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

Ingénierie des systèmes et du logiciel — Exigences de qualité du produit logiciel et évaluation (SQuaRE) — Modèle de référence de mesure et guide

Reference number
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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.

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).

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 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.

This document was prepared by 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 25020:2007), which has been technically revised.

The main changes compared to the previous edition are as follows:

— relationships among different types of quality measures have been added;

— application of measurement results and description of quality measure have been added;

— elements for documenting quality measures in Annex C have been supplemented and categorized;

— Annex D has been added showing a normalized measurement function for QMs;

— Annex E has been added showing the measurement information model in ISO/IEC/IEEE 15939;

— harmonized with ISO/IEC 25000:2014, ISO/IEC 25022:2016, ISO/IEC 25023:2016, ISO/IEC 25024:2015 and ISO/IEC/IEEE 15939:2017.

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 https://www.iso.org/members.html.

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Introduction

0.1 General

This document is a part of the SQuaRE series of International Standards. It provides a framework for measuring the quality characteristics and sub-characteristics (defined in ISO/IEC 2501n). This document serves as a guideline for developing and selecting quality measures for quality in use (in conjunction with ISO/IEC 25022), system and software product quality (in conjunction with ISO/IEC 25023), data quality (in conjunction with ISO/IEC 25024) and IT service quality (in conjunction with ISO/IEC TS 25025[1)]).

0.2 Quality measurement division

This document is a part of ISO/IEC 2502n Quality Measurement Division of the SQuaRE series that consists of the following International Standards:

— ISO/IEC 25020 — *Quality measurement framework*: provides a framework for developing quality measurement;

— ISO/IEC 25021 — *Quality measure elements*: provides a format for specifying QMEs (Quality Measure Elements) and a few examples of QMEs that can be used to construct software quality measures;

— ISO/IEC 25022 — *Measurement of quality in use*: provides measures, including associated measurement functions for the quality characteristics in the quality in use model;

— ISO/IEC 25023 — *Measurement of system and software product quality*: provides measures, including associated measurement functions and QMEs for the quality characteristics in the product quality model;

— ISO/IEC 25024 — *Measurement of data quality*: provides measures, including associated measurement functions and QMEs for the quality characteristics in the data quality model;

— ISO/IEC TS 25025 — *Measurement of IT service quality*: provides measures for the IT service quality model.

Figure 1 shows the relationship between this document and other standards in the ISO/IEC 2502n division.

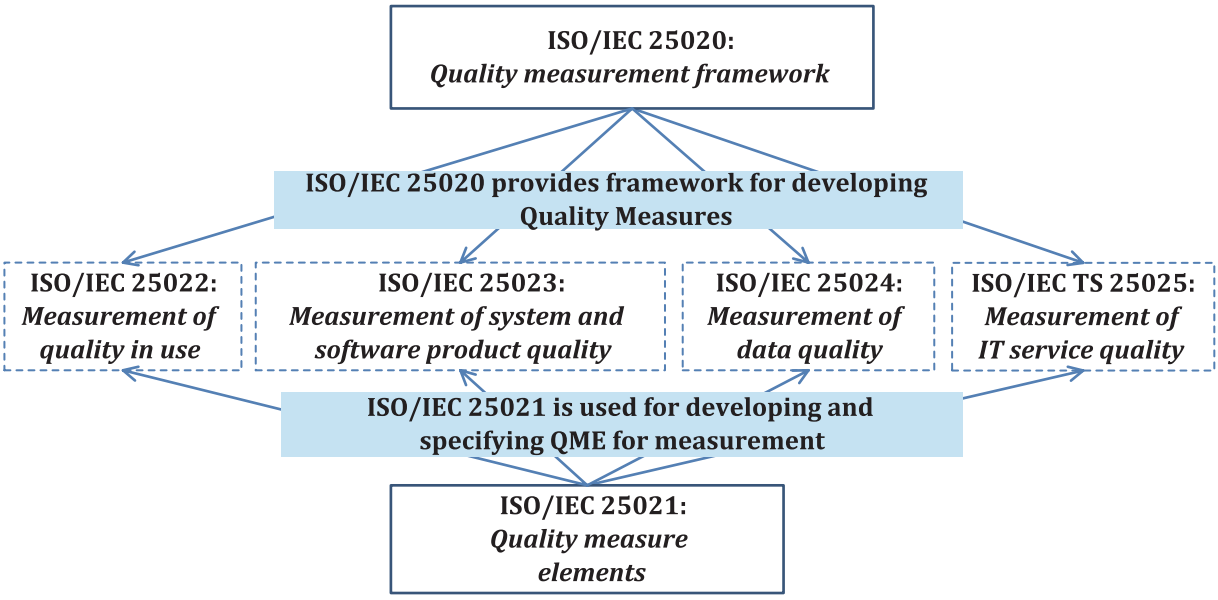


Figure 1 — Structure of the Quality Measurement Division

1) To be developed.

