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Information technology — Systems and software engineering — Guide for configuration management tool capabilities

Technologies de l'information — Ingénierie des systèmes et du logiciel — Guide pour les capacités d'outil de gestion de configuration

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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 International Standards 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

In exceptional circumstances, the joint 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 an International Standard, 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 an International Standard;

— type 3, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard ("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 Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

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ISO/IEC TR 18018, which is a Technical Report of type 2, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

Introduction

Configuration management (CM) is a process central to the software engineering life cycle. CM has been established as an ISO/IEC standard life cycle process in ISO/IEC 12207:2008, *Systems and software engineering — Software life cycle processes* and ISO/IEC 15288:2008, *Systems and software engineering — System life cycle processes*.

ISO/IEC 12207 and ISO/IEC 15288 describe a comprehensive set of processes, activities and tasks to be performed when acquiring or developing software. However, these documents do not address the capabilities that a CM tool user can expect from a tool in order to support the CM process and other software engineering life cycle activities. There is a gap between CM process descriptions and corresponding CM process automation which affects both tool users and tool suppliers.

This Technical Report provides guidance in the evaluation and selection for CM tools during acquisition. CM tool evaluation by prospective users can be complex, time consuming, and expensive. This Technical Report helps to characterize what a CM tool can and cannot do in the CM process.

This Technical Report provides guidance for tool manufacturers in implementing a minimum set of capabilities. The capabilities defined in this Technical Report are linked to ISO/IEC 12207 and ISO/IEC 15288, and will provide tool manufacturers with guidance on the characteristics their tools should support to meet these International Standards.

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Information technology — Systems and software engineering — Guide for configuration management tool capabilities

1 Scope

This Technical Report provides guidance for configuration management tool capabilities from which systems and software development life cycle activities can be supported.

ISO/IEC 14102:2008, *Information technology — Guideline for the evaluation and selection of CASE tools*, details a set of evaluation criteria for CASE tools without referencing a specific activity or task which the tool supports. This lack of consideration on a specific activity or task causes users confusion and difficulty in evaluating and selecting the right tools.

This Technical Report supplements ISO/IEC 14102:2008 by providing a set of minimum tool capabilities for configuration management. It can be used as the set of criteria by a potential user during an acquisition process, or by a configuration management tool supplier to help identify desirable tool capabilities.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 12207:2008, *Systems and software engineering — Software life cycle processes*

ISO/IEC 15288:2008, *Systems and software engineering — System life cycle processes*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
attribute
property associated with a set of real or abstract things that is some characteristic of interest

3.2
baseline
version of a configuration, 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

[ISO/IEC 12207:2008 and ISO/IEC 15288:2008]

3.3
branch
deviation from the main development line for a configuration item, which allows different persons to work on the same item at the same time

3.4
build
process of generating (archiving) an executable and testable system from source versions or baselines

NOTE   The build needs to compile and link the various versions in the correct order. The build tools can be integrated into a configuration management tool.

3.5
change request
CR
formal procedure for submitting a request for an adjustment of a configuration item

3.6
configuration item
entity within a configuration that satisfies an end use function and that can be uniquely identified at a given reference point

[ISO/IEC 12207:2008 and ISO/IEC 15288:2008]

3.7
configuration management
CM
coordinated activities to direct and control configuration

3.8
CM services
abstract description of work done by CM tools

NOTE   A service is self contained, coherent, discrete, and can be composed of other services.

3.9
CM tool
software product that can assist software engineers by providing automated support for configuration management activities

3.10
configuration status accounting
CSA
element of configuration management that consists of the recording and reporting of information needed to manage a configuration effectively

[ISO/IEC 24765]

3.11
delta
difference between two versions

3.12
software/system element
element that defines and prescribes what a software or system is composed of (for example, requirements, design, code, test cases, and version number)

NOTE   An element can contain sub elements or other software/system elements that are dependent on the top level element.

3.13
release
particular version of a configuration item that is made available for a specific purpose (for example, test release)

3.14
traceability
degree to which each element in a software development product establishes its reason for existing

3.15
version
identified instance of a configuration item

NOTE   Modification to a version of a software product, resulting in a new version, requires configuration management action.

3.16
version identifier
supplementary information used to distinguish a version of a configuration item from other versions

NOTE   Version numbers are used to compare the version of the software product against another version.

4   Application of this Technical Report

4.1   Overview

This clause presents the benefits to groups of people that acquire, supply, develop, operate, and maintain a CM tool. The objective is to provide a road map for the users of this Technical Report so that they can orient themselves in it and apply it judiciously.

