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Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Quality-in-use model

Ingénierie des systèmes et du logiciel — Exigences de qualité et évaluation des systèmes et du logiciel (SQuaRE)~~— Modèles~~ — Modèle de qualité ~~du système et du logiciel~~de fonctionnement

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

The main changes are as follows:

— ~~—~~ ~~Stakeholders~~stakeholders influenced by use of system or product are classified and ~~explicited~~explicated;

— ~~—~~ ~~Aspects~~aspects of interest for each ~~stakeholderare~~stakeholder are integrated and ~~show~~shown as quality characteristics;

— ~~--- Context~~context coverage which was shown as quality characteristics in the quality-in-use model of the previous version ~~was~~is removed.

~~This document is a part of the SQuaRE family of International Standards, which consists of the following divisions:~~

~~— — quality management division (ISO/IEC 2500n);~~

~~— — quality model division (ISO/IEC 2501n);~~

~~— — quality measurement division (ISO/IEC 2502n);~~

~~— — quality requirements division (ISO/IEC 2503n);~~

~~— — quality evaluation division (ISO/IEC 2504n);~~

~~— — SQuaRE extension division (ISO/IEC 25050 to ISO/IEC 25099).~~

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

As information system (ICT products, software, data) and IT services are widely used, the target of their effect and influence of using them can extend from their direct users to organizations and the society. To control the effect and influence as much as possible is a social responsibility of enterprises and public/society administrations.

A wide variety of organizational functions and personal activities are increasingly performed by information systems and IT services. Therefore, high-quality information systems and IT services are essential to providing value and avoiding potential negative consequences for th stakeholders. Unfortunately, quality assurance has traditionally focused primarily on functional requirements, giving far less attention to the non-functional attributes of a system/product. Comprehensive specification, design, and evaluation of all quality attributes of information systems and IT services are critical to optimizing the value of information systems to their stakeholders.

The purpose of the "quality-in-use" model is to represent the effects and influences that can be experienced by using information system and IT service system; that is, to define, measure, evaluate and improve the quality of systems and software products and IT services when using them. Quality-in-use can be influenced by many factors including the quality of software, data and IT services.

If context of use changes, effect and influence on a stakeholder also changes.

Such context of use changes are monitored through quality evaluations of quality-in-use characteristics/sub-characteristics so that changes/gaps from initially specified context of use are identified and fed back to the next quality improvement cycle.

Full details of the changes to the quality-in-use model are in Annex AAnnex A. The comprehensive specification of quality characteristics associated with a specific type of information system is represented in a quality model. A quality model can be used as an objective reference supporting requirements definition, evaluation, and validation/verification. By establishing agreed quality characteristics and their measurement, the SQuaRE family of standards provides a framework for reliable development and delivery of information systems and IT services.

This document introduces the structure of SQuaRE quality models and provides requirements for developing them. ISO/IEC 25002 describes how SQuaRE quality models in the quality model division (2501n) can be used in conjunction with other SQuaRE standards to guide quality-related activities across the information system lifecycle regardless of the development methodology. These quality models can guide the development of measures for evaluating the quality of information systems and IT services to meet the requirements of their stakeholders. These models provide a common language for describing quality characteristics that can be understood by all stakeholders. They also provide a basis for defining standard quantitative measures of quality characteristics for evaluating the quality properties of a target entity.

The complexity of information systems has grown exponentially with the advent of modern digital technologies. This complexity elevates the importance of non-functional requirements and qualities. SQuaRE quality models can help guide the development of modern digital technologies that are trustworthy and that delight their users.

Figure 1Figure 1 (adapted from ISO/IEC 25000) 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.