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0.3 Outline and organization of the SQuaRE series

The SQuaRE series consists of five main divisions and one extension division. The outlines of each division within the SQuaRE series are as follows.

— **ISO/IEC 2500n** - **Quality Management Division**. The standards comprising this division define all common models, terms and definitions referred further by all other standards in the SQuaRE series. The division also provides requirements and guidance for the planning and management of a project.

— **ISO/IEC 2501n - Quality Model Division**. The standards comprising this division present quality models for system/software products, quality in use and data. The IT service quality model is published as a Technical Specification.

— **ISO/IEC 2502n - Quality Measurement Division**. The standards comprising this division include a system/software product quality measurement reference model, definitions of quality measures, and practical guidance for their application. This division presents QMs on internal and external property of a system and software product, QMs for quality in use, QMs for data quality and QMs for IT service. Quality measure elements forming the foundations of the quality measures are defined and presented.

— **ISO/IEC 2503n - Quality Requirements Division**. The standards comprising this division help specify quality requirements. These quality requirements can be used in the process of quality requirements elicitation for a system/software product to be developed, designing a process for achieving necessary quality, or as inputs for an evaluation process.

— **ISO/IEC 2504n - Quality Evaluation Division**. The standards comprising this division provide requirements, recommendations and guidelines for system/software product evaluation, whether performed by independent evaluators, acquirers or developers. The support for documenting a quality measure as an Evaluation Module is presented as well.

— **ISO/IEC 25050-25099 - SQuaRE Extension Division.** These standards are reserved for SQuaRE extension International Standards, which currently include ISO/IEC 25051 and ISO/IEC TR 25060 to ISO/IEC 25069.

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

1 Scope

This document provides a framework for developing quality measurement.

The contents of this document are as follows:

— quality measurement reference model;

— relationships among different types of quality measures;

— guidelines for selecting quality measures;

— guidelines for constructing quality measures;

— guidelines for planning and performing measurements;

— guidelines for the application of measurement results.

It includes considerations for selecting quality measures and quality measure elements (Annex A), assessing the reliability of measurement and the validity of quality measures (Annex B), elements for documenting quality measures (Annex C), normalized measurement function for quality measures (Annex D) and the measurement information model in ISO/IEC/IEEE 15939 (Annex E).

This document can be applied for designing, identifying, evaluating and executing the measurement model of system and software product quality, quality in use, data quality and IT service quality. This reference model can be used by developers, acquirers, quality assurance staff and independent evaluators—essentially by people responsible for specifying and evaluating the quality of information and communication technology (ICT) systems and services.

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/IEEE 15939, *Systems and software engineering — Measurement process*

ISO/IEC 25000, *Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Guide to SQuaRE*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 25000 and ISO/IEC/IEEE 15939 and the following apply.

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

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

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

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3.1
attribute
inherent property or characteristic of an entity that can be distinguished quantitatively or qualitatively by human or automated means

Note 1 to entry: ISO 9000 distinguishes two types of attributes: a permanent characteristic existing inherently in something; and an assigned characteristic of a product, process or system (e.g. the price of a product, the owner of a product). The assigned characteristic is not an inherent quality characteristic of that product, process or system.

[SOURCE: ISO/IEC 25000:2014, 4.1, modified — Note 1 to entry has been removed; Note 2 to entry has become Note 1 to entry.]

3.2
base measure
measure (3.6) defined in terms of an *attribute* (3.1) and the method for quantifying it

Note 1 to entry: A base measure is functionally independent of other measures.

Note 2 to entry: Based on the definition of "base quantity" in the International Vocabulary of Metrology – Basic and General Concepts and Associated Terms, 2012.

[SOURCE: ISO/IEC/IEEE 15939:2017, 3.3]

3.3
derived measure
measure (3.6) defined as a function of two or more values of *base measures* (3.2)

Note 1 to entry: Adapted from the definition of "derived quantity" in the International Vocabulary of Metrology – Basic and General Concepts and Associated Terms, 2012.

[SOURCE: ISO/IEC/IEEE 15939:2017, 3.8]

3.4
indicator
measure (3.6) that provides an estimate or evaluation of specified *attributes* (3.1) derived from a model with respect to defined *information needs* (3.5)

[SOURCE: ISO/IEC/IEEE 15939:2017, 3.10]

3.5
information need
insight necessary to manage objectives, goals, risks and problems

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

3.6
measure, noun
variable to which a value is assigned as the result of *measurement* (3.8)

Note 1 to entry: The plural form "measures" is used to refer collectively to *base measures* (3.2), *derived measures* (3.3) and *indicators* (3.4).

