



**International
Standard**

ISO/IEC 25040

**Systems and software
engineering — Systems and
software Quality Requirements
and Evaluation (SQuaRE) — Quality
evaluation framework**

**Second edition
2024-09**

Open Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO/IEC 25040:2024](https://standards.iteh.ai/catalog/standards/iso/cb2f0771-f6a2-4350-92ea-b6ac43002891/iso-iec-25040-2024)

<https://standards.iteh.ai/catalog/standards/iso/cb2f0771-f6a2-4350-92ea-b6ac43002891/iso-iec-25040-2024>

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO/IEC 25040:2024](https://standards.iteh.ai/catalog/standards/iso/cb2f0771-f6a2-4350-92ea-b6ac43002891/iso-iec-25040-2024)

<https://standards.iteh.ai/catalog/standards/iso/cb2f0771-f6a2-4350-92ea-b6ac43002891/iso-iec-25040-2024>



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, 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
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Concepts of quality evaluation	2
4.1 Quality evaluation definition.....	2
4.2 Quality model and quality measures for quality evaluation.....	2
4.3 Measurement source.....	4
4.4 Tasks of quality evaluation.....	4
4.5 Quality rating module.....	4
4.6 Assessment using evaluation.....	5
5 Quality evaluation process reference model	5
5.1 Overview.....	5
5.2 Define the evaluation.....	7
5.2.1 Purpose.....	7
5.2.2 Outcomes.....	7
5.2.3 Activities.....	7
5.3 Design the evaluation.....	10
5.3.1 Purpose.....	10
5.3.2 Outcomes.....	10
5.3.3 Activities.....	11
5.4 Plan the evaluation.....	12
5.4.1 Purpose.....	12
5.4.2 Outcomes.....	12
5.4.3 Activities.....	13
5.5 Execute the evaluation.....	14
5.5.1 Purpose.....	14
5.5.2 Outcomes.....	14
5.5.3 Activities.....	14
5.6 Conclude the evaluation.....	14
5.6.1 Purpose.....	14
5.6.2 Outcomes.....	14
5.6.3 Activities.....	15
Annex A (informative) Measurement source	17
Annex B (informative) Examples of four types of quality evaluations	20
Annex C (informative) Quality evaluation process implementation through system/software life cycle processes	24
Bibliography	29

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.

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 document 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 or www.iec.ch/members_experts/refdocs).

ISO and IEC draw attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO and IEC take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO and IEC had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents and <https://patents.iec.ch>. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

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

For an explanation of 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 www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

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

This second edition cancels and replaces the first edition (ISO/IEC 25040:2011), which has been technically revised.

The main changes are as follows:

- alignment with the other SQuaRE divisions: quality management, model, measurement, and requirements;
- alignment with other standards for system/software life cycle processes and requirements engineering processes;
- expansion of its target entities from software to ICT products, data, and IT services;
- expansion of types of quality evaluation from only requirements conformity to four types: quality evaluation for suitability to a specific use, for qualification to quality standard, for conformity checking to requirements, and for suitability to the market;
- clarification of concepts relating to quality evaluation;
- provision of more practical guidelines for planning a quality evaluation.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

Many systems and services are now deeply embedded into social infrastructures used in daily life. This requires them to achieve much higher quality; for example, connected systems need to be interoperable, secure, reliable, maintainable, and usable. Therefore, quality evaluation becomes ever more important.

The result of quality evaluation is used to objectively judge the value of the target entity in various business situations, including:

- outsourcers judging whether the target entity satisfies their quality requirements, in the case of outsourcing it;
- consumers or acquirers determining which product or service to be selected for their application, in the case of acquisition.

This document provides requirements and recommendations for quality evaluation, as well as guidance for its tasks.

Target entities for quality evaluation include ICT (information and communication technology) products (systems, software products, etc.), data, and IT services. The quality model defined by ISO/IEC 2501n provides comprehensive quality characteristics and subcharacteristics according to the types of target entities. ISO/IEC 2502n defines quality measures corresponding to those quality models.

