Configuration Management

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Presentation Contents

- Introduction
  - Reasons for Configuration Management (CM)
  - CM Concepts
- Formal CM
  - Formal Baselines and Configuration Items (CIs)
  - Configuration Control Boards (CCBs)
    - Supported with Technical Review Boards (TRBs)
  - Change Control
  - CM Audits and Status Accounting
- Internal CM
  - Internal Baselines
  - CM of Design, Code, Hardware Items, Test Articles
- CM During Operation
- References

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
- CM helps manage complexity, interface dependencies, increases security, and recovery from errors

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

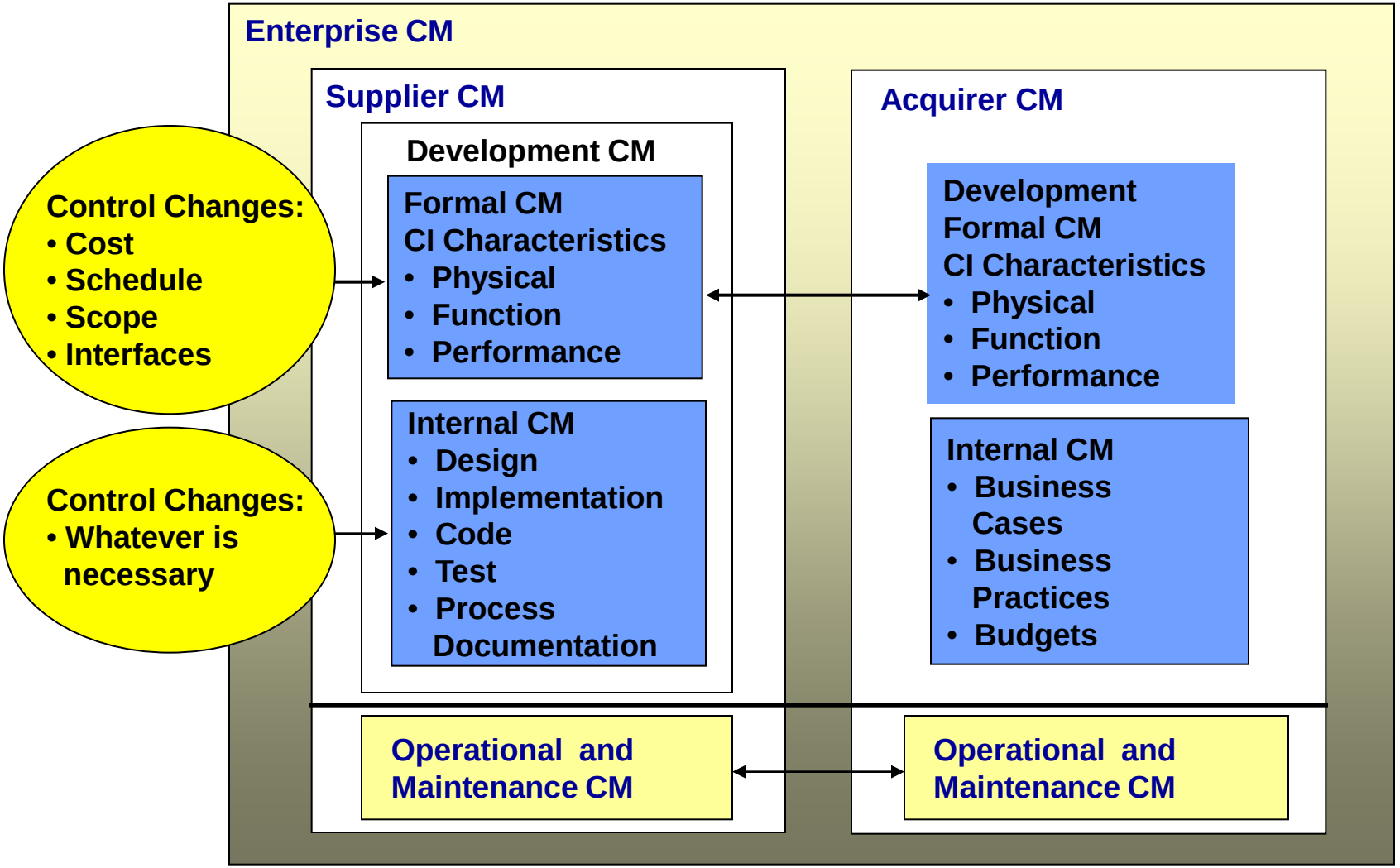
Application of CM

- **The CM concepts presented in this course can be applied to:**
  - **Hardware (H/W)**
  - **Software (S/W)**
  - **Facilities**

  And their appropriate documentation

During Development and Operation by the Acquirer and Supplier

Some Levels of CM



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  - Formal Baselines and Configuration Items (CIs)
  - Configuration Control Boards (CCBs)
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  - Status Accounting
  - CM Audits
- Internal CM
- CM during Operation
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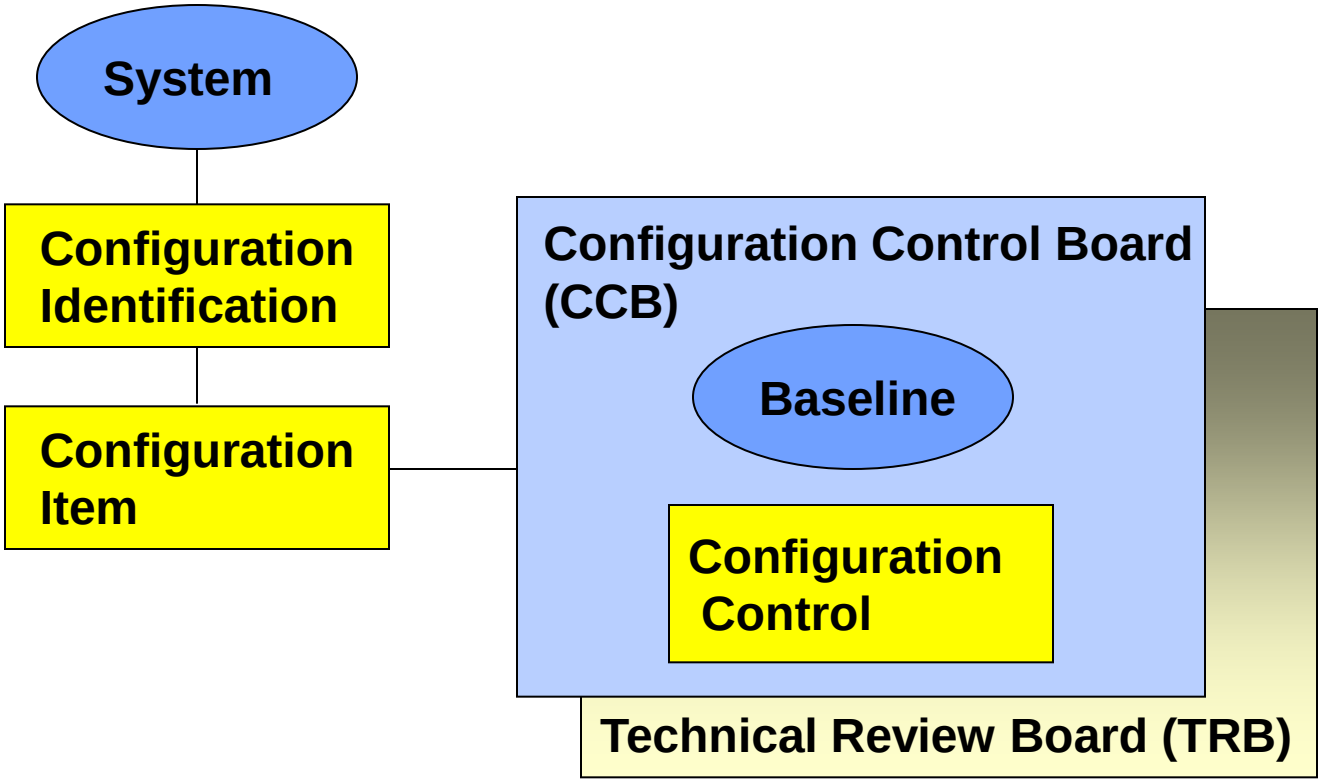
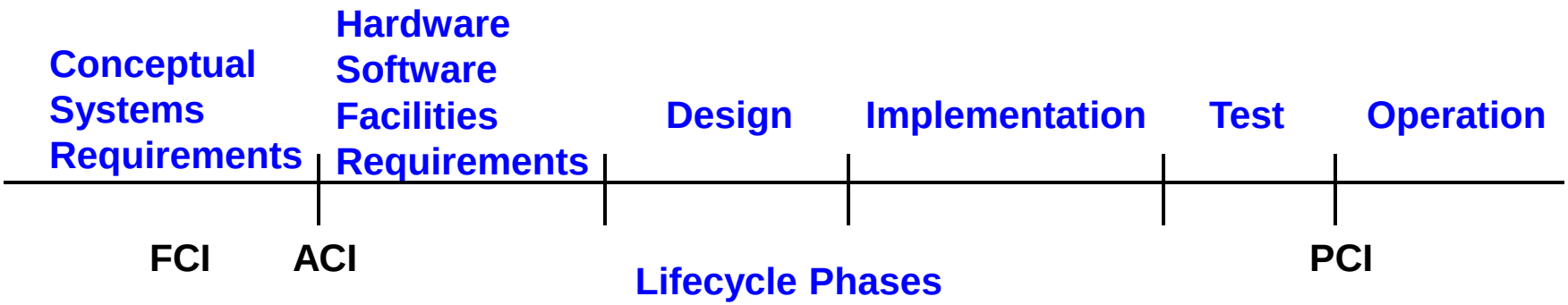
Configuration Management Overview



