

MBASE and CMMI

Ray Madachy

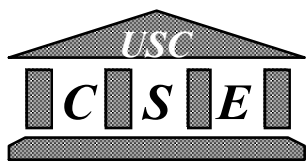
CS 577b

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Outline

- **The CMMI Paradigm Shift**
- **CMMI Organizational Guidelines
(from Rick Hefner, TRW)**
- **CeBASE Introduction and the
CMMI**



Definition of Terms

- **MBASE: Model-Based (System) Architecting and Software Engineering**
- **CeBASE: Center for Empirically-Based Software Engineering**
- **CMMI: Capability Maturity Model - Integrated**

The CMMI Software Paradigm Shift

- **The traditional software paradigm**
 - **Relation to SW CMM v.1.1**
- **Problems with traditional paradigm**
- **The CMMI software paradigm**
 - **Specific process area differences**
 - **Resulting implementation challenge**

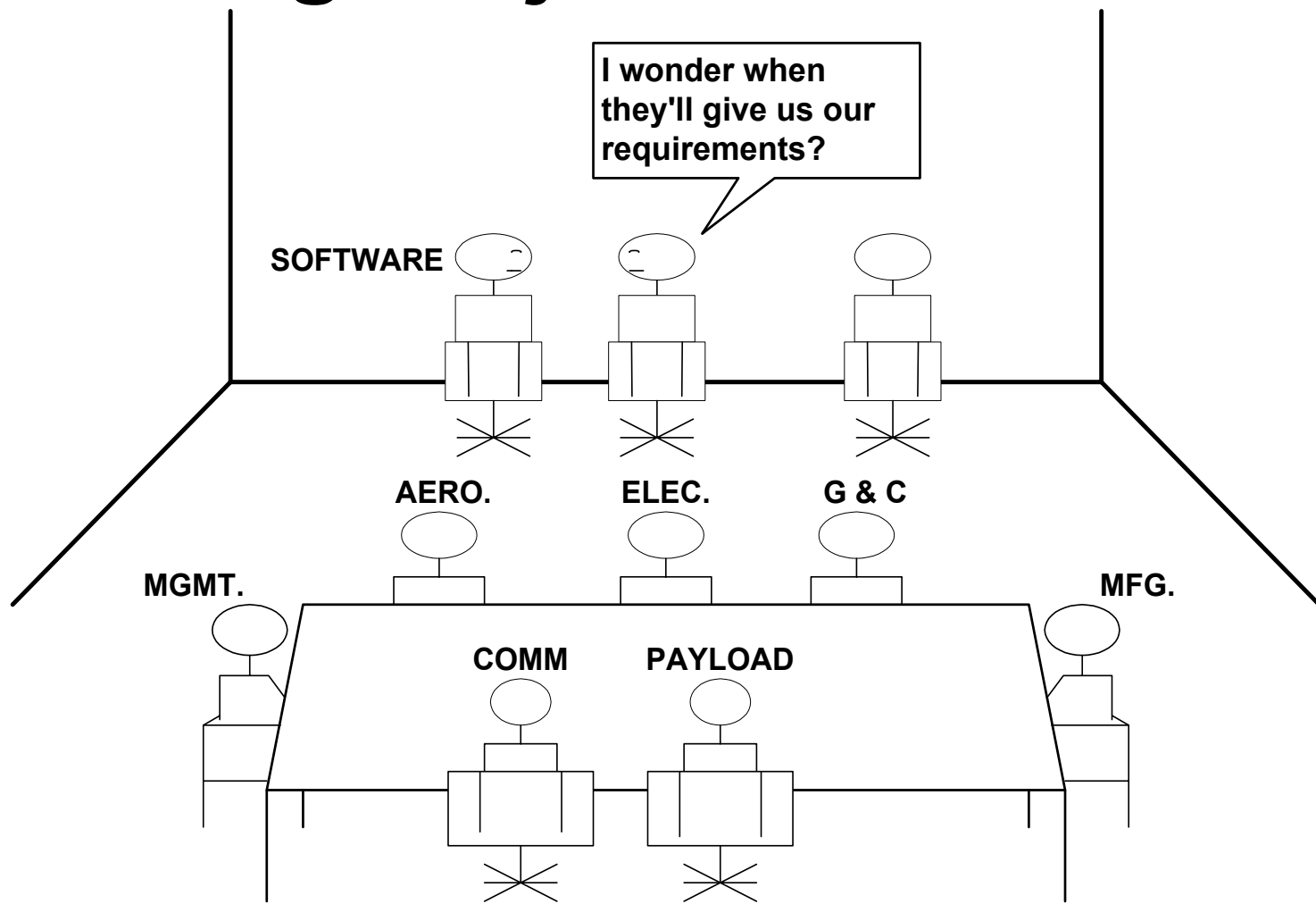
The Traditional Software Paradigm

- **System engineers establish system requirements**
 - Allocate some to software
- **Software engineers build software to requirements**
 - And do their requirements management
- **System engineers integrate software into system**

