INTERNATIONAL STANDARD

ISO/IEC
25021

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

Ingénierie des systèmes et du logiciel — Exigences de qualité et évaluation des systèmes et du logiciel (SQuaRE) — Éléments de mesure de la qualité

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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.

ISO/IEC 25021 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and System Engineering*.

This first edition of International Standard ISO/IEC 25021 cancels and replaces the first edition of Technical Report ISO/IEC TR 25021:2007.

The SQuaRE series of standards consists of the following divisions under the general title *Systems and Software Quality Requirements and Evaluation (SQuaRE)*:

- ISO/IEC 2500n, *Quality Management Division*,

- ISO/IEC 2501n, *Quality Model Division*,

- ISO/IEC 2502n, *Quality Measurement Division*,

- ISO/IEC 2503n, *Quality Requirements Division*, and

- ISO/IEC 2504n, *Quality Evaluation Division*.

Introduction

The purpose of this International Standard is to define and/or design an initial set of Quality Measure Elements (QME) to be used throughout the product life cycle for the purpose of Systems and Software Quality Requirements and Evaluation (SQuaRE). The document also gives a set of rules to design a QME or verify the design of an existing QME. The content of this document constitutes the link between the ISO/IEC 9126 series of standards and the subsequent SQuaRE series of standards.

A number of QMEs for quality measures that quantify some of the characteristic and subcharacteristic represent an initial list, which is to be used during the construction of the quality measures as referenced in ISO/IEC TR 9126-2, ISO/IEC TR 9126-3 and ISO/IEC TR 9126-4. Quality measures presented in the SQuaRE series (Figures 1, 2) were extracted from ISO/IEC TR 9126 series but it is not the only source. When evaluating selected quality measures, the user should first understand the definition of each property related to a QME used within the selected quality measures.

The main purposes of defining and using the Quality Measures Elements (QMEs) in this document are:

- To provide guidance for organisations developing and implementing their own QMEs;

- To promote the consistent use of specific QME for measuring and using the product properties that are relevant to different product quality characteristics and subcharacteristics;

- To help identify a set of QMEs that are uniquely required to derive all the quality measures for a given set of characteristics or a set of subcharacteristics of a product.

The QMEs are the common components of a number of quality measures. The intended usage of this International standard is that users will be able to select and define relevant valid QMEs to define internal, external, data or quality-in-use quality measures. Then, these can be used for quality requirements definition, products evaluation and quality assessment but not necessary limited to those. It is therefore recommended to use this document prior or together with the ISO/IEC 2502n series of standards.
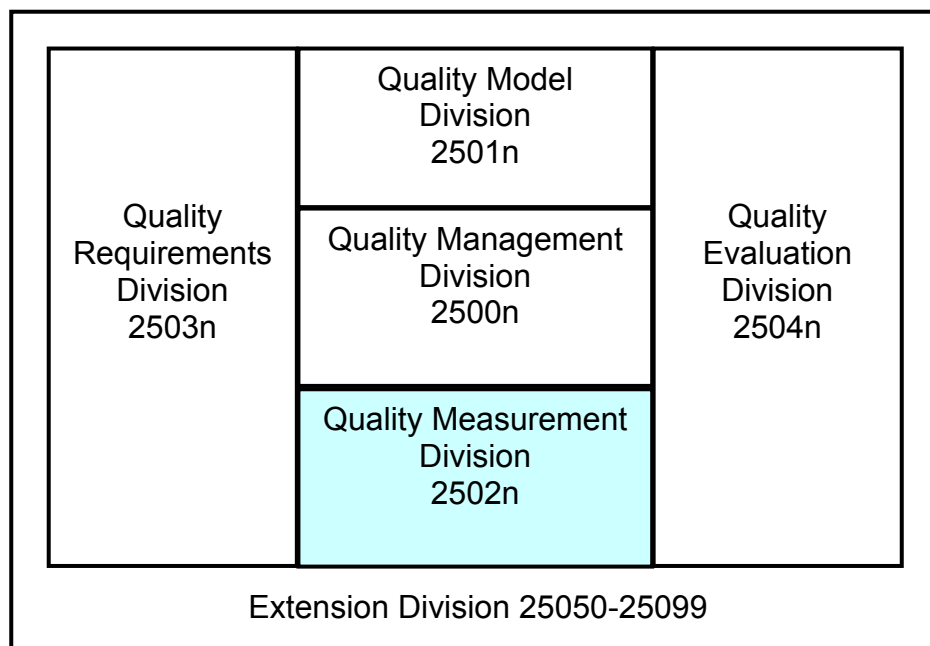