Configuration Management Audits – Configuration Status Accounting

Configuration Identification

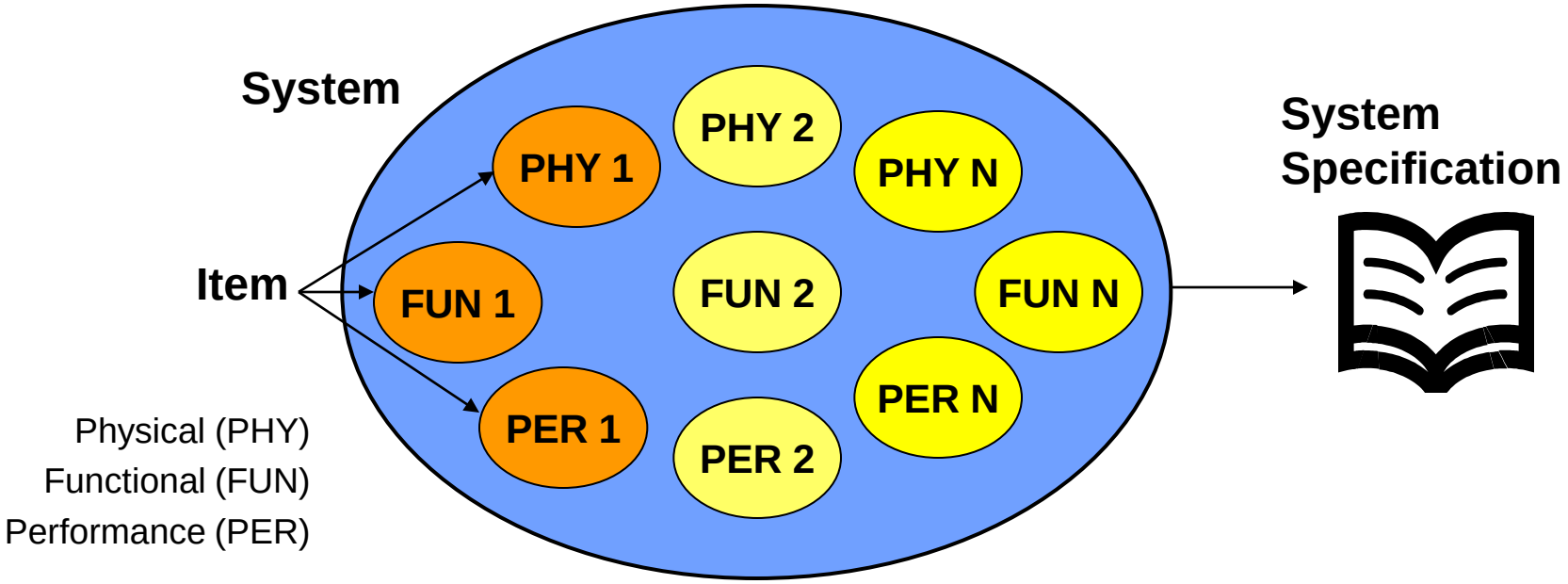
- Three level of Configuration Identification are established
  - Functional Configuration Identification (FCI)
  - Allocated Configuration Identification (ACI)
  - Physical Configuration Identification (PCI)



Functional Configuration Identification

Functional Configuration Identification (FCI)

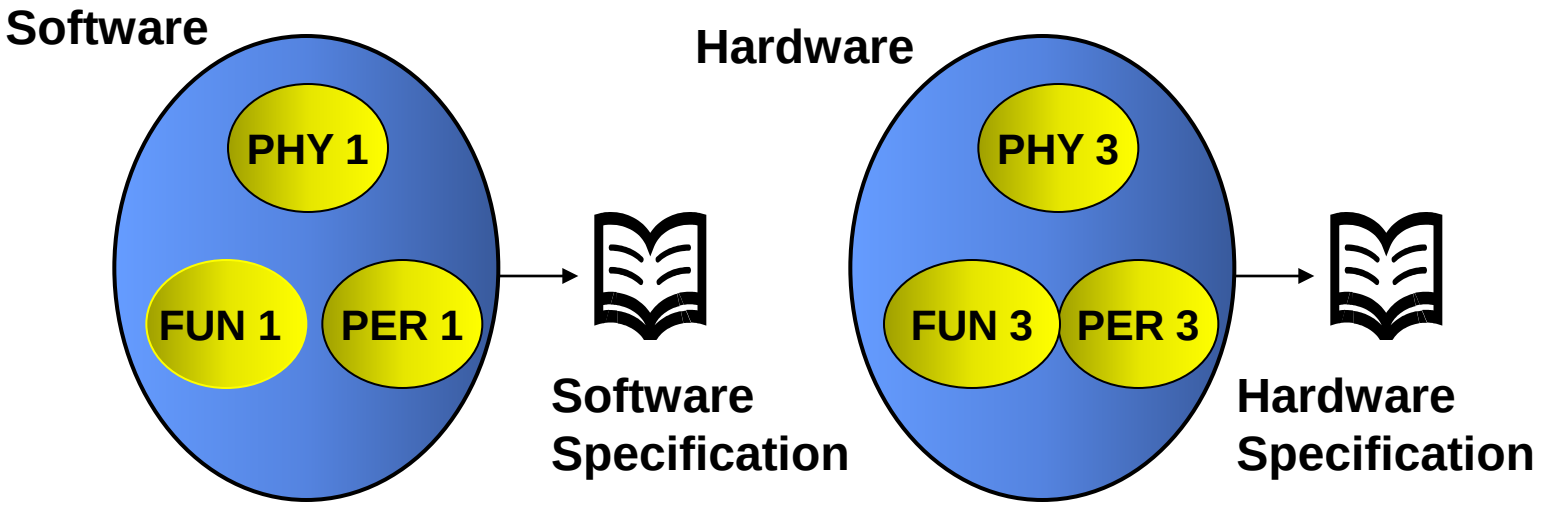
The identified system and system items and their physical, functional, and performance characteristics which are documented in a System Specification as requirements



Allocated Configuration Identification

Allocated Configuration Identification (ACI)

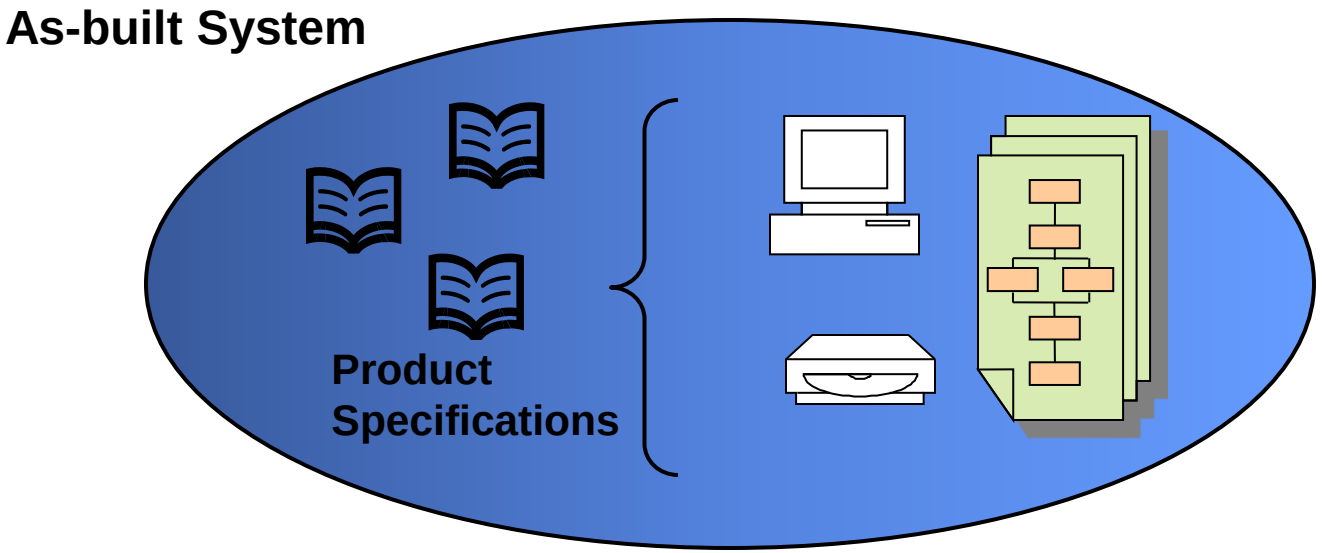
Later in development the physical, functional, and performance characteristics of the system are allocated to lower level entities: software, hardware, facilities, and are documented in Specifications for requirements



