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REPORT

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Information technology — Software life cycle processes — Configuration Management

Technologies de l'information — Procédés de cycle de vie du logiciel — Gestion de configuration

Contents

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of Technical Reports through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The main task of technical committees is to prepare Technical Reports, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of a Technical Report, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on a Technical Report;

— type 3, when a technical committee has collected data of a different kind from that which is normally published as a Technical Report ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until data they provide are considered to be no longer valid or useful.

ISO/IEC TR 15846, which is a Technical Report of type 1, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software engineering*.

Annex A forms an integral part of this Technical Report.

Introduction

Relationship with other Technical Reports

This Technical Report presents the requirements for the Software Configuration Management (SCM) Process. SCM is a supporting CM Process to the life cycle of a software product, as described in ISO/IEC 12207, "Information technology - Software life cycle processes". SCM provides continuity across the Operation, Maintenance and Development Processes.
Annex A (informative) of this Technical Report shows the relationship with the clauses of ISO/IEC 12207.
Where text has been quoted from ISO/IEC 12207:1995, that text is enclosed in a box, for ease of identification.
This Technical Report keeps consistency with ISO 10007 "**1995, Quality management — Guidelines for** *configuration management*". The relationship of the clauses in ISO 10007 to the clauses in this Technical Report is shown in annex A.

Types of software

SCM administers any information that can be stored in a computer, including the software products. For example: specifications, database schema, test cases, user operating instructions, reusable coded objects, source and executable code, or data.
SCM may also administer lists and records about software items of significance stored in other locations. For example: products installed at an operational site, or off-the-shelf products loaded on a network.
Software products used as tools in the software environment to create, maintain, archive or restore the deliverable software product, are also types of software capable of being administered by SCM, as are the instructions and any customization or parameters to operate the tool. The software environment (for example development) may be deliverable or may be proprietary.
SCM can apply to few or to all items of software from a life-cycle activity.

Implementation of the SCM Process

SCM may be performed by a combination of software tools, methods and techniques. This Technical Report does not specify how to implement or perform the activities and tasks in the SCM Process. The SCM requirements remain the same irrespective of the tools by which SCM is implemented.
A number of emerging requirements for SCM (e.g. for product delivery to multiple sites with different product configurations, or for concurrent modification of Configuration Items - CIs) may apply the SCM Process in this Technical Report to assist in controlling these emerging areas. Parties wishing to operate such tasks are advised to define the additional requirements in contract agreements or SCM policy and procedures.
NOTE A procedure may a document, a template, etc.

Benefits

This Technical Report can improve the visibility and accountability within the Operation, Maintenance and Development Processes by:

- providing an appropriate documented and repeatable scheme for identifying and controlling electronic documents, code, interfaces, databases, etc., to support the software life-cycle processes;
- supporting a chosen development, maintenance or operations methodology fitting the requirements, standards, policies and directives, organization and management philosophy;
- producing management and product information concerning the status of baselines, changes, releases, versions, archives, etc.;
- recursively defining a Software CI (SCI) to the level of individual items of significance to be controlled;
- controlling the libraries used to store SCIs together with their status and related information;
- invoking the ISO/IEC 12207 Processes to assure the integrity of the configurations;
- controlling the software environment to enable a software product to be configured and reconfigured over its useful life, including the software tools used to develop and verify the software product; to assure the integrity of the configuration (e.g. requirements tracker, SCM library guardian, release builder); and to run those tools (e.g. operating system);
- storing and retrieving information on anomalies for individual SCIs and for software product configurations;
- reporting the ownership for intellectual property considerations, such as licences or copyright.

SCM in contractual relationships

The SCM requirements are derived from at least three supply chain relationships:

- acquirer placing work on the software product supplier;
- supplier responsible for delivering the software product;
- subcontractor or software technicians to carry out the work.

A fourth relationship may exist where the acquirer and supplier agree to use a third party archive (for escrow). In this relationship, in addition to the bi-directional supply chain between acquirer and supplier, there is a triangular unidirectional flow from the supplier via the third-party archive to the acquirer (see Table 1 and Figure 1).

