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Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Product quality model

Ingénierie des systèmes et du logiciel — Exigences de qualité et évaluation des systèmes et du logiciel (SQuaRE) — Modèles de qualité du produit

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Foreword

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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).

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

This second edition of ISO/IEC 25010, together with the first edition of ISO/IEC 25002 and the first edition of ISO/IEC 25019, cancels and replaces ISO/IEC 25010:2011, which has been technically revised.

The main changes are as follows:

— This document revises the product quality model part of ISO/IEC 25010:2011. The other parts are moved to ISO/IEC 25002 on quality models overview and usage and ISO/IEC 25019 on quality-in-use model. The quality characteristics and subcharacteristics of the product quality model are revised for the purpose of better understanding and fitting the state of the art of ICT (information and communication technology).

— The target of the product quality model has been extended to include various types of ICT product and information system.

— Safety has been added as a quality characteristic with subcharacteristics, i.e. operational constraint, risk identification, fail safe, hazard warning and safe integration.

— Usability and portability have been replaced with interaction capability and flexibility respectively.

— Inclusivity and self-descriptiveness, resistance, and scalability have been added as subcharacteristics of interaction capability, security, and flexibility respectively.

— User interface aesthetics and maturity have been replaced with user engagement and faultlessness respectively.

— Accessibility has been split into inclusivity and user assistance.

— Several characteristics and subcharacteristics have been given more accurate names and definitions.

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

ICT (information and communication technology) products, including software products, are increasingly used to perform a wide variety of organizational and personal activities. Realization of goals and objectives for personal satisfaction, organizational success and/or human safety relies on high-quality ICT products. High-quality ICT products are essential to providing value and avoiding potential negative consequences for the stakeholders. The term “product” is used for ICT products which can include software, data, hardware and communication facilities, and other ICT products throughout this document. A product has a variety of influences on many classes of stakeholders including those who develop, acquire, and use the product. Stakeholders also include customers of businesses using the product, as well as the public under the influence of information systems using the product under real operation.

A comprehensive specification and evaluation of the target product is a key factor in ensuring value to stakeholders. This can be achieved by defining the necessary and desired quality characteristics associated with the stakeholders' goals and objectives for the system. This includes quality characteristics related to the product and data as well as the impact the system has on its stakeholders. It is important that the quality characteristics be specified, measured, and evaluated whenever possible using validated or widely accepted measures and measurement methods. The quality model in this document can be used to establish requirements, their criteria for satisfaction and the corresponding measures. A comparison with the product quality model in ISO/IEC 25010:2011 is given in Annex A.

This document is intended to be used in conjunction with the other documents in the SQuaRE family of International Standards (ISO/IEC 25000 to ISO/IEC 25099).

This document is a part of the SQuaRE family of International Standards. Figure 1 illustrates the organization of the SQuaRE family of International Standards. Similar standards are grouped into divisions. Each division provides guidance and resources for performing a different function in ensuring system and software product quality. This document belongs to the quality model division and is aligned with ISO/IEC 25002 belonging to the quality management division.

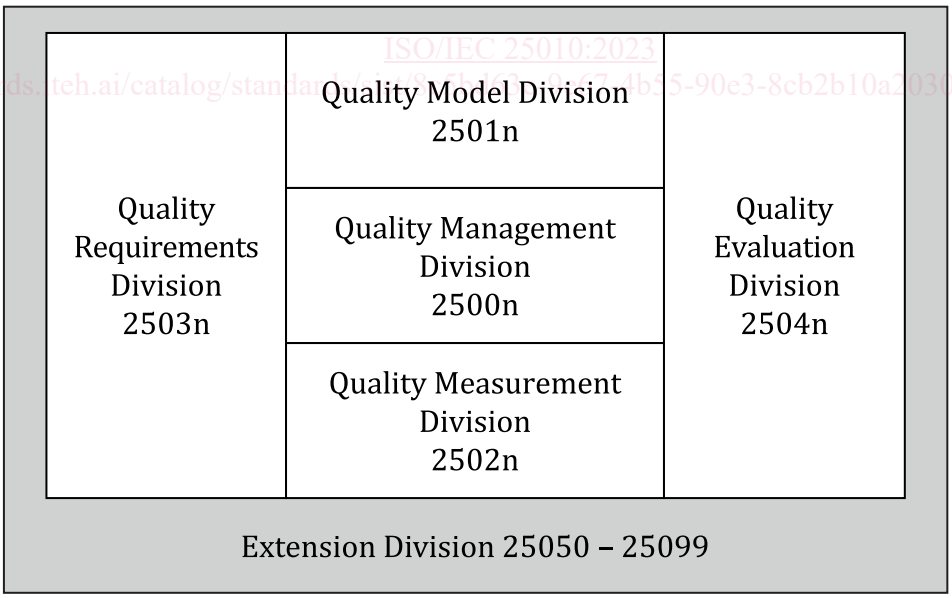

Figure 1 — Organization of SQuaRE family of International Standards

The divisions within the SQuaRE family are;

— 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 from the SQuaRE family. 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 25000: Guide to SQuaRE
  - ISO/IEC 25001: Planning and management
  - ISO/IEC 25002: Quality models overview and usage

- 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 25010: Product quality model
  - ISO/IEC TS 25011: Service quality models
  - ISO/IEC 25012: Data quality model
  - ISO/IEC 25019: Quality-in-use model
- 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 software product evaluation, whether performed by evaluators, acquirers or developers. The guideline for documenting a measure as an evaluation module is also provided.
- 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) and instructions for testing, Common Industry Format (CIF) for usability reports, and quality models and measures for new technologies such as cloud services and artificial intelligence.