Physical Configuration Identification

Physical Configuration Identification (PCI)

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



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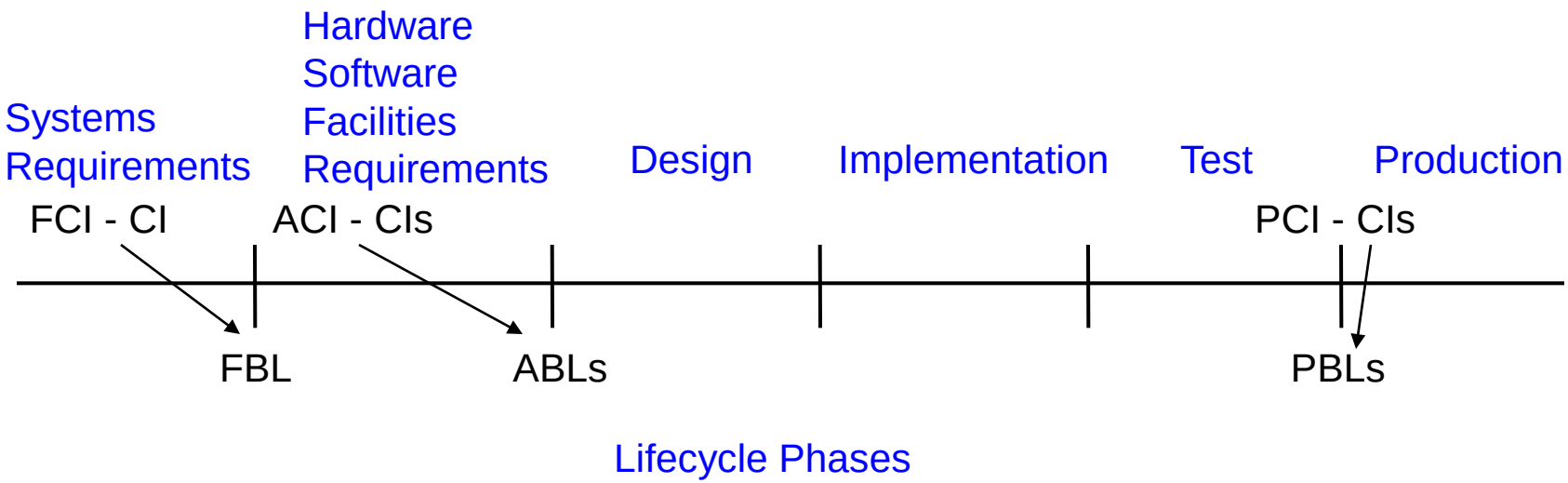
Formal Baselines

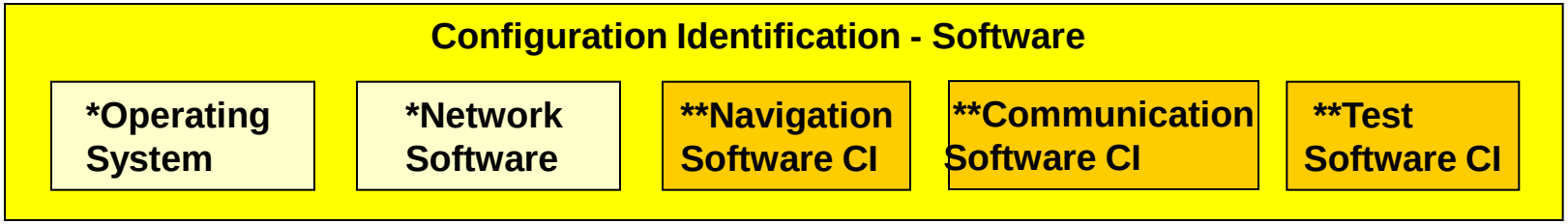
Baselines are established at strategic points in a system lifecycle. Three baselines may be defined

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



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



***Commercial products MAY not be subject to change – In operation (production) everything is under CM control**
****Applications software in development that is subject to change**

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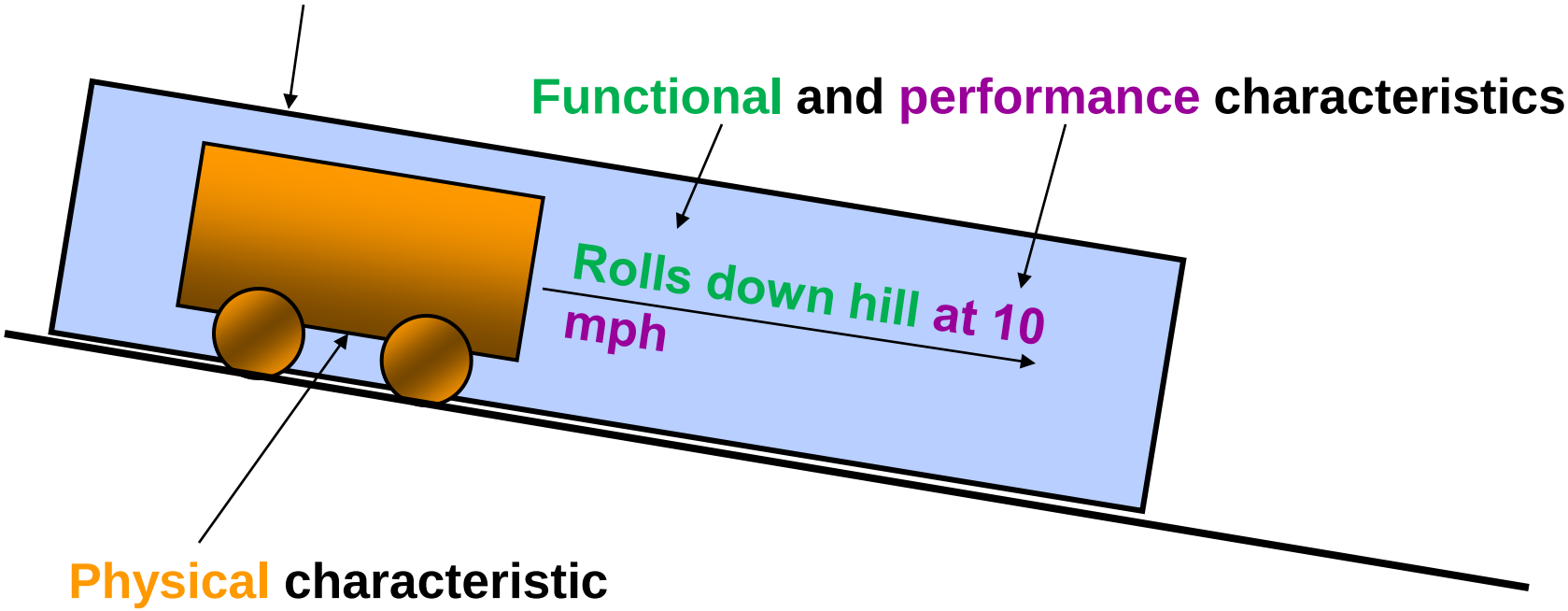
Configuration Item

Represents the characteristics (requirements) of a Configuration Item



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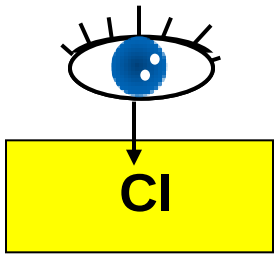
Baseline vs. Configuration Items

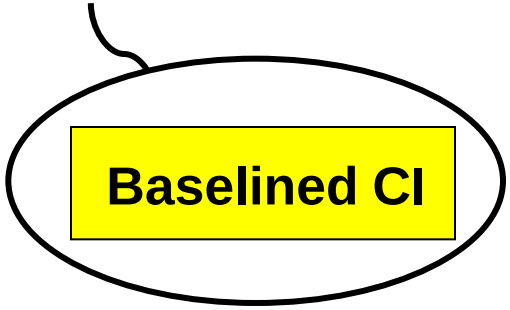
- **The approved and fixed (baselined) configuration of a CI at a specific time in its lifecycle that serves as a reference point for change control**

CIs are used for visibility



Visibility

Baselines are used for control



Control

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Configuration Control

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

  of changes to the physical, functional, and performance characteristics of a baselined CI
- Changes are requested with a Change Request (CR) form