Benefits to the prime acquirer

For the acquirer some benefits of SCM are:

- assurance of the completeness of the development, operations or maintenance requirements;
- flexibility to enable changes to the requirements to be made under controlled conditions;
- basis to establish evaluation criteria for SCM activities and tasks;
- provision of complete and incomplete (e.g. engineering release) items.

Use of this Technical Report is intended to help ensure:

- project objectives meet customer and organizational constraints;
- criteria and means for determining successful completion of project objectives are defined;
- SCM software life-cycle products and their inter-relationships are defined;
- inter-relationships between processes are defined, where an SCM activity interacts with other software life-cycle process(es), e.g. Software Quality Assurance;
- software baselines are controlled;
- a plan for SCM activities, or related planning document, is created, used, monitored and adjusted;
- SCM interfacing between two or more parties or processes is defined.

Where multiple teams and/or subcontractor relationships require more emphasis on interface management, the configuration control is normally tailored to cater to changes across interfaces rippling through levels of subcontracts or organizations.

Benefits to the software product supplier

Some benefits of SCM to the software product supplier are:

- looking after items fulfilling the requirements and by controlling change;
- support for the Joint Reviews Process by providing the status of SCIs (in this instance, the major software product from a life-cycle process) attached to management milestones;
- support for the Audit Process by concentrating on results which are measurable for compliance checking;
- support for the Quality Assurance, Verification and Validation Processes to the extent they are present in the software life cycle.

Benefits to a subcontractor or software technician

Some benefits of SCM to subcontractors or software technicians are:

- stable baselines with assurance these baselines can be rebuilt;
- consistent communication of status;
- status and interdependence of outstanding requirements;
- notification, analysis and reversal of change;
- delegated change authority;
- consistent method for handling, storing, replicating, packaging and releasing SCIs.

Benefits of any third party archive (escrow)

The status of SCIs may be shared between a supplier, an acquirer and a third-party agent charged with holding items until some contract condition is met, for example, final payment or liquidation of the supplier.

A benefit to the acquirer and supplier of a third-party agent applying SCM is the integrity of the deposited SCIs. This Technical Report provides requirements for guarding and retrieving these SCIs.

