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National Defense Industry Association (NDIA)

System Engineering Division

Systems Level Configuration Management

Al Florence **The MITRE Corporation**

Contents of Course

- Introduction
- Configuration Management Concepts
- Configuration Management in Detail
- Tailoring Configuration Management
- Points to Remember
- References / Suggested Reading
- Questions / Answers / Discussion
- Contact Information

Course Objectives

Provide students with an understanding of:

- Configuration Management (CM)
- Importance of CM
- Identification of Configuration Items (CIs)
- Baselines
- Controlling Changes to CIs
- Configuration Control Boards
- Classes of Changes
- Conducting Impact Assessments on Requested Changes
- Configuration Status Accounting
- Configuration Management Audits
- CM Responsibilities of Stakeholders
- CM Relationships between Acquirer and Supplier

Introduction (continued)

Why CM?

- CM ensures that the current configuration of items are known throughout their lifecycle
- CM ensures that changes to the configuration of evolving items are correct, controlled, managed, and documented

What is CM?

- **CM is a discipline applying technical and administrative direction and surveillance to:**
  - Identifying and documenting the physical, functional, and performance characteristics of items
  - Baselining those characteristics
  - Controlling changes to those characteristic
  - Providing status on those characteristics
  - Conducting audits on those characteristics
- **The CM tasks that produce these results are:**
  - Configuration Identification
  - Configuration Control
  - Configuration Status Accounting
  - Configuration Management Audits

Introduction (continued)

Application of CM

- **The CM concepts presented in this tutorial can be applied at the enterprise/systems/subsystem/program/project level to:**
  - Hardware
  - Software
  - Facilities

Introduction (continued)

Capability Maturity Model Integration (CMMI®)

The Software Engineering Institute's CMMI® has a supporting Process Area that requires organizations that are developing systems to conduct a minimum set of CM tasks on the development and maintenance of products in order to achieve CMMI compliance

CMMI (Continued)

Configuration Management Process Area (continued)

CMMI - Configuration Management

- SG 1 Establish Baselines
  - SP 1.1 Identify Configuration Items
  - SP 1.2 Establish a Configuration Management System
  - SP 1.3 Create or Release Baselines
- SG 2 Track and Control Changes
  - SP 2.1 Track Change Requests
  - SP 2.2 Control Configuration Items
- SG 3 Establish Integrity
  - SP 3.1 Establish Configuration Management Records
  - SP 3.2 Perform Configuration Audits

SG – Specific Goal

SP – Specific Practice

CMMI (completed)

Configuration Management Process Area (completed)

CMMI - Configuration Management

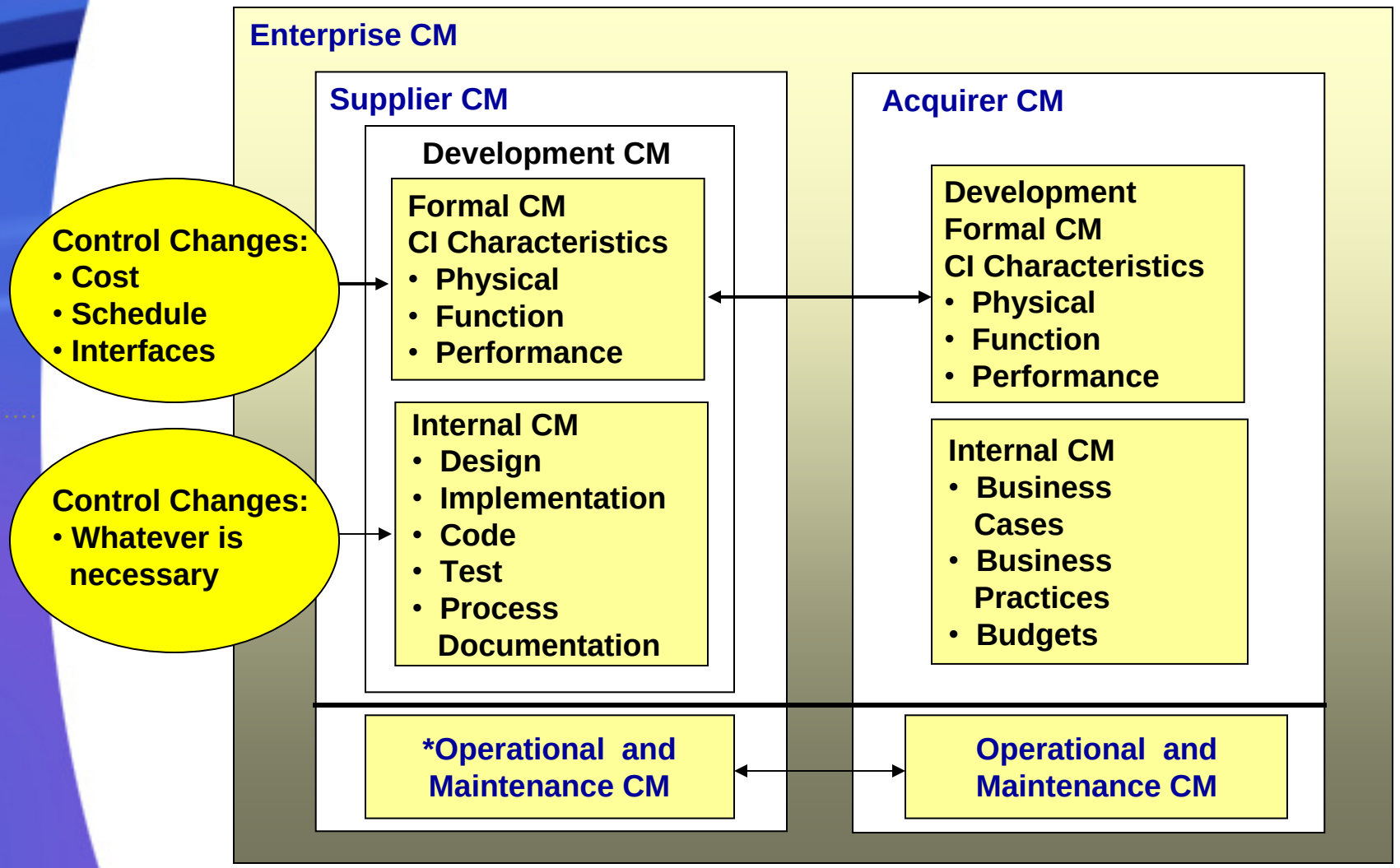
- GG 2 Institutionalize a Managed Process
  - GP 2.1 Establish an Organizational Policy
  - GP 2.2 Plan the Process
  - GP 2.3 Provide Resources
  - GP 2.4 Assign Responsibility
  - GP 2.5 Train People
  - GP 2.6 Manage Configurations
  - GP 2.7 Identify and Involve Relevant Stakeholders
  - GP 2.8 Monitor and Control the Process
  - GP 2.9 Objectively Evaluate Adherence
  - GP 2.10 Review Status with Higher Level Management

GG – Generic Goal

GP – Generic Practice

Introduction (continued)

Some Levels of CM



*Could be a different contractor

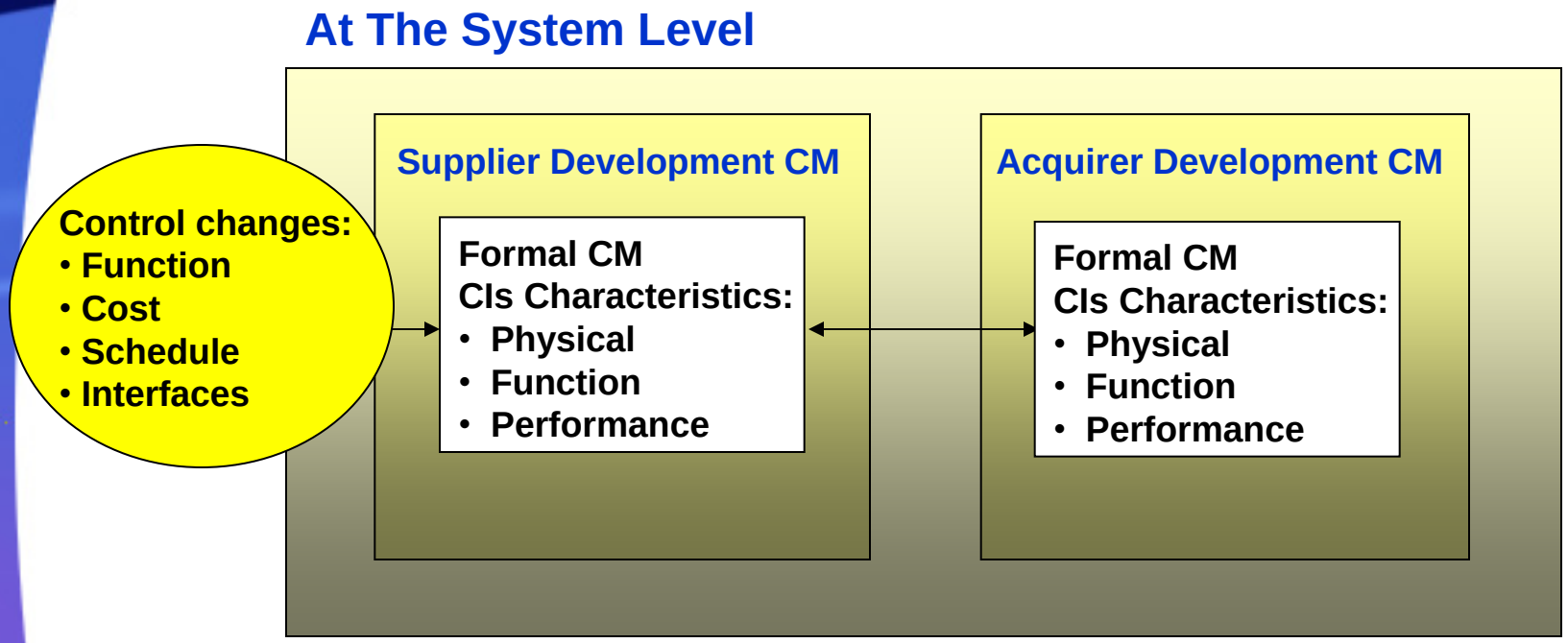
Introduction (continued)

Some Levels of CM (concluded)

- **Enterprise CM**
  - Covers all CM required for the entire enterprise (Acquirer/Supplier)
- **Supplier CM - Formal CM**
  - Development CM that concerns high level contractual issues such as specifications *(What shall be accomplished?)*
- **Supplier CM - Internal CM**
  - Development CM that concerns lower level contractual issues such as design, implementation, test, plans *(How is it accomplished?)*
- **Acquirer CM - Development Formal CM**
  - Acquirer CM that concerns high level contractual issues such as specifications *(What shall be accomplished?)*
- **Acquirer CM - Internal CM**
  - Acquirer CM that concerns internal business issues
- **Operational & Maintenance CM**
  - CM conducted after the system has been delivered and in operation

Introduction (Concluded)

CM Focus in this Course



This focus is chosen to serve as an example that can be applied, as appropriate, to other levels of CM and because this is one area in development that gets projects in trouble very quickly if not done properly.

Where are we?

- Introduction
- Configuration Management Concepts
- Configuration Management in Detail
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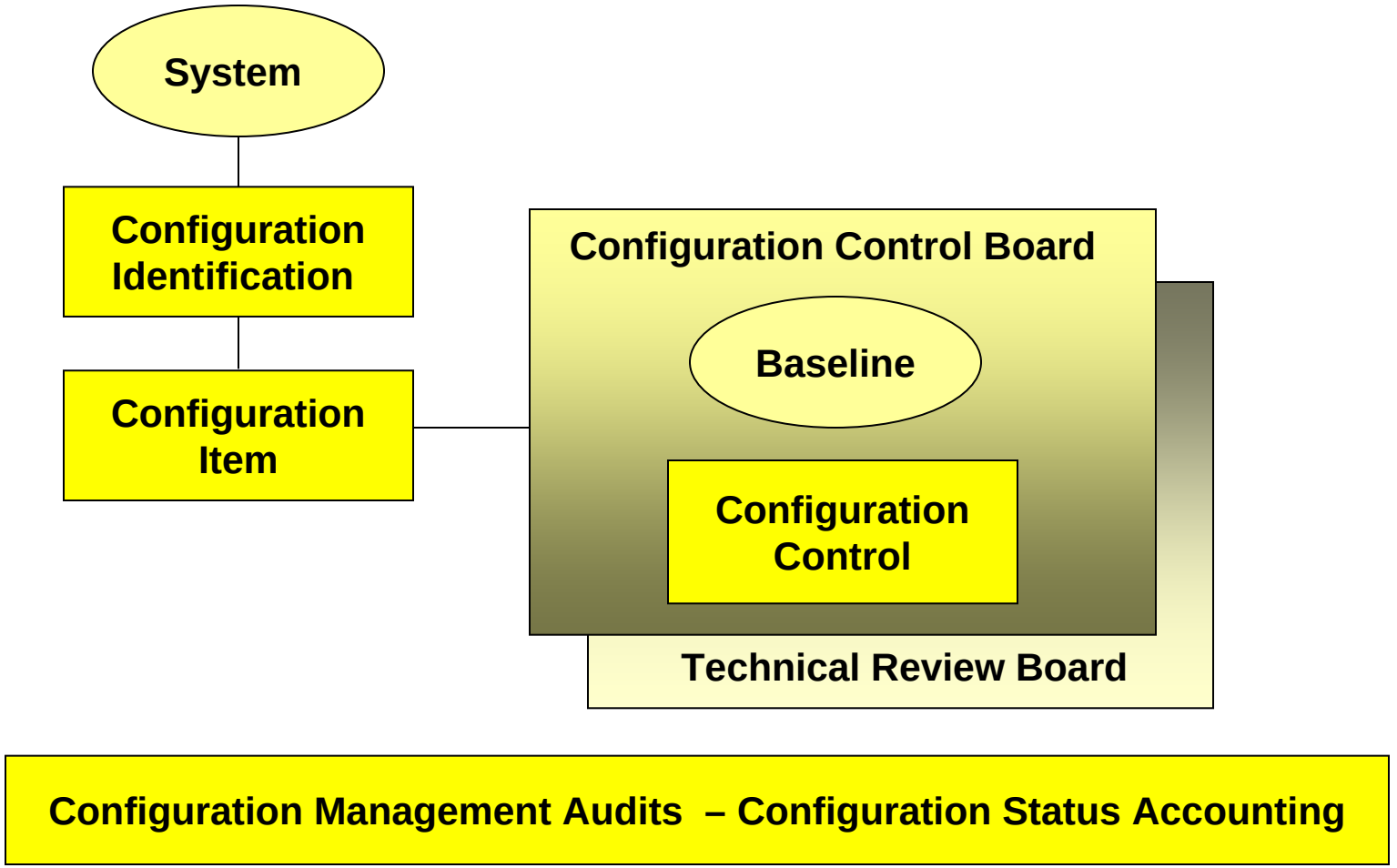
CM Concepts


