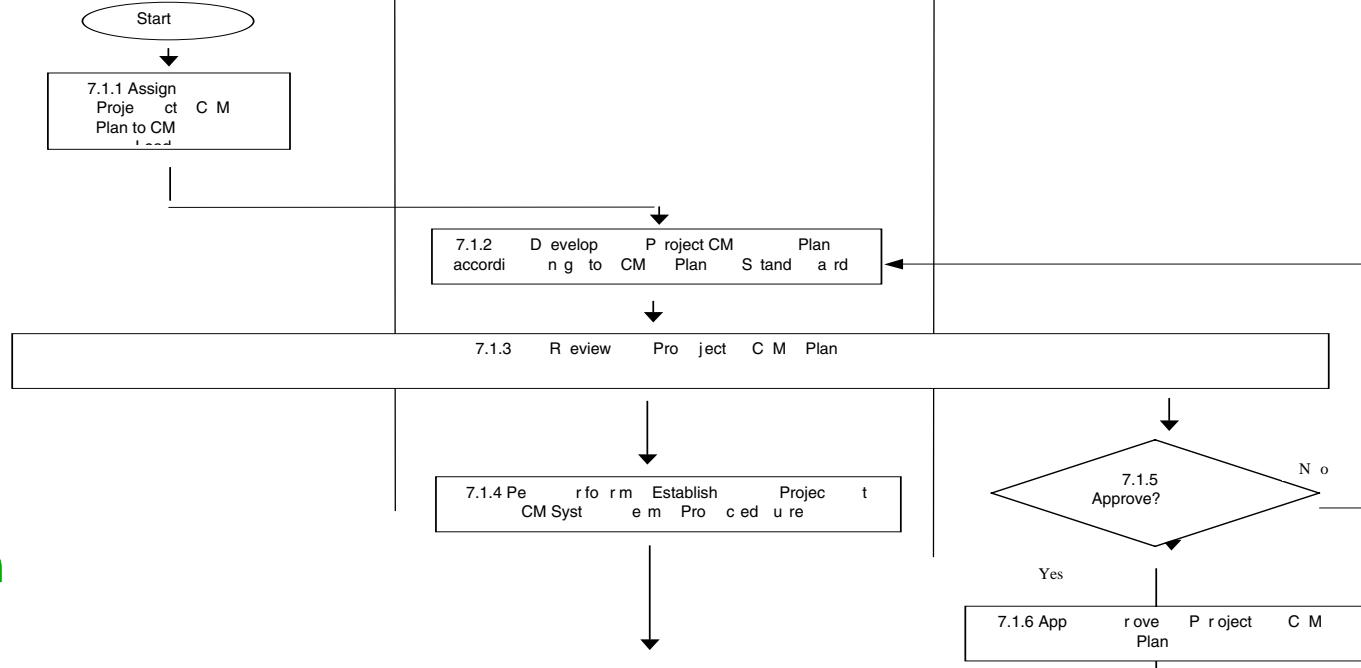| 7.1 Perform CM Planning	7.2 Perform Configuration Control