This document is one of the standards on SQuaRE developed by ISO/IEC JTC 1/SC 7 (ISO/IEC 25000 to ISO/IEC 25099). [Figure 1](#) (adapted from ISO/IEC 25000) illustrates the organization of the standards on SQuaRE developed by ISO/IEC JTC 1/SC 7. Similar standards are grouped into divisions. Each division provides guidance and resources for performing a different function in ensuring system and software product quality.

- ISO/IEC 2500n - quality management division. The International Standards that form this division define all common models, terms, and definitions referred to by all other International Standards on SQuaRE developed by ISO/IEC JTC 1/SC 7. This division also provides requirements and guidance for a supporting function that is responsible for the management of the requirements, specification, and evaluation of software product quality. Practical guidance on the use of the quality models is also provided.
- ISO/IEC 2501n - quality model division. The International Standards that form this division present detailed quality models for computer systems and software products, data, IT services and quality-in-use.
- ISO/IEC 2502n - quality measurement division. The International Standards that form this division include a quality measurement framework, mathematical definitions of quality measures, and practical guidance for their application. Examples are given of quality measures for internal and external property of product, data, IT services and quality-in-use. Quality measure elements (QME) forming foundations for quality measures for internal and external property of product are defined and presented.
- ISO/IEC 2503n - quality requirements division. The International Standards that form this division help specify quality requirements based on quality models and quality measures. These quality requirements can be used in the process of eliciting quality requirements for information systems and IT services to be developed or as input for an evaluation process.
- ISO/IEC 2504n - quality evaluation division. The International Standards that form this division provide requirements, recommendations and guidelines for quality evaluation for information systems and IT services.
- ISO/IEC 25050 to ISO/IEC 25099 - SQuaRE extension division. These International Standards currently include requirements for quality of ready-to-use software product (RUSP), common industry formats for usability reports, and quality models and measures for new technologies such as cloud services and artificial intelligence.

ISO/IEC 25040:2024(en)

Quality Requirements Division 2503n	Quality Model Division 2501n	Quality Evaluation Division 2504n
	Quality Management Division 2500n	
	Quality Measurement Division 2502n	
Extension Division 25050-25099		

Figure 1 — Organization of standards on SQuaRE developed by ISO/IEC JTC 1/SC 7

The SQuaRE standards can be used in conjunction with ISO/IEC/IEEE 12207 and ISO/IEC/IEEE 15288, particularly the processes for the specification and evaluation of quality requirements. ISO/IEC 25030 describes how quality models and measures can be used for systems and software quality requirements, and ISO/IEC 25040 describes how the quality models and measures can be used for systems and software quality evaluation.

The SQuaRE standards can also be used in conjunction with standards on software process assessment developed by ISO/IEC JTC 1/SC 7, which provide:

- a framework for software product quality definition in the customer-supplier process;
- support for quality review, verification, and validation, as well as a framework for establishing quantitative quality characteristics;
- support for setting organizational quality goals in the management process.

The SQuaRE standards can be used in conjunction with ISO 9001 (which is concerned with quality management system) to provide:

- support for setting quality goals;
- support for design review, verification, and validation.

Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Quality evaluation framework

1 Scope

This document provides the framework for quality evaluation of ICT (information and communication technology) products (including software products), data, and IT services, which includes its concepts, and requirements, and recommendations for its processes to be implemented and enhanced.

This document is applicable for those who need to perform quality evaluations on target entities, including development organization (integrators, developers, and quality assurance group), acquirers, IT service providers, and independent evaluators.

This document does not provide specific test methods for quality evaluation or guidance on utilizing evaluation results.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 25000, *Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Guide to SQuaRE*

ISO/IEC 25030, *Systems and software engineering — Systems and software quality requirements and evaluation (SQuaRE) — Quality requirements framework*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 25000 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

assessment

action of comprehensively evaluating the target entity based on documented criteria for a specific purpose

Note 1 to entry: Such purposes can include determining acceptance or release of the target entity.

3.2

implementation rating module

quality rating module (3.8) that can be directly applied to target entity

3.3

information need

insight necessary to manage objectives, goals, risks and problems

[SOURCE: ISO/IEC/IEEE 15939:2017, 3.12]

3.4

integrity level

degree of confidence that the system-of-interest meets the associated integrity level claim

[SOURCE: ISO/IEC/IEEE 15026-3:2023, 3.1, modified — Notes to entry have been removed.]

