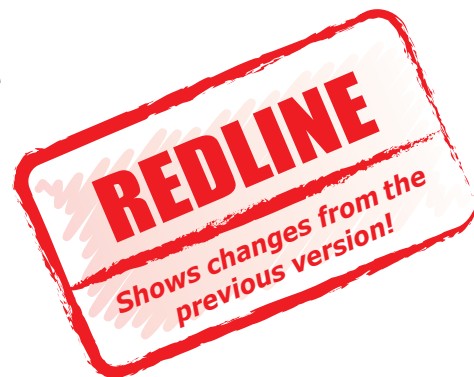


IEEE Standard for Configuration Management in Systems and Software Engineering

IEEE Computer Society

Sponsored by the
Software & Systems Engineering Standards Committee



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USA

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IEEE Standard for Configuration Management in Systems and Software Engineering

Sponsor

Software & Systems Engineering Standards Committee
of the
IEEE Computer Society

Approved 6 February 2012

IEEE-SA Standards Board

Abstract: This standard establishes the minimum requirements for processes for Configuration Management (CM) in systems and software engineering. The application of this standard applies to any form, class, or type of software or system. This revision of the standard expands the previous version to explain CM, including identifying and acquiring configuration items, controlling changes, reporting the status of configuration items, as well as software builds and release engineering. Its predecessor defined only the contents of a software configuration management plan. This standard addresses what CM activities are to be done, when they are to happen in the life cycle, and what planning and resources are required. It also describes the content areas for a CM Plan. The standard supports ISO/IEC/IEEE 12207:2008 and ISO/IEC/IEEE 15288:2008 and adheres to the terminology in ISO/IEC/IEEE Std 24765 and the information item requirements of IEEE Std 15939™.

Keywords: change control, configuration accounting, configuration audit, configuration item, IEEE 828, release engineering, software builds, software configuration management, system configuration management

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Introduction

This introduction is not part of IEEE Std 828-2012, IEEE Standard for Configuration Management in Systems and Software Engineering.

This revision to IEEE Std 828TM-2005 replaces the earlier focus on the contents of a Software Configuration Management Plan (SCMP) with a focus on the processes that comprise System and Software Configuration Management. The standard for the SCMP is now included as a normative Annex.

Configuration Management in Systems and Software Engineering is a specialty discipline within the larger discipline of Configuration Management (CM). The purpose of Configuration Management is to:

- a) Identify and document the functional and physical characteristics of any product, component, result, or service
- b) Control any changes to such characteristics
- c) Record and report each change and its implementation status
- d) Support the audit of the products, results, services, or components to verify conformance to requirements

Configuration Management is essential to Systems Engineering and to Software Engineering.

CM establishes and protects the integrity of a product or product component throughout its lifespan, from determination of the intended users' needs and definition of product requirements through the processes of development, testing, and delivery of the product, as well as during its installation, operation, maintenance, and eventual retirement. In so doing, CM processes interface with all other processes involved in the product's life.

Annex A provides a condensed view of the purposes and outcomes of the lower level CM processes described in this standard.

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IEEE Standard for ~~Software~~ Configuration Management in Systems and Software Engineering ~~Plans~~

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1. Overview

1.1 Scope

This standard establishes the minimum requirements for ~~contents of a Software~~ Configuration Management (CM) in Systems and Software Engineering, without restriction ~~SCM) Plan (also referred to as “the Plan”). This standard applies to the entire life cycle of critical software; e.g., where failure would impact safety or cause large financial or social losses. It also applies to noncritical software and to software already developed. The application of this standard is not restricted~~ to any form, class, or type ~~of software~~.

1.2 Purpose

~~This standard describes CM processes to be established~~ The SCM Plan documents what SCM activities are to be ~~done~~, how they are to be accomplished ~~done~~, who is responsible for doing specific activities, when they are to happen, and what specific resources are required. It addresses CM activities over ~~any portion of~~ a product's life cycle. This standard is consistent with IEEE's Software Engineering Body of Knowledge (SWEBOK), ISO/IEC/IEEE 12207:2008 and ISO/IEC/IEEE 15288:2008 ~~) project Stoneman release on the topic of configuration management and with IEEE/EIA Std 12207.0™ [B4]~~^{1,2}.

~~The content of the Plan is identified in Clause 3 of this standard. The required information is indicated by the words "shall" and "required." Additional optional information is also identified as appropriate. The user of this standard, however, is expected to expand and supplement the minimum requirements as necessary for the development environment, specific industry, organization, and project. Adapting a plan in conformance with this standard is described in Clause 4.~~

~~The primary users of this standard are assumed to be those planning SCM activities or performing SCM audits.~~

~~In considering adoption of this standard, regulatory bodies should be aware that specific application of this standard may already be covered by one or more IEEE standards documents relating to quality assurance, definitions, or other matters (see IEEE Std 730™ 2002 [B3]). It is not the purpose of this standard to supersede, revise, or amend existing standards directed to specific industries or applications.~~

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²The numbers in brackets correspond to those of the bibliography in Annex A.