7.3 Perform Configuration Status Accounting	7.4 Perform CM Audits
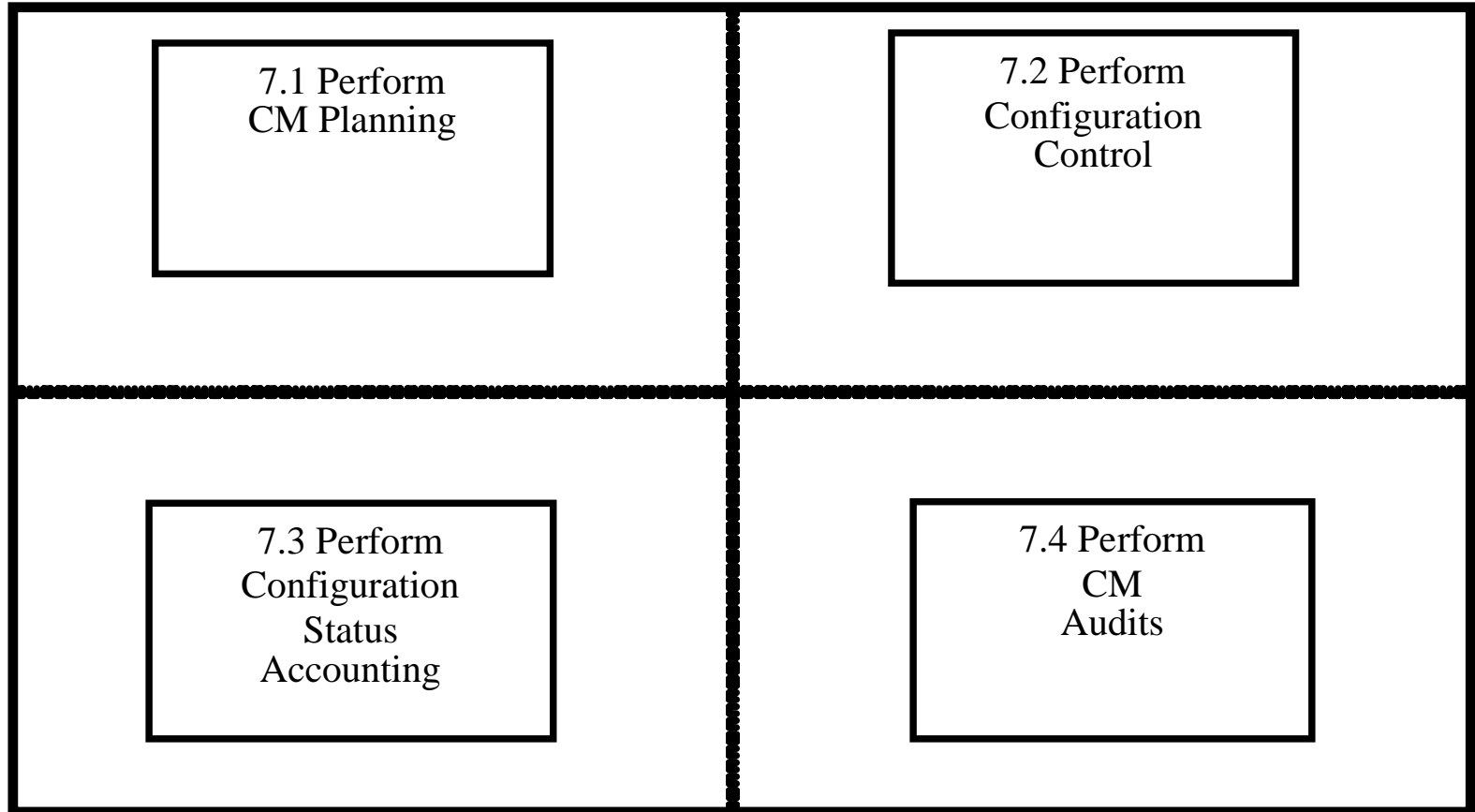
Example CM Process