The Gospel According to SW CMM v.1.1

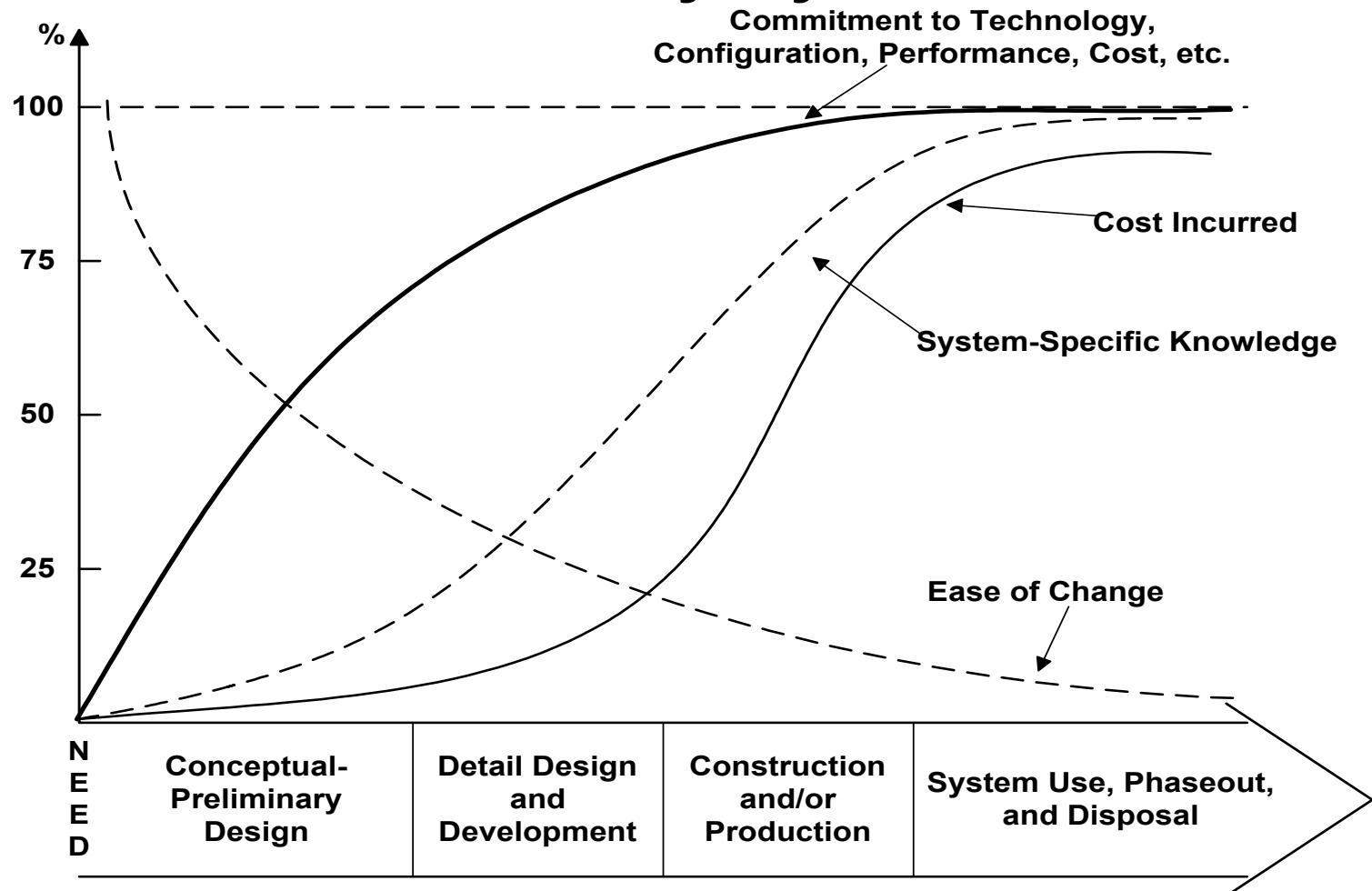
- **Requirements Management, Ability 1**
“Analysis and allocation of the system requirements
 - **is not the responsibility of the software engineering group**
 - **but is a prerequisite for their work.”**