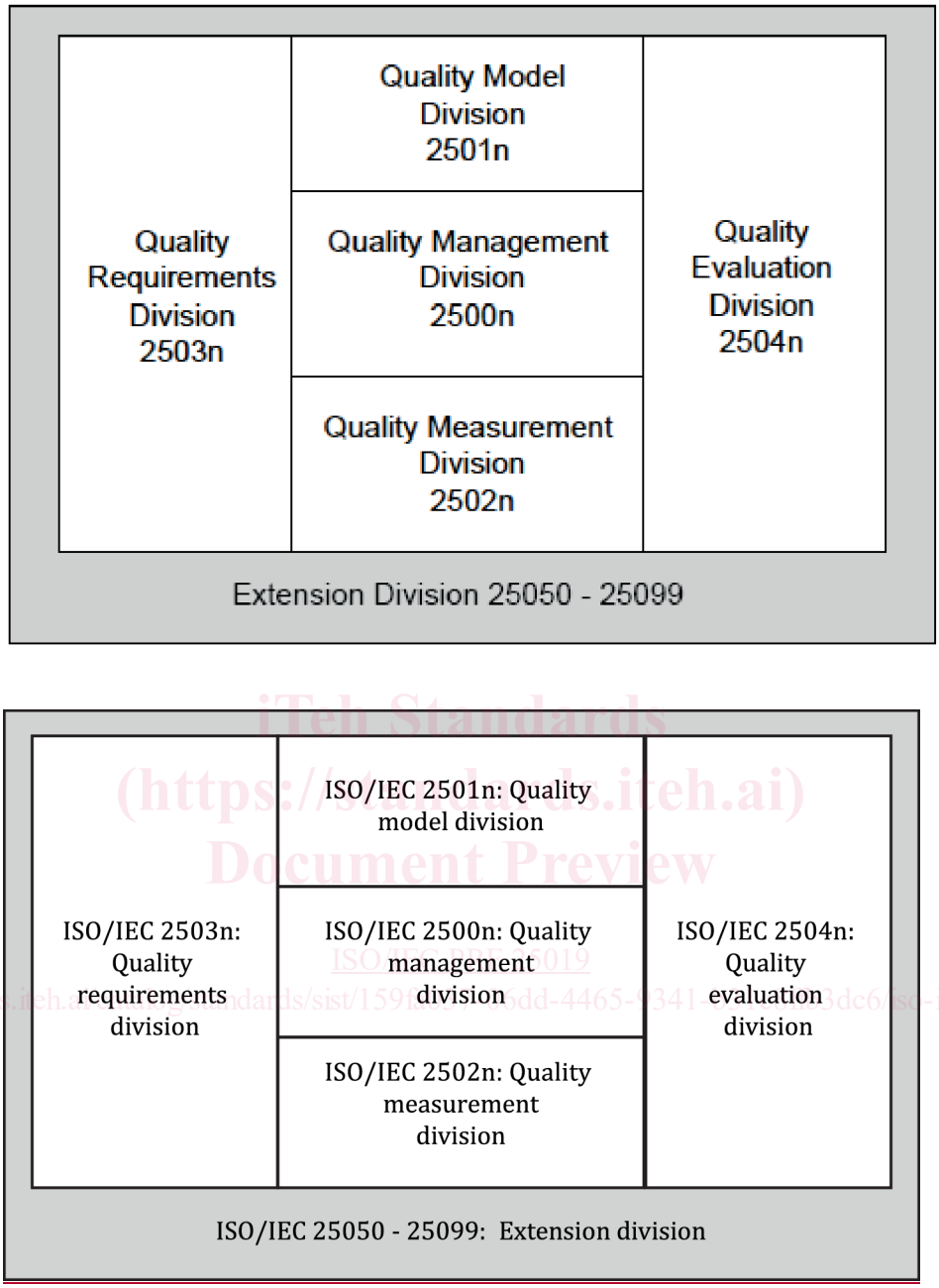

Figure 1 — Organization of SQuaRE family of International Standards

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. The 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. This document belongs to the quality model division. This document is aligned with ISO/IEC 25002 on quality models overview and usage.

- ISO/IEC 25010: Product quality model
- ISO/IEC 25011: IT 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), commercial off-the-shelf software and common industry formats 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

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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 system and software quality evaluation.