System
Configuration Identification
Configuration Item
Configuration Control Board
Baseline
Configuration Control
Technical Review Board
Configuration Management Audits – Configuration Status Accounting

CM Concepts (continued)

System

- A composite of items (e.g., hardware, software, facilities, personnel, material, services, and techniques) required to perform a complete operational role

Configuration Identification

- The identified configuration of items such as hardware, software, and facilities within a system, and their physical, functional, and performance characteristics

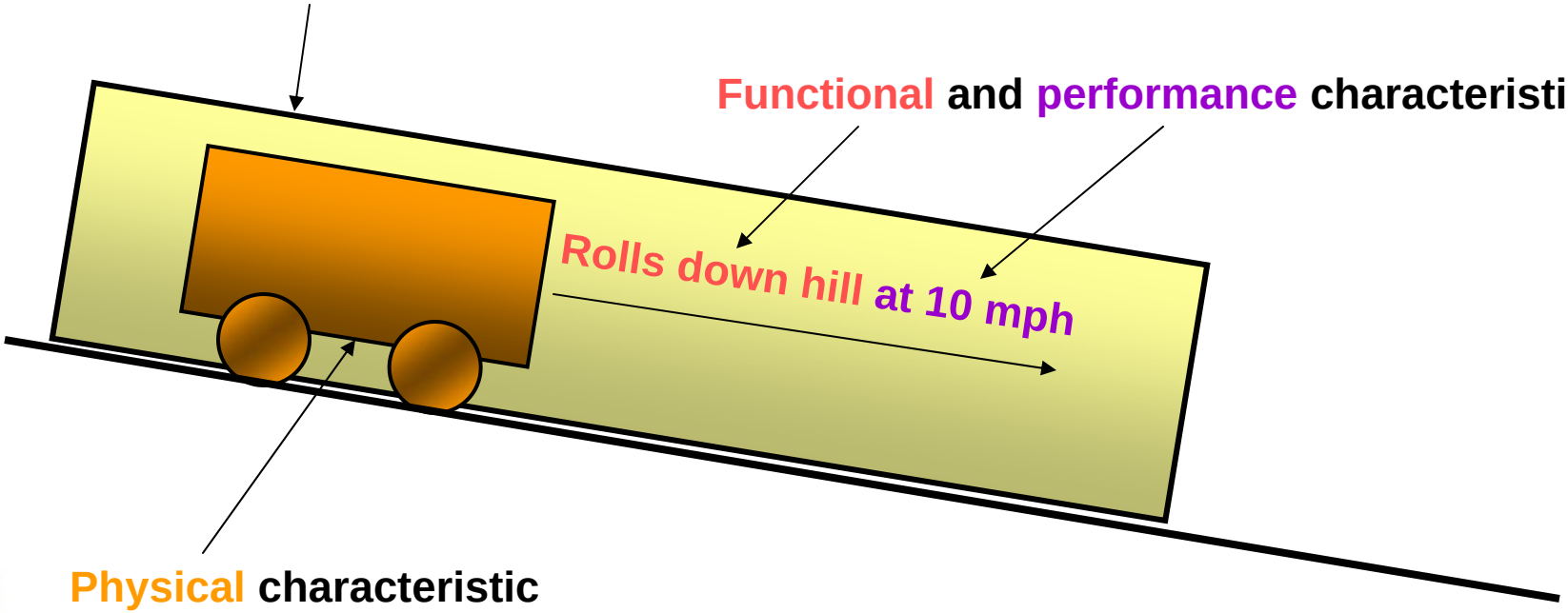
Configuration Item

- An identified configuration of an item, *or a portion of its parts*, that is designated for change control

CM Concepts (continued)

Configuration Item

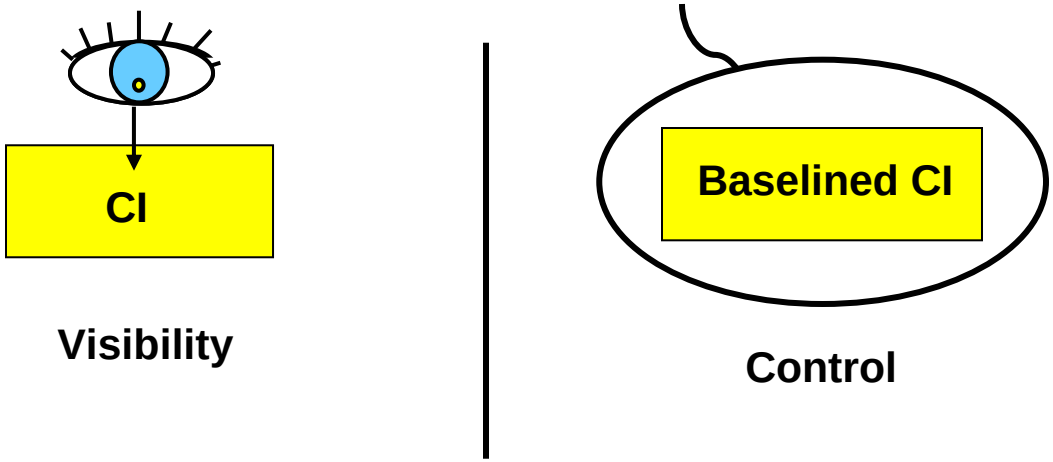
Represents the characteristics of a Configuration Item



CM Concepts (continued)

Baseline

- **The approved and fixed (baselined) configuration of a CI at a specific time in its lifecycle that serves as a reference point for change control**
  - CIs are used for visibility
  - Baselines are used for control



CM Concepts (continued)

Configuration Control

- **The systematic**
  - evaluation
  - coordination
  - approval or disapproval, and
  - implementation

  of changes to the physical, functional, and performance characteristics of a baselined CI

CM Concepts (continued)

Configuration Control Board (CCB)

- **Establishes baselines for CIs**
- **Reviews and approves / disapproves / defers Change Requests to CIs**
- **Membership comprised of management and other stakeholders and supported by subject matter experts (SMEs)**
  - Project Management
  - Systems Engineering
  - Software/Hardware Engineering
  - Test Engineering
  - Quality Assurance
  - Configuration Management
- **Chaired by the program / project manager or designee**

CM Concepts (continued)

Technical Review Board (TRB)

- **Provides technical and programmatic support to the CCB**
  - Conducts impact assessment on change requests (CRs) to baselined CIs
  - Makes approval / disapproval recommendations to the CCB
- **Membership comprised of program / project personnel and subject matter experts**
- **Chaired by a technical manager**

CM Concepts (concluded)

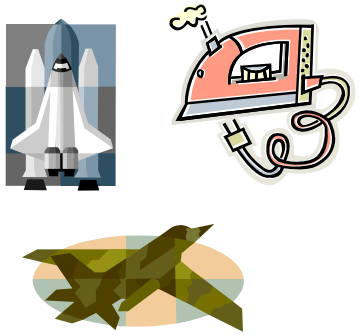
Configuration Management Audits

- **Audits are conducted on CM tasks by the CM organization and Quality Assurance to ensure that CM is being executed as described in CM process documentation**
- **At the end of development and prior to delivery, audits are conducted for the Acquirer to**:
  - Ensure that all products comply with their requirements
  - Ensure that all products comply with their design documents such as the software design, hardware design and facilities design documents

CM Concepts (continued)

Configuration Status Accounting (CSA)

- **CSA is performed to gather, correlate, maintain and provide status on controlled products (CIs), and on CM tasks**



Specifications

Products (CIs)

- CM Planning
  - Configuration Identification
  - Configuration Control
  - Configuration Audits
  - Configuration Status Accounting

CM Tasks

Where are we?

- Introduction
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- **Configuration Management in Detail**
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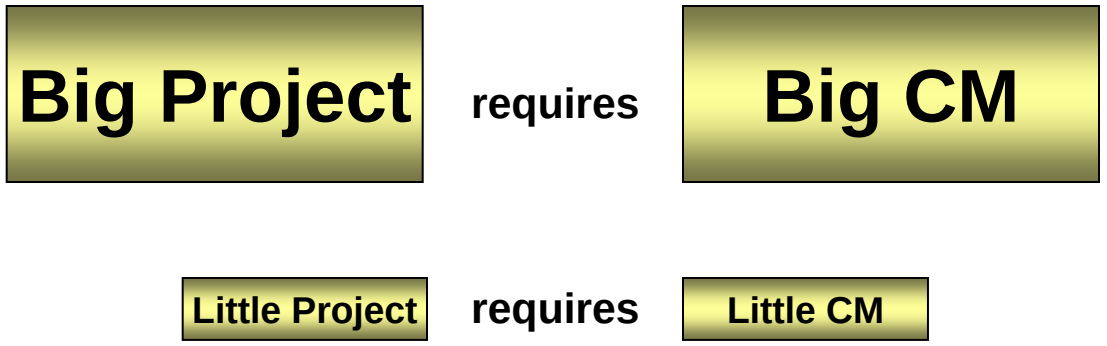
Configuration Management in Detail

This section will cover the following:

- **Configuration Management Planning**
- **Configuration Identification**
- **Configuration Control**
- **Configuration Status Accounting**
- **Configuration Management Audits**

CM Planning

- CM planning is essential if CM is to be effectively applied throughout the lifecycle of products
- When conducting CM planning for a particular program / project, the size, type, and scope of the applications and the program / project needs to be accounted for in order to provide the correct amount of CM



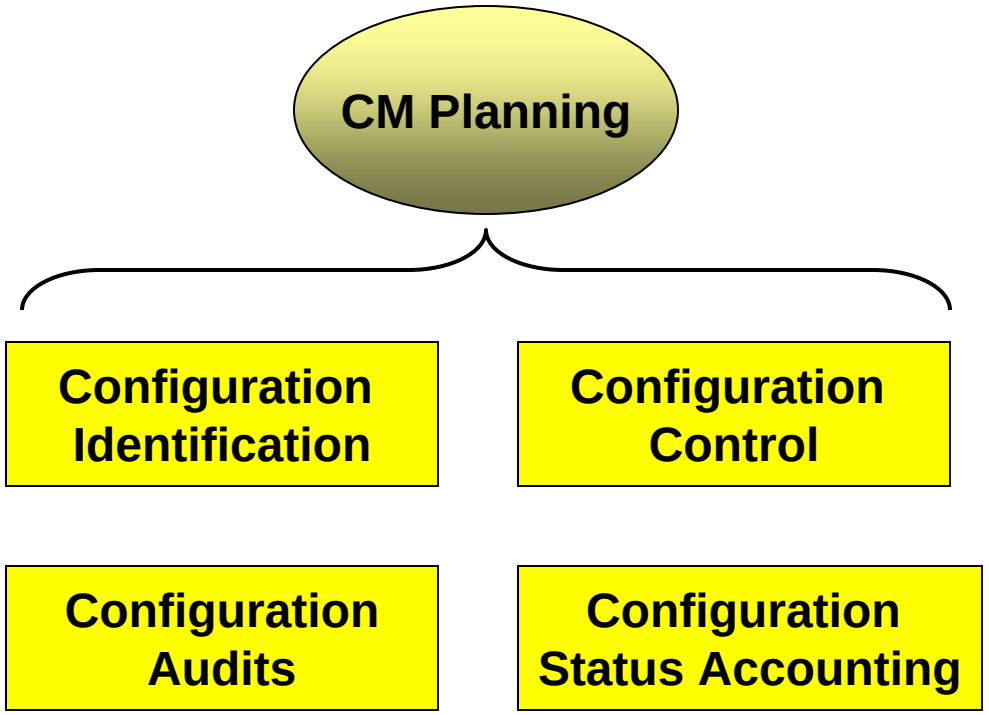
CM Planning (continued)

Planning Activities Are:

- Identifying CM Tasks
- Defining CM Roles and Responsibilities
- Selecting CM Tools
- Determining CM Resources
- Determining CM Training
- Defining CM Metrics
- Developing the CM Plan which is the output of planning

CM Planning (continued)

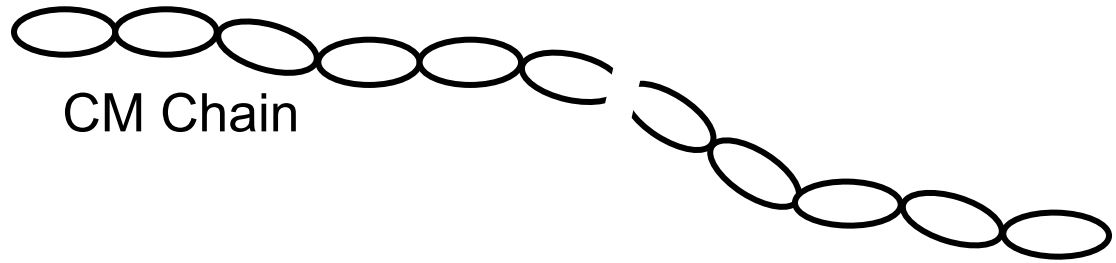
Identifying CM Tasks



CM Planning (continued)

Defining CM Roles and Responsibilities

- CM is NOT solely the responsibility of the CM organization
- CM involves all stakeholders of the program / project
- All organizations involved with the engineering and development of program / projects products have CM roles and responsibilities



