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Part 23: Measurement of product quality

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Partie 23: Mesurage de la qualité du produit logiciel et du système

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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.

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 following the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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Introduction

This document is a part of the SQuaRE family of International Standards. It provides a set of quality measures for the characteristics of ICT products, including software products, that can be used for specifying requirements, measuring and evaluating the product quality, in conjunction with other SQuaRE family of International Standards, especially ISO/IEC 25010, ISO/IEC 25030, ISO/IEC 25000-40 and ISO/IEC 25041. The term “Product” is used for ICT Products which can include software, data, hardware and communication facilities, and other ICT products throughout this document.

The set of quality measures in this document were selected based on their practical value. They are not intended to be exhaustive and users of this document are encouraged to refine them if necessary.

The proposed quality measures are primarily intended to be used for quality assurance and improvement of products during or post the development life cycle process.

The main users of this document are people carrying out quality requirement specification and evaluation activities as part of the following:

— development: including requirements analysis, design specification, coding, and testing through acceptance during the life cycle process;

— quality management: systematic examination of the software product or computer system, for example, when evaluating system or software product quality as part of quality assurance, quality control, and quality certification;

— supply: a contract with the acquirer for the supply of a system, software product, or software service under the terms of a contract, for example, when validating quality at qualification test;

— acquisition: including product selection and acceptance testing, when acquiring or procuring a system, software product, or software service from a supplier;

— maintenance: improvement of the software product or system based on quality measurement.

This document is a part of the Quality Measurement Division (legacy numbering: ISO/IEC 2502x; multipart numbering: ISO/IEC 25000-2x) that currently consists of the following International Standards:

— ISO/IEC 25020, Quality measurement framework: provides a reference model and guidance for measuring the quality characteristics defined in the ISO/IEC 2501n Quality Model Division .

— ISO/IEC 25021, Quality measure elements: provides a format for specifying quality measure elements and some examples of quality measure elements (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 25000-23 (former ISO/IEC 25023), Measurement of product quality: provides measures including associated measurement functions for the quality characteristics in the product quality model.

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

— ISO/IEC TS 25025, Measurement of IT service quality: provides measures including associated measurement functions for the quality characteristics in the IT service quality model.

Figure 1 depicts the relationship between this document and the other International Standards in the Quality Measurement Division (legacy numbering: ISO/IEC 2502x; multipart numbering: ISO/IEC 25000-2x). Developers, evaluators, quality managers, acquirers, suppliers, maintainers, and users of target system/software products can select measures from these International Standards for the measurement of quality characteristics of interest. This could be for defining requirements, evaluating system/software products, performing quality management activities, or for other purposes.

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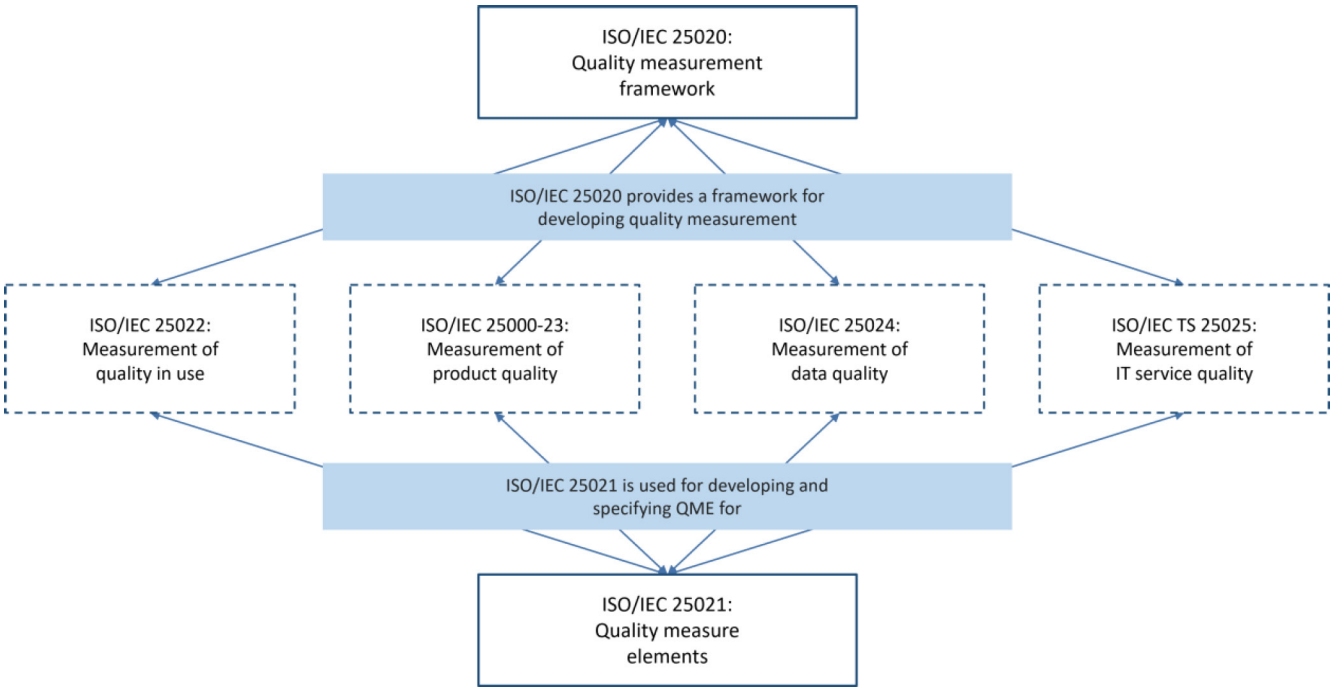