Figure 1 — Organisation of the SQuaRE series of international standards

Figure 1 illustrates the organisation of the SQuaRE series representing families of standards, further called Divisions.
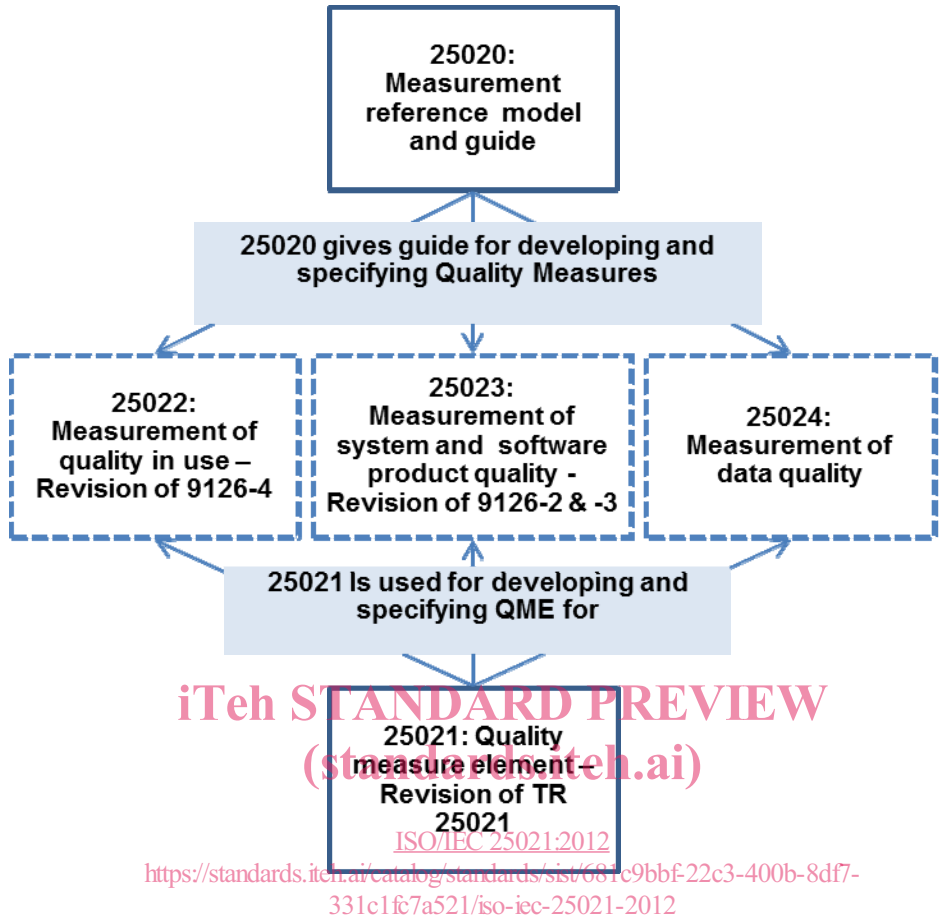
25020:
Measurement
reference model
and guide

25020 gives guide for developing and
specifying Quality Measures

25022:
Measurement of
quality in use –
Revision of 9126-4

25023:
Measurement of
system and software
product quality -
Revision of 9126-2 & -3

25024:
Measurement of
data quality

25021 Is used for developing and
specifying QME for

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25021: Quality
measure element –
Revision of TR
25021

Figure 2 — Structure of the Quality Measurement Division

ISO/IEC TR 9126-4
Quality in use measures

ISO/IEC TR 9126-3
Internal measures

ISO/IEC TR 9126-2
External measures

ISO/IEC 9126-1
Quality model

Quality characteristics
Quality subcharacteristics

Quality measures

ISO/IEC 25021
Quality measure elements
(QME)