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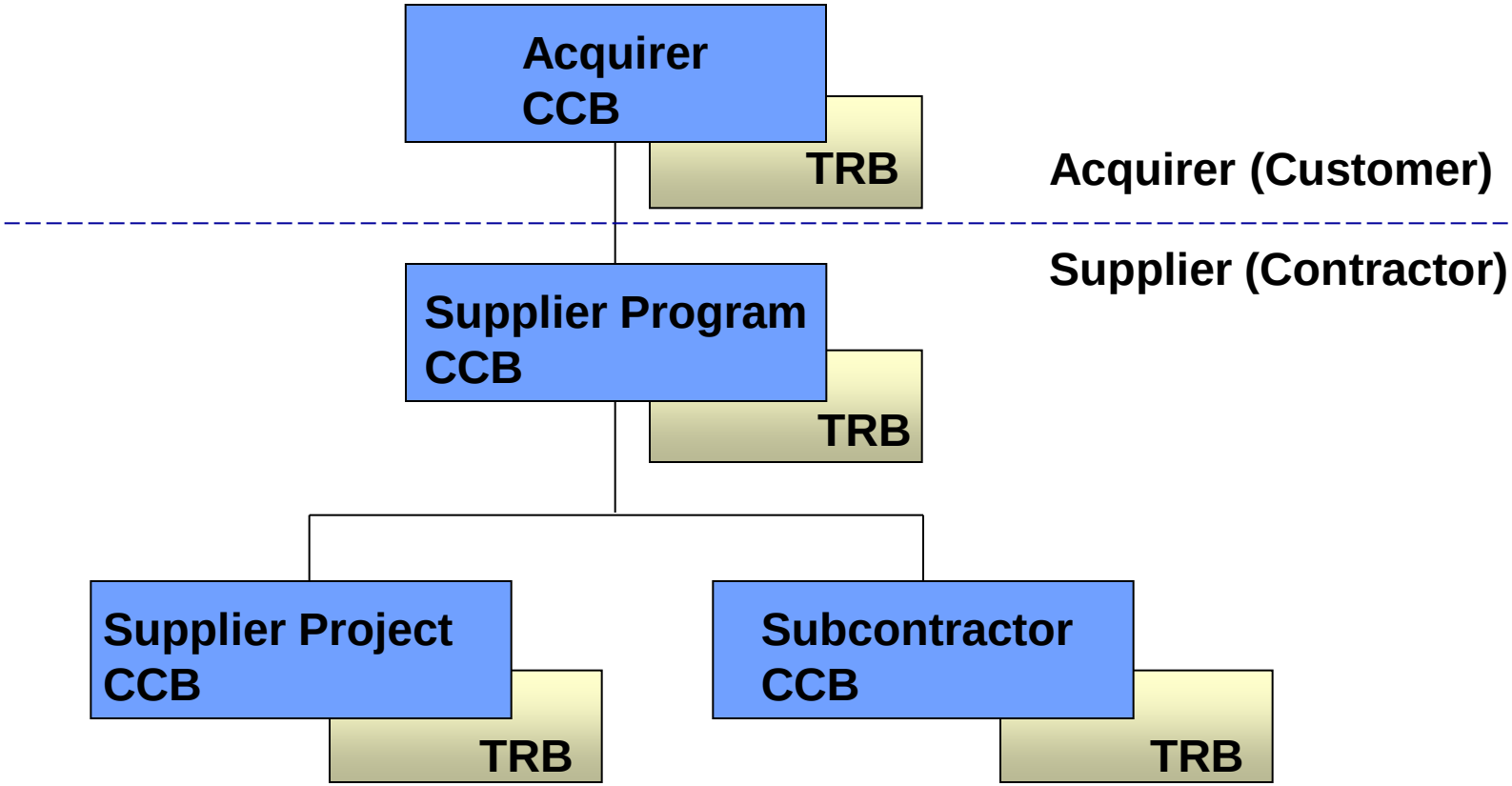
Configuration Control Board (CCB)

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

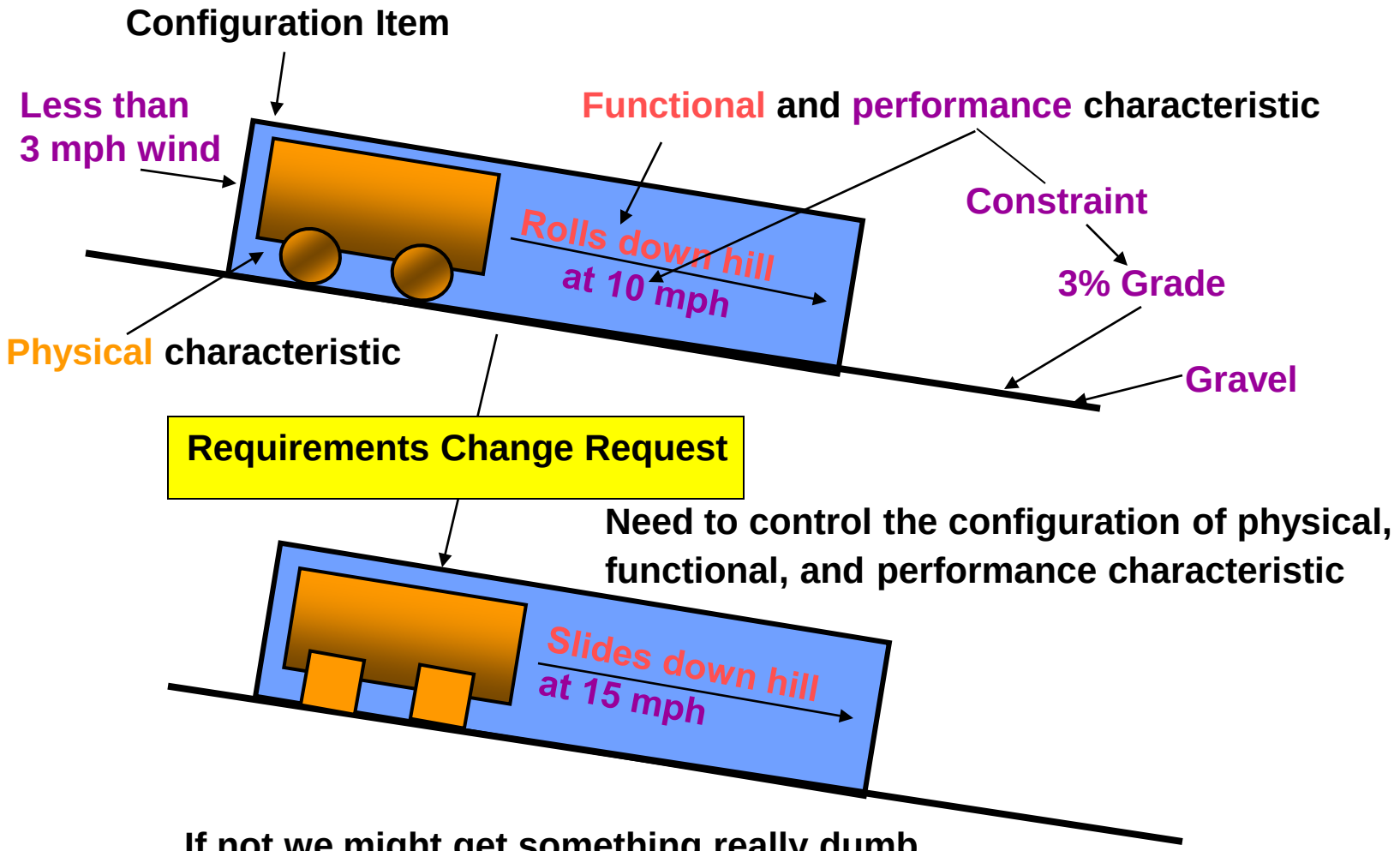
Technical Review Board (TRB)

- Provides technical and programmatic support to the CCB
  - Conducts impact assessment on 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