Resulting Project Social Structure



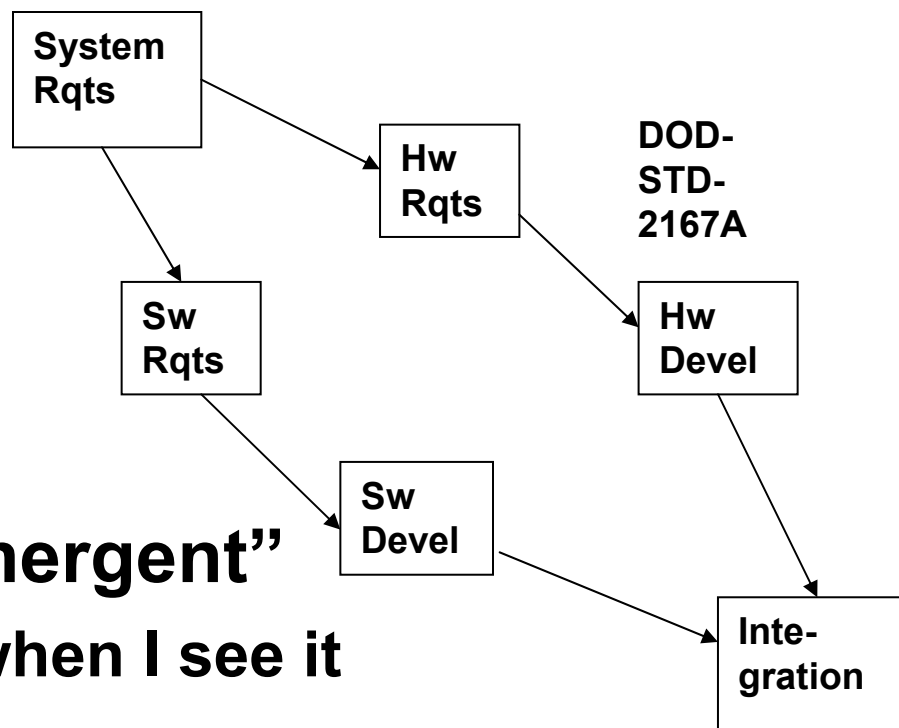
Foreclosure of Software Options

—Blanchard- Fabrycky, 1998

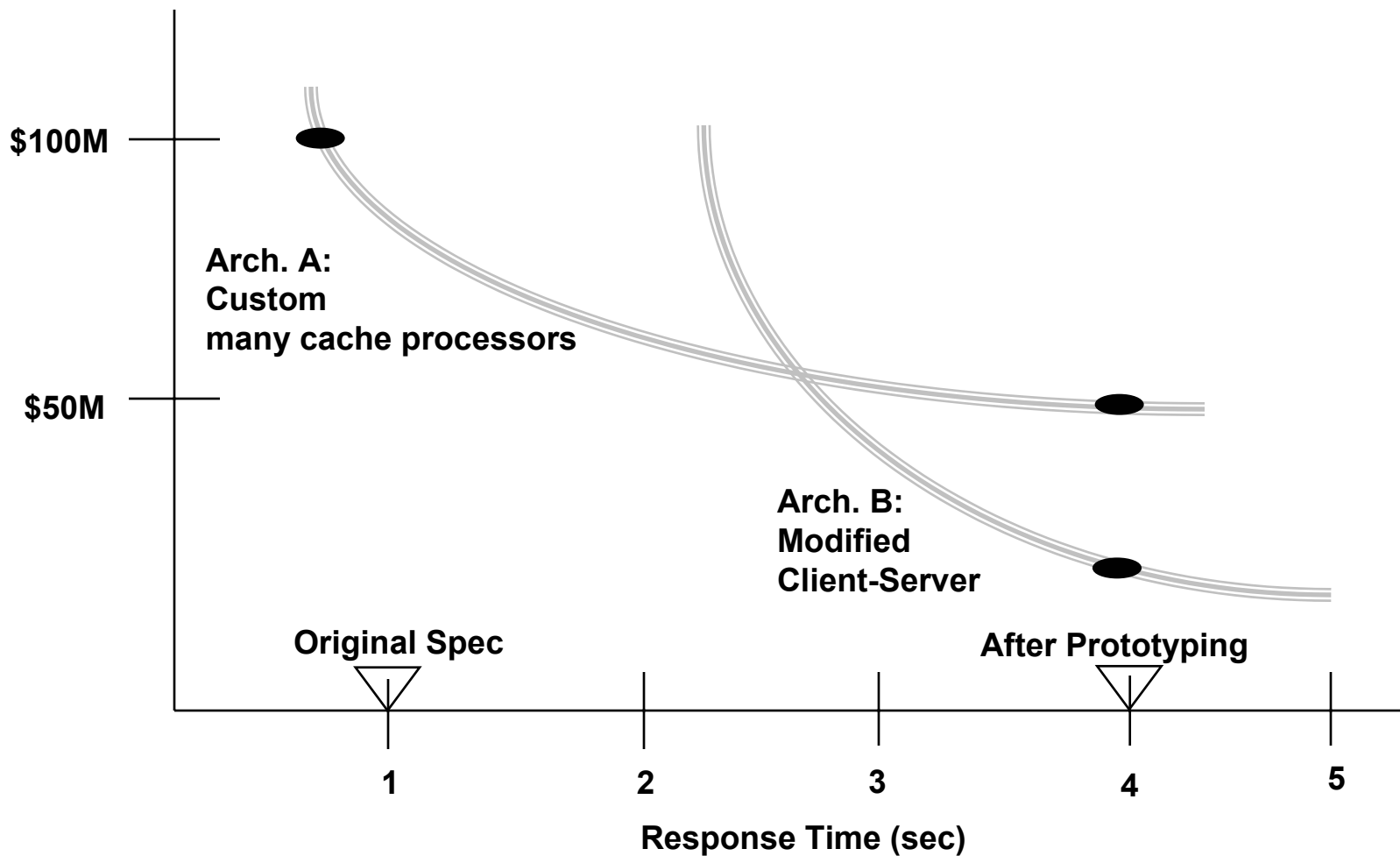


Problems with Sequential Engineering

- Takes too long
- Neglects risk
- HCI systems are “emergent”
 - IKIWISI: I’ll know it when I see it
- Breeds model clashes
 - 2167A, COTS, Ada, 4GL’s, CAIV



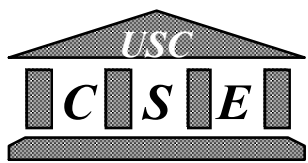
Sequential Engineering Neglects Risk





The CMMI Software Paradigm

- **System and software engineering are integrated**
 - **Software has a seat at the center table**
- **Requirements, architecture, and process are developed concurrently**
 - **Along with prototypes and key capabilities**
- **Developments done by integrated teams**
 - **Collaborative vs. adversarial process**
 - **Based on shared vision, negotiated stakeholder concurrence**



CMMI vs. SW-CMM V1.1

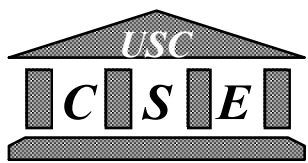
Level 2 (Staged Model)

CMMI Process Areas

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

SW Model

- RM
- SPP
- SPTO
- SSM
- None
- SPA
- SCM



CMMI vs. SW-CMM V1.1 Level 3 (Staged Model)

CMMI Process Areas

- Requirements Development
- Technical Solution
- Product Integration
- Verification
- Validation
- Organizational Process Focus
- Organizational Process Definition
- Organizational Training
- Integrated Project Management
- Risk Management
- Decision Analysis and Resolution
- Integrated Teaming
- Organizational Environment for Integration

SW Model

- SPE+
- SPE+
- SPE+
- SPE, PR
- SPE+
- OPF
- OPD
- TP
- ISM
- None
- None
- None
- None

CMMI vs. SW-CMM V1.1 Level 4 (Staged Model)

CMMI

CMMI Process Areas

- Quantitative Project Management
- Organizational Process Performance

SW Model

- QPM, SQM
- QPM



CMMI vs. SW-CMM V1.1 Level 5 (Staged Model)

CMMI

CMMI Process Areas

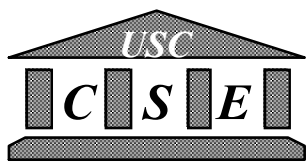
- Casual Analysis and Resolution
- Organizational Innovation and Deployment

SW Model

- DP
- TCM, PCM

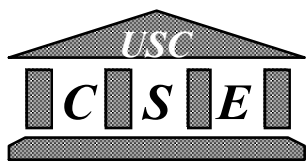
Resulting Implementation Challenge

- **Need a model that is**
 - **Well-grounded in software experience**
 - **Supportive of all CMMI process areas**
 - **Tailorable to individual situations**
 - **Specific about what to do**
 - **Supportive of future software/system trends**
 - **Rapid Application Development (RAD)**
 - **Cost/Schedule as Independent Variable (CAIV/SAIV)**
 - **COTS Integration**
 - **Web, Internet, Agents, et al.**
- **Spiral Model? Almost. Needs some refinements**
- **MBASE? Provides key refinements, but project-level only**
- **CeBASE? Integrates MBASE and organization-level Experience Factory**



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- **The CMMI Paradigm Shift**
- ➔ • **CMMI Organizational Guidelines**
- **CeBASE Introduction and the CMMI**