2. Definitions, acronyms, and abbreviations

For the purposes of this document, the following terms and definitions apply. [ISO/IEC/IEEE 24765¹](#) and the ~~*The Authoritative Dictionary of IEEE Standards*~~ [Dictionary: Glossary of Terms and Definitions²](#), ~~[B1]~~, should be consulted for terms not defined in this clause.

2.1 Definitions

baseline: [\(1\) specification or product that has been formally reviewed and agreed upon, that thereafter serves as the basis for further development, and that can be changed only through formal change control procedures \(2\) formally approved version of a configuration item, regardless of media, formally designated and fixed at a specific time during the configuration item's life cycle. \(ISO/IEC 24765:2009\)](#)

[NOTE—A software baseline is a set \(one or more\) of software configuration items formally designated and fixed at a specific time during the software life cycle. A baseline, together with all approved changes to the baseline, represents the current approved configuration. The term is thus used to refer to a particular version of a software configuration item that has been agreed on, e.g., as a stable base for further development or to mark a specific project milestone. In either case, any new baseline is agreed through the project's agreed change control procedures.³](#)

~~**2.1.1 control point (project control point):** [a project agreed-on point in time or times when specified agreements or controls are applied to the software configuration items being developed, \(e.g., an approved baseline or release of a specified document/code or project milestone\).](#)~~

build: [\(n\) an operational version of a system or component that incorporates a specified subset of the capabilities that the final product will provide \(ISO/IEC 24765:2009\); \(v\) to perform the steps required to produce an instance of the product.](#)

[NOTE—In software, this means processing source files to derive target files. In hardware, this means assembling a physical object.](#)

~~2.1.2 release: (A) a particular version of a configuration item that is made available for a specific purpose (e.g., test release). (B) The formal notification and distribution of an approved version. The following additional terms are used in a manner consistent with their definition or usage in IEEE/EIA-12207.0: baseline, component, configuration, configuration audit, configuration control, configuration control board, configuration identification, configuration item, configuration management, configuration status accounting, interface, interface control, software, software library, software life cycle, unit, and version.~~

~~The term “the Plan” is used throughout this standard to refer to the Software Configuration Management Plan.~~

configuration control board (CCB): (1) a group of people responsible for evaluating and approving or disapproving proposed changes to configuration items, and for ensuring implementation of approved changes (ISO/IEC 24765:2009) (2) qualified personnel who evaluate, for approval or disapproval, all proposed changes to the current developmental baseline. (ISO/IEC 2382-20:1990, 20.07.08) Syn: change control board (ISO/IEC 24765:2009)

configuration item (CI): aggregation of work products that is designated for configuration management and treated as a single entity in the configuration management process. (ISO/IEC 24765:2009)

NOTE—Configuration items may vary widely in complexity, size and type, ranging from an entire system including all hardware, software and documentation, to a single module or a minor hardware component.

configuration management (CM): (1) a discipline applying technical and administrative direction and surveillance to: identify and document the functional and physical characteristics of a configuration item, control changes to those characteristics, record and report change processing and implementation status, and verify compliance with specified requirements (ISO/IEC 24765:2009) (2) technical and organizational activities comprising configuration identification, control, status accounting, and auditing. (ISO/IEC 29881:2008--FISMA 1.1 functional size measurement method, 4.9)

constituent configuration item: an individual item to be controlled that is a constituent (part) of a larger configuration item, such as a reference model, hardware prototype or software build.

¹ The database standard ISO/IEC/IEEE 24765, Systems and Software Engineering-Vocabulary can be accessed at www.computer.org/sevocab.

² *IEEE Standards Dictionary: Glossary of Terms and Definitions* is available at <http://shop.ieee.org>.

³ Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

configuration management authority: Any person(s) or group designated to be responsible for assuring that CM activities are planned and carried out.

configuration management database (CMDB): a specific type of repository for CM information, usually a data store, used to record attributes of configuration items, and the relationships between configuration items, throughout their lifecycle. (ISO/IEC 20000-1:2011)

NOTE 1—The requirements for the specific type of CMDB tool used for a given project depend on the size and complexity of the project and product. For a small-scale project, a CMDB can be as simple as a spreadsheet.

