

Configuration Management Basics



Enchantment Chapter of INCOSE
October 12, 2011

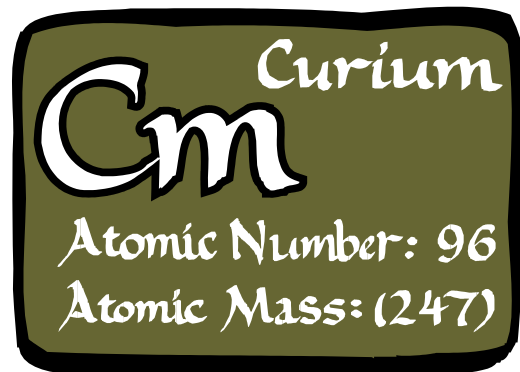
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Topics

- What is CM?
- CMII Summary
- Practical Suggestions for Applying CM Practices

What is Configuration Management (CM)?

A process that establishes and maintains consistency of a product's attributes with its requirements and product configuration information throughout the product's life cycle [EIA]



Why CM?

- CM ensures the effective management of the evolving configuration of a system, including all of its work products, during its life cycle [SE: pg 5.11]
- Change is inevitable, and managing the impact of change is the focus of CM
 - It is important to maintain *enough of* and the *right* information to ensure that deliverables can be related and are controlled based on engineering and management trade-off decisions

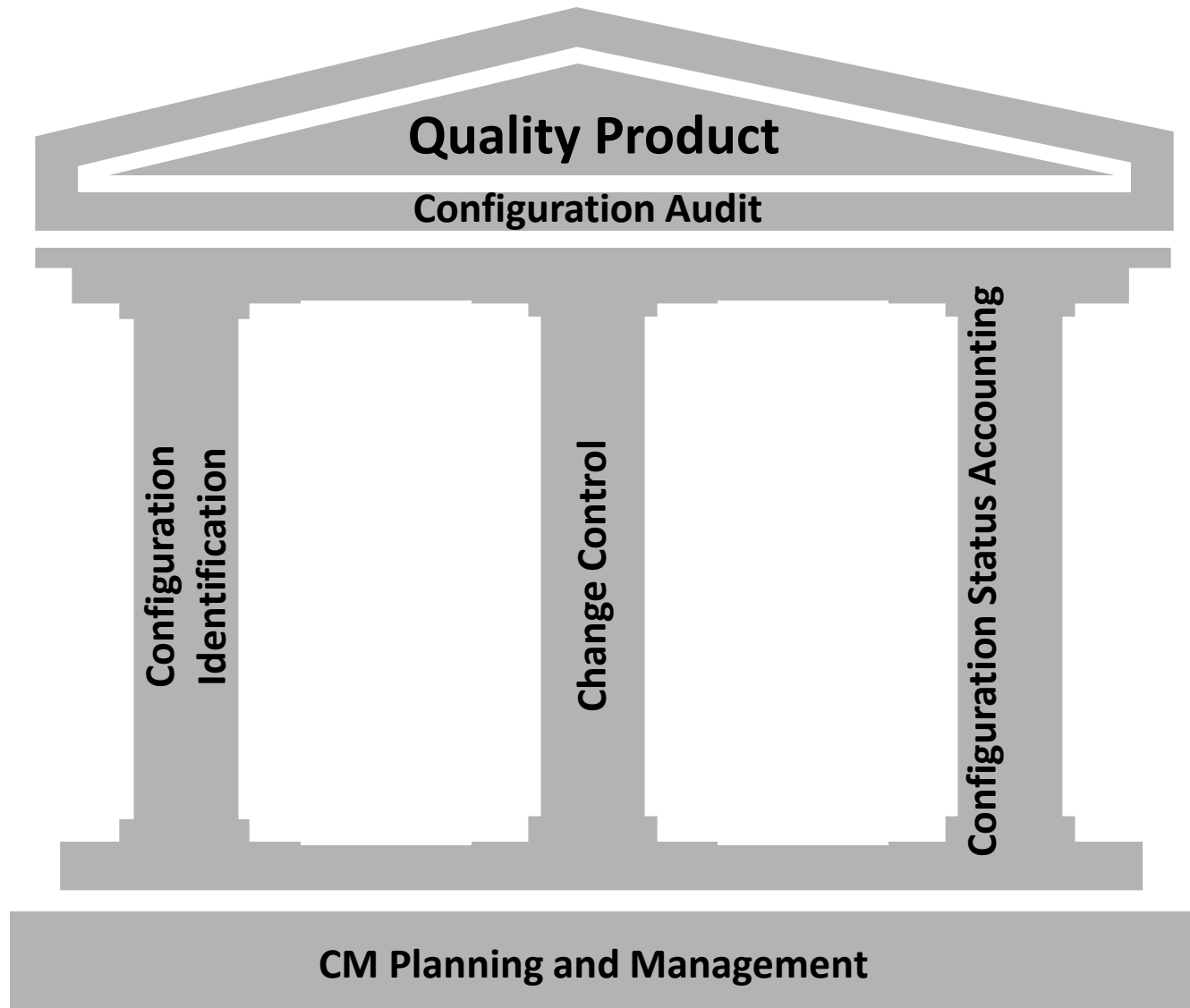
Systems engineering activities *rely* on product configurations being known and controlled