Figure 1 — Structure of the quality measurement division

The SQuaRE family is currently transitioning from the legacy numbering scheme, i.e., ISO/IEC 250xx, to a multipart numbering scheme under ISO/IEC 25000, i.e., ISO/IEC 25000-xx. During this transition period, documents using either numbering scheme can coexist within the family. The division structure described below is used to organize documents within the SQuaRE family regardless of the numbering scheme used.

The divisions within the SQuaRE family are as follows:

— **Quality Management Division (legacy numbering: ISO/IEC 2500x; multipart numbering: ISO/IEC 25000-x).** These international standards define common models, terms, and definitions referred to by other SQuaRE standards. This division provides requirements and guidance for supporting functions that are responsible for the management of requirements, specification, and evaluation of software product quality. Practical guidance on the use of the quality models is also provided.

— **Quality Model Division (legacy numbering: ISO/IEC 2501x; multipart numbering: ISO/IEC 25000-1x).** The international standards within this division present quality models for computer systems and software products, data, IT services and quality-in-use.

— **Quality Measurement Division (legacy numbering: ISO/IEC 2502x; multipart numbering: ISO/IEC 25000-2x).** These international standards define 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 properties of products, data, IT services and quality-in-use. quality measure elements (QME) forming foundations for quality measures for internal and external product properties are defined.

— **Quality Requirements Division (legacy numbering: ISO/IEC 2503x; multipart numbering: ISO/IEC 25000-3x).** These international standards 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.

— **Quality Evaluation Division (legacy numbering: ISO/IEC 2504x; multipart numbering: ISO/IEC 25000-4x).** These international standards define requirements, recommendations and guidelines for software product evaluation and for documenting a measure as an evaluation module.

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— **Quality Engineering Division (ISO/IEC 25000-7x).** These international standards define requirements, recommendations and guidelines for software quality engineering. This division provides processes, disciplines and techniques to implement required quality and improve it.

— **SQuaRE Extension Division (legacy numbering: ISO/IEC 25050 to ISO/IEC 25099 (except for ISO/IEC 2507x); multipart numbering: ISO/IEC 25000-5x to ISO/IEC 25000-9x (except for ISO/IEC 25000-7x)).** These international standards define requirements for quality of ready-to-use software products, approaches to testing and requirements for quality of commercial-off-the-shelf software, common industry formats for usability reports, and quality models and measures for new technologies such as cloud and artificial intelligence. This document defines a framework for quality engineering, which exists within the SQuaRE Extension Division.

NOTE In the legacy numbering scheme, not every ISO/IEC document with a number in the range ISO/IEC 25000 to ISO/IEC 25099 is a SQuaRE document. The division structure described in this document applies only to documents that are identified as belonging to the SQuaRE family.

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

Part 23:
Measurement of product quality

1 Scope

This document defines quality measures for quantitatively evaluating product quality in terms of characteristics and sub-characteristics defined in ISO/IEC 25010 and is intended to be used together with ISO/IEC 25010. It can be used in conjunction with the ISO/IEC 2503n and the ISO/IEC 2504n standards or to more generally meet user needs concerning ICT products and software products quality.

This document contains a basic set of quality measures for each characteristic and sub-characteristics. It includes, as informative annexes, considerations for the use of quality measures (Annex A), QMEs used to define product or system quality measures (Annex B), and a detailed explanation of measurement types (Annex C).

This document does not provide the specific ranges of values of the measures to rated levels or grades of compliance because these values are determined based on the nature of the system, product, or a part of the product, and depending on factors such as the category of the software, integrity level, and users' needs. Some attributes could have a desirable range of values, which does not depend on specific user needs but depends on generic factors;

2 Normative reference

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 25010, *Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Product quality model*

ISO/IEC 25020, *Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Quality measurement framework*

3 Terms and definitions

For this document, the terms and definitions given in ISO/IEC 25000 and the following

apply. ISO and IEC maintain terminological 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/

Note 1 to entry The essential definitions from ISO/IEC 25000 and the other ISO standards are reproduced here.

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3.1
accessibility
extent to which products, systems, services, environments and facilities can be used by people from a population with the widest range of user (3.19) needs, characteristics and capabilities to achieve identified goals (3.6) in identified contexts of us

[SOURCE: ISO 9241-210:2019]

3.2
ICT Product
product that uses Information and Communication Technologies, and can be a part of an information system

[SOURCE: ISO/IEC 25030:2019, 3.8, modified – The original note 1 to entry has been removed; 4 new notes to entry have been added.]