5 W's on 1 Page in a Process Model!

Patent Pending Approach

7.1 Perform CM Planning

PURPOSE : Develop CM Plans that meet project needs.

INPUTS/ENTRY CRITERIA :
CONTEXT
- **Project initiated AND Draft Project Plan**
- **Organizational CM Plan is approved and meets CM Standard.**

ROLES & ACTIVITIES:

PROCESS

Project Manager   CM Lead   QA

(Start)

7.1.1 Assign Project CM Plan to CM Lead

7.1.2 Develop Project CM Plan according to CM Plan Standard

7.1.3 Review Project CM Plan

7.1.4 Perform Establish Project CM System Procedure

7.1.5 Approve?   No

Yes

7.1.6 Approve Project CM Plan

Service CM Tailoring

What is the operational definition of a "project"?

How big does a "project" need to be before it can handle the overhead of the CMMI?

Small Change Requests (CRs) and Problem Reports (PRs) are what CM is all about.
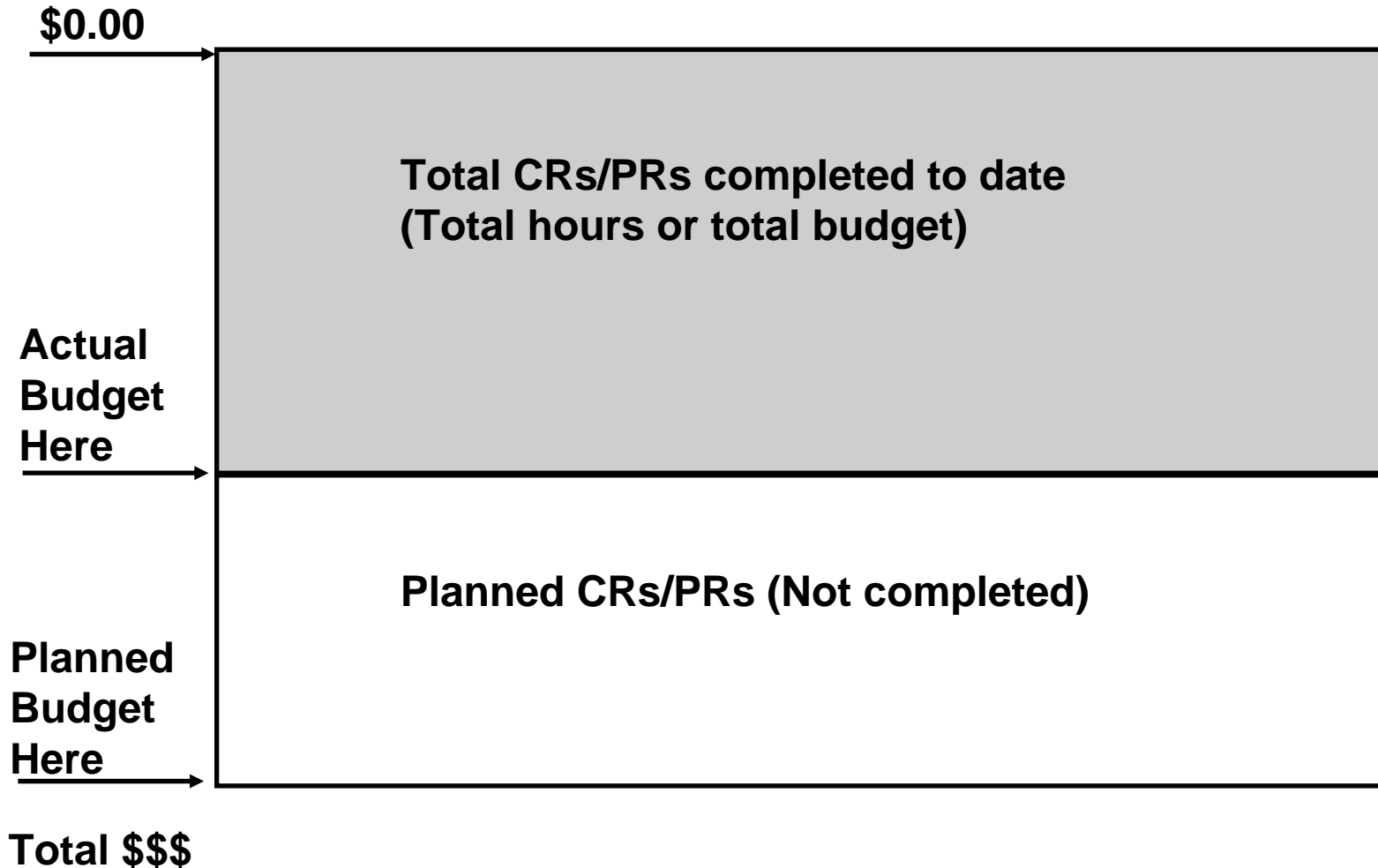
How do you plan for interrupt driven CRs and PRs? (e.g., you know the customer will make changes and you know there will be defects)

Budget for CRs/PRs based on historical data in an Annual Plan.