3.5

measurement source

set of artefacts used for quality measures when performing a *quality evaluation* (3.7)

3.6

quality analysis

analysis of rating results for multiple quality properties to determine the objective score or acceptability for the quality of the target entity

3.7

quality evaluation

systematic examination of the extent to which an entity is capable of fulfilling specified requirements

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.3267, modified — Note 1 to entry has been removed.]

3.8

quality rating module

set of quality measures, operational environment, and methods for conducting quality measurements and quality ratings on a specific category of target entities

3.9

template rating module

quality rating module (3.8) in which the measurement environment and rating method are parameterized for future use

[ISO/IEC 25040:2024](https://standards.iteh.ai/catalog/standards/iso/cb2f0771-f6a2-4350-92ea-b6ac43002891/iso-iec-25040-2024)

<https://standards.iteh.ai/catalog/standards/iso/cb2f0771-f6a2-4350-92ea-b6ac43002891/iso-iec-25040-2024>

4 Concepts of quality evaluation

4.1 Quality evaluation definition

A quality evaluation involves performing a series of tasks to generate objective and quantitative data regarding the quality of the target entity. This is achieved by measuring, rating, and interpreting the quality attributes of the target entities using established quality models and measures. The ultimate objective of a quality evaluation is to offer crucial and unbiased information that supports comprehensive decision-making during the planning, development, delivery, acceptance, maintenance, and procurement stages of the target entities.

4.2 Quality model and quality measures for quality evaluation

The SQuaRE standards offer quality models and measures, as presented in [Table 1](#), specifically designed for these three types of target entities which are ICT products, data, and IT services.

Table 1 — Target entity types and their associated quality models and measures

Target entity type	Quality to be evaluated	Quality model	Quality measures
IT service / ICT product	Quality-in-use	ISO/IEC 25019 Quality-in-use model	ISO/IEC 25022 Measurement of quality-in-use
IT service	IT service quality	ISO/IEC TS 25011 IT service quality models	ISO/IEC TS 25025 Measurement of IT service quality
ICT product	Product quality	ISO/IEC 25010 Product quality model	ISO/IEC 25023 Measurement of system and software product quality
Data	Data quality	ISO/IEC 25012 Data quality model	ISO/IEC 25024 Measurement of data quality

The quality model presents a framework that outlines the essential quality characteristics that the target entity should possess. Quality measurement serves as a method for quantifying these quality characteristics based on the established quality model. In the case of an ICT product or IT service as the target entity, the quality-in-use model can be utilized to evaluate the impact of the target entity during usage.

NOTE 1 When evaluating ICT products (or IT services), the quality-in-use model or the product quality model (or IT service quality model) can be selected depending on the purpose of the quality evaluation. When evaluating data quality, the data quality model is the only option.

When evaluating a particular target entity, the important quality (sub)characteristics vary by its category.

NOTE 2 ISO/IEC TR 12182 provides a framework for categorizations of IT systems and software, and a guide for its application.

EXAMPLE In the case of a server device as the target entity, usability is not a significant factor as there are no direct user interactions involved. When evaluating the time behaviour of the server, the relevant information requirement shifts from response time to the throughput of requests handled by the server.

Quality properties represent the information needs pertaining to the quality of the target entity. These properties are measured and quantified using quality measures. It is worth noting that in certain cases, multiple measures can correspond to a single quality property. Various measurement methods, including testing, inspection, static analysis, and document survey, are utilized. See [Figure 2](#).

<https://standards.iteh.ai/catalog/standards/iso/0771-16a2-4350-92ea-b6ac43002891/iso-iec-25040-2024>