[SOURCE: ISO/IEC/IEEE 15939:2017, 3.15]

3.7
measure, verb
make a *measurement* (3.8)

[SOURCE: ISO/IEC 25000:2014, 4.19]

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3.8
measurement
set of operations having the objective of determining a value of a *measure* (3.6)

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

[SOURCE: ISO/IEC 25000:2014, 4.20]

3.9
measurement function
algorithm or calculation performed to combine two or more *base measures* (3.2)

[SOURCE: ISO/IEC/IEEE 15939:2017, 3.20]

3.10
measurement method
logical sequence of operations, described generically, used in quantifying an *attribute* (3.1) with respect to a specified scale

Note 1 to entry: The type of measurement method depends on the nature of the operations used to quantify an attribute. Two types can be distinguished:

— subjective: quantification involving human judgment;

— objective: quantification based on numerical rules.

Note 2 to entry: Based on the definition of "method of measurement" in the International Vocabulary of Metrology – Basic and General Concepts and Associated Terms, 2012.

[SOURCE: ISO/IEC/IEEE 15939:2017, 3.21]

3.11
property to quantify
property of a target entity that is related to a *quality measure element* (3.14) and which can be quantified by a *measurement method* (3.10)

Note 1 to entry: A software artifact is an example of a target entity.

[SOURCE: ISO/IEC 25023:2016, 4.7]

3.12
quality in use
degree to which a product or system can be used by specific users to meet their needs to achieve specific goals with effectiveness, efficiency, freedom from risk and satisfaction in specific contexts of use

Note 1 to entry: Before the product is released, quality in use can be specified and *measured* (3.7) in a test environment designed and used exclusively by the intended users for their goals and contexts of use, e.g. User Acceptance Testing Environment.

[SOURCE: ISO/IEC 25000:2014, 4.24]

3.13
quality measure
QM
derived measure (3.3) that is defined as a *measurement function* (3.9) of two or more values of *quality measure elements* (3.14)

[SOURCE: ISO/IEC 25021:2012, 4.13, modified — The abbreviated term "QM" has been added.]

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3.14
quality measure element
QME
measure (3.6) defined in terms of a property and the *measurement method* (3.10) for quantifying it, including optionally the transformation by a mathematical function

Note 1 to entry: The system or software quality characteristic or subcharacteristic of the entity is derived afterwards by calculating a software *quality measure* (3.13).

[SOURCE: ISO/IEC 25000:2014, 4.26, modified — The abbreviated term "QME" has been added.]

3.15
quality measure on external property
QM on external property
measure (3.6) of the degree to which a system or software product enables its behaviour to satisfy stated and implied needs for the system including the software to be used under specified conditions

Note 1 to entry: *Attributes* (3.1) of the behaviour can be *measured* (3.7), verified and/or validated by executing the system or software product during testing and operation.

EXAMPLE The failure density against test cases found during testing is a quality measure on external property related to the number of faults present in the computer system. The two measures are not necessarily identical since testing may not find all faults, and a fault may give rise to apparently different failures in different circumstances.

[SOURCE: ISO/IEC 25000:2014, 4.11, modified — The term has been changed from "external measure of system or software quality" to "quality measure on external property"; "QM on external property" has been added as an alternative; in Note 1 to entry, the word "measured" has been added; in EXAMPLE, "number of failures" has been changed to "failure density against test cases".]

3.16
quality measure on internal property
QM on internal property
measure (3.6) of the degree to which a set of static *attributes* (3.1) of a software product satisfies stated and implied needs for the software product to be used under specified conditions

Note 1 to entry: Static attributes include those that relate to the software architecture, structure and its components, data structure and its formats, structure and appearance of graphical display on screen and menus for users or recipients of service.

Note 2 to entry: Static attributes can be verified by review, inspection, simulation and/or automated tools.

Note 3 to entry: Quality measures on internal property are typically associated with quality requirements on static properties and attributes that can be specified in or derived from requirements.

EXAMPLE Complexity measures and the number, severity, and failure frequency of faults found in a walk through are typical quality measures on internal property made on the product itself.

[SOURCE: ISO/IEC 25000:2014, 4.16, modified — The term has been changed from "internal measure of software quality" to "quality measure on internal property"; "QM on internal property" has been added as an alternative; in Note 1 to entry, more information on static attributes has been added; Note 3 to entry has been added.]

3.17
system and software product quality
product quality
capability of a system and/or software to satisfy stated and implied needs when used under specified conditions

Note 1 to entry: Product quality model refers to the system and software product quality model defined in ISO/IEC 25010.

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