Annual CM plan

$0.00

Actual Budget Here	**Total CRs/PRs completed to date (Total hours or total budget)**
Planned Budget Here	**Planned CRs/PRs (Not completed)**

Total $$$

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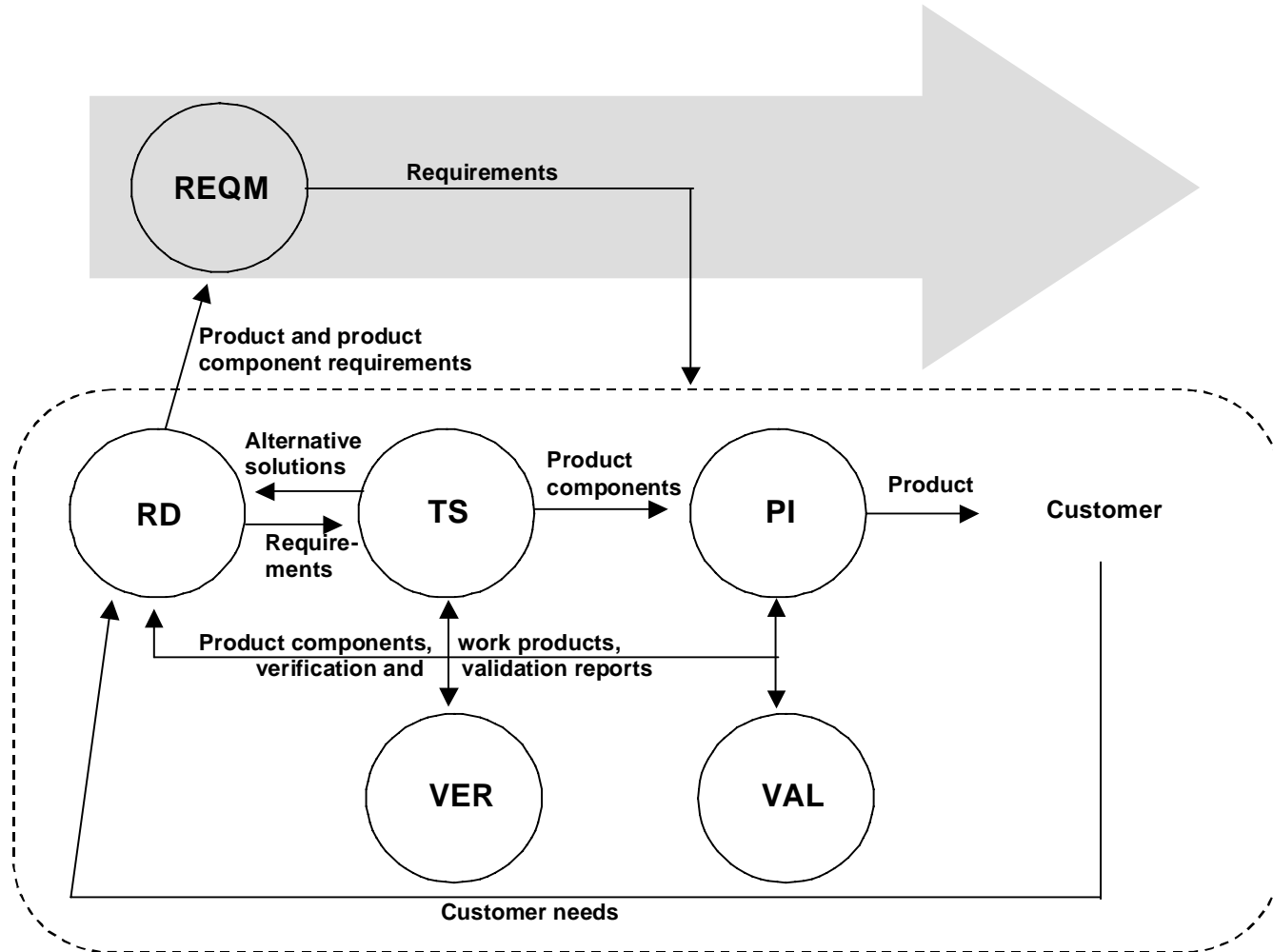**Motivation and Background**

