

Information technology—Guideline for the evaluation and selection of CASE tools

Sponsor

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Abstract: IEEE Std 1462-1998 is an adoption of International Standard ISO/IEC 14102: 1995. The International Standard deals with the evaluation and selection of CASE tools, covering a partial or full portion of the software engineering life cycle. The adoption of the International Standard by IEEE includes an implementation note, which explains terminology differences, identifies related IEEE standards, and provides interpretation of the International Standard.

Keywords: CASE tools, computer-aided software engineering, computer applications, computer software, software engineering



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Implementation note

(This implementation note is informative for IEEE Std 1462-1998, Adoption of International Standard ISO/IEC 14102: 1995, Information technology—Guideline for the evaluation and selection of CASE tools. It is not part of ISO/IEC 14102: 1995.)

IEEE Std 1462-1998 is an adoption of ISO/IEC 14102: 1995¹. The following implementation notes relate to IEEE interpretation of ISO/IEC 14102.

Terminology

The terms “metric” and “measurement” are both used in the document, and can be read as having the same meaning.

Some differences exist between the terminology used in IEEE Std 1462-1998 and that in IEEE Std 610.12-1990. The reader should use the local definitions in IEEE Std 1462-1998 where there is a conflict with those of IEEE Std 610.12-1990. In some cases, the definition in IEEE Std 610.12-1990 may provide further clarification. It is important to keep in mind, however, that full compatibility of definitions has yet to be achieved in the evolving field of software engineering.

Related IEEE standards

IEEE Std 610.12-1990, IEEE Standard Glossary of Software Engineering Terminology.²

IEEE Std 1348-1995, IEEE Recommended Practice for the Adoption of Computer-Aided Software Engineering (CASE) Tools.

The role of the standard

IEEE Std 1462-1998 deals with the technical evaluation of a CASE tool. This represents only a portion of the overall process that covers the introduction of a new CASE tool into the organization. For example, the business case including the business objectives that the CASE tool is intended to address are part of activities that would precede the use of IEEE Std 1462-1998.

Specifically, IEEE Std 1348-1995 covers the broader view, and places the evaluation as one of four steps. The reader is advised to review IEEE Std 1348-1995 together with IEEE Std 1462-1998 in order to establish a proper scope and business case for the evaluation. IEEE recommends that the evaluation of a CASE tool be treated as a project with its associated budget and schedule controls.

Section 9 and CASE tool characteristics

Section 9 of IEEE Std 1462-1998 describes a set of product characteristics against which the evaluation should be done. These are organized under the following four areas, which together form the basis for establishing the requirements and performing the final evaluation:

- 1) How the CASE tool meets the needs of the life cycle processes used;

¹ISO and ISO/IEC publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembé, CH-1211, Genève 20, Switzerland/Suisse. ISO publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

²IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.

- 2) How the CASE relates to the overall tool environment;
- 3) How the CASE tool itself performs; and
- 4) Other criteria.

The requirements are organized as characteristics and subcharacteristics, adopting the software product quality model as defined in ISO/IEC 9126: 1991, *Information technology—Software product evaluation—Quality characteristics and guidelines for their use*. The high-level characteristic (also referred to as quality factor) is subdivided into subcharacteristics, that in turn may be further subdivided. At the lowest level, they are referred to as atomic subcharacteristics. The evaluation of each chosen characteristic and subcharacteristic is done through the establishment of a value for each atomic subcharacteristic.

The user of IEEE Std 1462-1998 should select from the set of characteristics noted. However, the following should be noted:

- Characteristics from each of the four areas should be selected to cover each of the major tool features.
- The characteristics, once selected, should be prioritized. This is particularly true for Areas 1 and 3. These priorities should reflect the main objectives of the tool.

Compliance

IEEE Std 1462-1998 provides guidance in the steps recommended to undertake the evaluation of a CASE tool or tools, and in the features (characteristics) of the CASE tool. The four processes described are not mandatory; there are few “shall” statements, and the tailoring of these processes should be done carefully, since tailoring down may introduce added risk for a CASE evaluation project. Assumptions should be verified with experienced staff whenever possible.