Note 1 to entry: ICT products can constitute other ICT products (sub-products) and sometimes a component of an ICT product can also be considered an ICT product by itself. Examples of ICT products include computer hardware, software products, software components, and data.

Note 2 to entry: ICT product refers to the combination of one or more technology components (e.g., cloud, internet, data, multimedia, communication, hardware, firmware, software, and middleware) that enables modern computing and allows people and organizations to interact and operate in the digital world.

Note 3 to entry: ICT products do not include people, infrastructure, and other facilities which are independent of communication and data. ICT Product includes hardware with embedded computers, such as sensors and communicators, but not the users.

Note 4 to entry: While many artifacts like data sheets, user manuals, installation manuals, operations guide, and configuration guides contribute to the quality of an ICT Product and the information system that constitutes it, they are not ICT products by themselves.

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

Note 1 to entry: The term ‘measure” can refer to a base measure, a derived measure, or an indicator.

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

3.4
measure (verb)
make a measurement

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

3.5
measurement
set of operations having the objective of determining the 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 25000:2014, 4.20]

3.6
measurement function
algorithm or calculation performed to combine two or more quality measure elements

[SOURCE: ISO/IEC 25020:2019, 3.9]

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3.7
product
artifact that is produced, is quantifiable and is deliverable to the user as either an end item in itself or a component item

[SOURCE: ISO/IEC 25030:2019, 3.12, modified — The original notes 1 to entry have been added.]

Note 1 to entry: In this document, product refers to an ICT product that is part of an information system. ICT product components include subsystems, software, firmware, hardware, data, communication infrastructure, and other elements that are part of the ICT Product

3.8
quality measure
measure that is defined as a measurement function of two or more values of quality measure elements

[SOURCE: ISO/IEC 25002:2004]

Note 1 to entry: Quality measures can be considered as derived properties of an ICT product or information system.

Note 2 to entry: Inherent (structural) quality measures quantify structural properties of the ICT product or information system, while behavioural quality measures quantify properties that can be identified and measured on the ICT product or information system as a whole and its behaviour in a context of use.

3.9
quality measure element
QME
measure defined in terms of a property and the measurement method for quantifying it, including optionally the transformation by a mathematical function

[SOURCE: ISO/IEC 25020: 2019 3.14]

3.10
quality model
defined set of characteristics and relationships between them, which provides a framework for specifying quality requirements and evaluating the quality

[SOURCE: ISO/IEC 25000:2014, 4.27]

3.11
quality property
property of a target entity that is related to a quality measure element, and which can be quantified by a measurement method

[SOURCE: ISO/IEC 25020:2019, 3.11, modified – The term has been renamed. The original note 1 to entry has been removed; a new note to entry has been added.]

Note 1 to entry: Quality properties can be used either in the measurement ofF quality or just for providing qualitative feedback.

3.12
quality characteristic
category of quality attributes that bears on the quality of the ICT product or information system

Note 1 to entry: Quality characteristics can be further divided into quality sub-characteristics. While characteristics typically represent one aspect of quality that is of interest to stakeholders, quality sub-characteristics can help subdivide quality characteristics into individual aspects that help map them to quality properties.

[SOURCE: ISO/IEC 25000:2014, 4.34, formerly software quality characteristic, adapted to apply to a larger scope of products and systems, Note 1 to entry added]

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3.13
product quality
product quality capability of a system or its components to satisfy stated and implied quality needs when used under specific conditions

[SOURCE: ISO/IEC 25002:2024]

Note 1 to entry: This definition differs from the ISO 9000:2015 quality definition mainly because the software quality definition refers to the satisfaction of stated and implied needs, while the ISO 9000 quality definition refers to the satisfaction of requirements.

Note 2 to entry: Typically, users do not consider systems that only satisfy requirements as high-quality systems. Quality is related to satisfying and even surpassing expectations with associated constraints and conditions.

3.14
usability
extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use

[SOURCE: ISO/IEC 9241-210:2019, 3.13]

Note 1 to entry: The “specified” users, goals and context of use refer to the particular combination of users, goals and context of use for which usability is being considered.

Note 2 to entry: The word “usability” is also used as a qualifier to refer to the design knowledge, competencies, activities and design attributes that contribute to usability, such as usability expertise, usability professional, usability engineering, usability method, usability evaluation, usability heuristic.

3.15
user
person who interacts with a system, product or service

[SOURCE: ISO/IEC 9241-210:2019, 3.14]

Note 1 to entry: Users of a system, product or service include people who operate the system, people who make use of the output of the system and people who support the system (including providing maintenance and training).

3.16
user interface
all components of an interactive system (software or hardware) that provide information and controls for the user to accomplish specific tasks with the interactive system

[SOURCE: ISO/IEC 9241-210:2019, 3.16]

3.17
fault pattern
identifiable and recurring manner in which faults occur within a product or system

4 Abbreviated terms

The following abbreviated term is used in this document.

ICT information and communication technology

QM quality measure

QME quality measure element

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