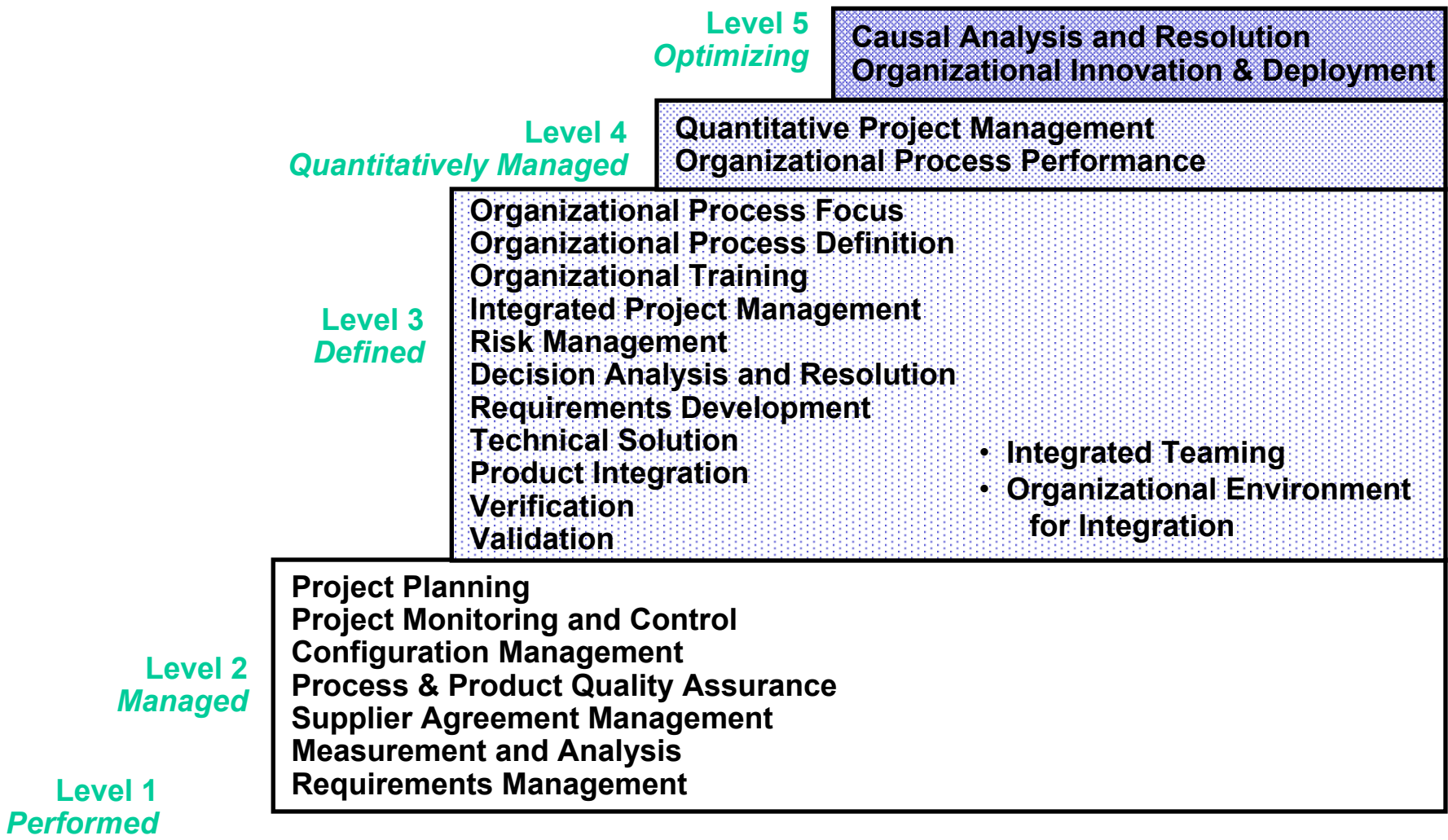
CMMI Introduction

- CMMI Structure
- Organizational Process Areas
- Organizational Assets
- Organizational Assessment & Improvement

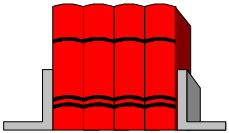


CMMI Process Areas

Staged Representation



Common Features (for all Process Areas)



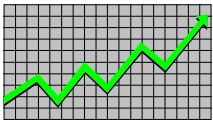
- **Commitment to Perform** includes practices that ensure the process is established and will endure.
 - Organizational policies



- **Ability to Perform** includes practices that establish the necessary conditions for implementing the process completely.
 - Plans, resources, responsibility, and training.



- **Activities Performed** includes practices that directly implement a process area.



- **Directing Implementation** includes measurement practices that are necessary to collect and analyze data related to the process.

- Configuration management, stakeholder involvement, monitor and control

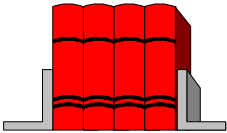


- **Verification** includes practices that ensure compliance with the process that has been established.
 - Senior management reviews, quality audits

Typical Organizational Responsibilities

		Commitment to Perform	Ability to Perform	Activities Performed	Directing Implementation	Verification
Level 5	Causal Analysis and Resolution (Support) Org Innovation and Deployment (Process)					
Level 4	Quantitative Project Management (PM) Organizational Process Performance (Process)					
Level 3	Organizational Process Focus (Process) Organizational Process Definition (Process) Organizational Training (Process) Integrated Project Management (PM) Risk Management (PM) Decision Analysis and Resolution (Support) Requirements Development (Eng) Technical Solution (Eng) Product Integration (Eng) Product Verification (Eng) Validation (Eng)	Organizational policies	Organizational training		Standard metrics	Senior management review Quality Assurance organization
Level 2	Project Planning (PM) Project Monitoring and Control (PM) Configuration Management (Support) Product and Process Quality Assurance (Support) Supplier Agreement Management (PM) Data Management (Support) Measurement and Analysis (Support) Requirements Management (Eng)					

Organizational Assets (for all Process Areas)



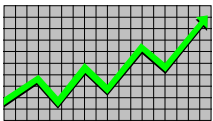
- **Organizational policies**



- **Organizational training office**



- **Organizational procedures**



- **Standard metrics**
- **Estimation process, tools & support**

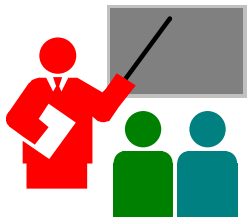
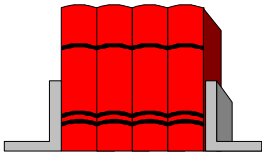


