INTERNATIONAL STANDARD

ISO/IEC 20741

First edition
2017-05

Systems and software engineering — Guideline for the evaluation and selection of software engineering tools

Ingénierie des systèmes et du logiciel — Lignes directrices pour l'évaluation et le choix des outils d'ingénierie logicielle



Reference number
ISO/IEC 20741:2017(E)

© ISO/IEC 2017



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword ..... **v**

Introduction ..... **vi**

1 Scope **1**

2 Normative references **2**

3 Terms and definitions **2**

4 Abbreviated terms **3**

5 Overview of evaluation and selection of software engineering tools **3**
5.1 Introduction of the evaluation and selection of software engineering tools 3
5.2 Framework of the evaluation and selection of software engineering tools 4
5.3 General process considerations 4
5.3.1 Sequencing of processes 4
5.3.2 Reducing cost and risk 5

6 Preparation process **5**
6.1 Purpose 5
6.2 Outcomes 6
6.3 Activities and tasks 6
6.3.1 Goal setting 6
6.3.2 Establishing selection criteria 7
6.3.3 Project planning and control 7

7 Structuring process **8**
7.1 Purpose 8
7.2 Outcomes 8
7.3 Activities and tasks 9
7.3.1 Requirements definition 9
7.3.2 Software engineering tool information gathering 10
7.3.3 Identifying final candidate software engineering tools 11

8 Evaluation process **11**
8.1 Purpose 11
8.2 Outcomes 12
8.3 Activities and tasks 12
8.3.1 Preparing for evaluation 12
8.3.2 Evaluating software engineering tools 13
8.3.3 Evaluation reporting 14

9 Software engineering tool selection process **14**
9.1 Purpose 14
9.2 Outcomes 15
9.3 Activities and tasks 15
9.3.1 Preparing for selection 15
9.3.2 Applying the selection algorithm 15
9.3.3 Recommending a selection decision 15
9.3.4 Validating the selection decision 15

10 General software tool characteristics **16**
10.1 Overview 16
10.2 Characteristics related to software engineering tool usage functionality 16
10.2.1 Overview 16
10.2.2 Software engineering tool operation environment characteristics 16
10.2.3 Software engineering tool integrability characteristics 17
10.2.4 Software engineering tool application characteristics 18
10.3 General quality characteristics 20
10.3.1 Overview 20

© ISO/IEC 2017 – All rights reserved

10.3.2 Functional suitability characteristics 20
10.3.3 Performance efficiency characteristics 20
10.3.4 Compatibility characteristics 21
10.3.5 Usability characteristics 21
10.3.6 Reliability characteristics 22
10.3.7 Security characteristics 23
10.3.8 Maintainability characteristics 24
10.3.9 Portability characteristics 25
10.4 General characteristics not related to quality 26
10.4.1 Overview 26
10.4.2 Acquisition process characteristics 26
10.4.3 Implementation characteristics 27
10.4.4 Support indicators characteristics 27
10.4.5 Evaluation or certification characteristics 28
Annex A (informative) **Examples of selection algorithms** **29**
Annex B (informative) **Evaluation report contents** **32**
Bibliography **34**

© ISO/IEC 2017 – All rights reserved

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

© ISO/IEC 2017 – All rights reserved

Introduction

Within systems and software engineering, software engineering tools represent a major part of the supporting technologies used to develop and maintain information technology systems. Their selection is carried out with careful consideration of both the technical and management requirements.

The objective of an evaluation process is to provide quantitative and comparable results of all candidate alternatives. The final selection can then be based on these results. To be widely useful and accepted, the software engineering tool evaluation and selection processes are supposed to help both the users and the suppliers of software engineering tools. The more objective, repeatable, and impartial the evaluation and selection processes are, the more widely acceptable they are. The information and guidance outlined in this document are intended to lead to more cost-effective selections of software engineering tools and to a greater uniformity in how software engineering tool functions and features are described.

For evaluating and selecting software engineering tools, a set of processes providing a procedure for evaluation and selection, a list of capabilities providing scope of functional requirements, and a list of characteristics providing scope of non-functional requirements are needed.

Evaluation and selection of software engineering tools is usually performed within a specific, purpose-oriented tool area for practical reasons, to manage the scope of evaluation and selection. Examples of such tool areas are requirements engineering tools and configuration management tools. Lists of capabilities are tool area specific, but the list of characteristics and the set of evaluation and selection processes are more generic for all software engineering tool areas.

This document defines a set of processes and a list of characteristics which can be used by all software engineering tool areas. This document can be used together with any tool area-specific standard which defines list of capabilities for the tool area.

International standards defining lists of capabilities for specific tool areas have been published, such as ISO/IEC 30130 for “software testing tools”, ISO/IEC TR 24766 for “requirements engineering tools”, and ISO/IEC TR 18018 for “configuration management tools”. Lists of capabilities for other tool areas of software engineering can be developed as a series of standards according to their priority.

It is supposed in this document that tool area is decided before starting the evaluation and selection. It is recommended that the decision would be based on ISO/IEC 15940 which defines the software engineering service for each tool area.

This document adopts the general model of software product quality characteristics and sub-characteristics defined in ISO/IEC 25010 and gives additional guidance how to apply the model when the software product is a software engineering tool. The document follows also the software product evaluation model defined in ISO/IEC 25041.