CM Planning (continued)

Defining CM Roles and Responsibilities (continued)

- **Configuration Management Manager**
  - Primary responsibility for the development of the CM plan
  - Responsible for overseeing tasks assigned to the CM Organization and ensuring that they are performed
  - Submits CM plans for approval
  - Serves on the CCB (provides scribe)
  - Conducts impact assessments on CRs

CM Planning (continued)

Defining CM Roles and Responsibilities (continued)

- **Configuration Management Practitioners**
  - Primary responsibility for developing, implementing and maintaining CM plans, processes, procedures, and tools
  - Responsible for CM Repository*
  - Prepare agendas and minutes for CCB meetings
  - Administration of CRs
  - Tracks the implementation of approved CRs
  - Conducts CM Process audits
  - Responsible for CM Status Accounting

***CM Repository stores CM documentation, CM records, CM artifacts, etc.**

CM Planning (continued)

Defining CM Roles and Responsibilities (continued)

- **Program/Project Manager**
  - Authorizes CM plans
  - Ensures adequate CM resources are provided
  - Enforces CM tasks
  - Chairs the Configuration Control Board (CCB)
- **Quality Assurance**
  - Audits CM activities to ensure that CM tasks are conducted in accordance with documented plans and processes
  - Conducts impact assessments on CRs
  - Serves on the CCB

CM Planning (continued)

Defining CM Roles and Responsibilities (continued)

- **Systems Engineering**
  - Primary responsibility for definition and identification of system level CIs
  - Conducts impact assessments on CRs
  - Conducts product audits at end of development
  - Serves on the CCB
- **Hardware / Software Engineering**
  - Primary responsibility for definition, identification and implementation of hardware / software CIs
  - Conducts impact assessments on CRs
  - Conducts product audits at end of development
  - Serves on the CCB

CM Planning (continued)

Defining CM Roles and Responsibilities (concluded)

- **Test Engineering**
  - Responsible for testing CIs
  - Conducts impact assessments on CRs
  - Provide test-related CM artifacts for the CM repository
  - Conducts product audits at end of development
  - Serves on the CCB

CM Planning (continued)

Defining CM Roles and Responsibilities (concluded)

Organizations	CM Planning	Configuration Identification	Configuration Control	Configuration Status Accounting	Configuration Management Audits
Project Manager	Approves	Supports	Approves Changes	Receives Reports	Supports
Configuration Management Organization	Conducts	Facilitates	Facilitates process	Conducts	Facilitates Conducts
Quality Assurance	Audits Process Artifacts	Audits Process Artifacts	Audits Process Artifacts	Receives & Audits Reports	Witnesses Conducts
Systems Engineering	Supports	Conducts	Supports	Receives Reports	Conducts Product Audits
HW/SW Engineering	Supports	Conducts	Supports	Receives Reports	Conducts Product Audits
Test Engineering	Supports	Supports	Supports	Receives Reports	Conducts Product Audits

*** CM facilitates Product Audits and conducts other CM audits**

**** QA may also facilitate Product Audits and conduct other CM audits**

Support involves providing information and subject matter expertise, and reviewing artifacts

CM Planning (continued)

Selecting CM Tools

- **CM tools should be used to:**
  - Store CM documentation and artifacts
  - Control versions
  - Track and status CRs
  - Support administration and communication
    - Create documents and reports
    - Develop presentations
    - Produce schedules
    - Collect measurements
    - Conduct analysis / create metrics

CM Planning (continued)

Determining CM Resources

- **CM resources are comprised of:**
  - CM personnel
  - Facilities
  - Funding
  - Equipment
  - Tools
  - Supplies
  - Administrative support

CM Planning (continued)

Determining CM Training

- **CM training may include:**
  - **Project management level CM orientation**
    - CM roles and responsibilities
  - **Program / project staff CM orientation and training**
    - Orientation on CM roles and responsibilities
    - Training on CM activities
  - **CM practitioner training**
    - CM roles and responsibilities
    - In-depth CM training on CM activities
    - Use of CM tools and CM repository

CM Planning (continued)

Determining CM Metrics

Measurements are collected during the execution of the CM activities. The following are some typical CM measurements:

- **Baselines**
  - Number of items pending baselining
  - Number of actual items baselined
- **Change Requests**
  - Number of CRs approved
  - Number of CRs implemented
- **For each CR**
  - Date approved
  - Planned date closed
  - Actual date closed

CM Planning (continued)

Determining CM Metrics

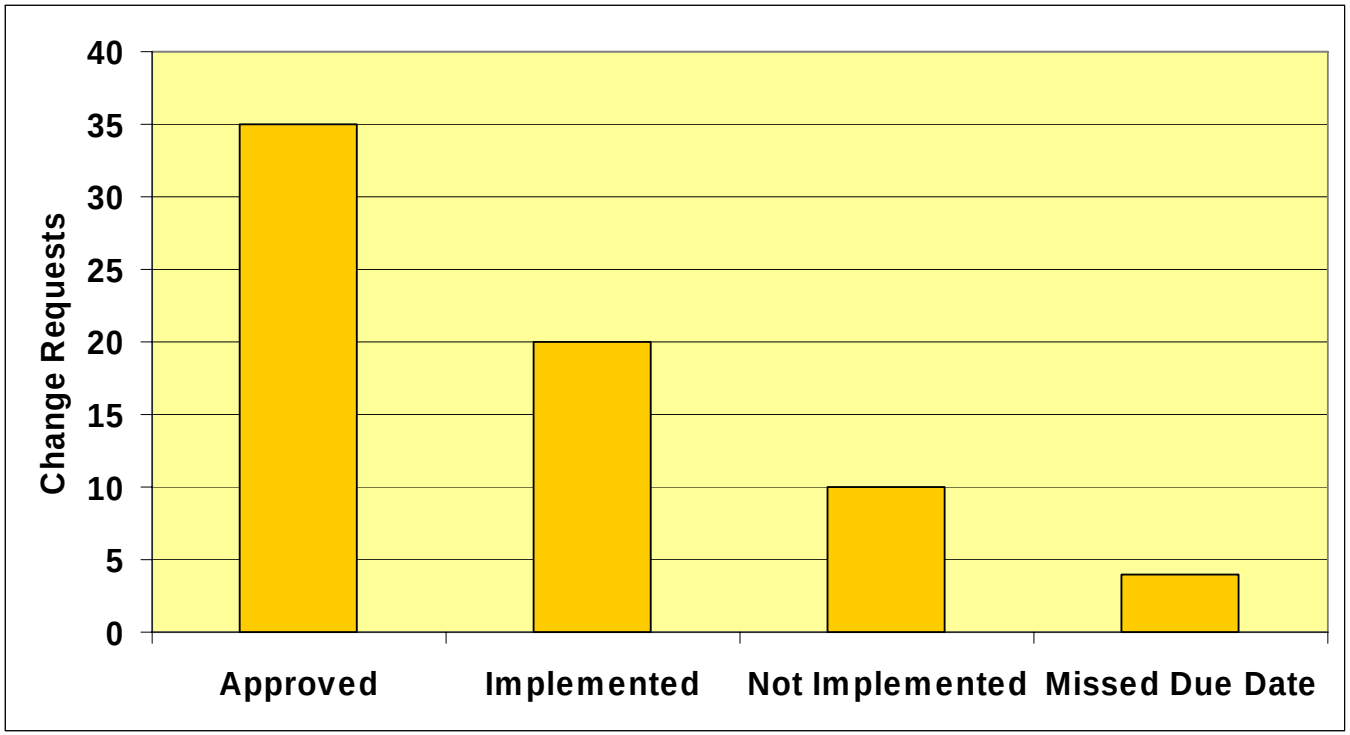
- **The measurements analyzed which result in metrics which can be shown in charts, graphs, tables, etc.**
- **Metrics can be used to:**
  - Provide status to management on the CM activities, products and services
  - Determine behavior of the CM process used to conduct the activities that produce products and services
  - Make management decisions and corrections to bring products and activities under control when required
  - Identify areas where the CM or engineering process is unstable, which may lead to process improvement

CM Planning (continued)

Metrics Example

Change Requests as of November 4, 2003

Number Approved	Number Implemented	Number Not Implemented	Number Missed Due Date
35	20	10	4



CM Planning (continued)

Developing the CM Plan

- The purpose of the CM Plan is to describe the processes, products, and organizational responsibilities required to implement effective CM functions on programs / projects
- The Plan presents CM as it is applied to a particular program / project and tailors the CM approach appropriately to the scope of the application
  - A large application needs BIG CM
  - A small application needs small CM
- More on tailoring CM will be presented later

The CM Plan should <u>not</u> include detailed CM processes that require frequent update

Developing the CM Plan (concluded)

The Plan contains the following:

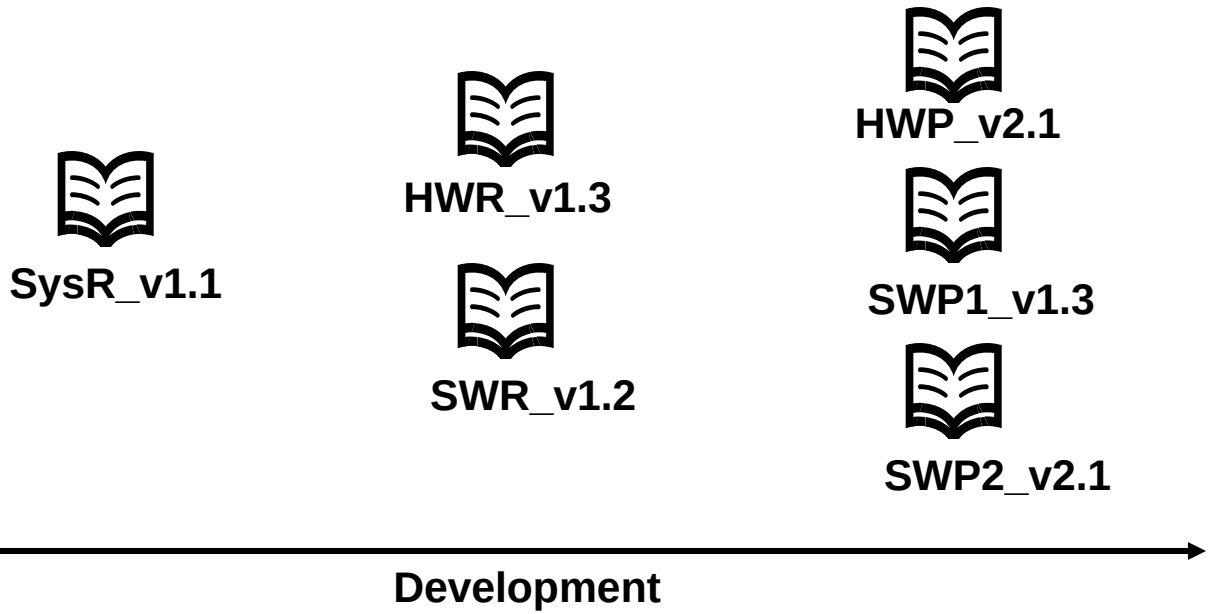
- **Introduction of the plan's purpose, scope, and contents**
- **An overview of the CM tasks**
  - Configuration Identification
  - Configuration Control
  - Configuration Audits
  - Configuration Status Accounting
- **Organizational CM roles and responsibilities**
- **CM risk management**
- **CM resources**
- **CM metrics**
- **High level milestone and schedules relating to CM**

Configuration Management in Detail

- **Configuration Management Planning**
- **Configuration Identification**
  - Configuration Items
  - Baselines
- **Configuration Control**
- **Configuration Status Accounting**
- **Configuration Management Audits**

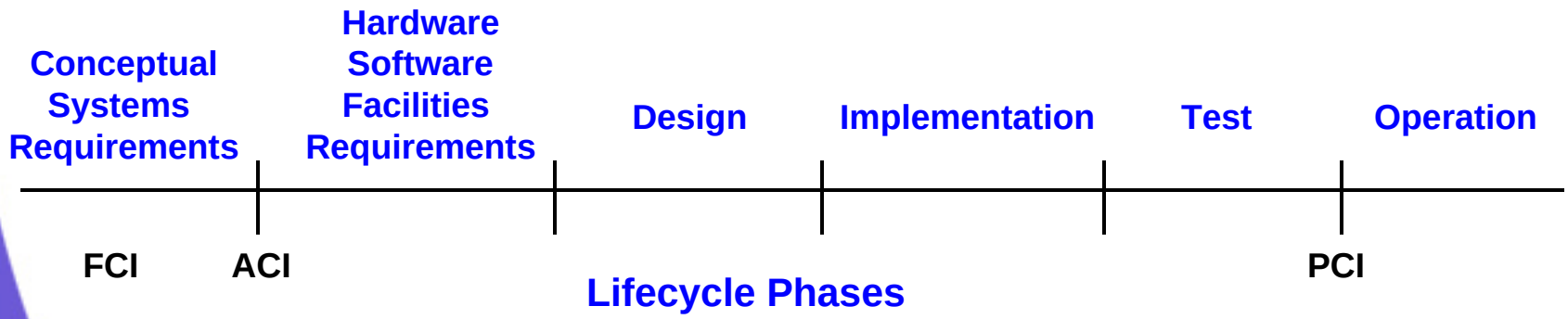
Configuration Identification

- Configuration Identification is established in the form of documentation of items that becomes more detailed as development proceeds
- It is important to assign unique identifiers to items
  - Supports version identification and control



Configuration Identification (continued)

- Three level of Configuration Identification are established
  - Functional Configuration Identification (FCI)
  - Allocated Configuration Identification (ACI)
  - Physical Configuration Identification (PCI)