- **Senior management review process**
- **Independent quality assurance organization**

Organizational Process Areas - Level 3



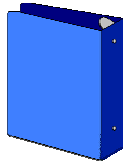
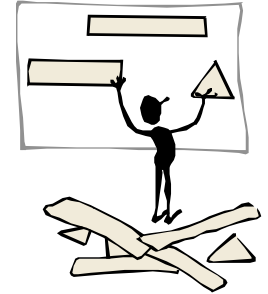
- **Organizational Process Focus**
 - Establishes and maintains an understanding of the organization's processes and process assets, build an infrastructure to support their use, and plan and coordinate the organization's process improvement activities.
- **Organizational Process Definition**
 - Establishes and maintains a usable set of organizational process assets.
- **Organizational Training**
 - Develops the skills and knowledge of people so they can perform their roles effectively and efficiently.



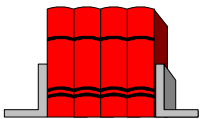
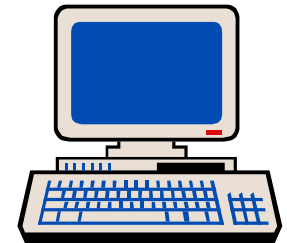
Organization's Process Assets



- Organization's standard process (including the process architecture and process elements)
- Descriptions of life cycles approved for use

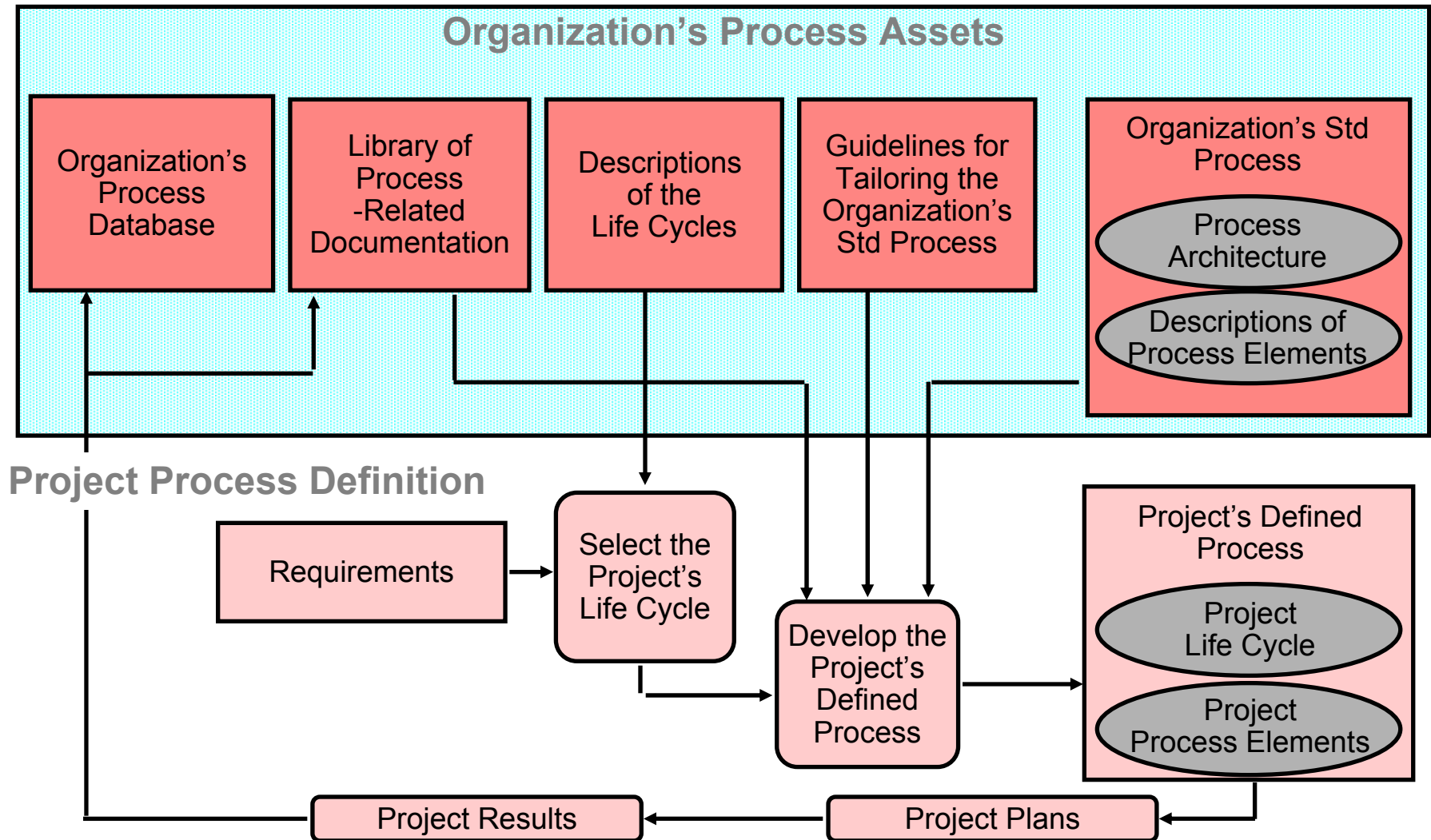


- Guidelines and criteria for tailoring the organization's standard process
- Organization's process database (historical cost and schedule data)
- Library of process-related documentation

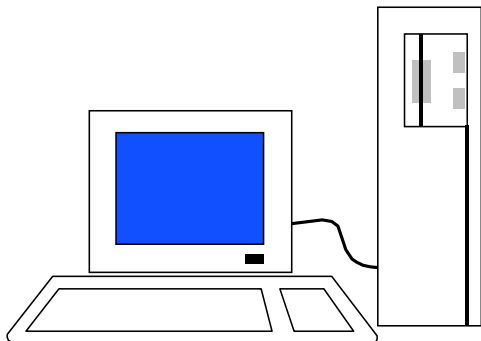


The process assets are available for use by the projects in developing, maintaining, and implementing their defined software process.