When Does CM Occur?

- CM activities occur throughout the life cycle of both the project and the product
 - CM begins at the initial determination of mission need and continues until project closeout or product retirement (from “lust to dust”)



Industry Standard CM Activities*



* Adapted from [EIA] Figure 1

CM Planning and Management

- Identify needs/requirements
 - Factors that might impact CM activities (e.g., team co-location, partners/subcontractors/suppliers, intellectual property)
 - Stakeholders' reporting needs
- CM Plan
 - CM work instructions/procedures that implement CM activities
 - Schedule/cost
 - Roles and responsibilities
 - Backup and disaster recovery plans and procedures
 - Role-based training

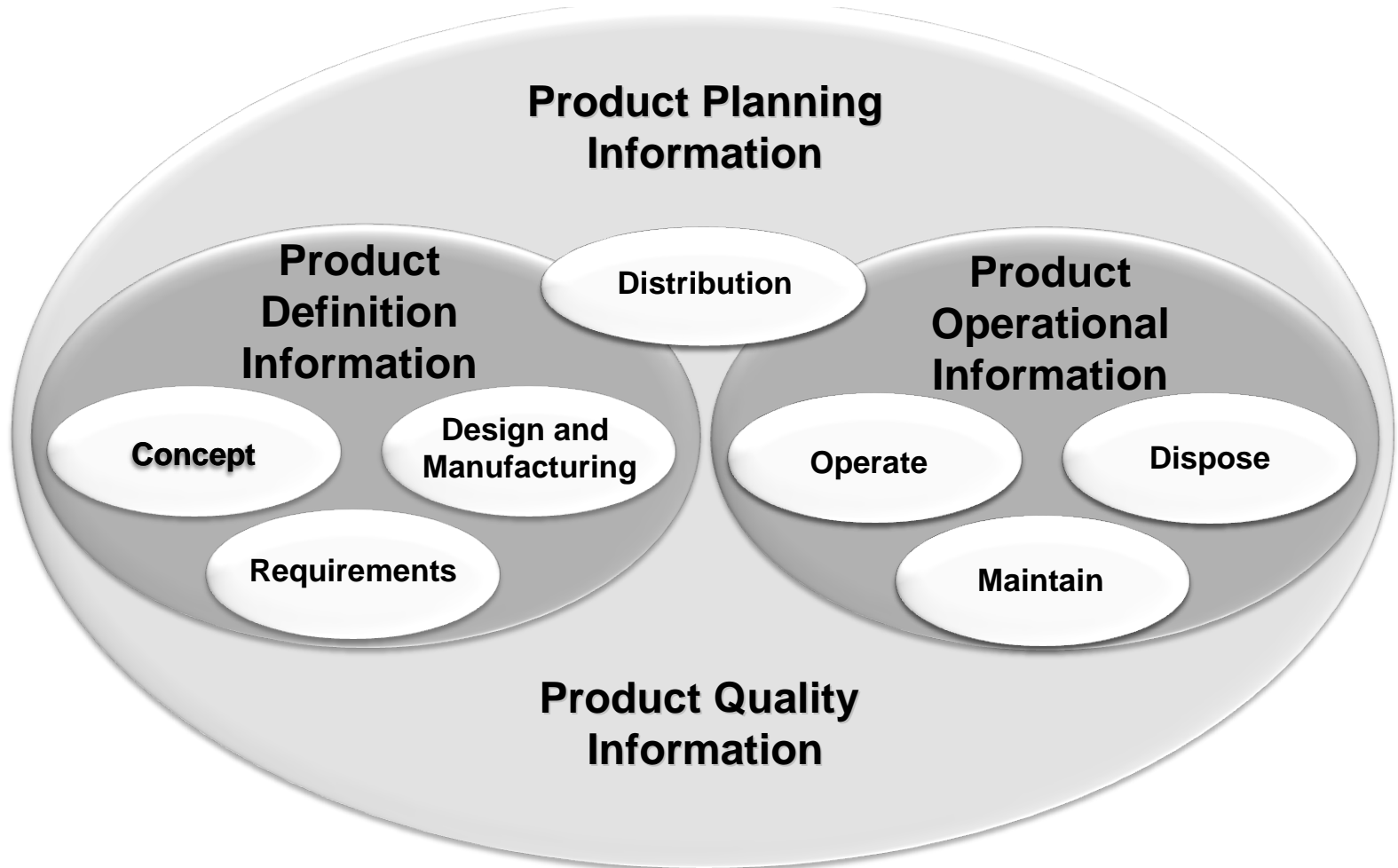


Configuration Identification

- Define configuration items (CI) of interest
 - CI is an entity within a configuration that satisfies an end-use function [ISO]
 - Name CIs (identification scheme, product units/groups (lots))
 - Determine CI interdependencies
 - Control CIs (change control)
- Define product structure
- Identify and control interfaces
- Establish baselines (e.g., “as-required”, “as-designed”, “as-built”)

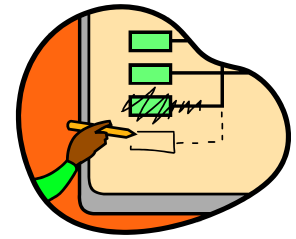


Product Configuration Information*



*Adapted from [EIA] Figure 2

Change Control



- Control of both changes to, and variances from, product configuration
- Once product configuration has been approved and baselined, changes to product configuration must be managed
 - Change is initiated by a change request (CR)
 - contains an **analysis** of the change requirements and **related impacts**
 - Change is implemented via a change order (CO) or change notice (CN)
 - Change is verified (changes consistent with product configuration information)
- Variances (which include deviations and waivers) from the approved product configuration require review and approval