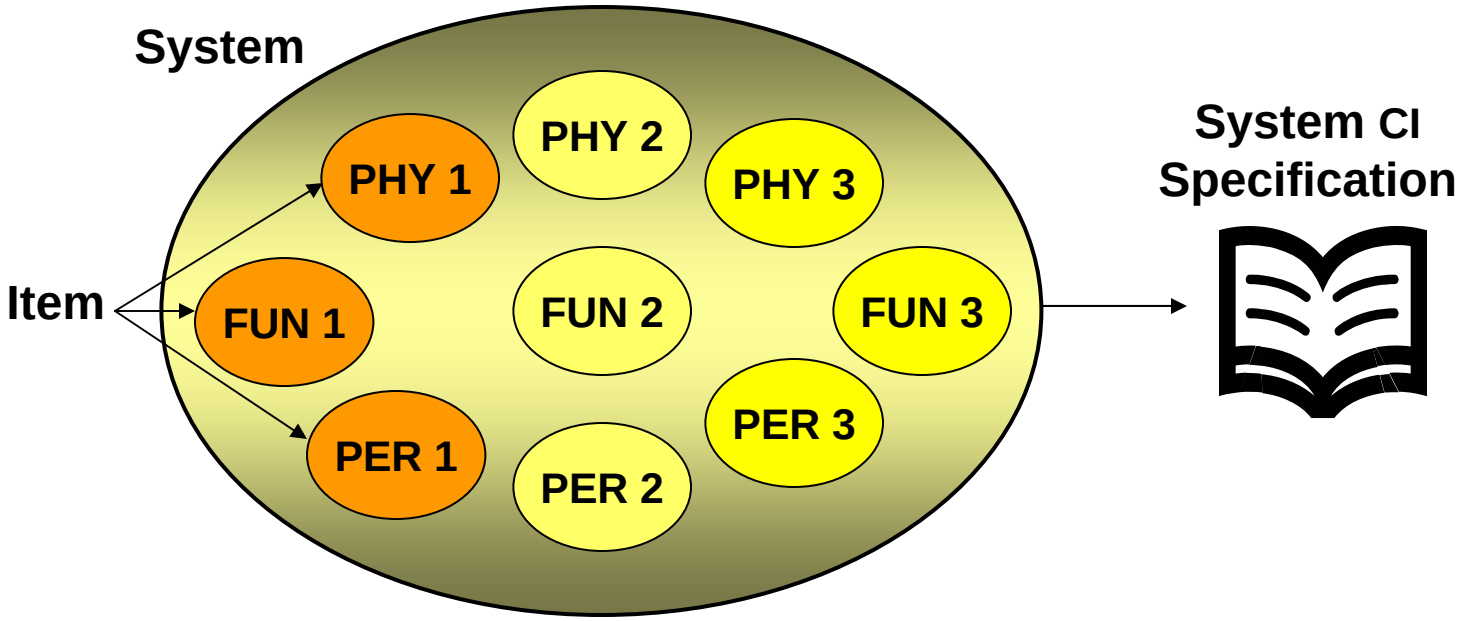


Configuration Identification (continued)

Functional Configuration Identification

Functional Configuration Identification (FCI)—[1, 2]

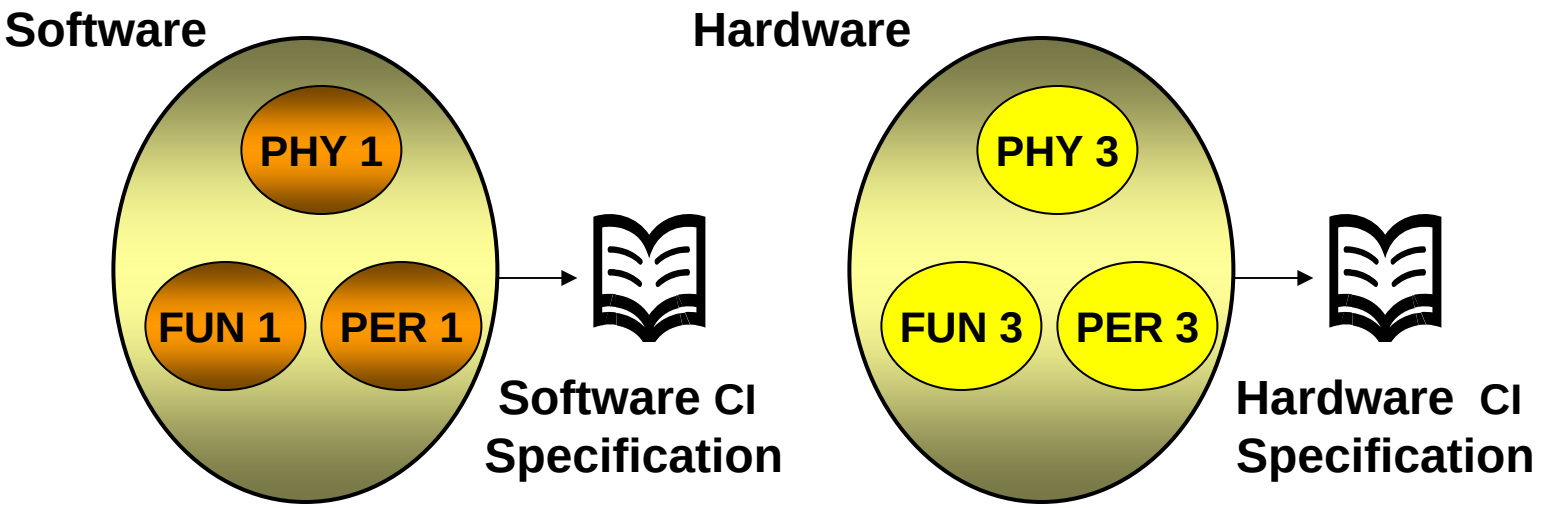
The identified system and system items and their physical, functional, and performance characteristics which are documented in a System CI Specification



Allocated Configuration Identification

Allocated Configuration Identification (ACI)—[1, 2]

Later in development the physical, functional, and performance characteristics of the system are allocated to lower level entities: software, hardware, facilities, and documented as CI Specifications

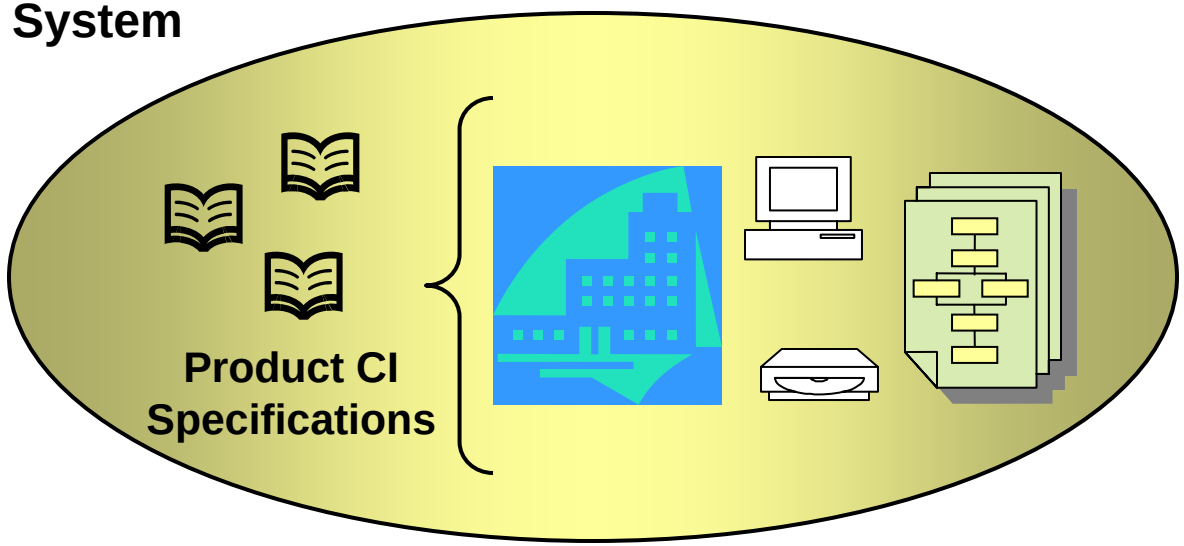


Configuration Identification (continued)

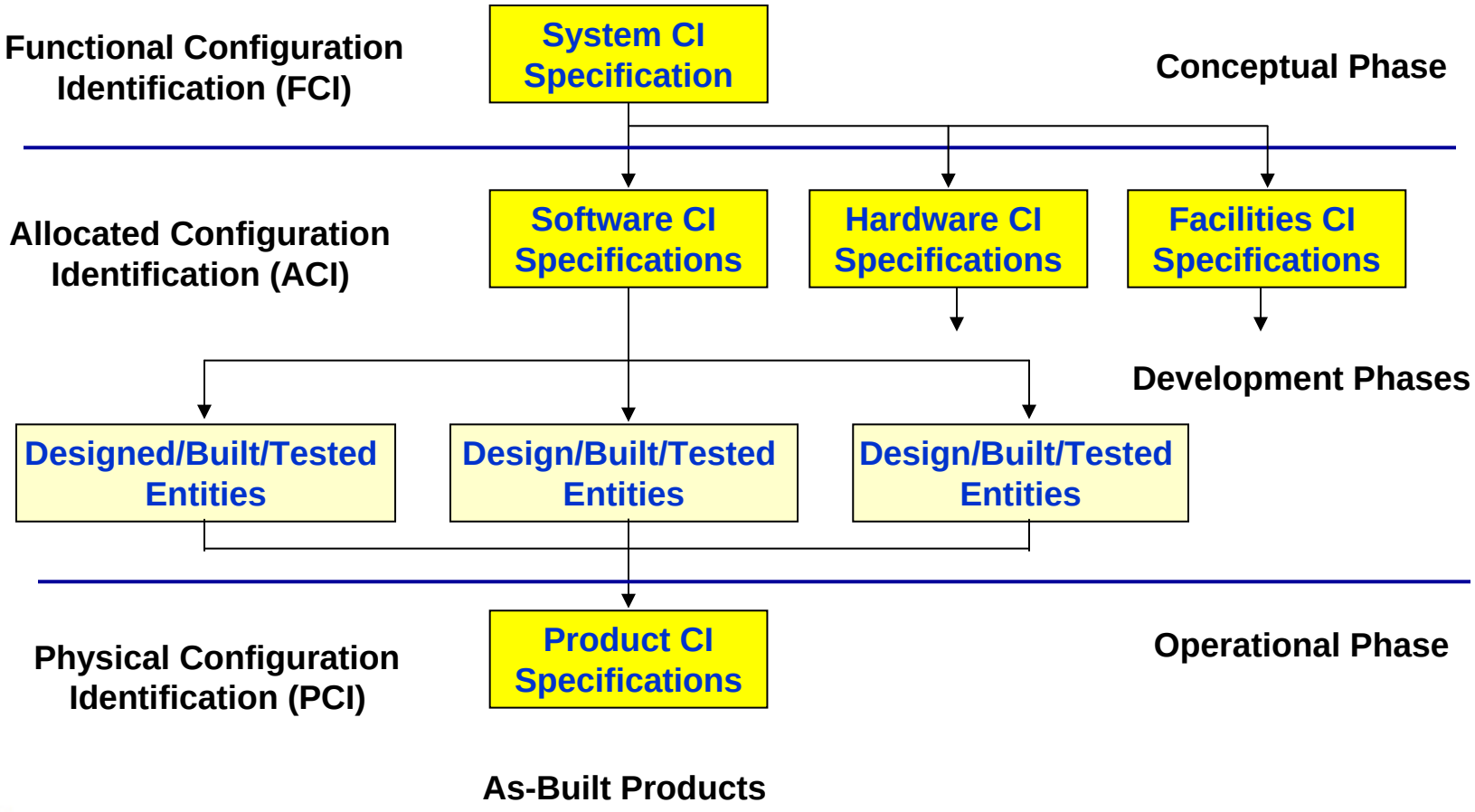
Physical Configuration Identification

Physical Configuration Identification (PCI)[1, 2]

Finally, the products of the developed system: software, hardware, facilities are defined in a series of Product CI Specifications that describe the as-built system



Configuration Identification (concluded)

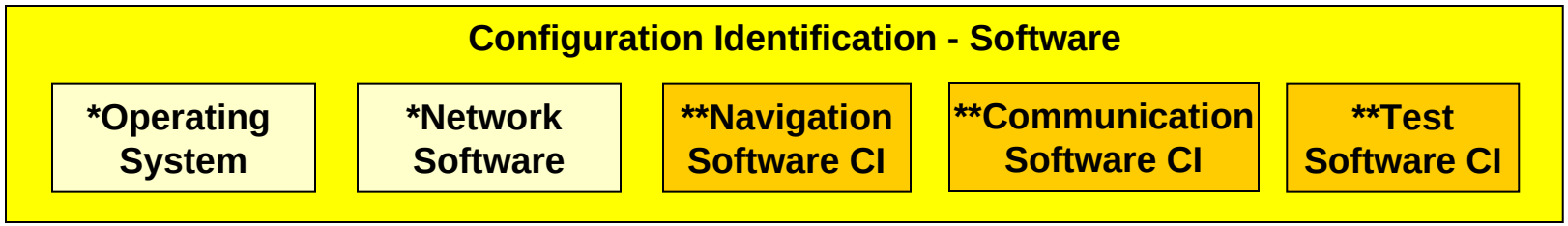


CM Concepts in Detail (continued)

Configuration Items

Configuration Identification and Configuration Items

- Configuration Identification is an activity that identifies items and their characteristics: physical, functional, and performance
- Not all items that are identified need be controlled at the same level of rigor
- Configuration Items are selected for formal change control from items identified