| Role	As Acquirer	As Supplier
Acquirer/operator/user	To software product supplier: request product receive SCM managed product	To final client: may supply software product may use software product to deliver information technology service
Software product supplier	To SCM Process supplier: requests SCM Process receives result of SCM activities and tasks	To acquirer/operator/user: supplies software product receives requirements for [tailoring] SCM Process
SCM Process supplier	To subcontractor or vendor: requests subcontractor work or tool receives subcontractor work or tool	To software product supplier: receives request for SCM Process supplies SCM results to software product
subcontractor or vendor	To lower-level subcontractor: may request work or tool [and so ad infinitum]	To SCM Process supplier: receives request for subcontractor work or tool supplies subcontractor work or tool
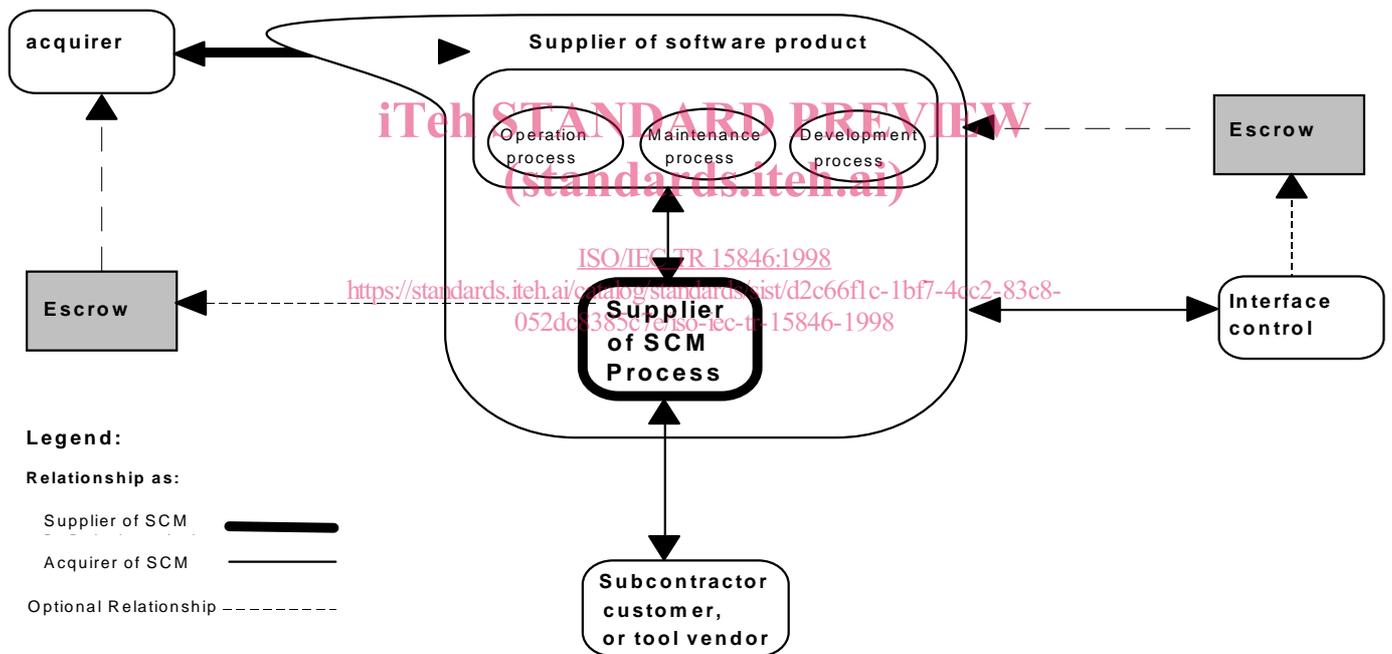
Figure 1 — Role relationship between Supplier of SCM Process and other parties.

Information technology — Software life cycle processes — Configuration Management

1 Scope

This Technical Report establishes the requirements for performance of the configuration management of computer software for development, maintenance and operations. This Technical Report is based on the Configuration Management (CM) Process of ISO/IEC 12207 (hereafter referred to as the Software Configuration Management (SCM) Process).

This Technical Report is applicable to:

— any software in any form;

— the entire software product life cycle and to individual development, maintenance and operations projects within that life cycle; software acquired from a subcontractor or vendor;

— the supplier and the acquirer of the software product.

This Technical Report is applicable for use in a two-party situation and may be equally applied where the two parties are from the same organisation. The situation may range from an informal agreement to a formal contract. This Technical Report may be used by a single party as self-imposed tasks, or be applied to off-the-shelf products.

1.1 Tailoring this Technical Report

Some software products and software life cycles may require requirements set forth in other applicable standards, contracts or to accommodate local practices. The SCM Process may be tailored by adding requirements.

The SCM Process may also be tailored to omit requirements of this Technical Report where specific requirements are identified as not applicable. Tailoring of this Technical Report in accordance with tailoring of ISO/IEC 12207 may be assisted by the mapping provided in this Technical Report (see annex A).

1.2 Process roles

The users of this Technical Report take the acquirer and supplier roles (see Figure1).

The supplier of the software product performing the Maintenance and Development Processes defined in ISO/IEC 12207 is the acquirer of SCM.

For the Operation Process, after acceptance of the software product, the acquirer may take the role of supplier of SCM to the final client or consumer.

The supplier of the SCM Process (hereafter referred to as "the SCM Process") may take the role of acquirer of subcontracted or vendor work.

2 Conformance

Not applicable.

3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this Technical Report. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply.

However, parties to agreements based on this Technical Report are encouraged to investigate the possibility of applying the most recent editions of the normative references indicated below. Members of ISO and IEC maintain registers of currently valid Technical Reports.

ISO/IEC 12207:1995, *Information technology — Software life cycle processes.*

ISO/IEC 2382-20:1990, *Information technology — Vocabulary — Part 20: System development.*

ISO/IEC 2382-1:1993, *Information technology — Vocabulary, Part 1: Fundamental terms.*

Informative references are listed in annex B.