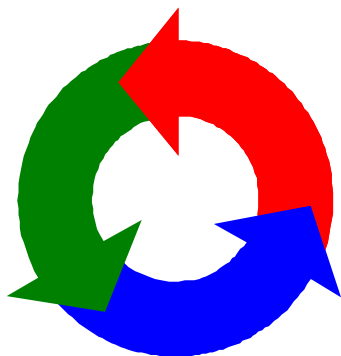
Conceptual Software Process Framework



Organizational Process Areas - Levels 4 & 5

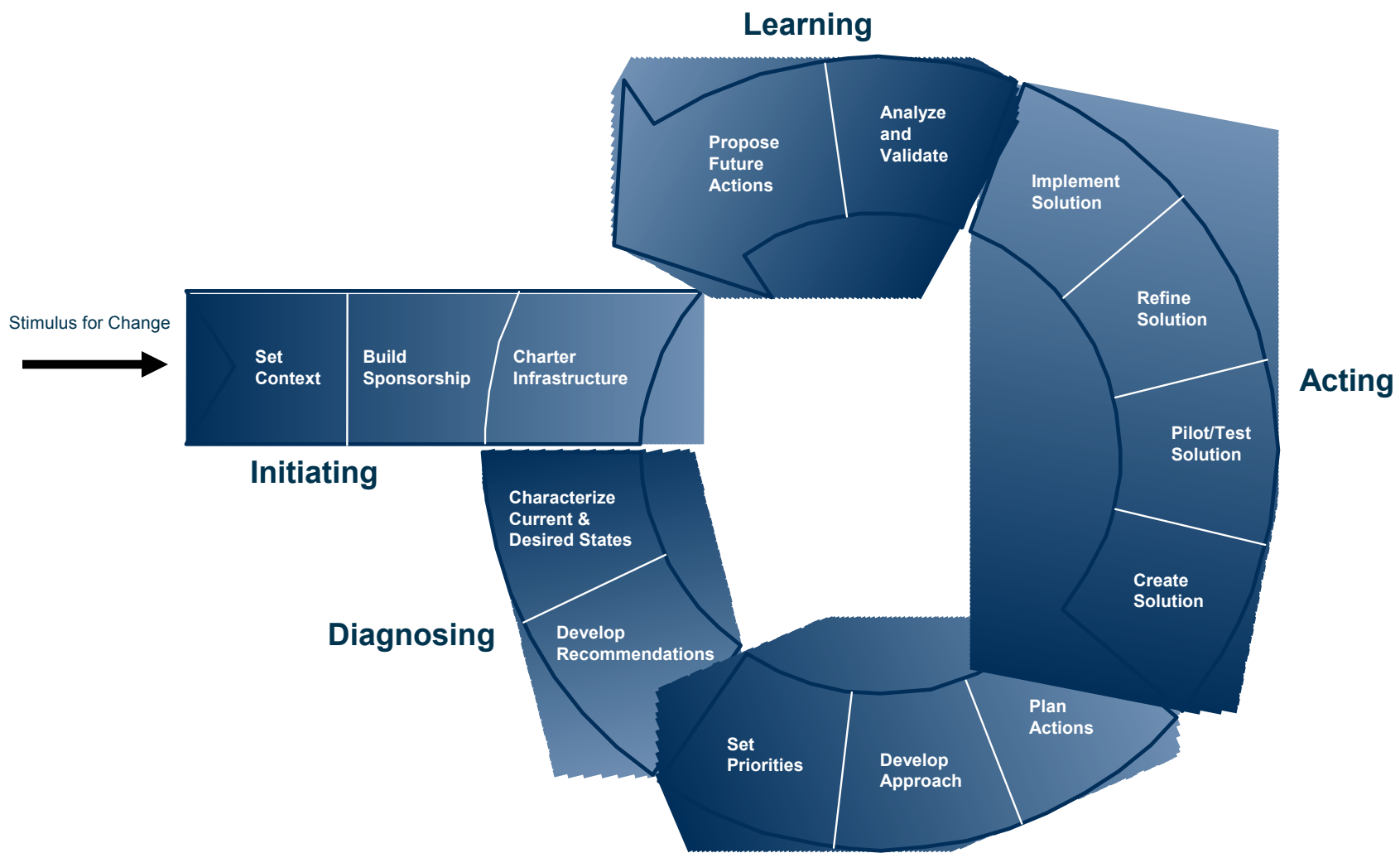


- Organizational Process Performance
 - Establishes and maintains a quantitative understanding of the performance of the organization's set of standard processes
 - Provides the process performance data, baselines, and models to quantitatively manage the organization's projects.



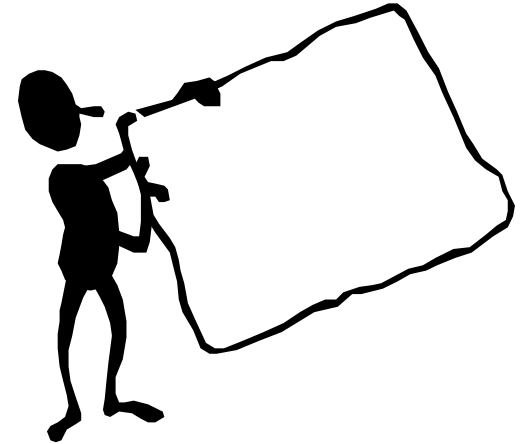
- Organizational Innovation and Deployment
 - Selects and deploys incremental and innovative improvements that measurably improve the organization's processes and technologies.

Organizational Assessment & Improvement



Assessment Principles

- Start with a process reference model.
- Use a formalized assessment process.
- Involve senior management as assessment sponsor.
- Focus assessment on sponsor's business goals.
- Observe strict confidentiality and non-attribution.
- Approach assessment collaboratively.
- Focus on follow-on process improvement activities.