IEEE recommends that any organization undertaking one or more tool evaluations should provide the general level of compliance that it requires for any tool evaluation project. The process activities for a given project can then be further tailored, since the number of activities may vary depending on the criticality of the CASE tool being evaluated.

In situations where the evaluation is being subcontracted, it is recommended that the organization (purchaser) formally specify the minimum processes, activities, and tasks that are to be followed in IEEE Std 1462-1998.

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sélection d'outils CASE*



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Contents

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	3
3 Definitions and acronyms	4
3.1 Definitions	4
3.2 Acronyms	5
4 Overview of evaluation and selection of CASE tools	6
4.1 Initiation process	6
4.2 Structuring process	7
4.3 Evaluation process	7
4.4 Selection process	8
4.5 General process considerations	8
4.5.1 Sequencing of processes	8
4.5.2 Reducing cost and risk	9
5 Initiation process	10
5.1 Goal setting	10
5.2 Establishing selection criteria	11
5.3 Project planning and control	12
6 Structuring process	13
6.1 Requirements definition	13
6.1.1 Organizational information gathering	13
6.1.2 Requirements identification	14
6.1.3 Requirements structuring	15
6.2 CASE tool information gathering	16
6.3 Identifying final candidate CASE tools	16

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7	Evaluation process	18
7.1	Preparing for evaluation	18
7.2	Evaluating CASE tools	19
7.2.1	Measurement	19
7.2.2	Rating	20
7.2.3	Assessment	20
7.3	Evaluation reporting	21
8	Selection process	23
8.1	Preparing for selection	23
8.2	Applying the selection algorithm	23
8.3	Recommending a selection decision	24
8.4	Validating the selection decision	24
9	CASE tool characteristics	25
9.1	Functionality - characteristics related to life-cycle processes.	25
9.1.1	Characteristic: Management Process	26
9.1.2	Characteristic: Development Process	26
9.1.2.1	Subcharacteristic: Modeling	27
9.1.2.2	Subcharacteristic: Construction	29
9.1.3	Characteristic: Maintenance Process	30
9.1.4	Characteristic: Documentation Process	31
9.1.5	Characteristic: Configuration Management Process	31
9.1.6	Characteristic: Quality Assurance Process	32
9.1.7	Characteristic: Verification Process	33
9.1.8	Characteristic: Validation Process	34
9.2	Functionality - characteristics related to CASE tool usage.	36
9.2.1	Characteristic: Environment in which the CASE tool operates.	36
9.2.2	Characteristic: CASE tool integrability.	37
9.2.3	Characteristic: Aspects of the CASE tool's application	39
9.3	General quality characteristics	40
9.3.1	Characteristic: Functionality	40
9.3.2	Characteristic: Reliability	41
9.3.3	Characteristic: Usability	41
9.3.4	Characteristic: Efficiency	43
9.3.5	Characteristic: Maintainability	44
9.3.6	Characteristic: Portability	44
9.4	General characteristics not related to quality	45
9.4.1	Characteristic: Acquisition	45

9.4.2	Characteristic: Implementation	46
9.4.3	Characteristic: Support Indicators	46
9.4.4	Characteristic: Evaluation or Certification	47

Annex A Considerations on the use of this International Standard	48
---	-----------

Annex B Examples of selection algorithms	50
---	-----------

Annex C Bibliography	55
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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. 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.

International Standard ISO/IEC 14102 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software engineering*.

Annexes A to C of this International Standard are for information only.

Introduction

Within software engineering, Computer-Aided Software Engineering (CASE) tools represent a major part of the supporting technologies used to develop and maintain software systems. Their selection must be carried out with careful consideration of both the technical and management requirements.

This International Standard defines both a sequence of processes and a structured set of CASE tool characteristics for use in the technical evaluation and the ultimate selection of a CASE tool. It follows the software product evaluation model described in ISO/IEC 9126:1991, *Information technology - Software product evaluation - Quality characteristics and guidelines for their use*. This International Standard adopts the general model of software product quality characteristics and subcharacteristics described in ISO/IEC 9126, and extends these when the software product is a CASE tool; it provides product characteristics unique to CASE tools. This larger set of characteristics is then organized into five groups. This grouping provides a more manageable approach to the overall evaluation and selection process.