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Questions and Answers

Engineering Process Areas

REQM

Requirements

Product and product
component requirements

Alternative
solutions

RD

TS

Product
components

PI

Product

Customer

Require-
ments

Product components,
verification and

work products,
validation reports

VER

VAL

Customer needs

• Reference: "CMMI[SM] for Systems Engineering and Software Engineering,", CMMI-SE/SW Staged Version, Version 1.1

Tailoring Engineering

For large or medium projects (e.g., large tasks/service requests/change requests), the CMMI can be used effectively.

For small and very small stand-alone tasks, the CMMI engineering process areas have a lot of overhead. One solution is a "mini-spec".

For very small tasks, sometimes it is better to run them under CM as a CR/PR and not formally define them as a "project".

If desired, CM systems can be made to handle CMMI requirements.

Example CR/PR States
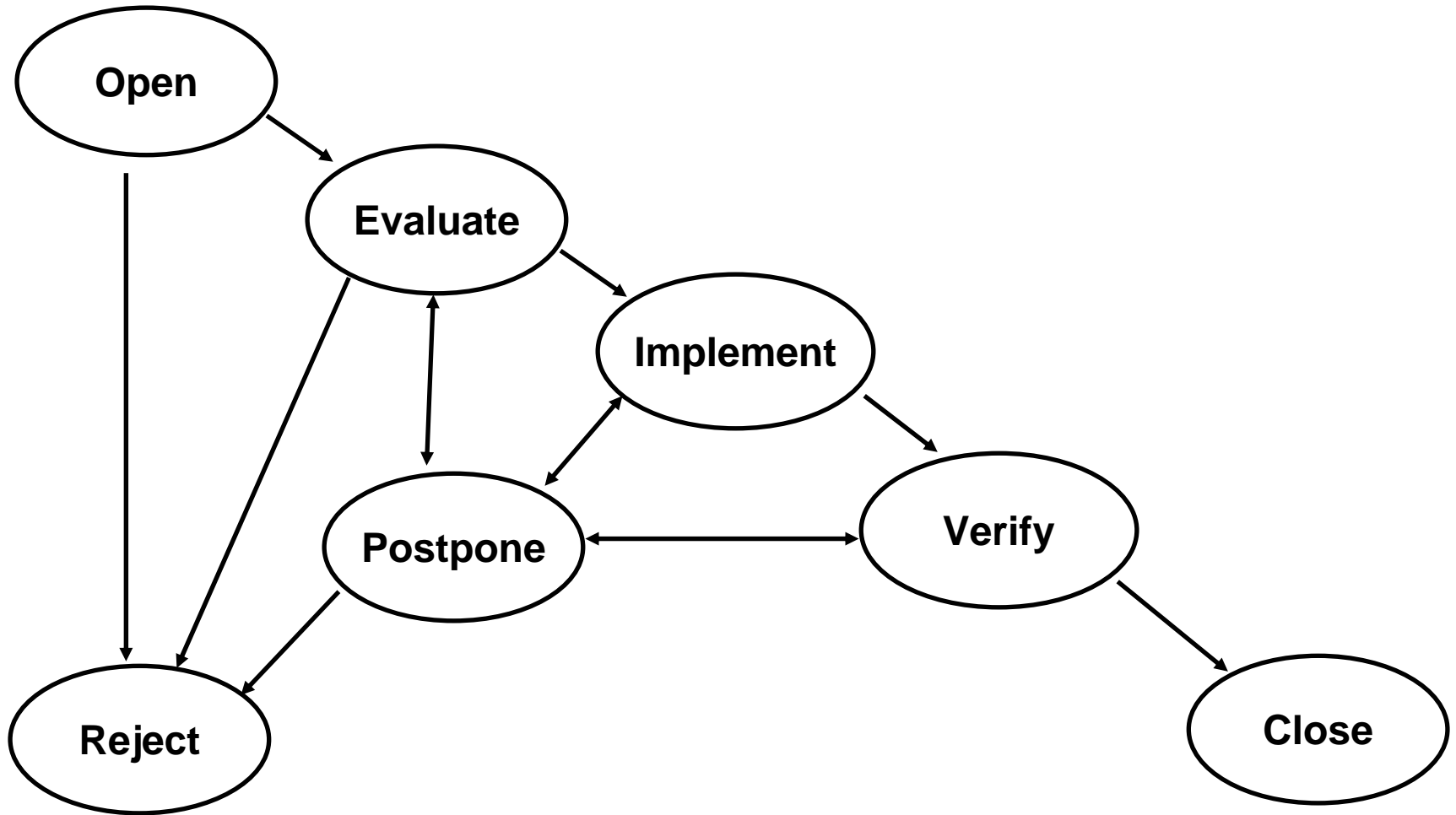
Example Requirements Matrix