4   Definitions

For the purposes of this Technical Report, the definitions given in ISO/IEC 12207 and the following definitions apply.

4.1
approved modification
the disposition of one or more proposed changes authorising change to any SCIs

NOTE There may be a many-to-many relationship of "proposed change" to "approved modification". A proposed change may cause modifications in several SCIs (even if only to the code and its test case). A modification may originate from several proposed changes, approved simultaneously or over a period of time while the modification is still in progress.

4.2
change authority
as "configuration board" in ISO 10007

NOTE Disposition is made by a designated change authority traditionally given the name "Change/Configuration Control Board". This authority may approve a proposed change, thus converting it to an approved modification, or may disapprove a proposed change, or may defer a decision.

4.3
proposed change
a report of anomaly, required or recommended enhancement from the time an idea is recorded until the disposition by a designated change authority

NOTES

1 The disposition may be to reject, to defer for further analysis, or to accept. Upon acceptance the proposed change becomes an approved modification.

2 There may be a one-to-one, one-to-many, or many-to-many relationship between proposed changes and approved modifications.

4.4
Software Configuration Management (SCM)
the process of applying configuration management (see ISO 10007) throughout the software life cycle to ensure the completeness and correctness of SCIs

4.5
software library
a controlled collection of SCIs to aid in development, operation and maintenance

4.6
software tool
a software product providing automatic support for software life-cycle tasks

NOTE Software tools include vendor software and in-house developed tools, whether supported by their creator or not. Tools include software run by the operating system and the operating system itself. Tools also include interpreted programs, such as macros, test scripts, or build instructions.

5 Symbols (and abbreviated terms)

5.1 Abbreviations and acronyms

The following abbreviations and acronyms appear within the text of this Technical Report:

CI   Configuration Item
CM   Configuration Management
SCI   Software Configuration Item
SCM   Software Configuration Management.

6 SCM Process Implementation

> **ISO/IEC 12207: 1995**
> 6.2.1 **Process implementation**. This activity consists of the following task:
> 6.2.1.1 A configuration management plan shall be developed. The plan shall describe: the configuration management activities; procedures and schedule for performing these activities; the organization(s) responsible for performing activities; and their relationship with other organizations, such as software development or maintenance. The plan shall be documented and implemented.
>   Note   The plan may be a part of the system configuration management plan.

The SCM Process is implemented to cover the entire, or any specific subset of, the software life cycle for an Operation, Maintenance or Development Process.

6.1 Initiating and defining the scope

6.1.1 Defining the inputs to the SCM Process

The SCM Process shall obtain the SCM requirements as input and ensure the SCM requirements are complete and understandable. These SCM requirements shall include:

- software products to be part of the SCM Process;
- evidence or assurance the SCM Process is carried as stated in a SCM Plan;
- software environment of the SCM Process.

Where the software product contains acquired, customer supplied, subcontracted, or vendor SCIs, the SCM Process shall identify, control changes to, account for the status of, and perform configuration evaluation (also known as "configuration audit") on any externally derived SCIs.

6.1.2 Defining the resources and constraints to the SCM Process

The SCM Process shall establish the organizational context, both technical and managerial, within which the SCM activities are to be implemented by defining:

a)   organizational units affected by SCIs being designated as baseline, participating in or responsible for any SCM activity;

b)   SCM roles and responsibilities of these organizational units;

c)   relationships between organizational units, acquirer supplier.

The SCM Process shall establish and maintain documents defining organizations, activities, tasks, procedures, formats for planning information and reports, and resources.

The SCM Process shall uniquely identify references to SCM procedures, standards, terminology and related documents.

6.1.3 Allocating responsibility and authority

The SCM Process shall plan, acquire and employ the necessary resources for SCM.

The SCM Process shall allocate the SCM activities to organizational units with authority and ability to carry them out, including:

a)   establishing baselines;

b)   approving/disapproving changes to baselines;

c) releasing software products;

d) approving/disapproving concession for deviation from SCM requirements.