CCB and TRB Hierarchy



Configuration Control



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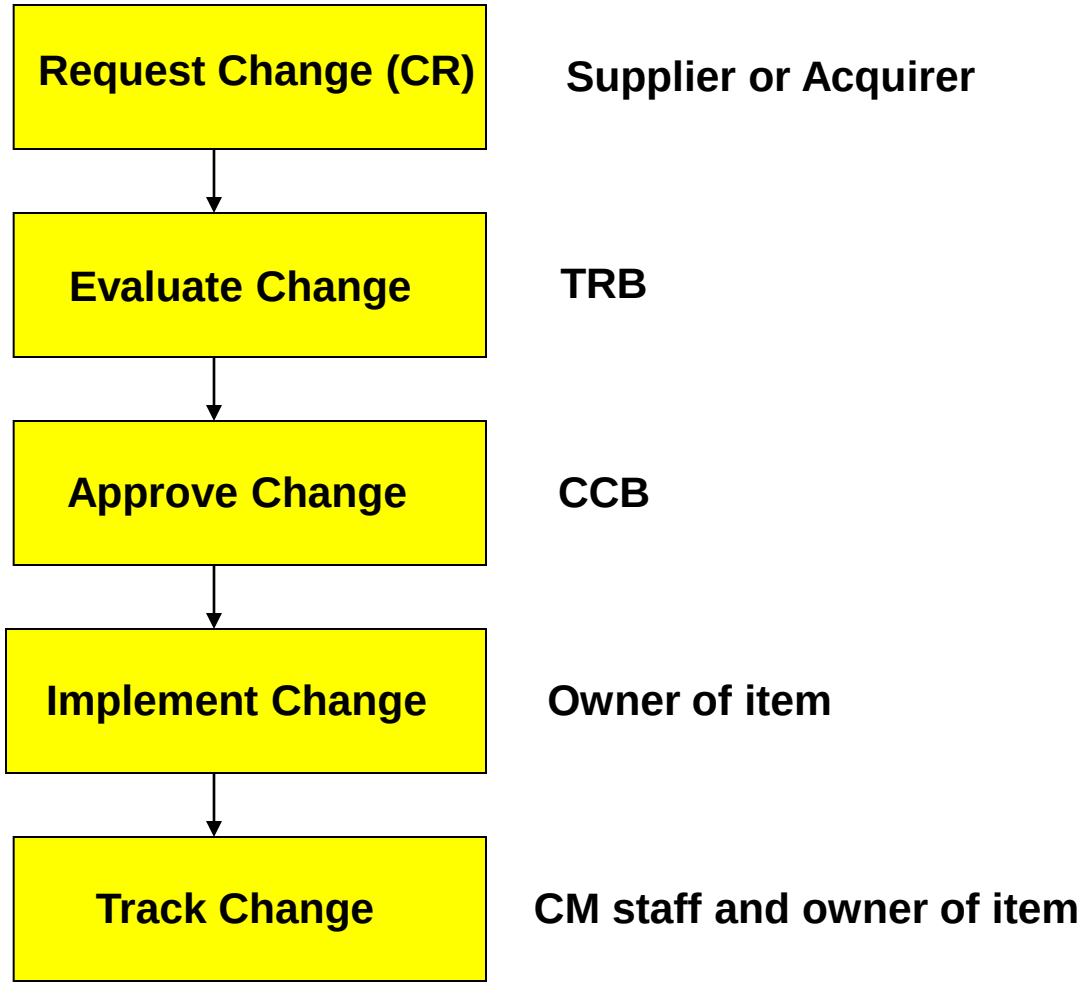
Change Flow



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
  - Scope
  - Interface

Classification of Changes

At least two types of changes can be defined:

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

Supplier must submit change to the Acquirer for approval before implementation (based on thresholds)

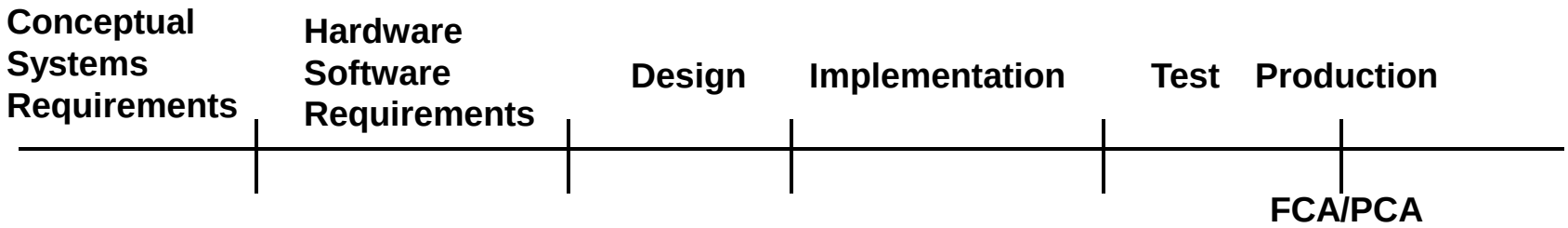
Classification of Changes concluded

- **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

CM Audits

- Functional Configuration Audits (FCA) and Physical Configuration Audits (PCA) are conducted by Engineering and facilitated by CM and/or Quality Assurance (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



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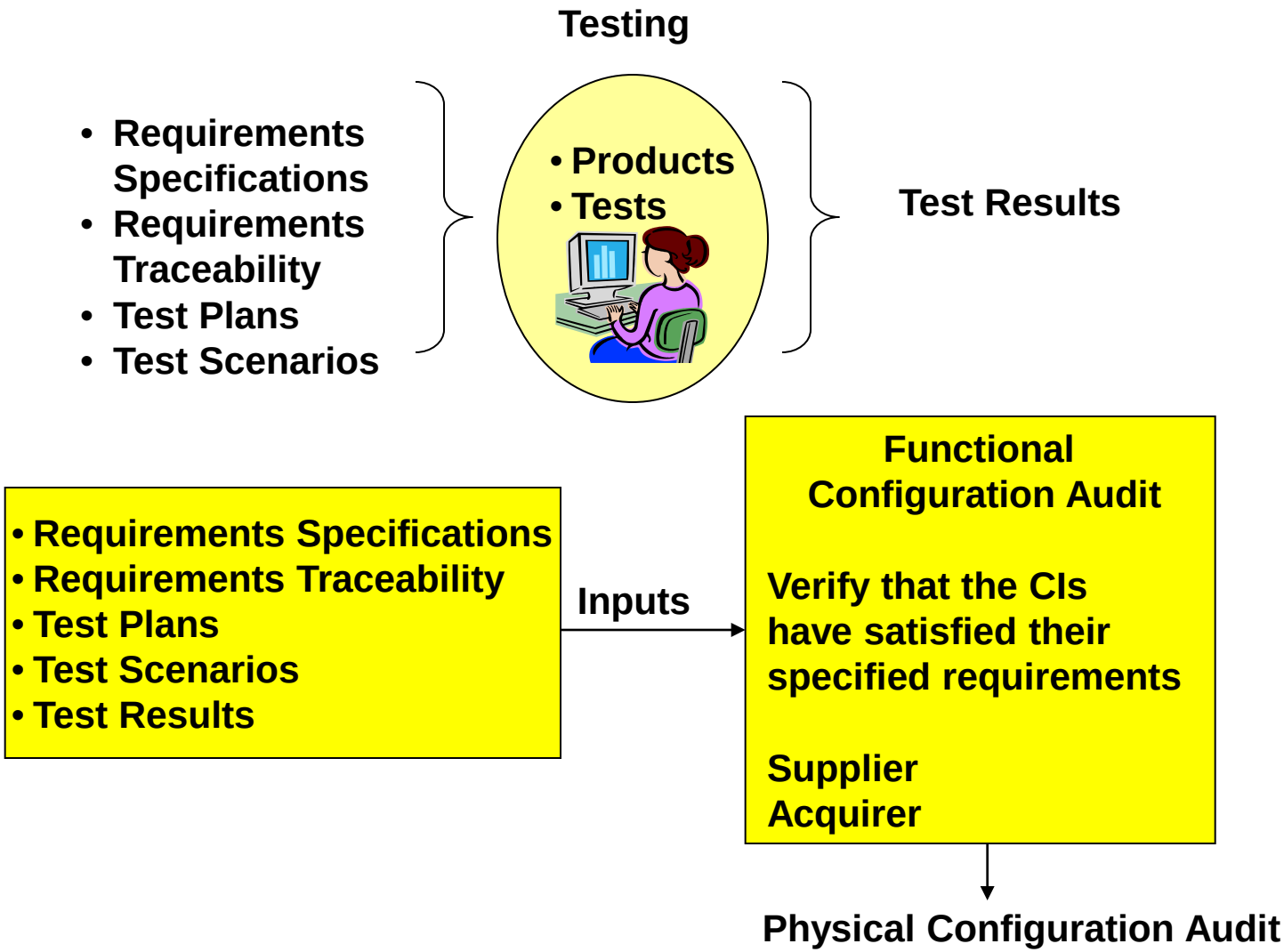
Functional Configuration Audit (FCA)

- 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
- 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

Functional Configuration Audit concluded



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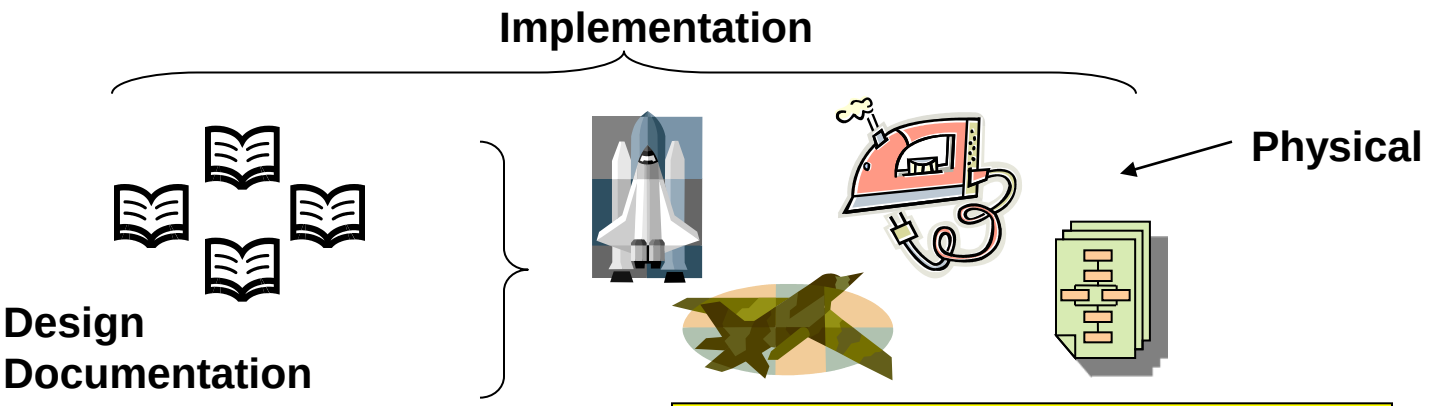
Physical Configuration Audit (PCA)