NOTE 2—Some commercial product CMDBs are specific to CIs in physical configurations, such as ports opened in a firewall; software CMDBs are inherent to CM tools and enable identification of all CIs in all states. CMDBs may be hierarchical or federated as needed to accurately determine and organize information about configuration items. CMDBs may provide information to help keep the Configuration Management System (CMS) updated and accurate.

functional configuration audit: an audit conducted to verify that the development of a configuration item has been completed satisfactorily, that the item has achieved the performance and functional characteristics specified in the functional or allocated configuration identification, and that it is operational and support documents are complete and satisfactory. (ISO/IEC 24765:2009)

ISO file: file “image” of an entire CD or DVD that is encoded according to ISO 9660.

life cycle: evolution of a system, product, service, project, or other human-made entity from conception through retirement. (ISO/IEC/IEEE 12207:2008)

physical configuration audit: an audit conducted to verify that a configuration item, as built, conforms to the technical documentation that defines it. (ISO/IEC 24765:2009)

NOTE—In addition to the definitions given in ISO/IEC/IEEE 24765, the following explanation applies: For software, the purpose of the software physical configuration audit (PCA) is to ensure that the design and reference documentation is consistent with the as-built software product.

release: (1) a delivered version of an application that may include all or part of an application (2) collection of new and/or changed configuration items that are tested and introduced into the live environment together (3) a software version that is made formally available to a wider community. (ISO/IEC 24765:2009)

release plan: a plan that describes what portions of system functionality will be implemented in which releases and the rationale for each release. It includes or provides reference to a description of release contents, release schedule, release impacts and release notifications.

repository: a (1) a collection of all software-related artifacts belonging to a system (2) the location/format in which such a collection is stored. (ISO/IEC 24765:2009)

software: (1) all or part of the programs, procedures, rules, and associated documentation of an information processing system. (2) computer programs, procedures, and possibly associated documentation and data pertaining to the operation of a computer system. (ISO/IEC 24765:2009)

software item: (1) source code, object code, control code, control data, or a collection of these items (2) an aggregation of software, such as a computer program or database, that satisfies an end use function and is designated for specification, qualification testing, interfacing, configuration management, or other purposes (3) identifiable part of a software product. (ISO/IEC 24765:2009)

software release management: management of the activities surrounding the release of one or more versions of software to one or more customers, including identifying, packaging, and delivering the elements of a product. (ISO/IEC 24765:2009)

software repository: a software library providing permanent, archival storage for software and related documentation. (IEEE Std 24765)

software version ID: an explicit and immutable version identifier (name or number) inserted into each configuration item, including each individual release, that can be used to identify the exact version of the configuration item in any instance or repository.

system: combination of interacting elements organized to achieve one or more stated purposes. (ISO/IEC/IEEE 15288:2008, 4.31) (ISO/IEC TR90005:2008, 2.1) (ISO/IEC 15939:2007, 3.39)

version: (1) an initial release or re-release of a computer software configuration item, associated with a complete compilation or recompilation of the computer software configuration item (2) an initial release or complete re-release of a document, as opposed to a revision resulting from issuing change pages to a previous release. (ISO/IEC 24765:2009)

versioning: the assignment of either unique version names or unique version numbers to unique states of software configuration items, usually for a specific purpose, such as a release of the software product to an external group or the identification of a specific baseline.

2.2 Acronyms and abbreviations

The following acronyms appear within the text of this standard:

CCB Change Control Board, Configuration Change Board

CI Configuration Item

CM Configuration Management

CMDB Configuration Management Database

CMP Configuration Management Plan

CMS Configuration Management System

COTS Commercial Off-The-Shelf

CD (see CD-ROM)

CD-ROM Compact Disc, Read-Only-Memory

DVD Digital Versatile Disc

FCA Functional Configuration Audit

ID Identification

PCA Physical Configuration Audit

QA Quality Assurance

RFC Request For Change

~~SCM software configuration management~~

~~SQA software quality assurance~~

3. Tailoring

This standard covers configuration items to be handled in any portion of the full system and software life cycle. The Supplier Configuration Item Control process may be omitted if there are no suppliers providing configuration items.

4. Audience

The primary users of this standard are assumed to be those with authority and responsibility for planning, managing, and performing CM. The user of this standard is expected to expand and supplement the minimum requirements as necessary for the development environment, specific industry, organization, and project. In addition, the audience for this standard includes all of those who contribute configuration items or who retrieve configuration items in order to use or change them.

In considering adoption of this standard, regulatory bodies should be aware that specific application of this standard may already be covered by one or more IEEE standards documents relating to quality assurance, definitions, or other matters.

Further, it is not the purpose of this standard to supersede, revise, or amend other existing standards directed to specific industries or applications.