The SQuaRE standards can also be used in conjunction with the ISO/IEC 33000 family of International (which are concerned with software process assessment) to provide. Standards which are concerned with software process assessment to provide:

— ——a framework for quality requirements 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 and ISO/IEC/IEEE 90003 (which are concerned with quality assurance processes) to provide:

— ——support for setting quality goals (and certification where applicable);

— ——support for design review, verification, and validation.

Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Quality-in-use model

1 Scope

This document defines a quality-in-use model composed of three characteristics (which are further subdivided into sub-characteristics) that can influence stakeholders when products or systems are used in a specified context of use. This model is applicable to the entire spectrum of information system and IT service system, including both computer systems in use and software products in use.

This document provides a set of quality characteristics for specifying, measuring, evaluating and improving quality-in-use.

In this document, because context of use is specified as prerequisite of quality-in-use, context of use is necessary to be re-specified to change prerequisite when a product or service intend to fulfil to context of use changes.

The model can be applied, in particular, by those responsible for specifying and evaluating software product quality, such as developers, acquirers, quality assurance and control staff, and independent evaluators. Activities during product development that can benefit from the use of the quality model can include, but are not limited to:

— ——identifying requirements for information system and IT service system in use;

— ——validating the comprehensiveness of a quality-in-use requirements specification;

— ——identifying information system and IT service system design objectives for quality-in-use;

— ——identifying quality-in-use control criteria as part of overall quality assurance;

— ——identifying acceptance criteria for information system and IT service system or information systems;

— ——establishing measures to address the consequences of using products in specified context-of -use;

— ——presenting evaluation items for ethics considerations when using information system and IT service system;

— ——supporting governance of digitalization activities.

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 Quality-in-use

3.1.1
affect
change the attitude of a *user* (3.1.31~~(3.1.31)~~) or other *stakeholder* (3.1.26~~(3.1.26)~~) regarding a decision to acquire or use a *system* (3.1.29~~(3.1.29)~~)

3.1.2
attribute
inherent property or characteristic of an entity that can be distinguished quantitatively or qualitatively by human or automated means

[SOURCE: ISO/IEC 25000:2014, 4.1, modified — Notes to entry have been removed.]

3.1.3
component
entity with discrete structure, such as an assembly or software module, within a *system* (3.1.29~~(3.1.29)~~) considered at a particular level of analysis

3.1.4
context of use
combination of *users* (3.1.31~~(3.1.31),~~) goals and tasks, resources, and environment

Note 1 to entry: The "environment" in a context of use includes the technical, physical, social, cultural and organizational environments.

[SOURCE: ISO 9241-11:2018, 3.1.15]

3.1.5
customer
organization (3.1.13~~(3.1.13)~~) or person that receives a *product* (3.1.14~~(3.1.14)~~) or service

Note 1 to entry: In interactive *system* (3.1.29~~(3.1.29),~~) customers are sometimes the same as *operators* (3.1.12~~(3.1.12).~~).

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.16, modified — The original note 1 to entry and EXAMPLE has been removed; a new note to entry has been added.]

3.1.6
data quality
capability of the characteristics of data to satisfy stated and *implied needs* (3.3.3~~(3.3.4)~~) when used under specified conditions

[SOURCE: ISO/IEC 25000:2014, 4.5, modified — "degree to which the characteristics of data satisfy" has been changed to "capability of the characteristics of data to satisfy".]

3.1.7
developer
individual or *organization* (3.1.13~~(3.1.13)~~) that performs development activities [including *requirements* (3.1.21~~(3.1.21)~~) analysis, design, testing through acceptance] during the *system* (3.1.29~~(3.1.29)~~) or software life cycle process

[SOURCE: ISO/IEC 25000:2014, 4.6]

3.1.8
direct user
person who directly interacts with the *product* (3.1.14~~(3.1.14)~~)

Note 1 to entry: This definition of the term "direct user" is originally for the term "user" that is defined in ISO/IEC 9241-11:2018, 3.1.7. In ~~ISO/IEC 25000 SQuaRE series~~this document, the term "direct user" is addressed to distinguish from *"indirect user*" (3.3.4 ~~(3.3.5)" .~~).