Classes of Assessment Methods

Class A:

- Full comprehensive method
- Thorough model coverage
- Provides maturity level

Class B:

- Less comprehensive, less expensive
- Initial, partial, self-assessment
- Focus on areas needing attention
- No maturity level rating

Class C:

- Quick look
- Checking for specific risk areas
- Inexpensive, little training needed



Standard CMMI Assessment Method for Process Improvement (SCAMPI)

- **Based on CMM®-Based Appraisal for Process Improvement (CBA IPI) and EIA/IS 731 Appraisal Method**
- **Must be led by authorized SCAMPI Lead Assessor**
- **Tailorable to organization and model scope**
- **Artifacts:**
 - **SCAMPI Method Description**
 - **Maturity questionnaire, work aids, templates**
- **Assuming an organization of 3-6 projects, 6-9 team members, experienced Lead Assessor**
 - **SCAMPI assessment of all process areas through Levels 2-5 in 2-3 weeks**
 - **SCAMPI assessment of process areas through Levels 3 in 1-2 weeks**

SCAMPI Lead Assessors

- **Prerequisites in relevant disciplines :**
 - Educational background in technical area
 - Work experience in systems engineering and/or software engineering (10 years)
- **Introductory model training**
- **Assessment team training and experience**
- **Intermediate model training, Lead Assessor training**
- **Lead SCAMPI while being observed by authorized CMMI Lead Assessor**