SQuaRE Quality measures

Quality measure 1
Quality measure 2
Quality measure 3
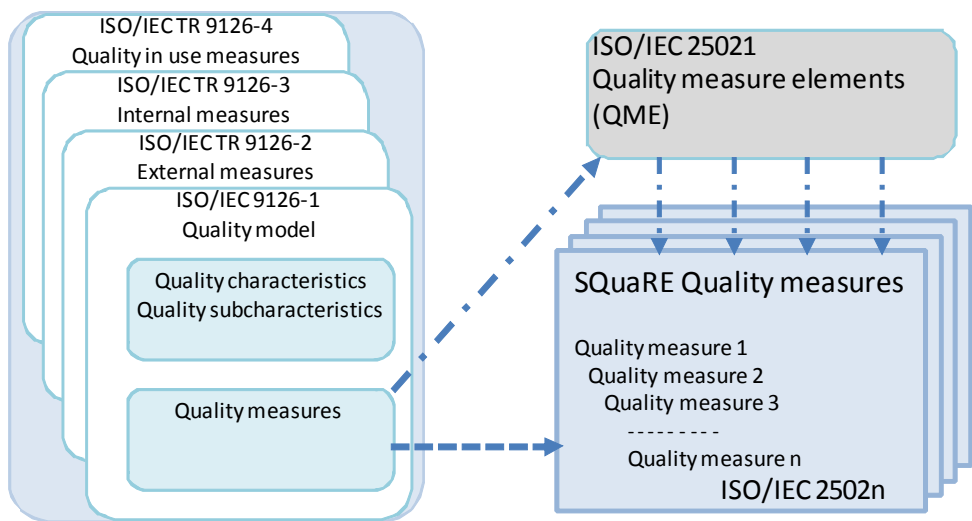- - - - - - - - -
Quality measure n
ISO/IEC 2502n

Figure 3 — The relationship of ISO/IEC 25021 as a link between the 9126 series and the SQuaRE series
of standard

The ISO/IEC 9126 series is composed of four documents that list and describe the characteristics, subcharacteristics and quality measures that are referred to as the quality model. The SQuaRE quality models categorize product quality into characteristics which are further subdivided into subcharacteristics and quality properties (ISO/IEC 25010). Each quality measure within ISO/IEC 9126 series is composed of at least two QMEs. The properties (of a product) are linked to the QME (ISO/IEC 25020), using a measurement method. The 2502n series designs and describes quality measures and associated QMEs for all the quality (sub)characteristics in the quality model.

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

1 Scope

This International Standard contains the following information:

- Requirements for defining QMEs as part of the specification of the product quality requirements with examples (see 6.2 Tables 1 and 2);

NOTE   Product quality includes system quality, software product quality, data quality and eventually system service quality.

- An initial set of QMEs, as examples (see Annex A Table A.1);

- A guideline for defining and quantifying the property of the product (target entity) for QMEs (see Annex B)

This document is intended for, but not limited to, developers, acquirers and independent evaluators of products, particularly those responsible for defining product quality requirements and for product evaluation. This International Standard is applicable when defining the QMEs to be used to implement quality measures such as those specified in ISO/IEC 25022, ISO/IEC 25023 and ISO/IEC 25024.

2 Conformance

When users define quality measures for a product, each of the referred QME shall be described according to the information items of format specified in Table 1 (see 6.2). The same should be applied for modifying an existing QME.

3 Normative references

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 25000:2005, *Software engineering — Software product Quality Requirements and Evaluation (SQuaRE) — Guide to SQuaRE*

ISO/IEC 25010:2011, *Systems and software engineering — Systems and software product Quality Requirements and Evaluation (SQuaRE) — System and software quality models*

ISO/IEC 25020:2007, *Software engineering — Software product Quality Requirements and Evaluation (SQuaRE) — Measurement reference model and guide*

ISO/IEC 15939:2007, *Systems and software engineering — Measurement process*

ISO/IEC Guide 99:2007, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*

4   Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 25000, ISO/IEC 25010, ISO/IEC 25020, ISO/IEC 15939, ISO/IEC Guide 99, and the following apply. The following definitions are replicated here for the convenience of the user of this document.

4.1
data quality
degree to which the characteristics of data satisfy stated and implied needs when used under specified conditions

[ISO/IEC 25012:2008]

4.2
external measure of software quality
measure of the degree to which a software product enables the behavior of a system to satisfy stated and implied needs for the system including the software to be used under specified conditions

NOTE 1   The behavior can be verified and/or validated by executing the software product during testing and operation.

NOTE 2   Based on the ISO/IEC 25000:2005 definition of external software quality.

NOTE 3   This definition was adapted from ISO/IEC 25010:2011.

4.3
internal measure of software quality
measure of the degree to which a set of static properties of a software product satisfies stated and implied needs for the software product to be used under specified conditions

NOTE 1   Static properties include those that relate to the software architecture, structure and its components.

NOTE 2   Static properties can be verified by review, inspection, simulation and/or automated tools.

NOTE 3   This definition was adapted from ISO/IEC 25010:2011.

EXAMPLE   Depending of the context specifications faults, design faults and code faults could be used as internal quality measures.

NOTE 4   Based on the ISO/IEC 25000:2005 definition of internal software quality.