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 can be used for systems and software quality requirements; and ISO/IEC 25040 describes how the quality models can be used for systems and software quality evaluation.

The SQuaRE standards can also be used in conjunction with ISO/IEC 33000 family of International Standards which are concerned with software process assessment to 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 assurance processes) 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) — Product quality model

1 Scope

This document defines a product quality model, which is applicable to ICT (information and communication technology) products and software products. The product quality model is composed of nine characteristics (which are further subdivided into subcharacteristics) that relate to quality properties of the products. The characteristics and subcharacteristics provide a reference model for the quality of the products to be specified, measured and evaluated.

NOTE 1 In this document, a 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.

This model can be used for requirements specification and evaluation of the target products' quality throughout their lifecycle by several stakeholders, including developers, acquirers, quality assurance and control staff and independent evaluators. Activities in the product lifecycle that can benefit from the use of this model include:

— eliciting and defining product and information system requirements;

— validating the comprehensiveness of requirements definition;

— identifying product and information system design objectives, and design necessary process for achieving quality;

— identifying product and information system testing objectives;

— identifying quality control criteria as the part of quality assurance;

— identifying acceptance criteria for a product and/or an information system;

— establishing measures of product quality characteristics in support of these activities.

NOTE 2 Usage of the quality model for measurement is explained in Annex C.

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 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
functional suitability
capability of a product to provide functions that meet stated and implied needs of intended users when it is used under specified conditions

Note 1 to entry: Functional suitability is concerned with whether the functions meet not only stated and implied needs, but also the functional specification (see C.1).

3.1.1
functional completeness
capability of a product to provide a set of functions that covers all the specified tasks and intended users' objectives

3.1.2
functional correctness
capability of a product to provide accurate results when used by intended users

Note 1 to entry: Precision is one of the attributes of correctness.

EXAMPLE In case of the products requiring high precision such as scientific software, the product can provide precise results with the needed degree as well as accurate results.

3.1.3
functional appropriateness
capability of a product to provide functions that facilitate the accomplishment of specified tasks and objectives

EXAMPLE A product provides the necessary and sufficient steps to complete a task, excluding any unnecessary steps.

Note 1 to entry: Functional appropriateness corresponds to suitability for the task in ISO 9241-110.

3.2
performance efficiency
capability of a product to perform its functions within specified time and throughput parameters and be efficient in the use of resources under specified conditions

Note 1 to entry: Resources can be CPU, memory, storage, and network devices.

Note 2 to entry: Resources can include other software products, the software and hardware configuration of the system, energy, and materials (e.g. print paper, storage media).

3.2.1
time behaviour
capability of a product to perform its specified function under specified conditions so that the response time and throughput rates meet the requirements

3.2.2
resource utilization
capability of a product to use no more than the specified amount of resources to perform its function under specified conditions

3.2.3
capacity
capability of a product to meet requirements for the maximum limits of a product parameter

Note 1 to entry: Parameters can include the number of items that can be stored, the number of concurrent users, the communication bandwidth, the throughput of transactions, and the size of a database.

3.3
compatibility
capability of a product to exchange information with other products, and/or to perform its required functions while sharing the same common environment and resources

3.3.1
co-existence
capability of a product to perform its required functions efficiently while sharing a common environment and resources with other products, without detrimental impact on any other product

3.3.2
interoperability
capability of a product to exchange information with other products and mutually use the information that has been exchanged

Note 1 to entry: Information is meaningful data; and information exchange includes transformation of data for exchange.

3.4
interaction capability
capability of a product to be interacted with by specified users to exchange information between a user and a system via the user interface to complete the intended task

Note 1 to entry: Interaction capability in the product quality model and its subcharacteristics focus on a set of attributes that enable interaction by users (or operators) to complete specific tasks in a variety of contexts of use. On the other hand, usability as defined in the quality-in-use model (ISO/IEC 25019) comprehensively focuses on outcomes of use to determine whether tasks are achieved by users with effectiveness, efficiency and satisfaction in a specific context of use.

Note 2 to entry: Interaction capability is a prerequisite for usability.

Note 3 to entry: Interaction itself is defined in ISO TR 25060 as “exchange of information between a user and an interactive system via the user interface”.

3.4.1
appropriateness recognizability
capability of a product to be recognized by users as appropriate for their needs

Note 1 to entry: Appropriateness recognizability depends on the ability to recognize the appropriateness of the product functions from initial impressions of the product or system and/or any associated documentation.

Note 2 to entry: The information can be provided by the product to assist users in making decisions about the adoption, acquisition, or use of products prior to the start of full-scale use, through demonstrations, tutorials, documentation or, for a website, the information on the home page.

3.4.2
learnability
capability of a product to have specified users learn to use specified product functions within a specified amount of time

3.4.3
operability
capability of a product to have functions and attributes that make it easy to operate and control

Note 1 to entry: Operability is related to controllability, user error robustness and conformity with user expectations as defined in ISO 9241-110. It is also related to the effectiveness and efficiency of physical interface devices (e.g. mouse, touch pen).

3.4.4
user error protection
capability of a product to prevent operation errors