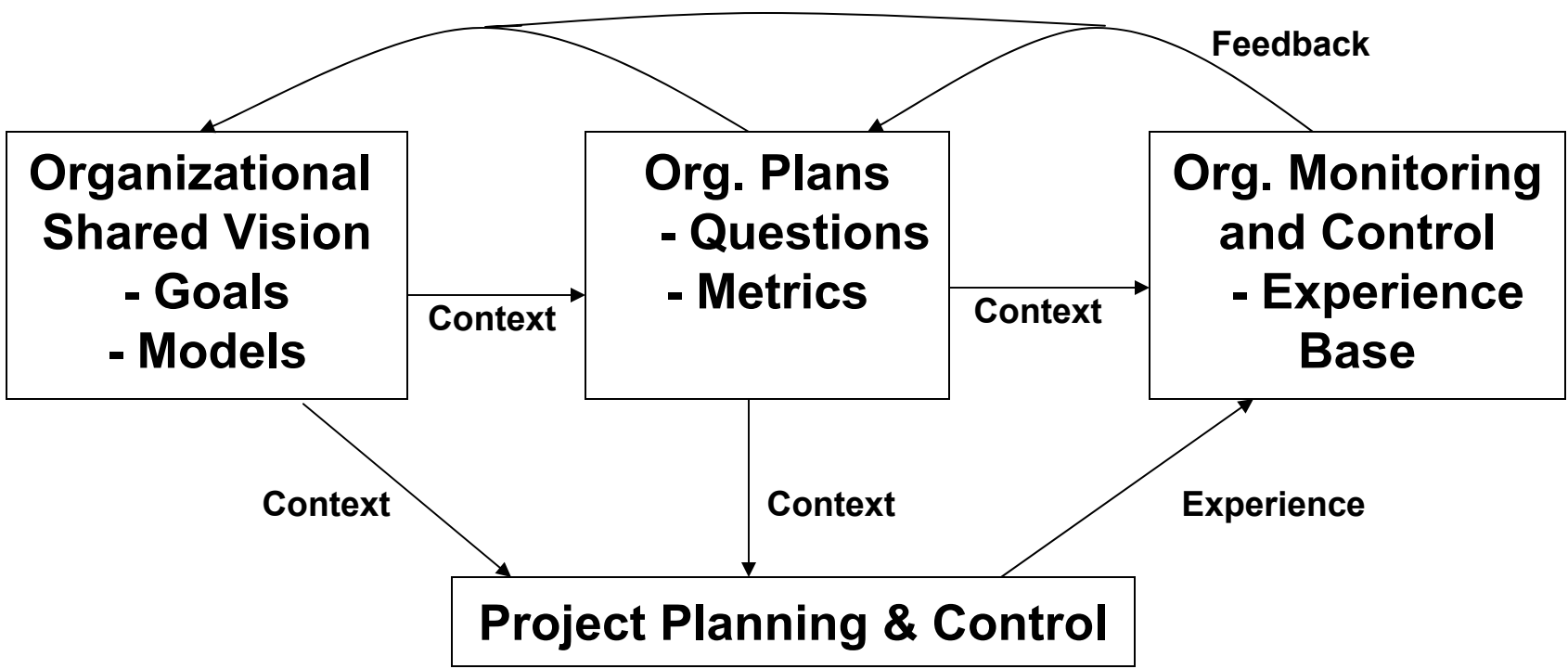


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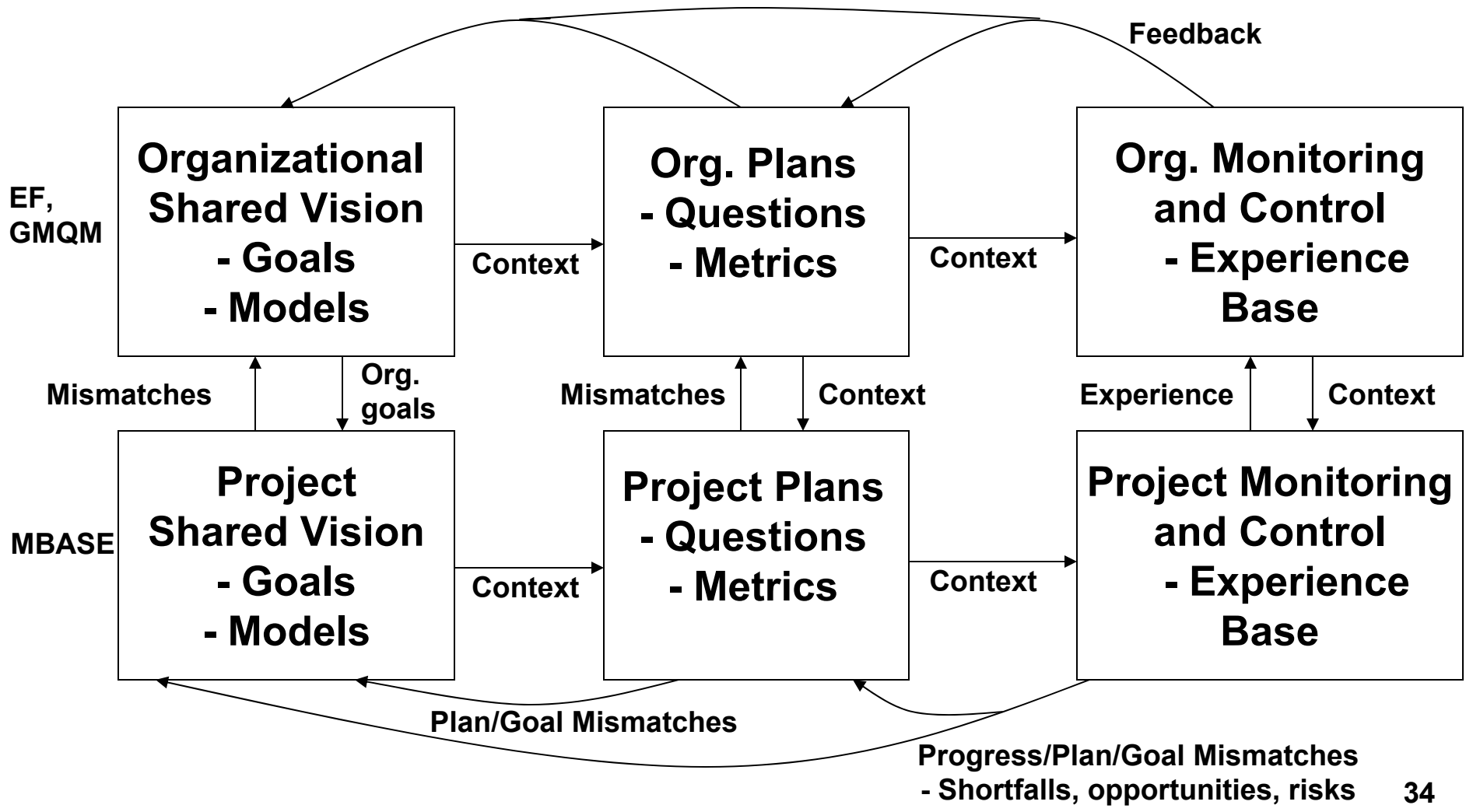
The Experience Factory

- Basili et al., 1994





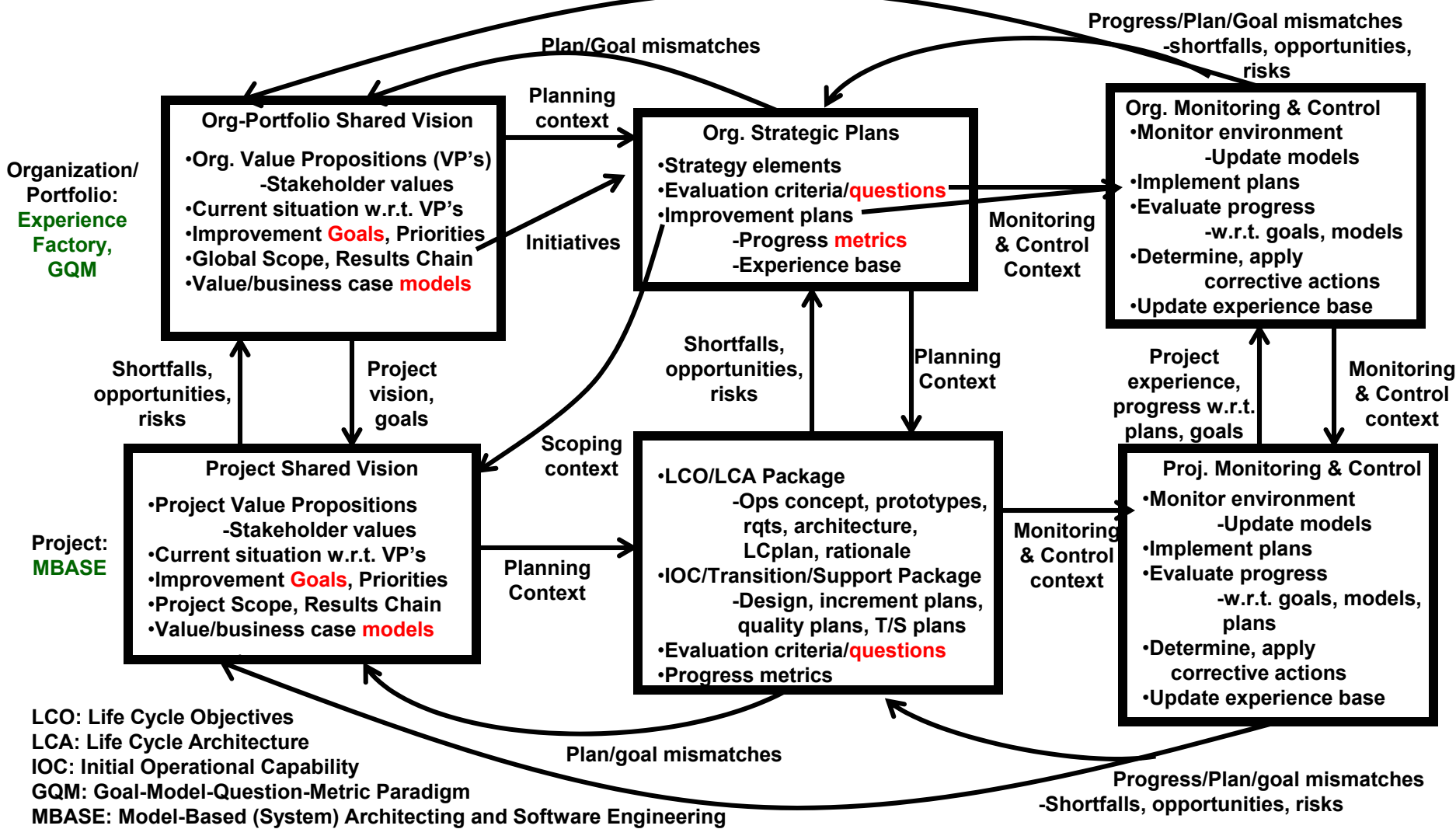
The CeBASE Method = MBASE + Experience Factory





The CeBASE Method

-Applies to organization's and projects' **people, processes, and products**



LCO: Life Cycle Objectives
 LCA: Life Cycle Architecture
 IOC: Initial Operational Capability
 GQM: Goal-Model-Question-Metric Paradigm
 MBASE: Model-Based (System) Architecting and Software Engineering