4. Adapting the plan

~~This standard permits significant flexibility in preparing an SCM Plan. A successful Plan reflects its project environment. It should be written in terms familiar to its users and should be consistent with the development and procurement processes of the project.~~

~~To conform to the requirements set forth in other applicable standards or to accommodate local practices, a Plan may be adapted upward, to add information, or to use a specified format. The Plan may also be adapted downward, omitting information required by this standard, when specific standard requirements are identified as not applicable to this project.~~

4.1 Upward adaptation

~~Some information requirements applicable to a particular project may not be stated in this standard due to its scope of establishing the minimum required contents of an SCM Plan. If additional requirements are applicable to the project, the Plan shall so state these additions as part of the Introduction and indicate the reason for their insertion. A cost benefits analysis should be completed for each additional requirement. Requirements that are additional should be agreed on by all affected project functions and the parties responsible for approval of the plan.~~

4.2 Downward adaptation

~~Some information requirements stated in this standard may not apply to a particular project due to the project's limited scope, low complexity, or unusual environment. If a requirement is not applicable to the project, the Plan shall so state this deletion as part of the Introduction and indicate the reason for removal. Requirements that are inapplicable should be agreed upon by all affected project functions and all parties responsible for approval of the Plan.~~

~~The Plan shall omit none of the six major classes of information. Detailed information may be omitted as indicated above but within the limits of the consistency criteria stated in Clause 5.~~

~~If certain information has not been decided on or is unavailable at the time the Plan is initially approved, the Plan shall mark those areas or sections as "to be determined" and shall indicate, as part of Plan maintenance, information on how and when further information will be provided.~~

4.3 Format

~~The information may be presented in the Plan in any sequence or presentation style deemed suitable for the Plan's users. To achieve consistency and convenience within a single organization or industry segment, a standard format for SCM plans is desirable and appropriate. To customize this standard for a particular group of users, a supplement to the standard specifying Plan structure and standard terminology may be used.~~

5. The configuration management process

CM is central to, and provides essential services to, all the major processes of systems and software engineering as shown in Figure 1. All of these, along with the higher level descriptions of CM and SCM processes, are described in ISO/IEC/IEEE 12207:2008 and ISO/IEC/IEEE 15288:2008. The normative sections of this standard are mapped to these standards in Annex L.