The SCM Process shall identify and appoint a single point of contact.

The SCM Process shall determine the criteria for obtaining approval for changes to a baseline.

The SCM Process shall identify the change authority and assign the sphere of authority.

6.1.4   Criteria for selection of SCIs

The SCM Process shall establish criteria for selecting SCIs based on the software products:

a) required;

b) to be used by the software environment;

c) to be used to derive the release, including instructions and parameters of the tool for the derivation.

The SCM Process shall define criteria to select sufficient SCI to manage the performance parameters and physical characteristics of SCIs.

NOTE The SCM Process should avoid selection of too many SCIs that hamper visibility to management and increase cost.

6.1.5   Defining the outcomes from the SCM Process

As required, the SCM Process shall plan to transfer the following outputs:

a) information to operate the software environment;

b) SCI identification schema;

c) tools and software environment to recreate the SCIs;

d) scheme for SCI version control;

e) documents supporting the SCI structure;

f) meaning of the SCI status;

g) status of SCIs;

h) integrity of the SCI status;

i) SCIs.

6.2   Planning

For a specific software product, the SCM Process shall plan the dependency of SCM activities on the software life-cycle milestones or events (for example, introduction of interface control) affecting the SCM implementation.

The representatives of those performing or interacting with the SCM activities shall review and approve the SCM planning information.

As required, the SCM Process shall provide for transfer of the SCM Process and the advancement of the SCM software products.

The SCM Process shall plan to terminate the SCM activities, as appropriate.

The SCM Process shall update the SCM planning information to reflect changes. The SCM Process shall review and receive approval from those involved before the changed SCM tasks are performed.

The following information shall be included in, or referenced by, the SCM Plan, as appropriate:

a) identification of the contract;

b) scope of SCM support of the specified software life-cycle processes;

c) identification of known software products to be delivered;

d)   identification of other software products required for subsequent maintenance or affecting the integrity of those items identified in c) above;

e)   organizational definitions and inter-relationships;

f)   roles and responsibilities;

g)   list of needed resources, and when the resources are needed;

h)   relationship of SCM to any hardware or system CM and the procedures for interfacing the activities including subcontractor SCM control, as appropriate;

i)   procedure for status reporting, including format, schedule and distribution;

j)   procedure for controlling changes, including proposing a change, and assigned authorities for changing and advancing SCIs;

k)   policy for prior version support, including the number of versions to be retained;

l)   support for individual customers with multiple versions;

m)   review for verifying the baselines;

n)   audit for verifying the integrity of the SCM Process to be applied;

o)   risk that the SCM Process will be unable to provide the required tasks, thus impacting cost, schedule or performance of SCM tasks;

p)   procedure for release management and delivery;

q)   interface control.

6.3   Controlling execution

The SCM Process shall provide the software environment with adequate tools, equipment and training in sufficient time for personnel to carry out the SCM tasks as defined in the SCM Plan. The SCM Process shall perform the SCM tasks as documented in the SCM Plan.

6.4   Review and evaluation of the SCM Process

The SCM Process shall ensure the SCM tasks comply with the SCM Plan. The SCM Process shall carry out such processes as the Problem Resolution and/or Process Improvement Processes to rectify any divergence from the SCM Plan.

6.5   Closing

The SCM Process shall terminate the SCM activities, as appropriate.

7   Software configuration identification

> **ISO/IEC 12207: 1995**
> 6.2.2 **Configuration identification**. This activity consists of the following task:
> 6.2.2.1 A scheme shall be established for the identification of software items and their versions to be controlled for the project. For each software item and its versions, the following shall be identified: the documentation that establishes the baseline; the version references; and other identification details.

The SCM Process shall establish an identification scheme for the software products to be controlled as SCIs and as baselines.

7.1   Identifying SCIs

The SCM Process shall provide a unique identification to each SCI. The SCM Process shall document the relationship between SCIs.

The SCM Process shall provide unique identification to the tools used to develop, control, build, verify, load and re-create the SCIs.