- A formal examination of the as-built physical configuration of CI products against their design documentation
- 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

Physical Configuration Audit concluded



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

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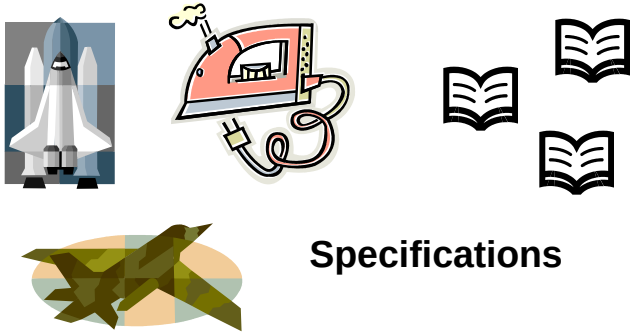
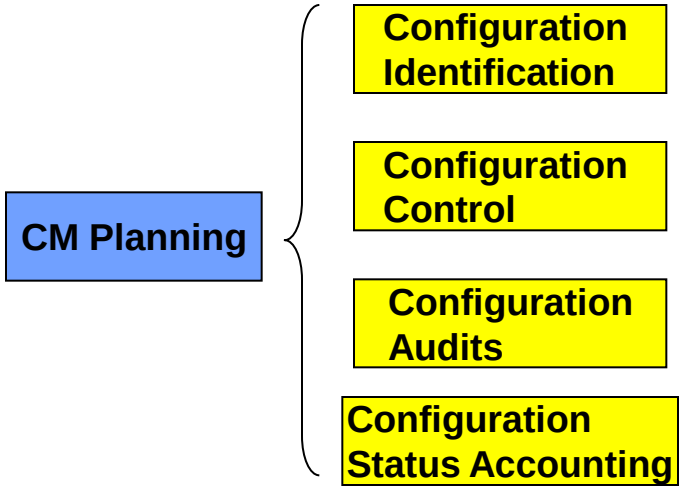
Configuration Status Accounting (CSA)

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



Products (CIs)

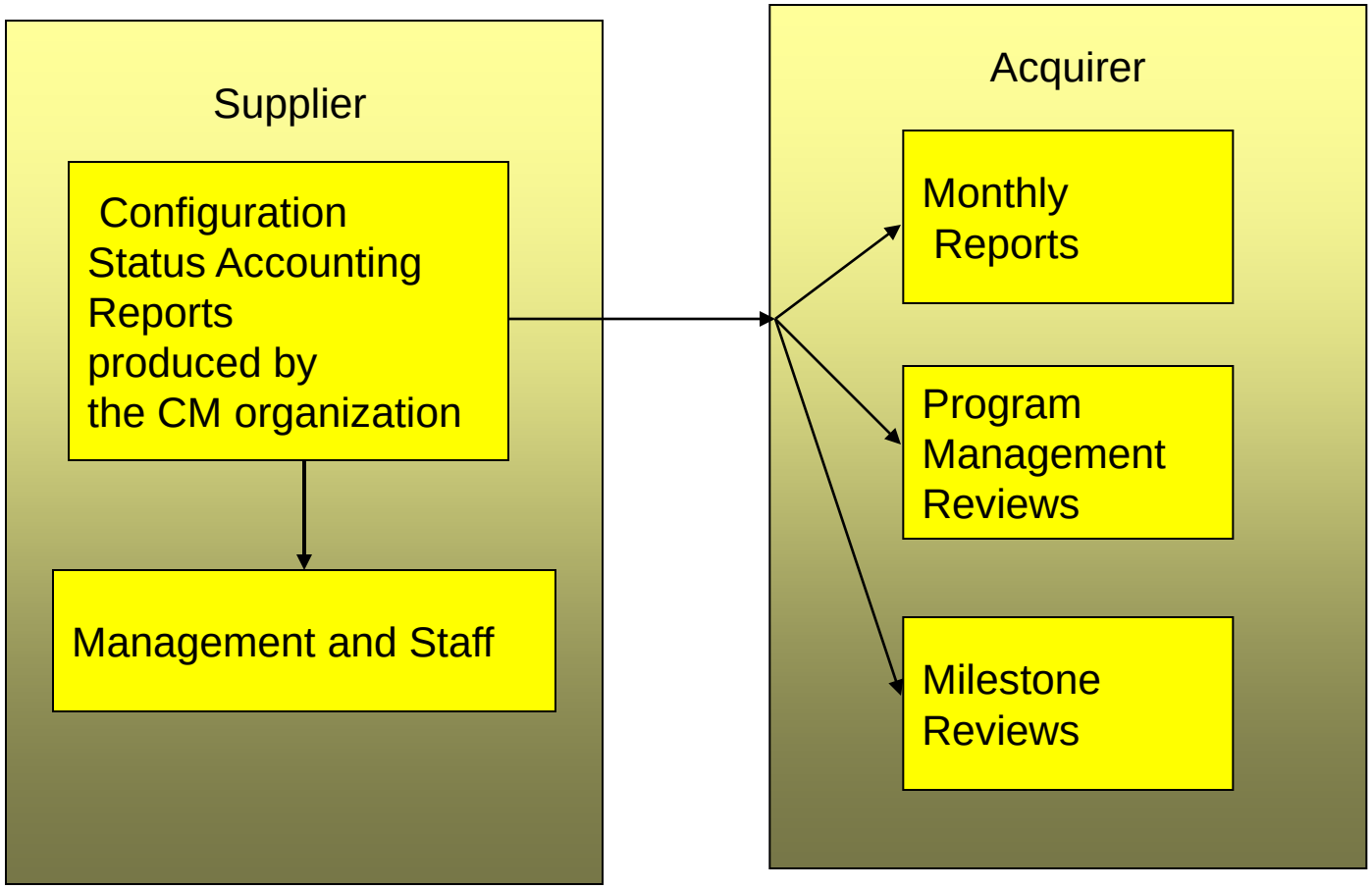


CM Tasks

Configuration Status Accounting concluded

- CSA provides the means for reporting status on:
  - Configurations
    - FCI
    - ACI
    - PCI
  - Baselines
    - FBL
    - ABL
    - PBL
  - Other
    - CM metrics
    - CM activities
    - CM Audits

Configuration Status Accounting concluded



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- Operational CM
  - During Operation / Maintenance
- References

Internal CM versus Formal CM

- Formal CM is concerned with
  - High Level baselines
    - FBL
    - ABL
    - PBL
  - Master Schedules
  - Budgets
  - Contractual Items
- Internal CM is concerned with
  - Design BL
  - Code BL
  - Hardware component BL
  - Test BL
  - COTS BL
  - Etc.

Internal CM Concerns

- Documents
  - Design
  - Database
  - Test procedures
  - Etc.
- Plans
  - Project plans
  - CM plans
  - QA plans
  - Risk Management plans
  - Test plans
  - Etc.

Technical Review Board (TRB)

Formal CM Under Configuration Control Board
Internal CM Under Technical Review Board

- **TRB is Chaired by Deputy PM or Lead Systems Engineer with members from**
  - **Systems**
  - **Software**
  - **Hardware**
  - **Test**
  - **CM**
  - **QA**
  - **Etc.**

Internal CM Concerns concluded

- Internal CM is concerned with
  - Version Control
    - Documents
    - Code
    - Hardware items
    - COTS
  - Data Management
    - Documents
    - Plans
    - Process Documentation
    - Procedures
    - Metrics
    - Action Items
    - Etc.