While the technical evaluation may answer how well a CASE tool meets its user's stated requirements, it may also answer the question of how well the tool meets its claimed functionality.

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 will in part depend on the resources allocated to the overall evaluation and selection process. The user of this International Standard is asked to deal with these issues at an early stage.

To be widely acceptable, these CASE tool evaluation and selection processes must be of value to the users of CASE tools, to the suppliers of CASE to community at large. The information outlined in this International Standard should lead to more cost effective selections of CASE tools and to a greater uniformity in how CASE tool functions and features are described.

Information technology - Guideline for the evaluation and selection of CASE tools

1 Scope

This International Standard deals with the evaluation and selection of CASE 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 CASE tools and selecting the most appropriate CASE tools from several candidates. These processes are generic, and organizations must tailor them to meet organizational needs. The CASE tool evaluation and selection processes should be viewed in the larger context of the organization's technology adoption process.

This International Standard provides:

- a. Guidance on identifying organizational requirements for CASE tools.
- b. Guidance on mapping those requirements to CASE tool characteristics to be evaluated.
- c. A process for selecting the most appropriate CASE tool from several tools, based on measurements of the defined characteristics.

Primary users of this International Standard are organizations that intend to adopt CASE tools to support their software life cycle processes. CASE tool suppliers may also use this International Standard to describe characteristics of their CASE tools.

This International Standard 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 may be used in software engineering activities, nor CASE tools of very narrow scope or specific purpose (e.g., a compiler).
- c. Planning for the implementation of CASE tools within an organization (even though it is recognized that this is an important subject).

NOTE - A user of this International Standard may make the best possible selection of a CASE tool and have no guarantee of a successful implementation. ISO/IEC JTC1 SC7 WG4 is working on a draft technical report, Adoption of CASE Tools, which addresses this subject.

This International Standard contains a set of processes, activities, and tasks designed to be tailored. The tailoring process is the selection of applicable processes, activities and tasks.

Compliance with this International Standard is defined as the performance of the processes, activities, and tasks selected from this International Standard for the evaluation and selection project. Any organization imposing this International Standard as a condition of trade is responsible for specifying the minimum set of required processes, activities, and tasks which constitute compliance for a given application of this International Standard. Defining and documenting that specification forms part of the initiation process (clause 5).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based upon this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5807:1985, *Information processing - Documentation symbols and conventions for data, program and system flowcharts, program network charts and system resources charts.*

ISO/IEC 12119:1994, *Information technology - Software packages - Quality requirements and testing.*

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

ISO/IEC 9126:1991, *Information technology - Software product evaluation - Quality characteristics and guidelines for their use.*

3 Definitions and acronyms

3.1 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1.1 assessment: An action of applying specific documented criteria to a specific software module, package or product for the purpose of determining acceptance or release of the software module, package or product. (ISO/IEC 9126:1991)

3.1.2 atomic subcharacteristic: The highest level evaluation categories are called characteristics. Characteristics are usually subdivided into subcharacteristics. Many subcharacteristics may be further subdivided into lower level subcharacteristics. At the lowest-level, when no further subdivision is appropriate, the subcharacteristics are referred to as atomic subcharacteristics.

3.1.3 CASE tool: A software product that can assist software engineers by providing automated support for software life-cycle activities as defined in ISO/IEC 12207:1995.

NOTES

1 - A CASE tool may provide support in only selected functional areas or in a wide variety of functional areas.

2 - CASE tools may be used in several modes:

- As stand alone tools; in this case, only compatibility with environment elements should be addressed.
- In small groups which communicate directly with one another; it may be supposed that integration is predefined, perhaps proprietarily.
- In the presence of a larger framework of the SEE; in this case the ability of the tool to use the relevant services of the framework should be addressed.