4.4
measure (noun)
variable to which a value is assigned as the result of measurement

NOTE   The term "measures" is used to refer collectively to base measures, measures, and indicators.

[ISO/IEC 15939:2007]

4.5
measure (verb)
make a measurement

[ISO/IEC 25000:2005]

4.6
measurement
set of operations having the object of determining a value of a measure

[ISO/IEC 15939:2007]

NOTE   Measurement can be nominal, ordinal, interval and ratio scale type.

4.7
measurement function
algorithm or calculation performed to combine two or more quality measure elements

NOTE   This definition is modified from ISO/IEC 15939:2007 definition of measurement method.

4.8
measurement method
logical organisation of operations, described generically, used in measurement

NOTE   This definition is modified from ISO/IEC 15939:2007 definition of measurement method.

4.9
measurement procedure
logical organisation of operations, applied specifically, used in the performance of particular measurements according to a given measurement method

NOTE 1   This definition is modified from ISO/IEC 15939:2007 definition of measurement procedure.

NOTE 2   A measurement procedure is usually recorded in a document that is sometimes itself called a "measurement procedure" and is usually in sufficient detail to enable an operator to carry out a measurement without additional information.

4.10
model
specification of the concepts, relationships and rules that are used to define a methodology

[ISO/IEC 24744:2007, Software Engineering — Model for Development Methodologies]

4.11
property to quantify
property of a target entity that is related to a quality measure element and which can be quantified by a measurement method

NOTE 1   A software artifact is an example of a target entity.

NOTE 2   A sub-property is related to a property.

4.12
quality in use measure
measure of the 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, satisfaction and context coverage in specific contexts of use

NOTE   Based on the ISO/IEC 25010:2011 definition of quality in use.

4.13
quality measure
derived measure that is defined as a measurement function of two or more values of quality measure elements

4.14
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

4.15
repeatability (of results of measurement)
closeness of the agreement between the results of successive measurements of the same measurand carried out under the same conditions of measurement

[ISO/IEC TR 14143-3:2003]

4.16
reproducibility (of results of measurement)
closeness of the agreement between the results of measurements of the same measurand carried out under changed conditions of measurement

[ISO/IEC TR 14143-3:2003]

NOTE   Repeatability and reproducibility may be expressed quantitatively in terms of the dispersion characteristics of the results.

4.17
target entity
fundamental thing of relevance to the user, about which information is kept, and need to be measured

4.18
unit (of measure)
a particular quantity defined and adopted by convention, with which other quantities of the same kind are compared in order to express their magnitude relative to that quantity

NOTE 1   Only quantities expressed in the same units of measurement are directly comparable. Examples of units include the number of faults and the number of failures. Hour and meter are also unit of measure.

NOTE 2   Units of measurement have conventionally assigned names and symbols.

NOTE 3   Based on the ISO/IEC 25000:2005 definition of unit of measurement.

5   Abbreviated terms

In this International Standard, the following abbreviations are used:

a)   QME - Quality measure element;

b)   QM - Quality measure;

6   Quality measure elements concept

6.1   Presentation of the measurement method model

To understand and indicate quality (sub)characteristics, QM is defined and then QMEs are defined.

A measurement function is applied to QME to generate QM. A measurement method shall be applied to a property to define and identify a way to quantify a QME.
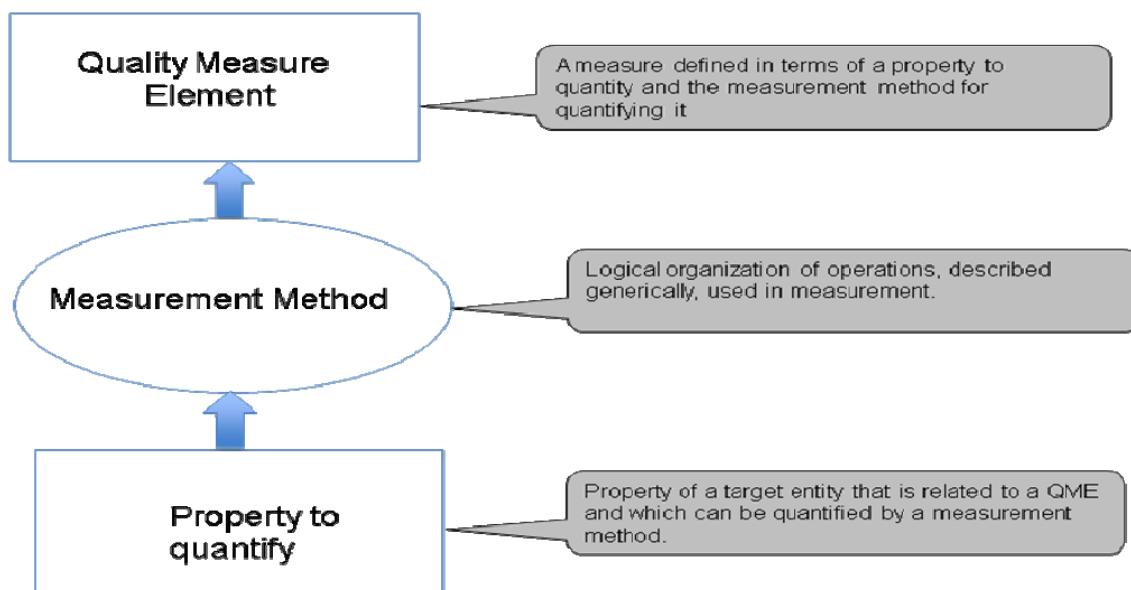
Figure 4 — Relationship between property to quantify, measurement method and QME