- Change Control Board
 - Evaluate proposed changes to determine that it is necessary (or desirable), that the estimated risks and consequences are acceptable, and that the effectivity is established
 - Often has the responsibility and authority to evaluate deviations and waivers

Configuration Status Accounting (CSA)

- Formal reports*
 - Product configuration information
 - Status of proposed changes
 - Status of the implementation of approved changes throughout the product life cycle
- Data about the product configuration and the product configuration information needs to be captured as it is created during the product life cycle (often during configuration identification or configuration change management activities)
 - To maintain integrity and credibility, CSA information needs to have controlled access for authorized users



Configuration Audit



- Determines whether a product conforms to its requirements and product configuration information
 - Functional configuration audit: A formal evaluation to verify that a CI is controlled and has achieved the functional and performance characteristics specified in its product configuration information
 - Example: verification (test, analysis, inspection, demonstration)
 - Physical configuration audit: A formal evaluation to verify that a CI has achieved the physical characteristics specified in its product configuration information
 - Example: comparing the as-built CIs to the as-designed CIs; differences need to be accounted for

CMII Summary

Why CMII?

“An organization that cannot accommodate change and keep requirements clear, concise and valid has no choice but to operate in the corrective action mode. Highly inflated costs have always been a defense industry problem. Traditional CM does not enable any entity to escape the corrective action mode.”