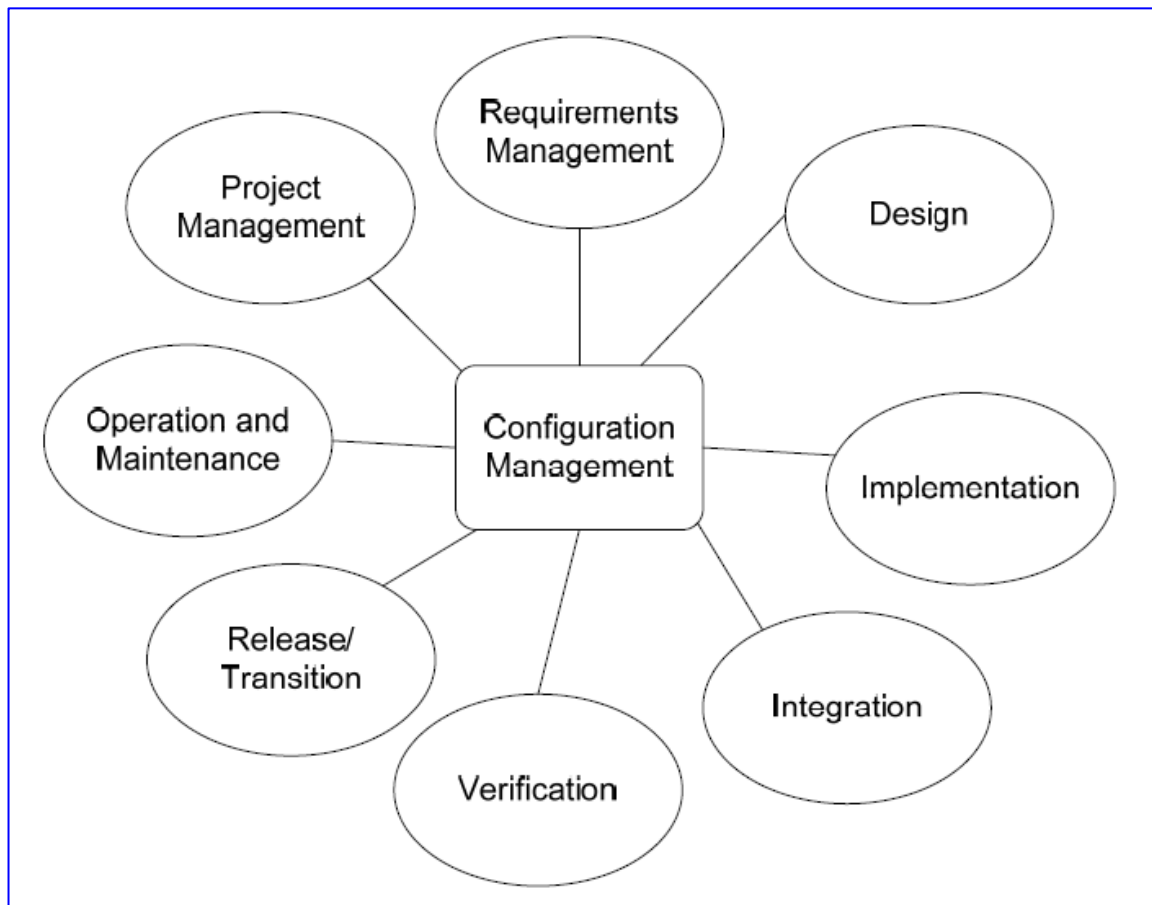


Figure 1—Example life cycle processes that CM supports

Configuration Management is essential throughout the product's life cycle, from inception (identification of the need for the product) through its end-of-life disposal. The intensity of CM activity, however, varies according to different technical processes being invoked during the life cycle.

The Configuration Management process in systems and software engineering comprises seven primary lower-level processes and two special instances of applying those lower-level processes (as shown in Figure 2), all designed to manage the Configuration Items (CIs) within a given project or for a given product, beyond the life of a single project. The primary lower-level processes are Planning, Management, Configuration Identification, Configuration Change Control, Configuration Status Accounting, Configuration Auditing, and Configuration Release Management. The special instances are Interface Control and Supplier Configuration Item Control. The items to be managed by these special instances require exercising all the primary processes. The special instances are called out separately here to highlight their importance.

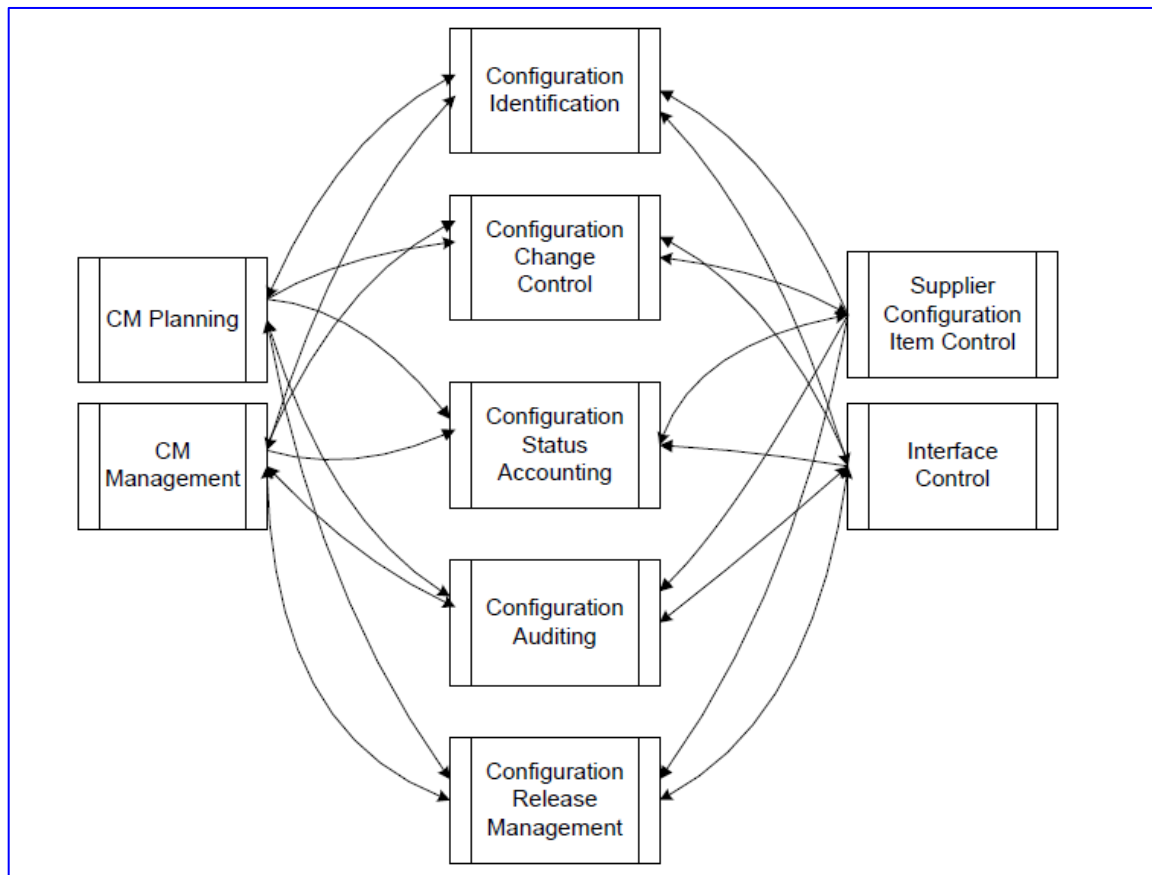


Figure 2—Lower-level processes

[Additional information on how these lower-level processes are applied throughout the lifecycle is given in Annex A and following.](#)