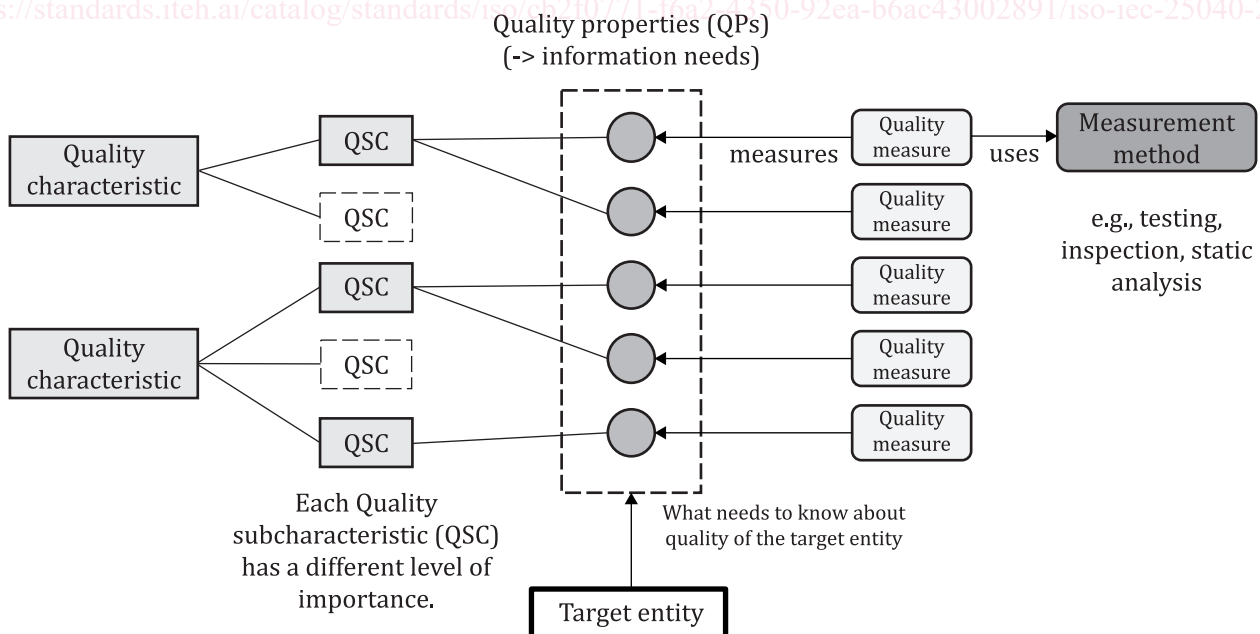


Figure 2 — Relationship among quality characteristics, quality properties and quality measures

4.3 Measurement source

A measurement source is a set of artefacts used for quality measurement when conducting a quality evaluation. The measurement source depends on what is available at the time of the evaluation. Design artefacts (design specifications, prototypes, inspection-related documents, test specifications, etc.) are available even when the target entities themselves do not yet exist. On the other hand, final products (executable objects, source code, data, usage manuals, maintenance manuals, results of inspection and/or testing, etc.) are available near their delivery. The measurement source determines the applicable quality measures.

NOTE [Annex A](#) shows a list of artefacts that can be included in measurement sources, what can be measured from them, and information on how to measure them.

4.4 Tasks of quality evaluation

Quality evaluation consists of the following three tasks (see [Figure 3](#)).

- Quality measurement: quantitatively measuring the quality property of the target entity using specific quality measure. Its objective is to obtain objective and quantitative information about the quality properties of the target entity.
- Quality rating: comparing the measured values obtained from quality measurement against predetermined quality rating levels to determine the appropriate quality level for each quality property of the target entity. For instance, the measured response time is classified as the level of "excellent" if it falls within the range corresponding to the level.
- Quality analysis: analysing the quality rating results obtained from multiple quality properties. The focus is on assessing the acceptability of the target entity, taking into account each individual quality characteristic or subcharacteristic, as well as the overall quality. This analysis also includes identifying strengths and weaknesses for each quality attribute and generating recommendations based on the assessment findings.