Extracted from [CMIIa] pg 6

According to industry surveys, 30%-50% of resources are spent on addressing product quality problems (corrective actions)

[CMIIb] pg 4, [CJ], [JS].



CMII Summary

Enterprise Focus*

- CMII expands the scope of CM to include any information that could impact safety, security, quality, schedule, cost, profit or the environment.
- CMII shifts the emphasis to integrated process excellence and provides the how-to for:
 - (1) accommodating change;
 - (2) optimizing the reuse of standards and best practices;
 - (3) ensuring that all requirements remain clear, concise and valid;
 - (4) communicating (1), (2) and (3) to users promptly and precisely;
 - (5) achieving conformance to requirements in each case

CMII Summary*

CM Practices per CMII

Transforms CM into a Business Process Infrastructure to Manage All Requirements

CMII	<i>Configuration Management:</i>	<i>Ensures that configurations conform to released requirements;</i>
	<i>Requirements Management:</i>	<i>Ensures that documented requirements are clear, concise and valid;</i>
	<i>Release Management:</i>	<i>Ensures that documents are authorized and released prior to use;</i>
	<i>Change Management:</i>	<i>Keeps released documents and data up to date;</i>
	<i>Data Management:</i>	<i>Ensures data bases are accurate and deliverable data is secure;</i>
	<i>Records Management:</i>	<i>Retains traceability of work and proof that work products conform;</i>
	<i>Document & Library Control:</i>	<i>Protects knowledge assets and prevents unauthorized changes;</i>
	<i>Enabling Software Tools:</i>	<i>Serve to enhance overall process reliability and efficiency.</i>

*Extracted from [CMIIa] pg 4

CMII Summary

Core CM Business Processes

- As-planned/as-released baselines
- 4-tier, 9-step development process (design-produce “V”)
- Naming, numbering and reuse
- Validation and release records
 - Co-ownership and validation by designated user
- Changes and revision records
 - “Closed loop” change process
 - Problem Report/Change Request/Change Notice
 - Roles
 - Fast-track vs. more formal review track
 - Verification of change

Come to the 12/2/2011 CMII Tutorial for More Details!

Suggestions for Applying CM Practices

- Use a risk-informed graded approach
 - Use intrinsic characteristics of the project, consequence of failure to determine level of rigor needed
 - High rigor: links to support extensive traceability (e.g., “Build Book”/ROA)
 - Low rigor: version-controlled repository
 - Needed level of rigor may change throughout the project, protect intellectual capital to form foundation (e.g., requirements/research objectives, architecture, project management work products)
- Define metadata and relationships/links to support search/retrieval
- Determine access controls
- Understand breadth/depth of CIs
- Define product structure
- Define change process, select CM tool/repository to support the process
 - Know when to invoke formal change control
 - *After* work product has been approved and is part of the product baseline, not during development
 - Criteria for fast-track changes
- Monitor “how it’s working for ya” (e.g., use, throughput), improve



Questions?



References

ID	Reference
[CJ]	Capters Jones, Estimating Software Costs, New York, McGraw-Hill, 1998.
[CMIIa]	CMII Research Institute, White Paper CMII 805C – CMII Vs. Other CM Certification Programs, 2009. www.cmisweb.net/information/805_Compare_CM_Certifications.pdf , downloaded 10/5/2011.
[CMIIb]	Institute of Configuration Management, Course I – The CMII Model, I-C rev D' Corrective Action, Causes and Solutions, pg 4.
[EIA]	Electronics and Information Technology Association, National Consensus Standard for Configuration Management, ANSI/EIA-649-A, Arlington, VA, 2004.
[ISO]	International Organization for Standardization (ISO), Quality Management Systems – Guidelines for Configuration Management, ISO 10007:2003(E), Geneva, Switzerland, 2003.
[JS]	Joe Schofield, Competitive Analytics – IT Parallels, International Software Measurement and Analysis Conference, Richmond, Virginia, September 2011.
[SE]	International Council on Systems Engineering (INCOSE), Systems Engineering Handbook – A Guide for System Life Cycle Processes and Activities, version 3.1, August 2007.