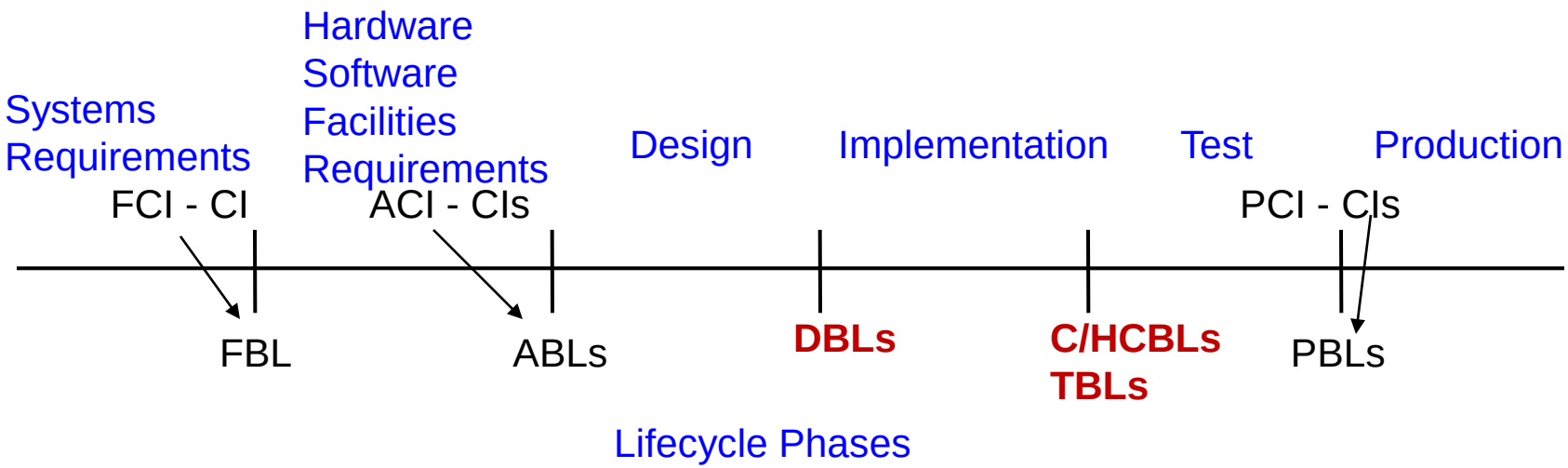
Internal CM & Testing

- **Internal CM during testing is concerned with**
  - **Code changes (TRB)**
  - **Design changes (TRB)**
  - **Test case changes (TRB)**
  - **Requirements changes**
    - **Requires escalation to CCB for formal CM**

Internal Baselines

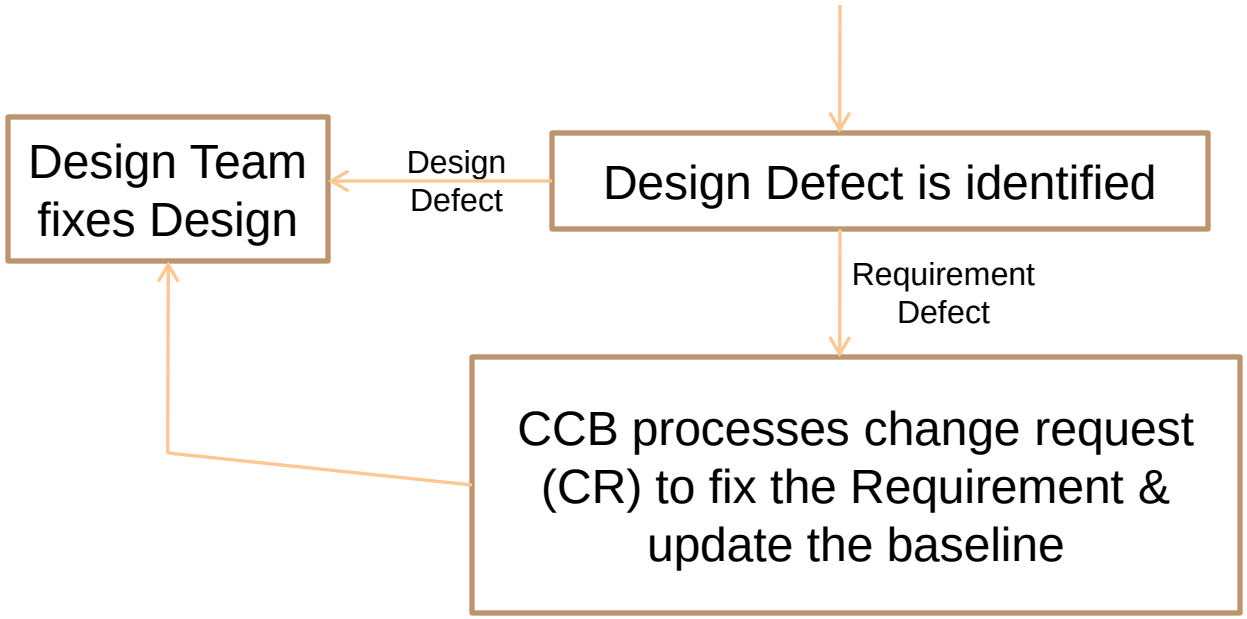
Internal baselines are established at strategic points in a system lifecycle. Three internal baselines may be defined

- Design Baseline (DBLs)
- Code/Hardware Components Baseline (C/HCBLs)
- Test Baseline (TBLs)