3.1.9
information system
system (3.1.29~~(3.1.29)~~) that comprises ~~Information Communication Technology (ICT)~~ *products* (3.3.2~~(3.3.3),~~), ICT environment, and the people who use them or are impacted by them which become a combination of interacting elements organized to achieve one or more stated purposes

Note 1 to entry: While information systems can be part of larger systems that include other electro-mechanical products and their *users* (3.1.31~~(3.1.31),~~ this document considers these *components* (3.1.3~~(3.1.3)~~) as part of the *context of use* (3.1.4~~(3.1.4)~~) of the system only if they have a direct relevant relationship to the ICT products and users who are part of the information system. However, many of the quality *attributes* (3.1.2~~(3.1.2)~~) can be applied to these larger systems of systems as well.

Note 2 to entry: Information system in this document can be recognized as a system of interest with the other interacting systems comprising the operational environment. An individual system is the same as the system defined in ISO/IEC/IEEE 15288, i.e. "a combination of interacting elements organized to achieve one or more stated purposes".

Note 3 to entry: An embedded software system is not an information system for the purpose of this document. information system in this usage is intended to describe a scope for quality concerns that include the *target entities* (3.1.30~~(3.1.30)~~) effect on each other. The target entities included under the term information system include *ICT products* (3.3.2~~(3.3.3),~~) IT services and their operational environment comprised of one or more systems.

3.1.10
measure,noun
variable to which a value is assigned as the result of *measurement* (3.1.11~~(3.1.11)~~)

Note 1 to entry: The plural form "measures" is used to refer collectively to base measures, derived measures, and indicators.

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

3.1.11
measurement
set of operations having the object of determining a value of a *measure* (3.1.10~~(3.1.10)~~)

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

[SOURCE: ISO/IEC/IEEE 15939:2017, 3.17, modified — The original note 1 to entry has been replaced by a new one.]

3.1.12
operator
individual or *organization* (3.1.13~~(3.1.13)~~) that performs the operations of a *system* (3.1.29~~(3.1.29)~~)

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.29, modified — Notes 1 to 3 to entry have been removed.]

3.1.13
organization
group of people and facilities with an arrangement of responsibilities, authorities~~,~~ and relationships

EXAMPLE~~:~~ company, corporation, firm, enterprise, institution, charity, sole trader, association, or parts or combination thereof, whether incorporated or not, public or private.

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.30, modified — "whether incorporated or not, public or private" has been added in the EXAMPLE; note 1 to entry has been removed.]

3.1.14
product
artefact that is produced, is quantifiable, and is deliverable to *user* (3.1.31~~(3.1.31)~~) as either an end item in itself or a *component* (3.1.3~~(3.1.3)~~) item

Note 1 to entry: In this document, product refers to an *ICT product* (3.3.2~~(3.3.3)~~) that is part of an *information system* (3.1.9~~(3.1.9).~~). ICT product components include subsystems, software, firmware, hardware, data, communication infrastructure, and other elements that are part of the ICT product.

[SOURCE: ISO/IEC 25030:2019, 3.12, modified — The original notes 1 and 2 to entry have been replaced by a new note to entry.]

3.1.15
quality-in-use
extent to which the *system* (3.1.29~~(3.1.29)~~) or *product* (3.1.14~~(3.1.14),~~), when it is used in a specified *context of use* (3.1.4~~(3.1.4),~~), satisfies or exceeds *stakeholders'* (3.1.26~~(3.1.26)~~) needs to achieve specified beneficial goals or outcomes.

Note 1 to entry: Beneficial goals can be stated as targets, in predefined conditions with managed economic, environmental, organizational, and societal *risks* (3.1.22~~(3.1.22).~~).

Note 2 to entry: The quality-in-use model can be used as a guide to represent the *user's* (3.1.31~~(3.1.31)~~) expectations about the system's behaviour.

Note 3 to entry: Users of the quality-in-use includes direct and *indirect users* (3.3.4~~(3.3.5).~~). When applied to *direct users* (3.1.8~~(3.3.1),~~), quality-in-use appears as "effect", and to other stakeholders it appears as "influence~~" (3.1.8).~~".