The user of the measurement method shall identify and collect data related to quantifying the property (Figure 4). Depending on the context of usage and objective(s) of the QME, a number of properties and sub properties can be identified. These are the input of the measurement method. Those properties are extracted and defined from the artefacts, components, content or behaviour of the target entity (e.g. documentation, code).
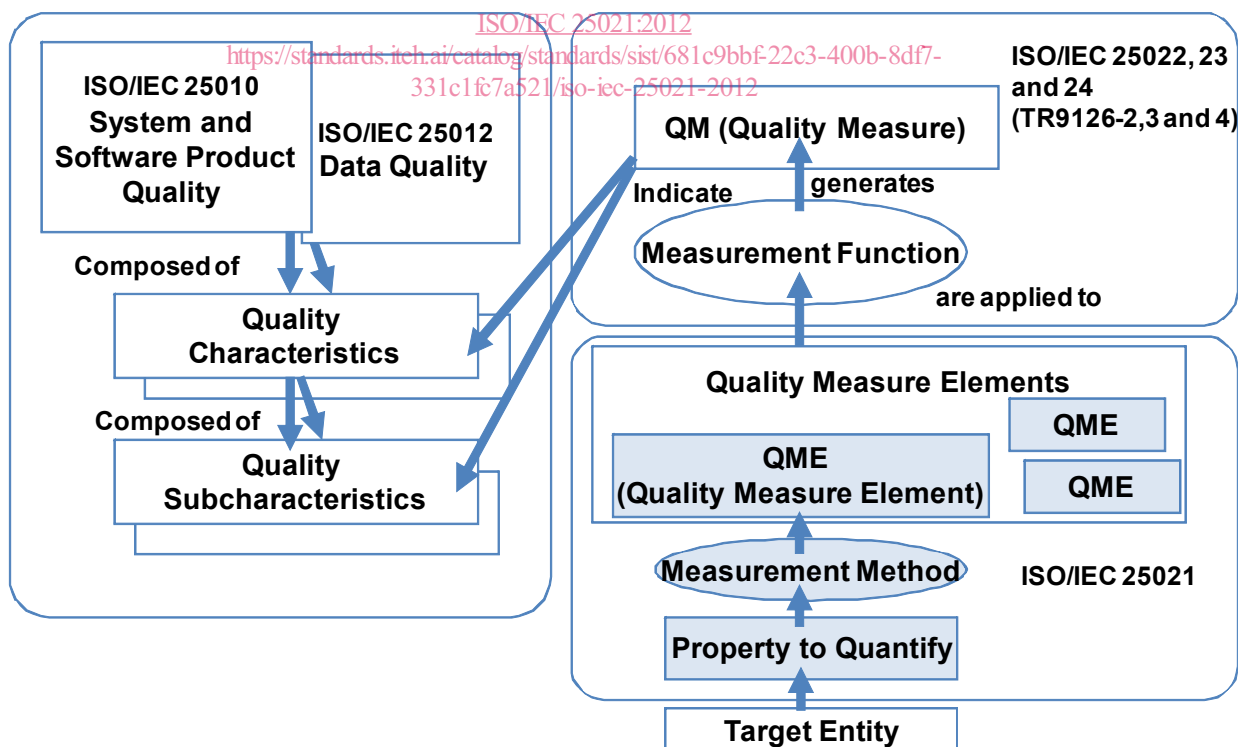
Figure 5 — Relationship among property to quantify, measurement method, QME and QM