3.1.4 characteristic: An aspect of a product by which it can be described and evaluated. A characteristic may be refined into multiple levels of subcharacteristics that bear on its ability to satisfy stated or implied needs.

3.1.5 measurement: The action of applying a software quality metric to a specific software product. (ISO/IEC 9126:1991)

NOTES

1 - Measurement can apply to metrics other than software quality metrics.

2 - An object may be measured directly, or may be measured indirectly by the application of metrics to information about or representations of the object.

3.1.6 metric: A quantitative scale and method which can be used to determine the value a subcharacteristic takes for a specific software product.

3.1.7 rating: The action of mapping the measured value to the appropriate rating level. Used to determine the rating level associated with the software for a specific quality characteristic. (ISO/IEC 9126:1991)

NOTE - Rating and rating levels can be applied to characteristics other than quality characteristics.

3.1.8 rating level: A range of values on a scale to allow software to be classified (rated) in accordance with the stated or implied needs. Appropriate rating levels may be associated with the different views of quality, i.e., users, managers or developers. These levels are called rating levels. (ISO/IEC 9126:1991)

3.1.9 Software Engineering Environment: The software engineering environment (SEE) is that portion of the system which provides automated support for the engineering of software systems and the management of the software process. It includes platform, system software, utilities, and CASE tools installed.

NOTE - The SEE architecture has two aspects:

- the CASE tools which provide facilities for supporting life-cycle processes, and
- a general framework which provides a set of capabilities that offer common services used by the tools.

3.2 Acronyms

BMT	Bench Mark Test
CASE	Computer Aided Software Engineering
GUI	Graphical User Interface
SEE	Software Engineering Environment
SQL	Structured Query Language

4 Overview of evaluation and selection of CASE tools

This section provides an overview of the evaluation and selection of CASE tools discussed in this International Standard as shown in Figure 1. Evaluation and selection of CASE tools includes four major processes:

Initiation Process
Structuring Process
Evaluation Process
Selection Process

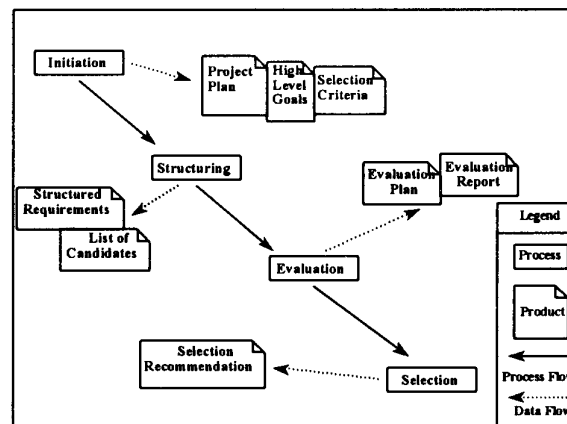


Figure 1 - Overview of evaluation and selection of CASE tools

A key process is the structuring of a set of requirements against which candidate CASE tools are to be evaluated, and upon which selection decisions will be based. The CASE tool characteristics defined in clause 9 form the basis for requirements structuring, and play a central role in the overall process.

4.1 Initiation process

The purpose of the initiation process is to define the general objectives and requirements of the intended evaluation and selection of CASE tools, to establish the high level direction, and to define the management aspects of the effort (e.g., schedule, resources, cost).

The initiation process, discussed in detail in clause 5, is composed of three activities:

- **goal setting:** provides the rationale and general policy for evaluation and

selection.

- **establishing selection criteria:** provides criteria to be used in the subsequent selection process.
- **project planning:** results in a plan which includes generic planning information and also information which defines the structure of the evaluation and selection effort.

4.2 Structuring process

The purpose of the structuring process is to elaborate a set of structured requirements, based upon the CASE tool characteristics of clause 9 against which CASE tools should be evaluated, and to obtain the necessary information on CASE tools to permit evaluation. It is assumed that a set of general organizational information and guidelines is available to be used as inputs.