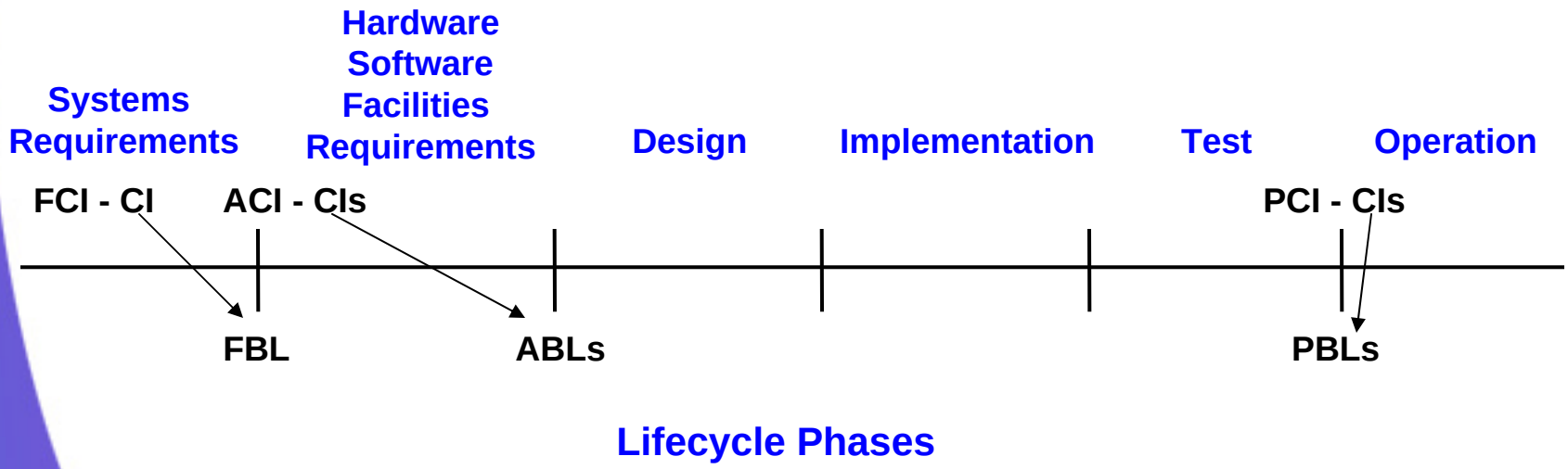


***These are commercial products not subject to change – In operation (production) everything is under CM control**
****Applications software in development that is subject to change**

Baselines

Baselines are established at strategic points in a system lifecycle. Three baselines may be defined

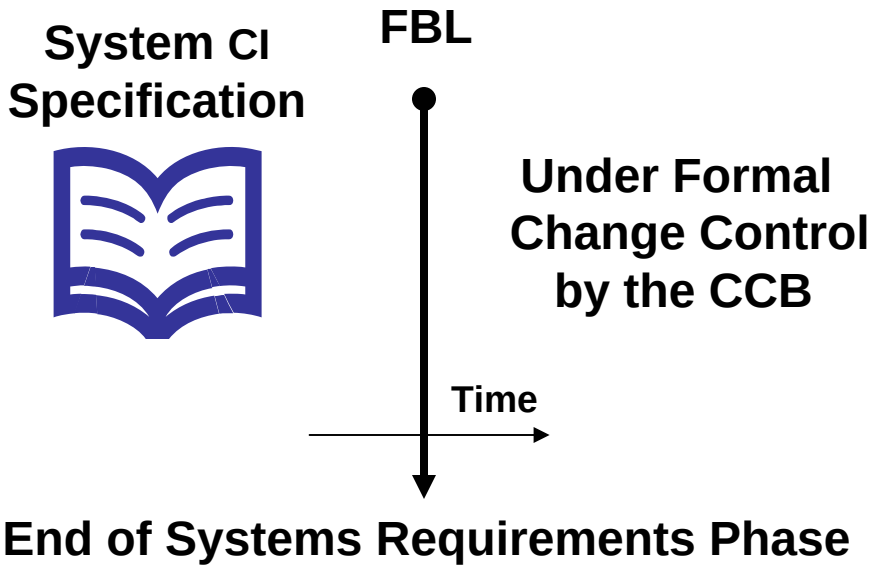
- Functional Baseline (FBL)
- Allocated Baseline (ABL)
- Product Baseline (PBL)



Baselines (continued)

Functional Baseline

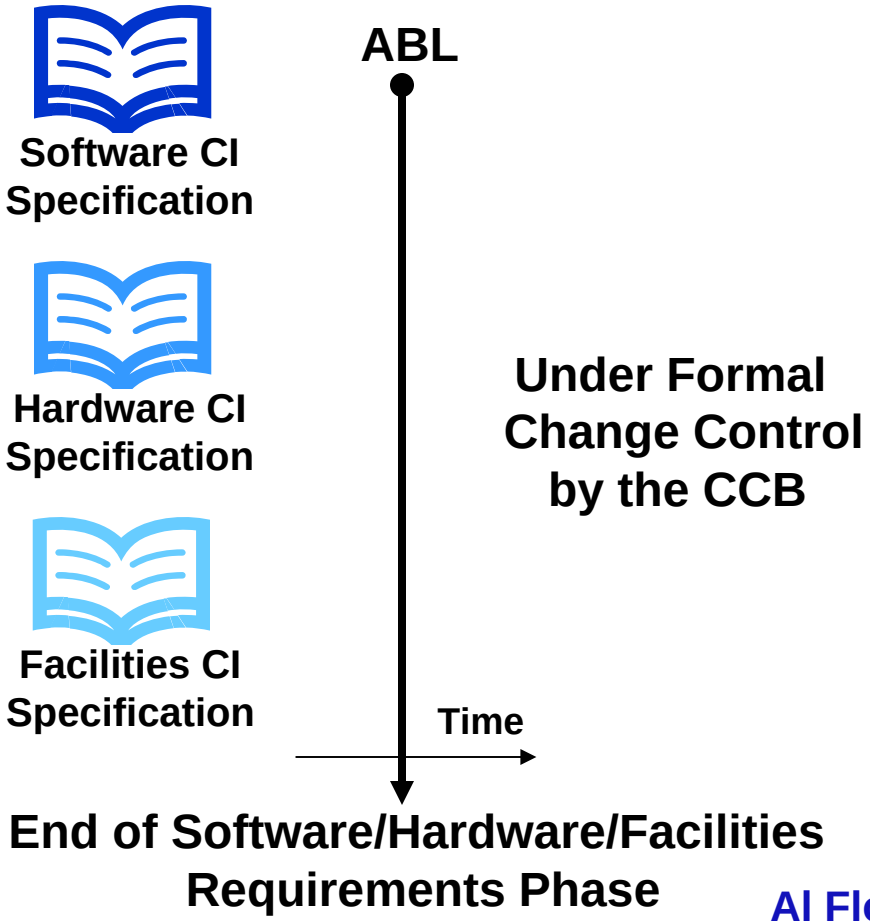
Functional Baseline (FBL)—Established for the CI of the System Functional Configuration Identification when System Requirements Phase of the system lifecycle is completed [1, 2]



Baselines (continued)

Allocated Baseline

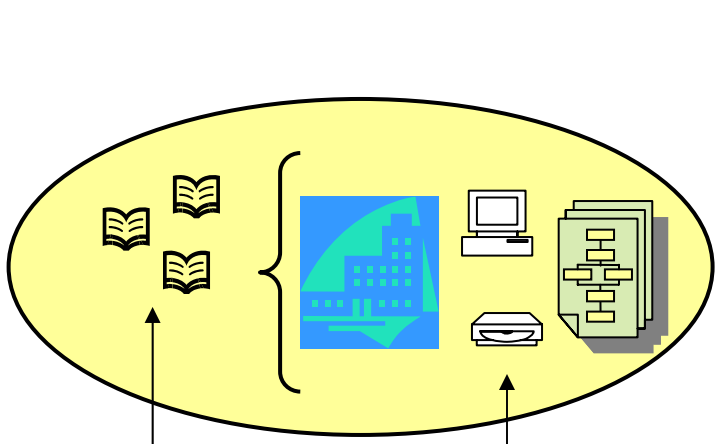
Allocated Baseline (ABL)—[1, 2] Established for the CIs of the Allocated Configuration Identification later in development for software, hardware, facilities, etc.

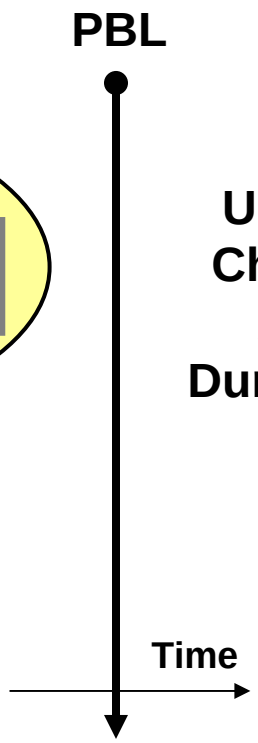


Baselines (continued)

Product Baseline

Product Baseline (PBL)—[1, 2] Established for the developed products (CIs) of the Physical Configuration Identification at the end of development

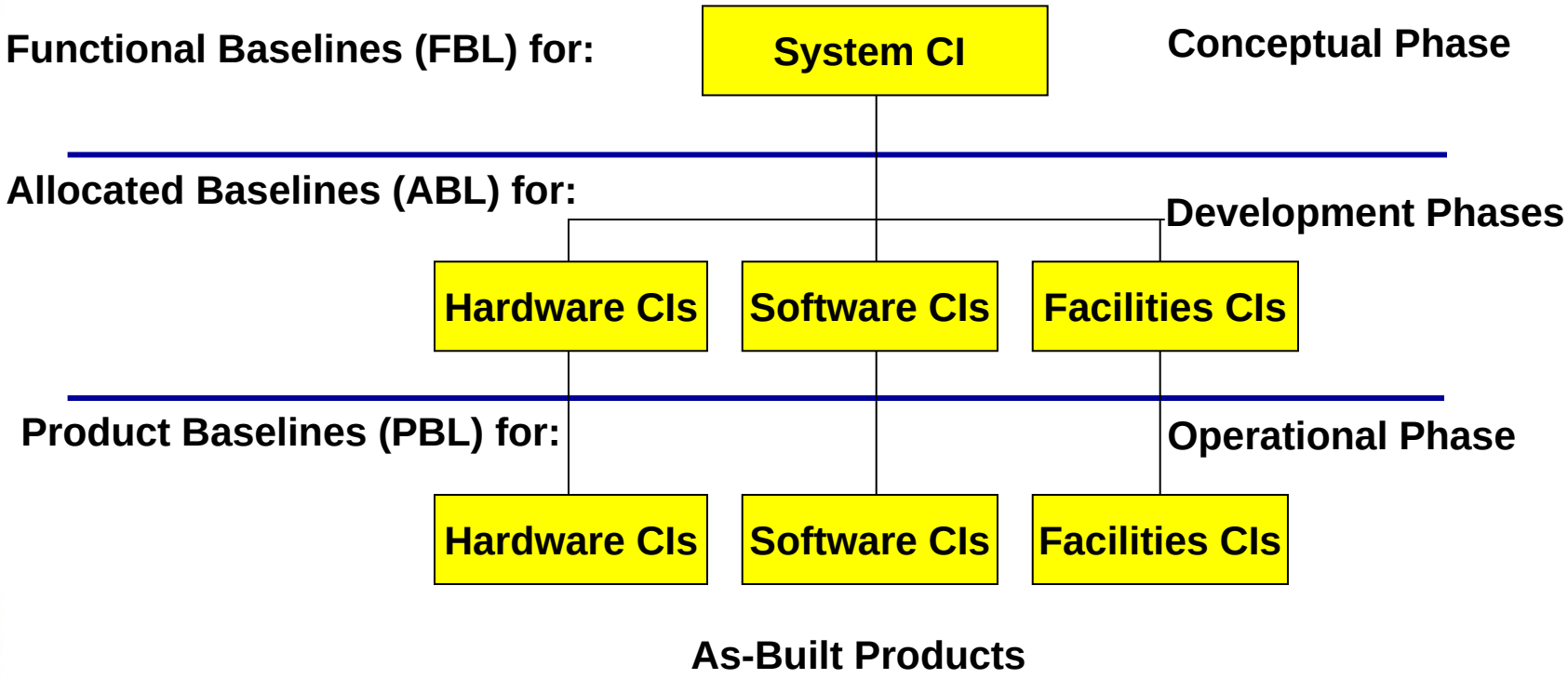




Under Formal Change Control by the CCB During Operation

End of Development Prior to Delivery to Customer

Baselines (continued)



Baselines (concluded)

It gets more complex:

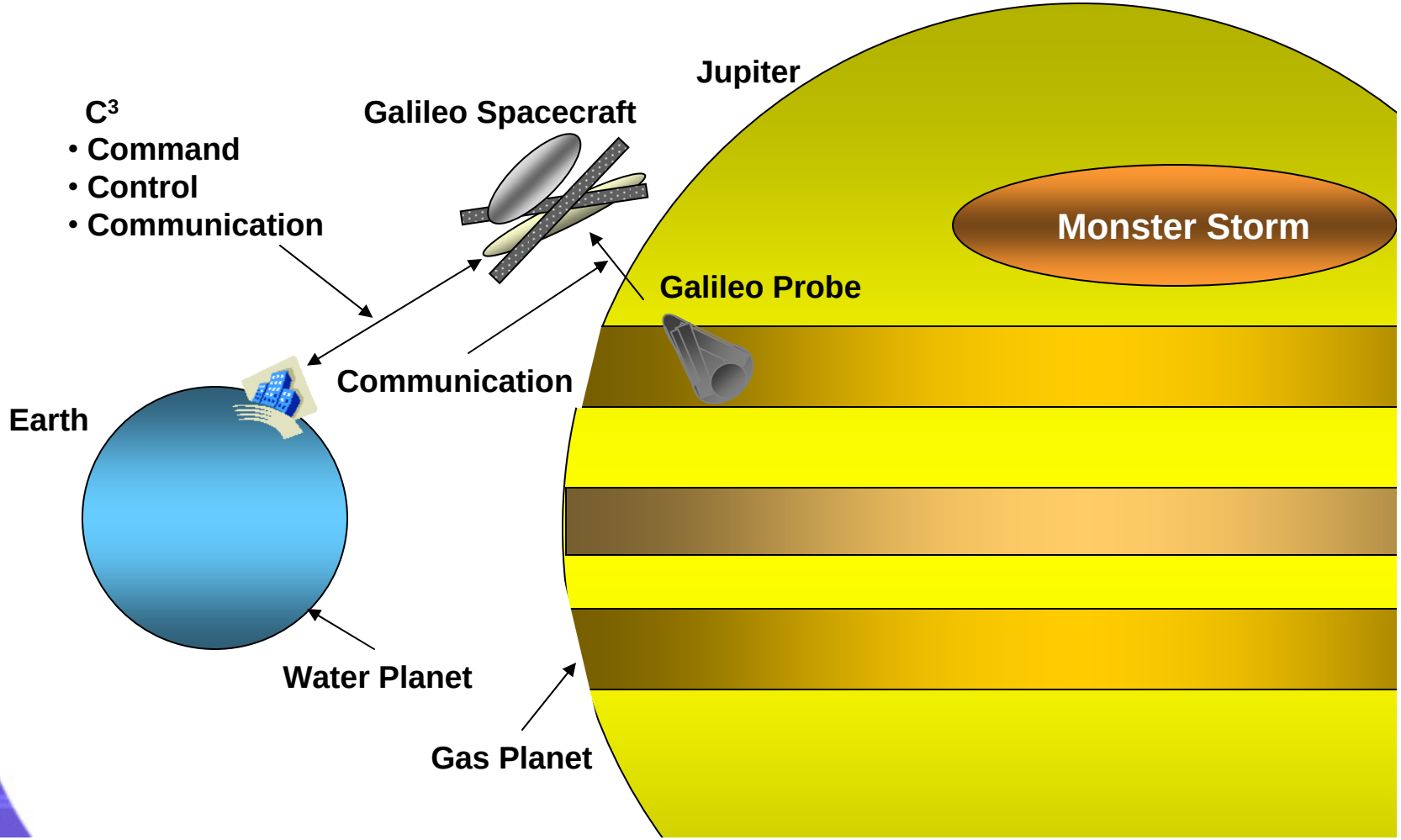
- **As development progresses CIs evolve and include more detail:**
  - Initially the CIs are represented as requirements documented in CI Requirements Specifications
  - Later the CIs are represented in:
    - Design documents
    - Test plans
    - Code (for software)
    - Test procedures
    - Test results

  - During development only CIs that have achieved the Functional Baseline and the Allocated Baseline for the CI Specifications are designated for formal CCB control*

*** As described for this presentation and as reflected in references 1 and 2.**

Example

A NASA spacecraft (Galileo) orbits Jupiter and releases a probe to conduct scientific experiments on the planet's atmosphere



Example (continued)

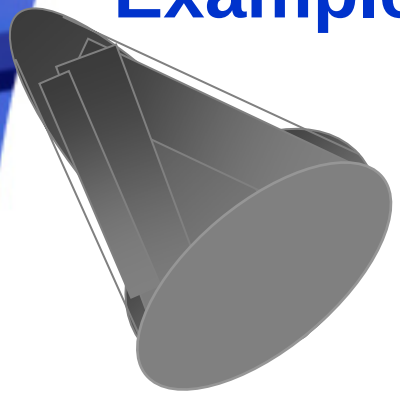
Functional Configuration Identification

1. Identify 3 configuration Items of one subsystem – earth station, spacecraft, probe
2. List the some physical, functional, and performance characteristics of one item
3. Allocate these characteristics to software, hardware, systems, and facilities as appropriate
4. Write these allocations as “shall” requirements

Example (continued)

- **Jupiter**
  - A gas planet
  - No terrestrial surface
  - High atmospheric pressures
  - Compresses to a hard state at surface
- **Spacecraft**
  - 45 minute one way communication delay at speed of light to/from earth/spacecraft
- **Probe**
  - Autonomous control
  - One way communications from probe to spacecraft
  - 40 minute science data collection life
  - Implodes due to high atmospheric pressures

Example (continued)



PROBE

Configuration Items:

1. Parachute
2. Heat Shield
3. Science Instruments

Heat Shield characteristics:

A. Physical:
- **A.1 Three feet in diameter**
- **A.2 Half inch thick graphite**
- **A.3 Perfect circular and spherical curvature shape**

B. Functional:
- **B.1 Protect probe from over heating**

C. Performance:
- **C.1 Jettisoned 48 hours 20 minutes after separation from spacecraft**
- **C.2 Jettisoned within one second of jettison command**
- **C.3 Withstands temperatures up to 500 degrees Fahrenheit**

Example (continued)

Probe Heat Shield

Heat Shield Allocations:

A. Physical:	
A.1 Three feet in diameter	**Hardware (HW)**
A.2 Half inch thick graphite	**Hardware**
A.3 Perfect circular and spherical curvature shape	**Hardware**
B. Functional	
B.1 Protect probe from over heating	**System**
C. Performance	
C.1 Jettisoned 48 hours 20 minutes after separation from spacecraft	**Software/HW**
C.2 Jettisoned within one second of jettison command	**Software/HW**
C.3 Withstands temperatures up to 500 degrees Fahrenheit	**Hardware**

Example (completed)

Probe Heat Shield

Allocated Shall Requirements:

HW1 Heat Shield physical hardware requirements
- **HW1.1 The heat shield shall be three feet in diameter.**
- **HW1.2 The heat shield shall be constructed of half inch thick graphite.**
- **HW1.3 The heat shield shall be of a perfect circular and spherical curvature shape.**

Sys1 Heat Shield functional system requirements
- **Sys1.1 The heat shield shall protect the probe from over heating.**

SW1 Heat Shield software performance requirements (Also Hardware)
- **SW1.1 The heat shield shall be jettisoned 48 hours 20 minutes after separation from spacecraft.**
- **SW1.2 The heat shield shall be jettisoned within one second of jettison command.**

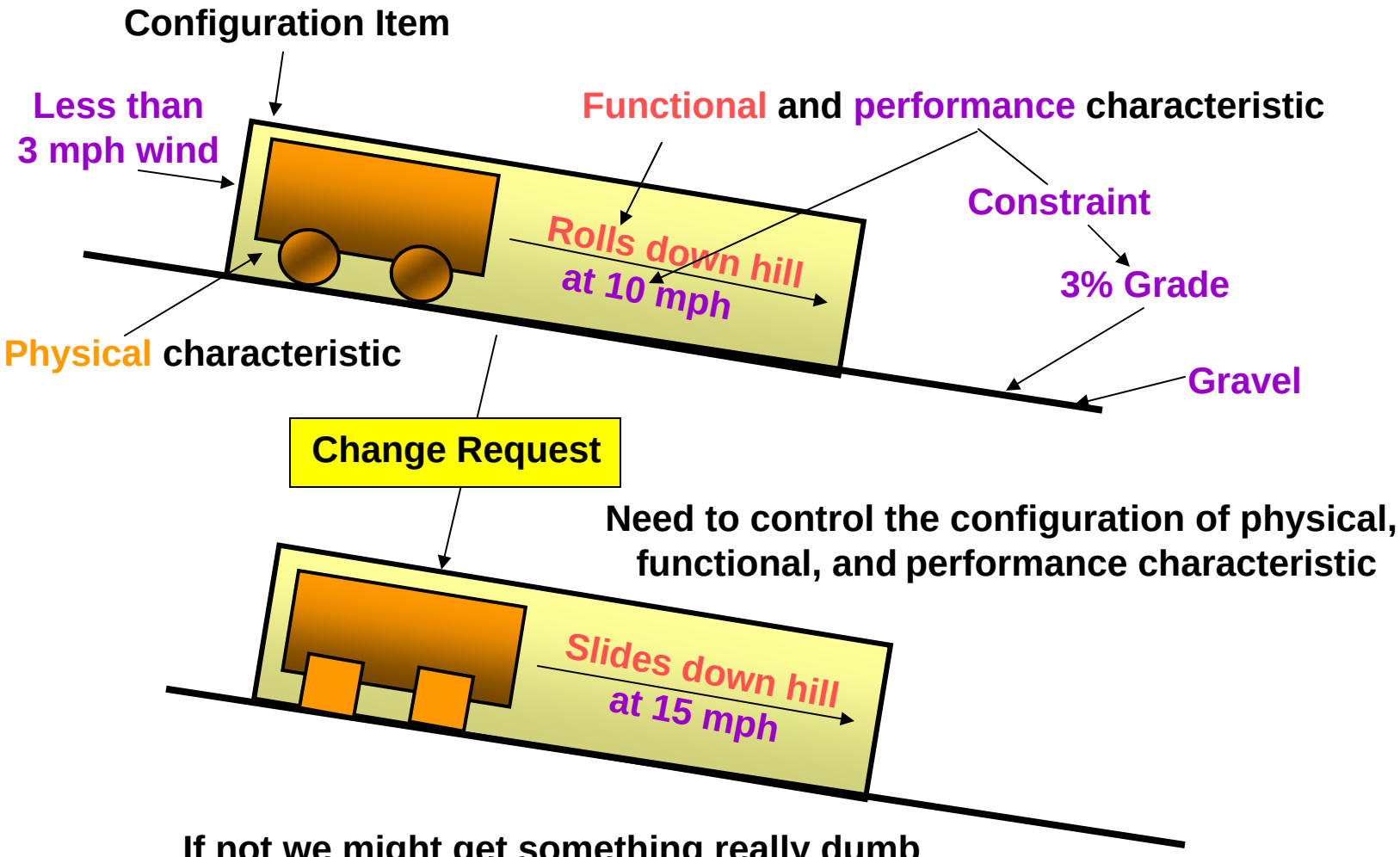
HW2 Heat Shield hardware performance requirements
- **HW2.1 The heat shield shall withstand temperatures up to 500 degrees Fahrenheit.**

Configuration Management in Detail

- Configuration Management Planning
- Configuration Identification
- Configuration Control
  - CCB and TRB
- Configuration Management Audits
- Configuration Status Accounting

CM Concepts in Detail (continued)

Configuration Control



Configuration Control (continued)

How are Changes Accomplished?

- **Request Change**
  - Someone requests a change to a CI using a CR form
- **Evaluate Change**
  - The TRB conducts an impact assessment to ensure that all stakeholders evaluate the impact against their interests
- **Approve Change**
  - The CCB approves, disapproves or defers the CR
- **Implement Change**
  - The change is implemented in all affected items
- **Track Changes**
  - Changes are audited to verify that they are implemented as approved and tracked against the change schedule

CM Concepts (concluded)

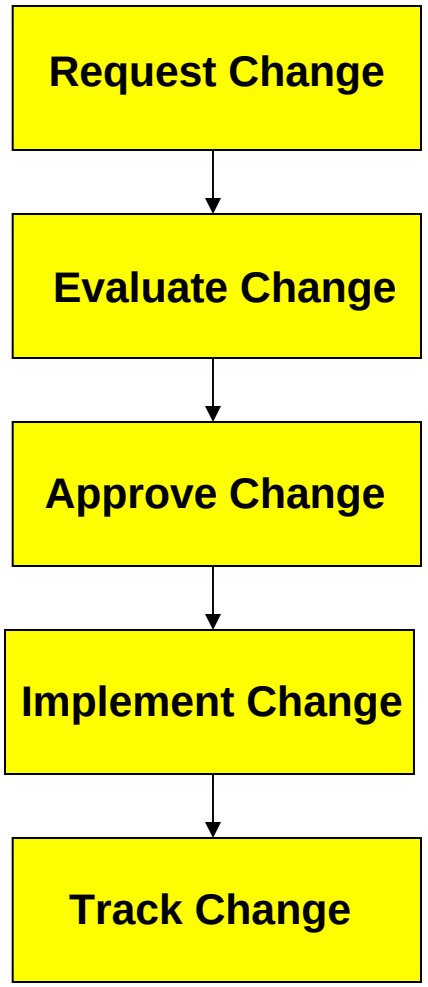
CR Example

Change Request

CR #	**Date:** 12/4/2003	**Requestor:** ET	**Class:** I ☐ II ☐
Problem: A requirement to deploy the probe's parachute does not exist			
Change: Add the following requirement: The probe's parachute shall be deployed 10 seconds after the heat shield has been jettisoned			
Impacts: Enter figures for cost and schedule and list affected interfaces or "None" and attach impact assessments Systems: Hardware: Software: Test: Configuration Management: Quality Assurance: Contracts: Other [Specify]:			
Approve:	TRB Date: CCB Date:	Chair: Chair:	
Disapprove:	TRB Date: CCB Date:	Chair: Chair:	
Assignee:		**Due Date:**	

Configuration Control (continued)

Change Flow



Supplier or Acquirer

TRB

CCB

Owner of item

CM staff and owner of item

Configuration Control (continued)

Impact Assessments

- **Impact assessments need to be conducted by all stakeholders:**
  - Systems
  - Hardware
  - Software
  - Test
  - Configuration Management
  - Quality Assurance
  - Contracts
  - Others
- **On CI characteristics:**
  - Physical
  - Functional
  - Performance
- **Against their interests:**
  - Cost
  - Schedule
  - Interface

Configuration Control (continued)

Classification of Changes

At least two types of changes can be defined:

- **[1, 2] Class I—affects the Acquirer's interest in one or more of these factors:**
  - Physical characteristics
  - Functional capability
  - Performance
  - External interfaces
  - Cost
  - Schedule

Supplier must submit change to the Acquirer for approval before implementation (Based on Thresholds)

Classification of Changes (concluded)