© ISO/IEC 2017 – All rights reserved

Systems and software engineering — Guideline for the evaluation and selection of software engineering tools

1 Scope

This document gives guidelines for the evaluation and selection of software engineering tools, covering a partial or full portion of the software engineering life cycle.

It establishes processes and activities to be applied for the evaluation of software engineering tools and selecting the most appropriate software engineering tools from several candidates.

It establishes, for selected processes, the tasks and activities that can be applied for the evaluation of software engineering tools and selecting the most appropriate software engineering tools from several candidates.

It establishes processes that can be applied for the evaluation of software engineering tools and selecting the most appropriate software engineering tools from several candidates.

As these processes are generic, organizations can adapt these generic processes to meet organizational needs. The software engineering tool evaluation and selection processes can be viewed in the larger context of the organization's technology adoption process.

This document provides the following:

a) guidance on identifying organizational requirements for software engineering tools;

b) guidance on mapping those requirements to software engineering tool characteristics to be evaluated;

c) a process for selecting the most appropriate software engineering tool from several tools, based on measurements of the defined characteristics.

NOTE 1 Guidance on mapping those requirements to software engineering tool capabilities to be evaluated is not covered by this document, but is covered by a series of standards for each tool area.

Primary users of this document are organizations that intend to adopt software engineering tools to support their software life cycle processes. Software tool suppliers can also use this document to describe characteristics of their software engineering tools.

This document is not intended to apply to:

a) software engineering frameworks whose purpose is to provide mechanisms for data, control and presentation integration;

b) general purpose tools (e.g. word processors, spreadsheets) which can be used in software engineering activities, nor software engineering tools of very narrow scope or specific purpose (e.g. a compiler);

c) planning for the implementation of software engineering tools within an organization.

NOTE 2 A user of this document can make the best possible selection of a software engineering tool and yet have no guarantee of a successful implementation.

The methods described in this document are useful not only for the selection of software engineering tools, but for any project where COTS/FOSS software can be selected instead of engaging in new software development.

© ISO/IEC 2017 – All rights reserved

To follow the guidance provided in this document consists in applying the activities and tasks that are attached to the defined processes to evaluate and select software. Organizations using this document for trade purposes can specify the minimum set of processes and their related activities and tasks, suitable to their given application.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
atomic sub-characteristic
lowest level sub-characteristics

Note 1 to entry: The highest level evaluation categories are called characteristics. Characteristics are usually subdivided into sub-characteristics. At the lowest level, when no further subdivision is appropriate, the sub-characteristics are referred to as atomic sub-characteristics.

3.2
characteristic
aspect of a product by which it can be described and evaluated

Note 1 to entry: A characteristic can be refined into multiple levels of sub-characteristics that bear on its ability to satisfy stated or implied needs.

3.3
measure (noun)
variable to which a value is assigned as the result of measurement

Note 1 to entry: The term “measures” is used to refer collectively to base measures, derived measures, and indicators.

[SOURCE: ISO/IEC 15939:2007, 2.15, modified — The words “plural form” have been changed to “term”.]

3.4
measure (verb)
make a measurement

[SOURCE: ISO/IEC 25040:2011, 4.39]

3.5
measurement
set of operations having the object of determining a value of a measure

Note 1 to entry: Measurement can include assigning a qualitative category such as the language of a source program (ADA, C, COBOL, etc.).

[SOURCE: ISO/IEC 15939:2007, 2.17, modified — Note 1 to entry has been changed.]

3.6
software engineering tool
software product that assists software engineers by providing automated support

© ISO/IEC 2017 – All rights reserved

3.7
rating
action of mapping the measured value to the appropriate rating level

Note 1 to entry: Used to determine the rating level associated with the software for a specific quality characteristic.

Note 2 to entry: Rating and rating levels can be applied to characteristics other than quality characteristics.

3.8
rating level
scale point on an ordinal scale which is used to categorize a measurement scale

Note 1 to entry: The rating level enables software to be classified (rated) in accordance with the stated or implied needs (see 8.2).

Note 2 to entry: Appropriate rating levels can be associated with the different views of quality, i.e. "Users", "Managers" or "Developers".

4 Abbreviated terms

BMT benchmark test

COTS commercial off-the-shelf

FOSS free/open-source software

GUI graphical user interface

5 Overview of evaluation and selection of software engineering tools

5.1 Introduction of the evaluation and selection of software engineering tools

This document defines both a set of processes and a structured set of software engineering tool characteristics for use in the technical evaluation and the ultimate selection of a software engineering tool. It follows the software product evaluation model defined in ISO/IEC 25041.

This document adopts the general model of software product quality characteristics and sub-characteristics defined in ISO/IEC 25010 and extends these when the software product is a software engineering tool; it provides product characteristics unique to software engineering tools as described in 10.2 to 10.4. This larger set of characteristics is then organized into three groups; they are characteristics related to software engineering tool usage functionality, general quality and not related to quality.

NOTE The capabilities of software engineering tools are defined in a series of standards for each tool area.

The objective of the technical evaluation process is to provide quantitative results on which the final selection can be based. Measurement assigns numbers (or other ratings) to attributes of entities; a major activity of evaluation is to obtain these measurements for use in selection. The final selection results should aim to achieve objectivity, repeatability and impartiality. These objectives and the confidence in the outcomes depend in part on the resources allocated to the overall evaluation and selection process. The user of this document is asked to deal with these issues at an early stage.

© ISO/IEC 2017 – All rights reserved