5. Conformance to the standard

~~An SCM Plan shall satisfy the criteria in 5.1 through 5.4 in order to conform with this standard.~~

5.1 Minimum information

~~The Plan shall include the six classes of SCM information identified in Clause 3: introduction, management, activities, schedules, resources, and plan maintenance. Within each class, all of the required information stated in Clause 3 of this standard, as indicated by the words “shall” and “required,” shall be documented within the Plan. If certain required information is not applicable, the reasons shall be so stated (see 4.2). If a sequence of information other than the sequence of this standard is used, an explicit cross reference between the Plan and the standard shall be provided.~~

5.2 Presentation format

~~One document, section title, or such reference shall exist that is specifically labeled “Software Configuration Management Plan.” Within this document, each of the six classes of information shall be included. While the information may be provided in a number of presentation styles, the requirement is to provide all Plan information and references in a single document.~~

5.3 Consistency criteria

~~The documented information shall satisfy the following consistency criteria:~~

- ~~a) All activities defined in the Plan (see 3.3.1 through 3.3.7) shall be assigned to an organizational unit (see 3.2.2).~~

~~b) All activities defined shall have resources identified to accomplish the activities (see 3.5).~~

~~e) All CIs identified in the Plan (see 3.3.1) shall have defined processes for baseline establishment and change control (see 3.3.2).~~

5.4 Conformance declaration

~~If the preceding criteria are met, then the conformance of any SCM planning documentation with this standard may be stated accordingly: “This SCM Plan conforms with the requirements of IEEE Std 828-2005.”~~

6. CM planning lower-level process

6.1 Purpose

The purpose of CM planning is to produce and communicate effective and workable CM plans (CMPs), whether for a project or for on-going CM services to an organization. Activities of this lower-level process determine the scope of the CM management and technical activities; identify process outputs, project tasks and deliverables; establish schedules for project task conduct, including achievement criteria, and required resources to accomplish CM project tasks.

The purpose of CM planning is to identify the activities and tasks (both technical and managerial) required to manage the configuration of the product, as specified in the requirements, be it at inception or at any other point in the product’s life cycle, including eventual disposal (retirement or replacement) of the product.

NOTE—CM management information describes the allocation of responsibilities and authorities for CM activities and their management to organizations and individuals within the project structure, while CM technical information describes the technical CM activities that should be carried out, as well as the environment and tools that should be used.

6.2 Activities and tasks

See Annex D for more information on the development of the CMP.

6.2.1 Develop CM plan

6.2.1.1 Identify management information needs

The CM authority shall interview the project or management team's needs for information about the status of configuration items (CIs).

6.2.1.1.1 Determine reporting needs

The types (e.g., number of defect reports associated with configuration items) of information that will be required shall be determined.

6.2.1.1.2 Determine reporting frequency

The frequency with which required information shall be reported shall be determined.

6.2.1.2 Identify information needed to manage CM activities

The CM authority shall consider the following topics for inclusion in the CMP. Any omitted topics shall be listed with the reasons they are omitted.

- a) the plan's purpose, scope of application, key terms, and references
- b) the responsibilities and authorities for managing and accomplishing the planned CM activities, including those for managing third-party configuration items
- c) CM activities and tasks to be performed
- d) the required coordination of CM activities with the other activities in the project or organization, and the interfaces necessary to achieve coordination
- e) tools and physical and human resources required for execution of the plan, including those needed for environments, infrastructure, tools, techniques, processes, equipment, and training
- f) tools to be used in the performance of CM activities
- g) how the plan will be maintained while in effect

- h) sizing and estimation of effort and duration for each of the CM activities
- i) milestones such that the activities are broken into manageable elements of work
- j) estimated costs of the activities (human and material resource costs)
- k) resourcing of planned CM activities (time allocations as well as human and material resources)
- l) dependencies between CM activities and other project activities
- m) forward and backward task dependencies
- n) naming scheme for product builds

NOTE—See Annex K for specific information about software builds.