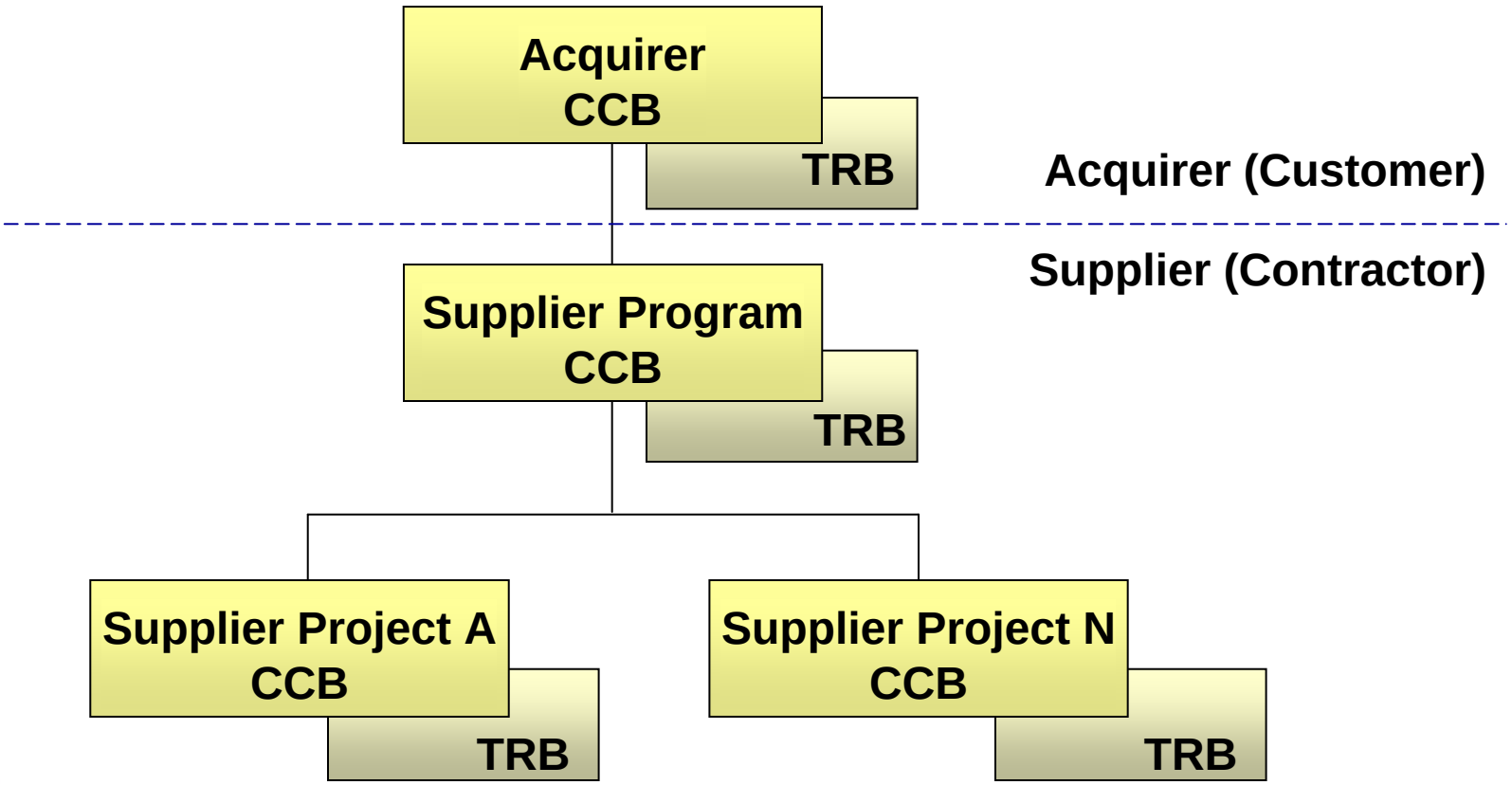
- [1, 2] **Class II**
  - Does not affect any of the class I factors
  - Affects changes such as:
    - Spelling or typographical errors
    - Addition of clarifying comments
    - Changes that do not affect external interfaces, change functionality or degrade performance

Supplier may implement it without Acquirer's approval but must inform Acquirer of change

CCB and TRB

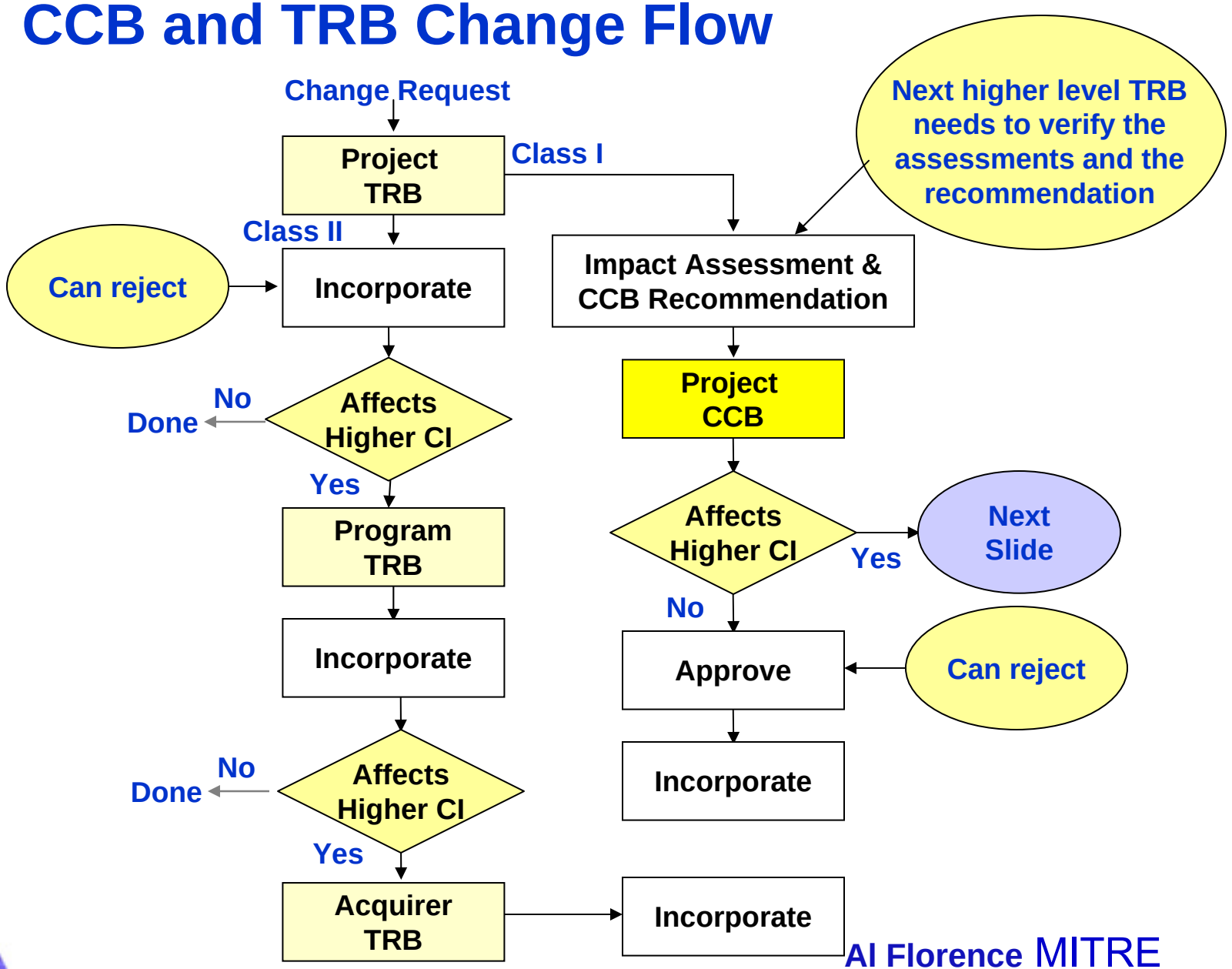
- CCB is a formal board dealing with contractual items such as requirements specifications
- CCB membership consists of senior and program management
  - Very busy, and "$$$" to deal with lower-level items
- TRBs are less formal and deal with internal control of items such as design, implementation, and test
- TRBs act as a winnowing agent on items that should not go to the CCB
- TRBs conduct impact assessments on CRs and make recommendation to the CCB of approval or rejection
- TRB membership consist of program technical management and subject matter experts, "$$" that provides technical support to the CCB

CCB and TRB Hierarchy



CCB and TRB (continued)

CCB and TRB Change Flow



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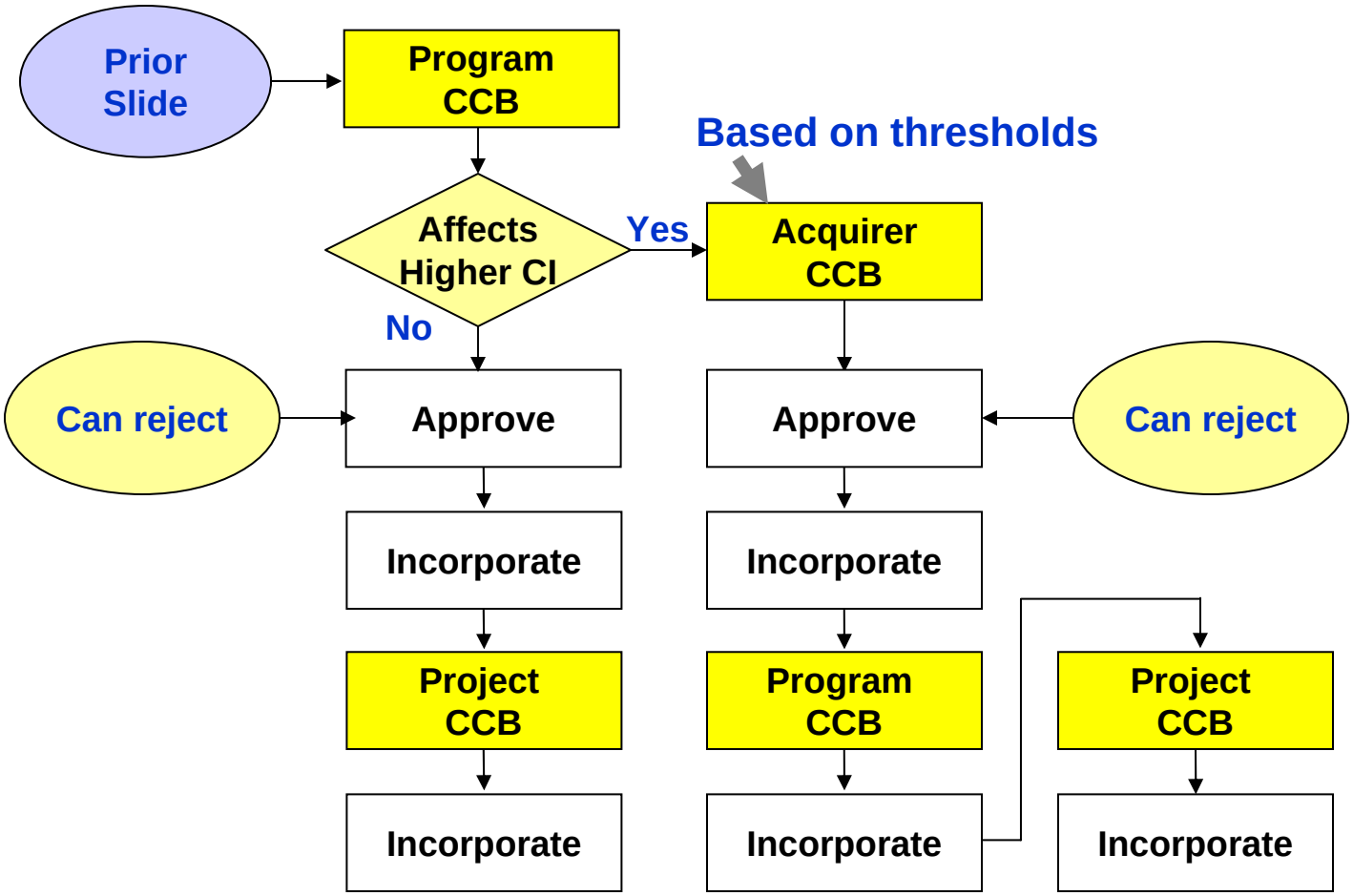
CCB and TRB Change Flow (concluded)

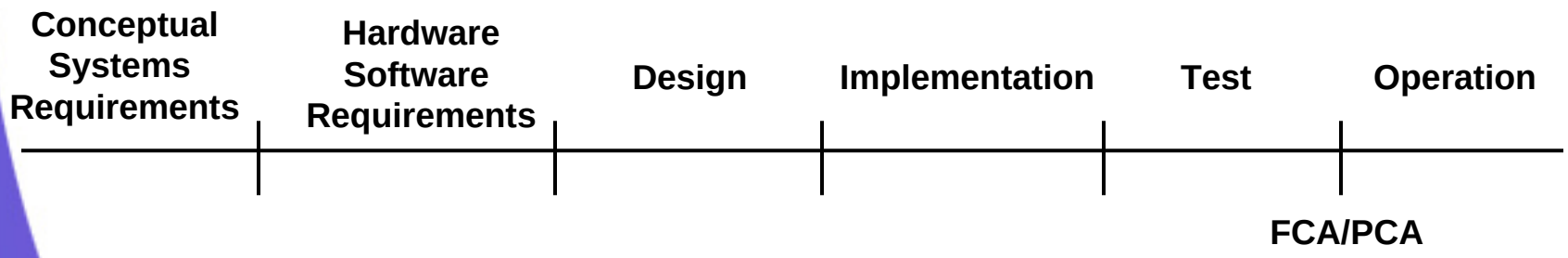


Configuration Management in Detail

- Configuration Identification
- Configuration Items
- Baselines
- Configuration Control
- **Configuration Management Audits**
- Configuration Status Accounting

CM Audits

- Functional Configuration Audits (FCA) and Physical Configuration Audits (PCA) are conducted by Engineering and facilitated by CM and/or QA
- Other audits conducted by QA and CM may include:
  - Audits of CM Repository that contains CM records, documentation, processes, procedures, artifacts, etc.
  - Audits of Program/Project organizations to ensure CM process is being followed
  - Audits of status of approved CRs
  - Audits to ensure that CIs are consistent with CM records



CM Audits (continued)

Functional Configuration Audit (FCA)

- A formal examination of test results of the as-built functional configuration of CIs, prior to acceptance, to verify that the CIs have satisfied their specified requirements [1, 2]
- This audit is conducted by the Supplier for the Acquirer and attended by
  - Management
  - System Engineering
  - Hardware / Software Engineering
  - Test Engineering
  - QA and CM
  - Contracts

  of both the Acquirer and Supplier

CM Audits (continued)

FCA (completed)