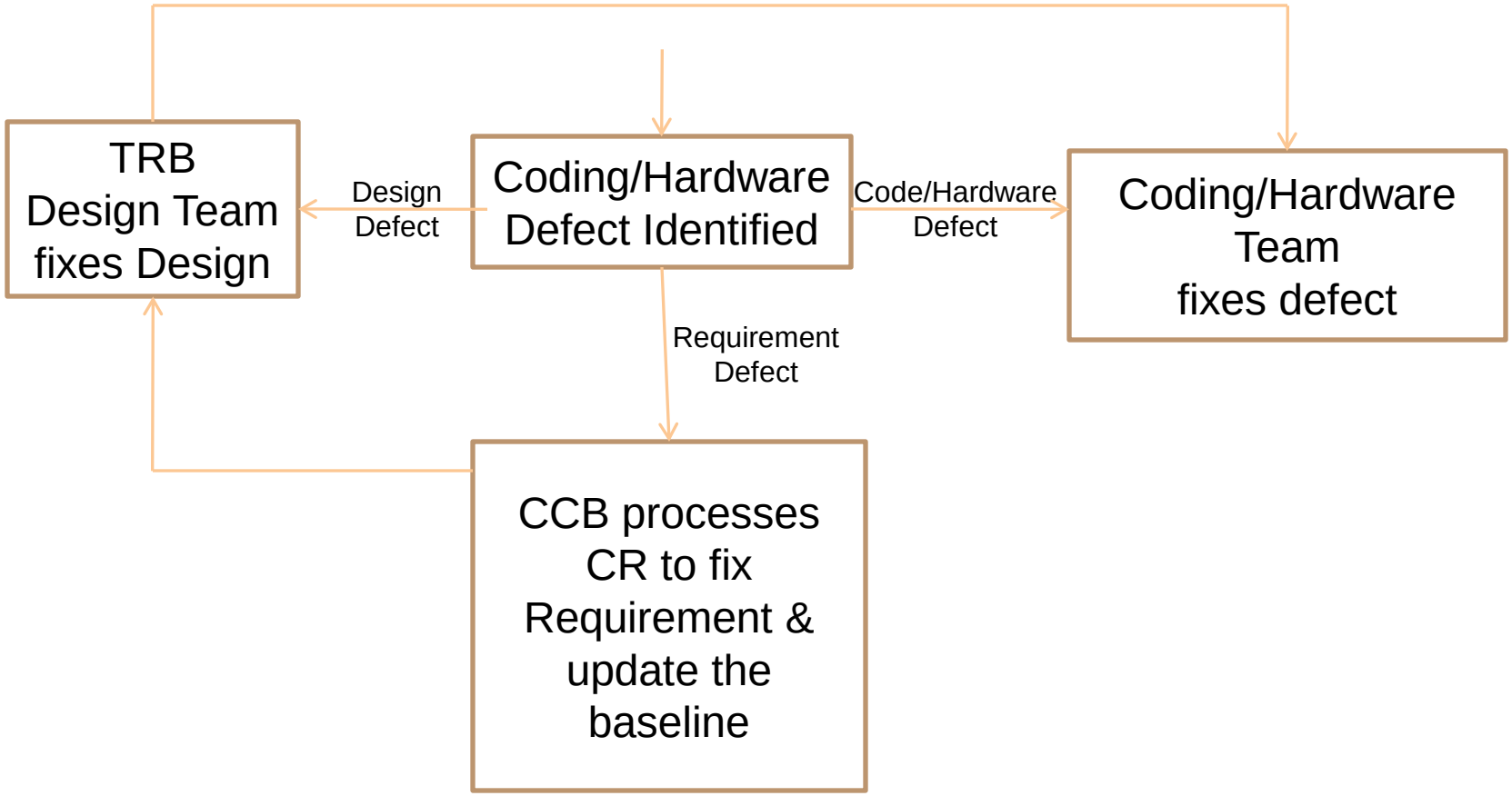
Internal CM During Design

Design not yet Baselined



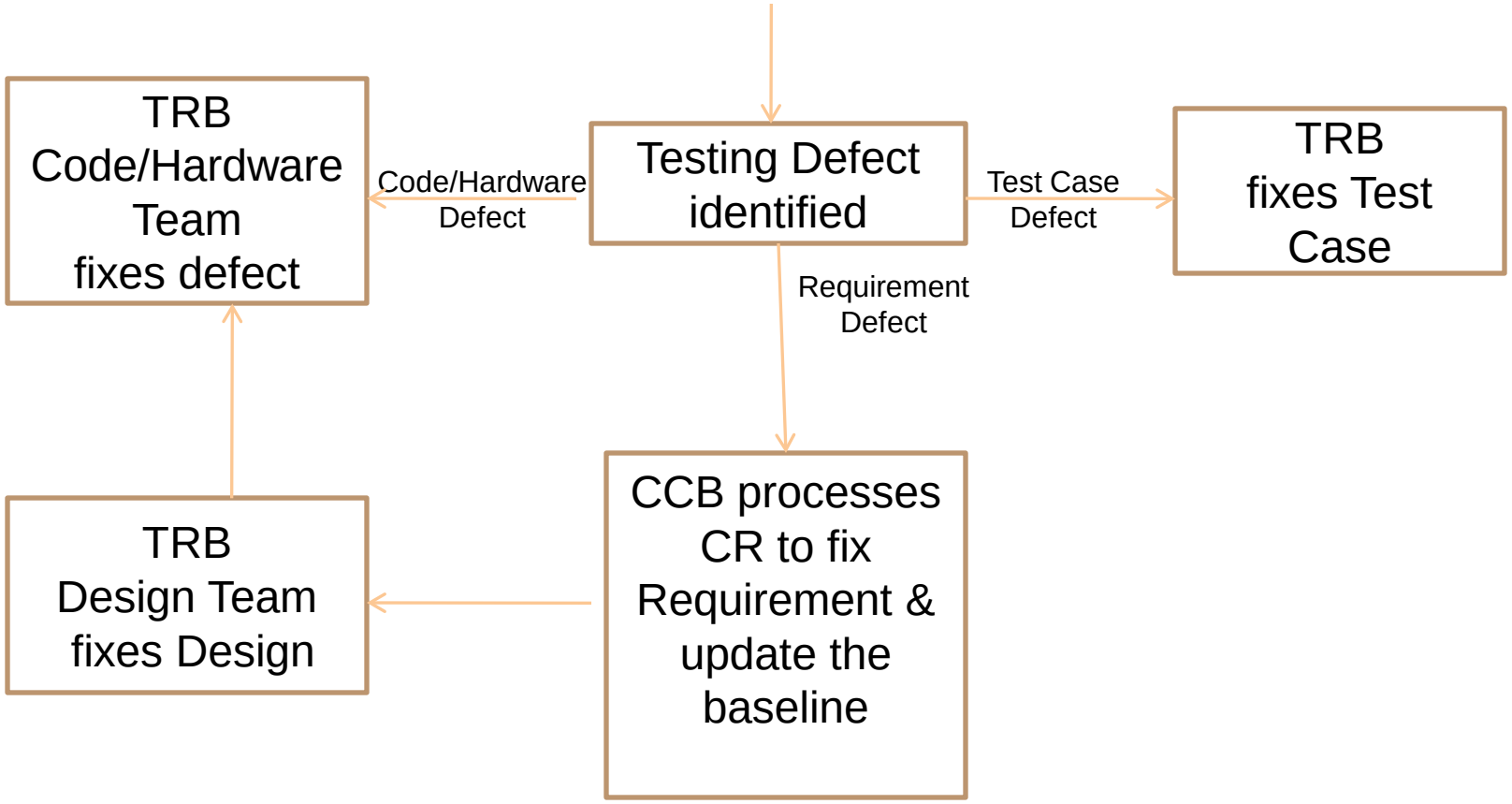
Internal CM During Coding

Design Baselined, Code not Baselined



Internal CM During Testing

Design, Code & Test Cases Baselined



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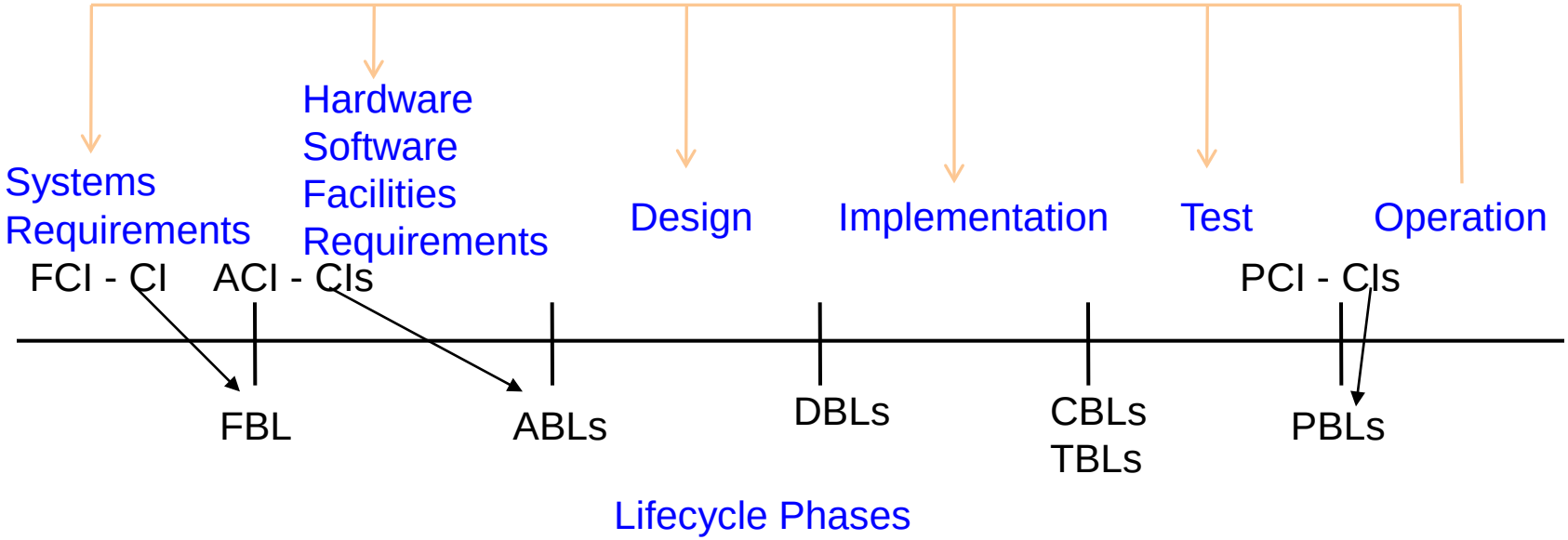
- Internal CM
- CM during Operation
  - During Operation / Maintenance
- References

CM During Operation

- CM during operation does not differ from CM conducted during development
  - Formal CM
  - Internal CM
- The players may change
  - A different operation contractor
  - A different operation agency
    - Acquisition Agency vs. Operation Agency
- The Production Baseline has been established

CM During Operation Concluded

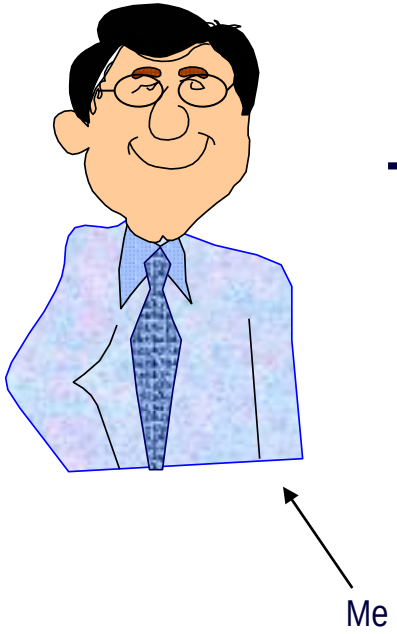
Defects and changes during operation may require repeat of activities that were conducted during development and reestablishment of baselines as appropriate.



References/Suggested Reading

- *IEEE Std. 828-1998 IEEE Standard for Software Configuration Management Plans*
- *IEEE 1042, Guide to Software Configuration Management*
- *ANSI/EIA-649-1998 National Consensus Standard for Configuration Management*
- *IEEE 828-2005 – Standard for Software CM plans*
- *MIL-STD-973 Military Standard for Configuration Management (cancelled, but still good reference)*
- *CM Today Yellow Pages, Your Source for Daily CM News,* www.cmtoday.com/yp/configuration_management.html
- *CM BoK – Configuration Management Body of Knowledge*. www.cmcrossroads.com/cgi-bin/cmwiki/bin/view.cgi/CM/CMBoK, CM Crossroads, CM Community Forums
- *Capability Maturity Mode Integration (CMMI®), Version 1.3* Software Engineering Institute

Contact Information



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