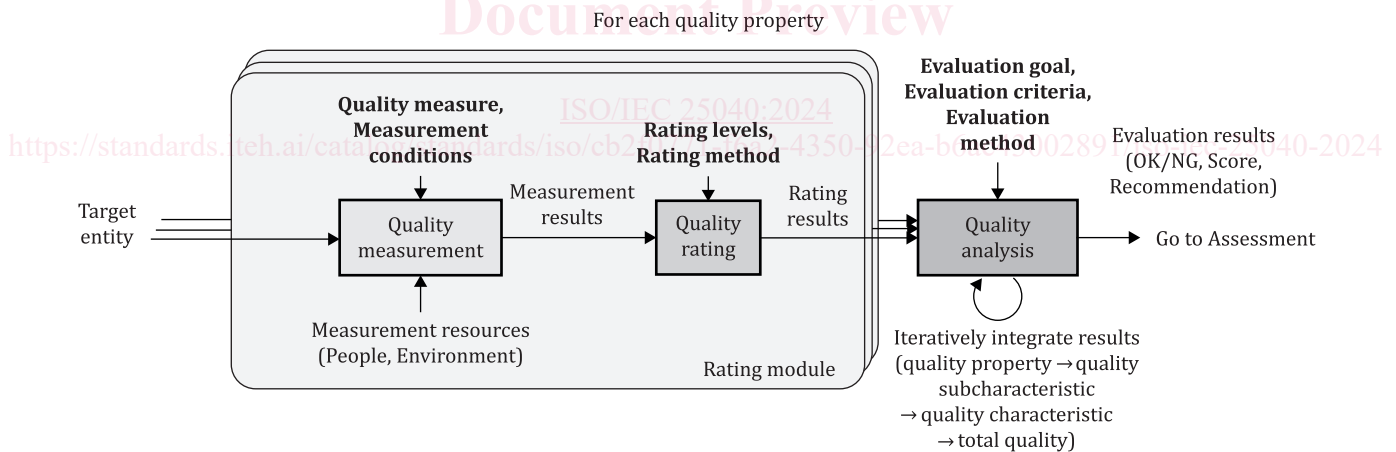


Figure 3 — Tasks of quality evaluation

4.5 Quality rating module

A quality rating module is a cohesive collection of measures, operational environment, and rating methods for performing quality measurements and ratings on a category of target entities. By utilizing the quality rating module, one can obtain quality rating results that align with the specified information needs.

The following are elements that a quality rating module can encompass:

- quality (sub)characteristics to be evaluated;
- categories of target entities eligible for evaluation;

- quality measures employed for evaluation;
- measurement conditions and operational environment, including relevant parameters;
- defined quality rating levels;
- resource requirements;
- assumptions and constraints applicable to the quality rating module (e.g. this module does not need to consider potential interaction problems arising from inexperienced or untrained users; this is because the users interacting with the target entity are supposed to be trained adequately.)

An implementation rating module is a quality rating module that can be directly applied to existing target entities. On the other hand, a template rating module is a parameterized quality rating module that allows for flexibility in the measurement environment and rating method, making it suitable for future use. To create an implementation rating module, the parameters of a template rating module are applied and customized.

NOTE The category of the target entity plays a significant role in determining the quality (sub)characteristics to evaluate, their relative significance, the applicable quality rating modules (including rating level setting and range of acceptance), and the pass/fail criteria for quality analysis. ISO/IEC TR 12182 offers an example of categorization for ICT products that can be referenced in this context.

4.6 Assessment using evaluation

An assessment is a type of decision-making process that occurs during various stages, such as planning, development, shipping, acceptance, maintenance, or purchase of the target entity. It involves evaluating the quality of target entity based on specific criteria or requirements.

A quality evaluation can provide objective information about the quality of the target entities for assessment purposes. The rigor of the quality evaluation largely depends on the type of assessment being conducted.

For example, in industries such as aviation or healthcare, safety assessments are critical, involving analysing safety protocols, equipment performance, and adherence to regulatory standards. The rigor of the quality evaluation for such assessment must be high to ensure the safety of individuals and prevent potential hazards. On the other hands, in the early stages of product development or project planning, there is a case that preliminary assessments are conducted to gather initial insights or make rough estimates as a starting point for further evaluation and decision-making. In this case, the rigor of the quality evaluation can be low because the data is not as accurate as in later stages.

Assessments can be involved with various activities such as identifying target entities for acquisition, making acceptance decisions, determining delivery schedules, deciding on phase transitions, evaluating market value at the end of each phase.

NOTE While the results of a quality evaluation can be used as input for certain assessments, quality evaluation itself is conducted independently from any specific assessment.

5 Quality evaluation process reference model

5.1 Overview

The quality evaluation process reference model intends to present the general quality evaluation process. It consists of the five steps:

- a) define the evaluation;
- b) design the evaluation;
- c) plan the evaluation;
- d) execute the evaluation;