4.2   CM personnel

Personnel involved in the performance of one or more CM activities will benefit from this Technical Report as follows:

— obtain a better understanding of the relationship between the activities in which they are involved and CM tool capabilities

— identify processes or activities that can be improved through better support by a CM tool

— have an objective basis for a better comparison, evaluation, and assessment of CM tools

4.3   Tool suppliers

Suppliers of software engineering tools will benefit from this Technical Report as follows:

— develop CM tools consistent with the International Standards ISO/IEC 12207:2008, ISO/IEC 15288:2008, and ISO/IEC 14102:2008

— provide CM tools that can be shown to support an internationally accepted set of capabilities

4.4   Acquirers

People involved in the purchase of CM tools will benefit from this Technical Report as follows:

— review CM services that can contribute to CM process improvement

— identify criteria for selecting CM tools

— compare competing CM tools based upon this Technical Report

5 Capabilities of configuration management tools

5.1 Overview of configuration management tool capabilities

Throughout the systems and software life cycle, different artifacts (e.g., hardware, software, documents) exist in different versions at different times and changes arise constantly. Configuration Management (CM) verifies and assures that a product performs as intended by providing visibility and control of product's functional and physical characteristics. A CM tool can provide automated assistance for CM activities: configuration identification, change management, reports, status accounting, and auditing. This Technical Report provides the tool capabilities for the automation of CM activities to support software and systems lifecycle processes.

NOTE   The following documents have been reviewed for identifying the CM tool capabilities: ISO/IEC 12207:2008, ISO/IEC 15288:2008, ISO/IEC TR 15846, ISO/IEC TR 19759 SWEBOK, ISO/IEC 14102:2008, ISO 10007:2003, ISO/IEC 15940:2006, IEEE 828:1990, ANSI/EIA 649:1998, and commercial tool information. The life cycle processes and activities from these references have been used as the basis for the CM tool capability categorization found in this document.

5.2 Configuration management tool capabilities

5.2.1 Overview

The CM activities described in ISO/IEC 12207:2008 and ISO/IEC 15288:2008 includes configuration identification, configuration baselining, configuration control, configuration status accounting, configuration auditing, and release management and delivery. Besides of these CM activities, integrating CM tools into the software development environment is also a key for automated CM support. The CM tool should provide not only the capabilities supporting the CM activities but also the tool integration capability into other tools and platforms.

5.2.2 Configuration identification

Configuration identification should capture the attributes of the software to be controlled: the software contents, the different versions of contents, the operation data, and any other essential elements that constitute the configuration item. The tools should provide the following capabilities for the configuration items:

— identifying configuration items

— specifying configuration item relationship

— defining states and specifying status of configuration items

NOTE   Refer to ISO/IEC 12207:2008 and ISO/IEC 15288:2008 for the output of software lifecycle process, activity, and task.

5.2.3 Configuration baselining

For each configuration item and its versions, the tool should provide the following capabilities for baselines:

— creating baseline

— storing the baseline with its version references and identification details

— tracing baselines

— reporting baseline status

5.2.4   Configuration control

The tool should provide the following capabilities for configuration control:

— controlling changes

— controlling access

— controlling versions

5.2.5   Configuration status accounting

The tool should provide the following capabilities for status accounting:

— recording status information

— tracing the status

— reporting status of configuration management items

5.2.6   Configuration auditing

The tool should provide the following capabilities for configuration audits:

— planning audit

— auditing the functional completeness of configuration items against requirements

— auditing the physical completeness of the configuration items (whether their design and code reflect an up-to-date technical description)

— reporting audit results

— analyzing anomaly

5.2.7   Release management and delivery

The tool should provide the following capabilities for release management and delivery:

— building software products

— storing the master copies of the code and documentation over the life of the software product

— replicating, packaging, and delivering of code and documentation in accordance with the policies of the organizations involved

— tracking build and release identification

5.2.8   Other configuration management tool capabilities

The tool should provide the following general capabilities:

— integrating with other tools and platforms

5.3 Configuration identification

5.3.1 Overview

Configuration identification is the basis for the subsequent control of the software configuration. This activity includes identifying items to be controlled, establishing an identification scheme for the items and their versions, and specifying the relationship and status of the configuration items.

5.3.2 Identifying configuration items

Configuration item identification should capture at a minimum the following characteristics of the software/system elements to be controlled:

— software/system element contents (e.g., requirements, design, analysis, code, test cases, and traceability between the elements)

— different versions of configuration item and its constituent components

— software/system element operation data (e.g., history of change, version number, number of change requests)

— name of configuration item.

The tool should provide the following capabilities for configuration item identification:

— generating a unique identifier to distinguish each item (e.g., alphabetic, alphanumeric)

— providing a means of documentation (e.g., templates or forms) of the configuration information to be used to describe each configuration item (e.g., configuration identification number, link to other configuration item, link to software structure, link to baseline, link to version hierarchy, link to storage, owner, creation date, version number, and configuration status)

— linking to change requests associated with the configuration item.

5.3.3 Specifying configuration item relationship

The structural relationships among the configuration items affect other CM activities or tasks, such as software building or analyzing the impact of proposed changes. The tool should provide the following capabilities for configuration item relationships:

— the tracing to and from the configuration items

— the tracing the configuration item relationship links both upward and downward in the software hierarchy

— the mapping of the identified configuration items to the elements of software structure (e.g., system, sub-system, component, library, or unit code).

5.3.4 Defining states and specifying status of configuration items

A configuration item may have a lifecycle that goes through different states (e.g., checked-in, checked-out, change-requested, change-approved, change-rejected, change-reviewed, change-tested, and change-completed). Changes in state are triggered by conditions or events (e.g., submit, retrieve, change-request-submit, change-approve, change-review, change-reject, testing, and change-complete).

The status of a configuration item is defined by the state in which it exists at any given time.