- o) performance goals and required service levels to be achieved
- p) configuration audits to be performed (scope, duration, outputs)
- q) risks to the successful execution of the CMP and appropriate mitigation strategies and levels of effort required to mitigate; communication of residual risks to the appropriate persons

NOTE—A detailed description of the contents of the CMP is provided in Annex D.

6.2.1.3 Document CM plan

A CMP shall be established either in stand-alone form or by reference to other locations such as other documents or automated systems. Location information shall be provided to those responsible for performing CM activities and to their management.

NOTE—As with any other activities in a technical project, the CM activities should be allocated among the project team members. These team members may be part of a development group, test group, or other. CM planning includes negotiating for agreement to allocate resources to CM activities.

7. CM management lower-level process

7.1 Purpose

The purpose of CM management is to implement, monitor, control, and improve CM services. This includes determining the status of the CM activities to ensure that the CM activities and tasks are carried out according to plans and schedules, within projected budgets, and satisfy technical objectives. In addition, known risks are monitored and the effectiveness of mitigation strategies assessed. Project metrics are collected and analyzed for leading indication of CM issues to be managed. This lower-level process includes redirecting the CM activities as appropriate to correct identified deviation and variations from other CM project management or technical processes. Redirection may include re-planning as appropriate.

NOTE—ISO/IEC/IEEE 16085, ISO/IEC/IEEE 15939, ISO/IEC/IEEE 16326, and IEEE Std 1490™ should be consulted for further information.

7.2 Activities and tasks

7.2.1 Manage implementation of CMP

Human and physical resources needed for environments, infrastructure, tools, techniques, processes, equipment, and training shall be procured.

All personnel resourced for CM tasks shall be informed of their responsibilities as documented in the CMP and trained to carry them out.

Tools and environments shall be properly installed and configured.

7.2.2 Monitor CM activities

7.2.2.1 Monitor resource usage

If there is any shortfall in planned resources, then any resultant added risks to the CMP shall be communicated to the appropriate persons for development of mitigation actions. The CMP shall be modified as necessary upon agreement of appropriate management on appropriate mitigation actions. Should any residual risk remain, the CM authority and the Project Manager shall decide on an appropriate course of action.

7.2.2.2 Monitor progress

CM activities shall be tracked against the CM schedule as a regular part of Project Management. This includes planned deliveries and deliverables from third parties.

7.2.2.3 Monitor risks

Monitor the effectiveness of risk management plans and the emergence of new risks.

7.2.2.4 Identify variances

Adherence to the plan shall be tracked such that variances are identified and rectification actions taken.

7.2.2.5 Update plans

The CMP shall be updated as required when information that affects the currency of the CMP changes.

The CMP shall be updated as necessary to ensure continued CM planning during the life cycle of the product.

At a minimum, periodic reviews of this plan shall occur at the start of each iteration/phase of the emerging product.

At that time, proposed changes, if any, shall be evaluated and, with the requisite approval, implemented within the plan.

All CMP changes shall be communicated to the project team.

NOTE—For a discussion of configuration management planning in the system or software life cycle, see Annex F.

8. Configuration identification lower-level process

8.1 Purpose

The purpose of configuration identification is to determine naming schemes for configuration items (CIs), identify the items that require control as CIs, and to apply appropriate names to them. Additionally, the physical and functional characteristics of the CIs are identified.

The scope of configuration identification includes:

- a) determining the CIs that are to be managed and determining what documentation information is to be used for describing the physical and functional characteristics of each CI
- b) planning for the collection, storage, retrieval, and change control of baselined versions of the items and their descriptive documentation information
- c) establishing and maintaining associations between versions of each item and its descriptive information
- d) establishing versioned assemblies or collections of CI versions that satisfy the totality of end use functions
- e) establishing and maintaining associations between versions of such assemblies or collections and the descriptive documentation information of the physical and functional characteristics of the assembly or collection, and
- f) describing the product structure through the selection of CIs and identification of their inter-relationships.

8.2 Activities and tasks

8.2.1 Establish the structure and hierarchy of configuration items

A structure and hierarchy shall be determined based on the product's architecture (that is, its components and the relationship(s) among them). Software, firmware, hardware, and documentation/description items shall all be taken into account. A branching model facilitating traceability of changes to the software items shall be established in the development and release environments.

8.2.2 Identify configuration items

Using established selection criteria, CM personnel shall work with the producers of project artifacts to identify which items are to be controlled and the descriptive documentation to be associated with each. These items shall be identified as CIs.

Product configuration information includes both product definition and product operational information.

NOTE 1—CM personnel should work with the producers of project artifacts to verify this list is complete.

NOTE 2—Controlled items may be intermediate and final outputs. For example, approved requirements documents become CIs at the point when changes to them must go through a defined change control process. The approved requirements are then baselined as CIs. That is, that CI becomes the baseline on which design activities are based.