Functional

- Requirements Specifications
- Requirements Traceability
- Test Plans
- Test Scenarios

Testing

- Products
- Tests

Test Results

- Requirements Specifications
- Requirements Traceability
- Test Plans
- Test Scenarios
- Test Results

Inputs

Functional Configuration Audit

Verify that the CIs have satisfied their specified requirements

Supplier
Acquirer

Physical Configuration Audit

CM Audits (continued)

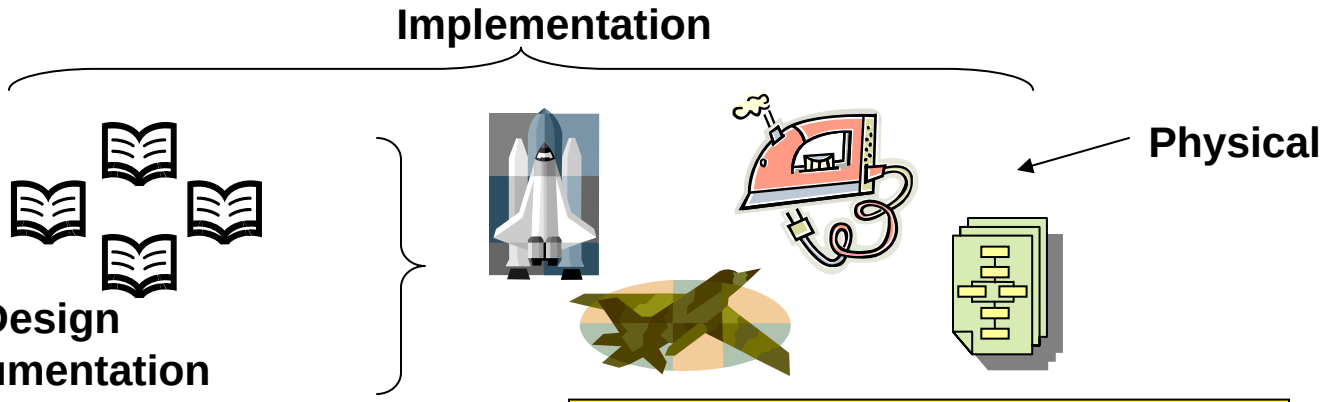
Physical Configuration Audit (PCA)

- A formal examination of the as-built physical configuration of CI products against their design documentation [1, 2]
- This establishes the Product Baseline
- This audit is conducted by the Supplier for the Acquirer and attended by
  - Management
  - System Engineering
  - Hardware / Software Engineering
  - Test Engineering
  - QA and CM
  - Contracts

  of both the Acquirer and Supplier

CM Audits (completed)

PCA (completed)



Supplier As-Built Products:

- Design Documentation
- Code
- Hardware
- Etc.

Inputs

Physical Configuration Audit

Examination of the "as-built" configuration of CIs against their documentation

Supplier
Acquirer

Outputs

Product Baselines

Configuration Management in Detail

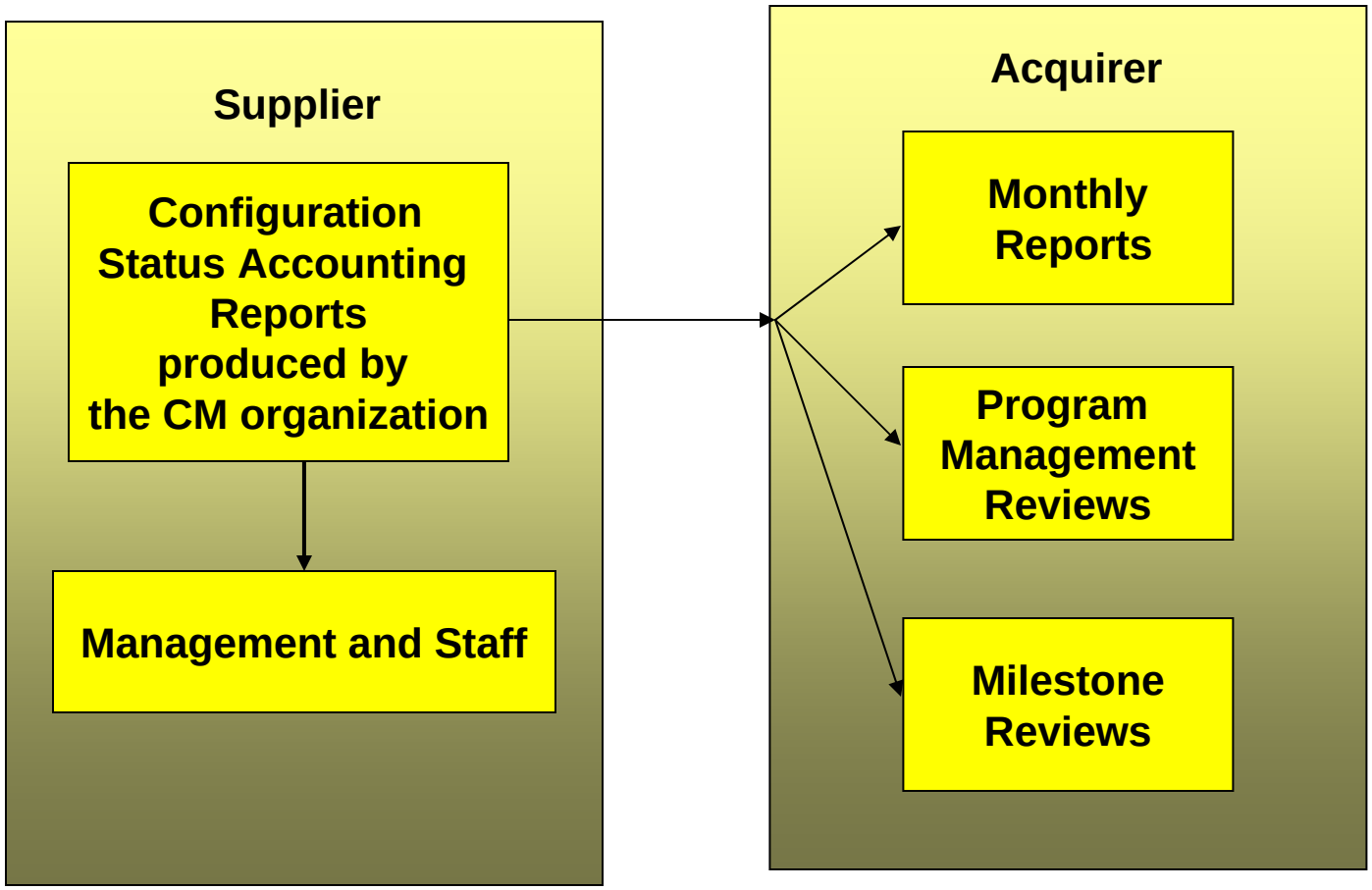
- Configuration Management Planning
- Configuration Identification
- Configuration Control
- Configuration Management Audits
- **Configuration Status Accounting**

CM Concepts in Detail (continued)

Configuration Status Accounting

- The Configuration Status Accounting (CSA) task gathers, correlates, maintains, and provides status on CM controlled products and CM tasks
- Provides the means for reporting status on:
  - Configurations
    - FCI
    - ACI
    - PCI
  - Baselines
    - FBL
    - ABL
    - PBL
  - Other
    - CM metrics
    - CM activities
    - CM Audits
- Conducted by both the Supplier and the Acquirer

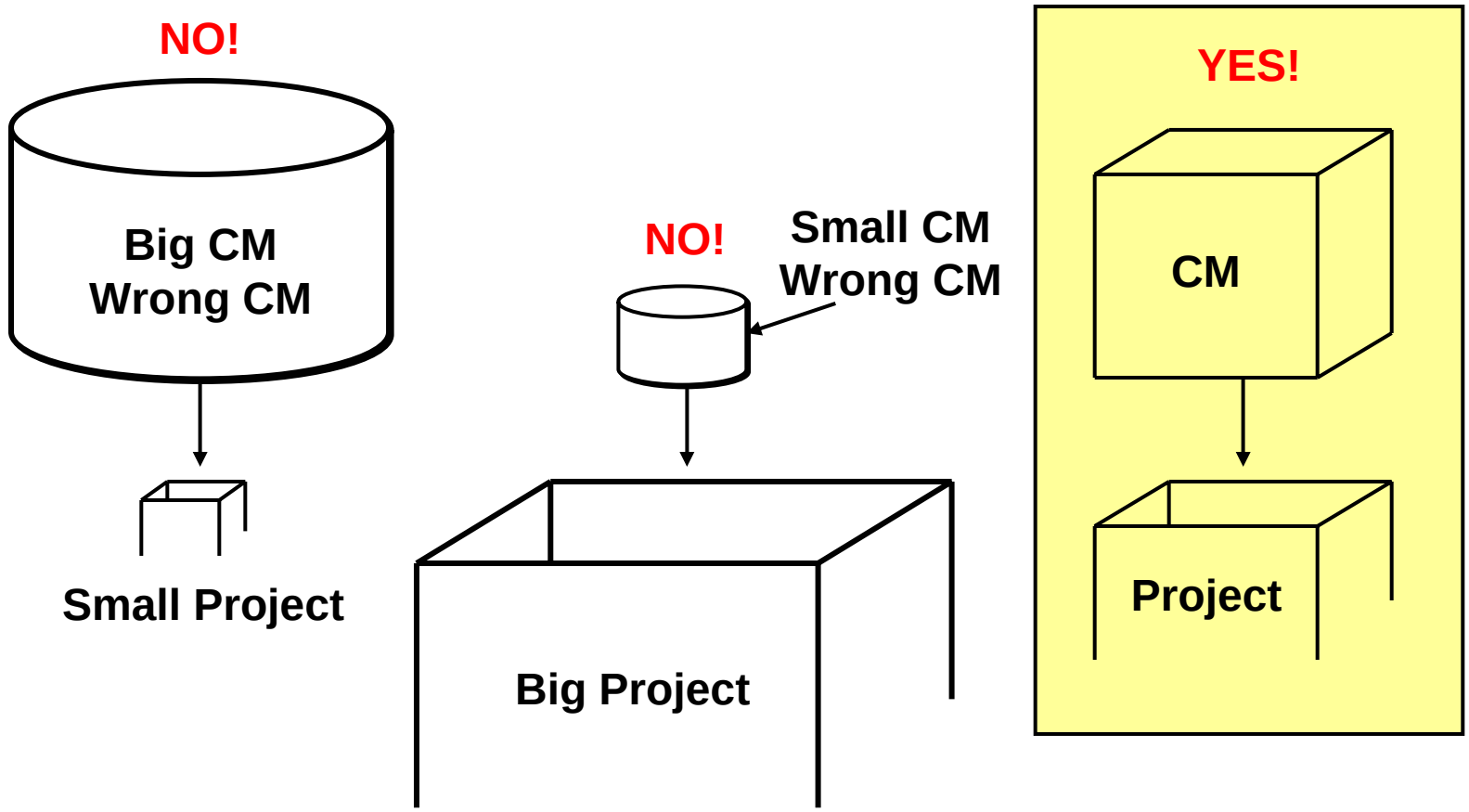
Configuration Status Accounting (concluded)



Where are we?

- Introduction
- Configuration Management Concepts
- Configuration Management in Detail
- **Tailoring Configuration Management**
- Points to Remember
- References / Suggested Reading
- Questions / Answers / Discussion
- Contact Information

Tailoring Configuration Management



The shoe "gotta" fit to be comfortable

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Tailoring CM (continued)

- CM can be very dangerous if under or over applied
  - Too much CM can stifle projects with bureaucracy
  - Too little CM will result in the projects getting out of control
- No CM will result in late deliveries, cost overruns, poor reliability, and even total failure
- CM needs to be tailored and appropriately applied to the scope of the application; the following are some factors to consider when tailoring:
  - Cost
  - Schedule
  - Function
  - Performance
  - Safety
  - Security
  - Criticality
  - Reliability
  - Size of Application
  - Number of Suppliers
  - Relationship of Supplier / Acquirer
  - Number of Staff

Tailoring CM (concluded)

- For large, complex, critical projects, CM needs to be applied to its fullest formal extent
- For smaller, less complex projects, CM may need to be tailored by analyzing the tailoring factors
  - For example, a TRB may not be necessary
- For small, non-complex projects (6 or fewer staff members, $500,000, 6 months) a formal CCB may not even be necessary
- The important point is to apply the concepts and principles of CM as appropriate and necessary

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Points to Remember

- CM is important to ensure that current configurations of items are known throughout their lifecycle and that changes to those configurations are managed and controlled
- CM starts early in the development lifecycle and continues until the system is removed from operation
- Configuration items are baselined at a specific time in their lifecycle as a reference point for change control

Points to Remember

- Impact assessments must be conducted on CRs against function, cost, schedule, interface by all affected entities
- CM needs to be tailored and appropriately applied to the scope of the application
- CM relationships and responsibilities between the Acquirer and Supplier must be understood and adhered to
- All organizations have CM roles and responsibilities which need to be appropriately applied if CM is to be successful

References / Suggested Reading

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4. *CM BoK – Configuration Management Body of Knowledge*. www.cmcrossroads.com/cgi-bin/cmwiki/bin/view.cgi/CM/CMBoK, CM Crossroads, CM Community Forums

References / /Suggested Reading

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6. *IEEE Guide to Software Configuration Management*, ANSI/IEEE Std. 1042-1987, September 1988

7. *IEEE Standard For Software Configuration Management Plans*, IEEE Std. 828-1998, October 1998

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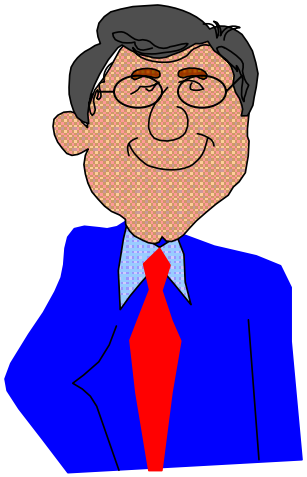
Questions / Answers
Discussion

Contact Information



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