#	Requirement	Reference	Allocation	Stability (H/M/L)	Risk (H/M/L)	Priority (H/M/L)

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Other CMMI Processes

Project Management, Engineering, CM - Covered.

Process Management PAs (i.e., OPD, OPF, OT, OPP, OID) apply well to Service/Maintenance organizations because they are at the organizational level (not the "project" level).

Most support process areas (i.e., PPQA, DAR, CAR) also apply well to Service/Maintenance organizations because they are like organizational level processes (e.g., supporting projects).

Metrics (e.g., MA, QPP) at the project level need to be tailored to Service/Maintenance organizations.

Lean Measurement Framework^{SM}

Based on three industry best practices (will be presented on next few slides).

Helps organizations focus on the "vital few" metrics.

Based on the three primary usage scenarios for metrics.

Based on metrics that are strongly supportive of goals and objectives.

Award winning measurement framework from American Society for Quality (ASQ).

Lean Measurement Framework^{SM}

GOALS	KEY QUESTIONS	METRICS	DC	DS
PLAN		**Cost, defects, effort, size, schedule, etc.**		
CONTROL		**Cost, defects, effort, size, schedule, etc.**		
IMPROVE		**Cost, defects, effort, size, schedule, etc.**		

• DC = Data Collection; DS = Data Storage

Some Example Lean Metrics

Data Box

Takt Time

Lead Time

Process Time

Changeover Time

Available Time

Value-Added Time

Demand Rate

Number of People

Inventory

Percent Complete and Accurate

Information Technology Used

Reliability

Metrics are "Top Down"

Organizational vision, mission, and strategy should drive metrics. Metrics should be driven by and connect to goals and objectives.

Strategic Planning should identify measurable success criteria and measurable objectives:

- **Compliance (e.g., Government requirements)**
- **Industry Standards (e.g., Baldrige, CMMI^{SM}, ISO, etc.)**
- **Market Share**
- **Performance (e.g., CPI, SPI)**
- **Productivity**
- **Quality**
- **ROI**
- **Time to market**

Some Lessons Learned - (1)

Project management processes need the most tailoring.

CM is a strong service/maintenance process - use it!

Engineering processes need to be tailored to service/maintenance (e.g., small projects).

Organizational and support processes work well for service/maintenance.

Some Lessons Learned – (2)

Define an operational definition of a "project".

CMMI and processes must be tailored to service/maintenance organizations.

Implement a lean solution (e.g., lean processes, procedures, templates, etc). Many CMMI implementations are NOT lean.

Not every part of business needs to be under CMMI (only do what makes business sense).

Make a "project" large enough to handle CMMI overhead (i.e., should make business sense).

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