The structuring process, discussed in detail in clause 6, is composed of three activities:

- **requirements analysis:** transforms organizational needs into measurable structures.
- **CASE tool information gathering:** captures a snapshot of the current state-of-the-art in CASE tools.
- **identifying final candidate CASE tools:** candidate CASE tools are identified for evaluation using the results of the last two activities.

NOTE - During the evaluation, requirements may require revision. If this occurs, some repetition of activities of this, and subsequent processes may be necessary.

4.3 Evaluation process

The purpose of the evaluation process is to produce technical evaluation reports that will be the major input for the selection process. Each evaluation process results in a profile of the quality and other characteristics of the tool which was evaluated. Comparisons between tools are not made as part of this process.

The evaluation process, discussed in detail in clause 7, is composed of three activities:

- **preparation for evaluation:** finalization of the various details of the

evaluation (e.g., scenario, subcharacteristics, metrics, tool characteristics) in an evaluation plan.

- **evaluating CASE tools:** measurement, rating and assessment.
- **evaluation reporting:** an evaluation report is prepared which provides the results of the evaluation for each CASE tool considered.

4.4 Selection process

The purpose of the selection process is to identify the most suitable CASE tool(s) among the candidate tools, and to ensure that the recommended tool(s) meets the original goals. The selection process compares the results of the evaluations of the candidate tools to determine which is the most appropriate for selection.

The selection process, discussed in clause 8, is composed of four activities:

- **preparing for selection:** the selection criteria are finalized and the selection algorithm is defined.
- **assessing the evaluation results:** the selection algorithm is applied to the evaluation results.
- **recommending a selection decision:** the best of the candidates is determined.
- **validating the selection decision:** the recommended selection is validated against the original goals.

4.5 General process considerations

There are several considerations that apply to the processes described in this International Standard on a global basis. The intent is for the user of this International Standard to tailor its application in such a way as to maximize the probability of a successful evaluation and selection process, and minimize its cost and risk.

4.5.1 Sequencing of processes

This International Standard does not impose the sequence of process activities described above and in the following sections. It is up to the organization to select the relevant processes and activities needed to meet its evaluation and selection goals. The organization will decide which to employ, in what sequence, and with what

degree of parallelism. The sequencing of the processes' activities is then documented in the project plan developed during the initiation process.

4.5.2 Reducing cost and risk

In general, organizations which apply this International Standard will want to minimize the cost of the entire evaluation and selection process to the extent possible, while maintaining the level of effort necessary to select the most appropriate CASE tool(s) for their use. These objectives may be addressed by minimizing the number of tools evaluated, minimizing the cost of evaluating specific tools, and ensuring that the formality of the process is appropriate to the organization.

The activities of CASE tool information gathering and identifying final candidates for selection (see clause 6) effectively allow the user of this International Standard to screen the available tools against the organization's needs, and eliminate from consideration tools which do not, or are not likely to, substantially address the organization's needs.

NOTE 1 - It may be that the organization is unable to find any tool which appear likely to sufficiently meet its needs. In such a case, the stated needs themselves should be re-examined, and if they are found to accurately reflect the organization's actual requirements for technology improvement, the overall evaluation and selection process may be abandoned. Similarly, if the final candidate tools appear to be marginal in addressing the organization's needs, the level of detail and formality of the subsequent activities should be made to reflect the risk factor, and the organization should be prepared to not select a tool if the evaluation process so indicates, as the typical cost of bringing a new tool into operational use is substantial.

Evaluations of candidate tools may have already been performed and be available to the organization. Such information may be used to reduce the cost of candidate tool evaluation.

NOTE 2 - Previous evaluations which have been performed on a different version of the candidate tool may still yield useful information. Similarly, evaluations which addressed a different set of organizational needs may still provide useful information.

This International Standard calls for the development of several plans and reports, and implicitly, for their review by various personnel within the organization. In addition, activities are required to perform the four processes outlined. The format and level of detail of the data products is left to the discretion of the organization, as is the level of effort necessary to perform the activities.

NOTE 3 - Some organizations may need to limit the scope, detail and formality of the processes to apply this International Standard within existing resource constraints.