NOTE 3—Items that are likely to need controlling include, but are not limited to, baselined requirements specifications, interface specifications, designs, code, builds, build data, database-related items such as triggers, schema and SQL scripts, unit and coverage tests, and the standards that were used to create such items. In addition, the following are typically included: design drawings, parts lists, reference models, baselined models or prototypes, and maintenance and operating manuals. The determining factor is whether an item or information will be needed if the project needs to reinstate a previous baselined position in the life cycle to once again move forward on the build cycle.

8.2.3 Describe configuration items

Once an item has been identified as a CI, the producer of the item shall produce an item description and maintenance information.

8.2.4 Name configuration items

8.2.4.1 Establish naming convention

CM shall ensure a consistent naming convention is designed to enable each CI to be uniquely named. CM shall ensure that the naming convention takes into account the need to accommodate multiple versions of items that may arise from the creation of a number of different baselines.

CM shall ensure that the naming scheme is extensible and capable of accommodating configuration items originating from third party suppliers.

NOTE 1—This activity includes such items as reference implementations, hardware prototypes, and COTS, subcontracted, and supporting software.

NOTE 2—The design of the naming system should consider efficient storage, retrieval, tracking, reproduction, and distribution of CIs.

8.2.5 Assure CIs are placed in CM repository

8.2.5.1 Establish controlled repositories

CM shall identify the controlled repositories for the CIs and describe how the identified CIs are to be controlled in the appropriate repository.

NOTE—Additional information regarding software asset management can be found in the ISO/IEC 19770 series of standards.

For each electronic repository, the branching structure, format, location, documentation requirements, receiving and inspection requirements, and access control procedures shall be specified.

8.2.5.2 Acquire electronic CIs

After electronic CIs are identified, named, and completed, they shall be deposited in the appropriate CM repository (e.g., library).

8.2.5.3 Acquire physical CIs

CM shall ensure that any physical configuration items that are developed or acquired are appropriately labeled and stored.

8.2.5.4 Establish criteria for baselines

Criteria for establishing a CI as a baseline item (an approved configuration item) shall be defined and incorporated in the CMP. The criteria shall define the formal approval(s) required to assign baseline status to a CI, such as manager sign-off for a project plan, or quality criteria for a software or system product.

NOTE—A baseline provides a logical basis for comparison. A specific version of a single work product by itself, or a set of work products together can be established as a baseline. During the course of product development, a series of baselines is established, enabling assessment of the evolving product's maturity at different points in time.

8.2.5.5 Define how baselines are established

This task shall include identifying:

- a) The events that establish a baseline
- b) The items that are to be controlled in the baseline
- c) The procedures used to establish and change the baseline
- d) The authority required to approve changes to the approved baselined items

8.2.5.6 Identify baselines

During each iteration/phase of a development project, newly developed CIs and new versions of pre-existing CIs shall be identified as CIs.

At the close of each iteration/phase, approved CIs shall be baselined for the project.

CM shall ensure that all updates, deletions, and additions to identified items are performed only as an outcome of the change control process.

8.2.5.7 Establish change control process

CM activities shall ensure that a documented change control lower-level process describes how changes to baselines and their associated items are requested and dispositioned.

CM activities shall ensure that the appropriate approvals bodies are in place to make decisions about requested changes.

CM activities shall ensure that data is included with any change to provide traceability to the original Request for Change.

8.2.5.8 Establish physical storage procedures

CM shall specify procedures for the physical storage of documents needed for disaster recovery, such as procedures for access to stored records and documents and stored physical media, reference hardware, and electronic media, including the physical marking and labeling of items.

NOTE—Off-site archiving, data retention periods, and technical data recovery procedures should also be described.

8.2.5.9 Establish CM procedures

CM procedures shall describe how to retrieve and reproduce controlled items from the repository.

These activities shall include verification of marking and labeling, tracking of controlled copies, and protection of proprietary and security information.

8.2.5.10 Assure system maintenance for CM repository reliability

CM shall ensure that baselines are reproducible from the same sources from which they were originally created.

CM shall ensure that backup storage of its baselined data is maintained to facilitate technical data recovery.
CM shall ensure that a technical data recovery procedure is defined and deployed.

For a discussion on applying configuration identification in the software life cycle, see Annex G.

9. Configuration change control lower-level process

9.1 Purpose

The purpose of configuration change control is to maintain the integrity of the product in all of its states, from requirements to a validated working product, as changes to it are needed both under development and post-release.

Configuration items may be constituent or composite. A baselined software or system product is a composite configuration item: It is composed of more than one constituent item.

Configuration change control for constituents differs from change control for product or system baselines. Each may be managed by different processes and tool sets and with different levels of formality.