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Systems and software engineering — Measurement process

Ingénierie des systèmes et du logiciel — Processus de mesure

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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 15939 was prepared by Joint 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 15939:2002), which has been technically revised.

Introduction

Measurement supports the management and improvement of processes and products. Measurement is a primary tool for managing system and software life cycle activities, assessing the feasibility of project plans, and monitoring the adherence of project activities to those plans. System and software measurement is also a key discipline in evaluating the quality of products and the capability of organizational processes. It is becoming increasingly important in two-party business agreements, where it provides a basis for specification, management, and acceptance criteria.

Continual improvement requires change within the organization. Evaluation of change requires measurement. Measurement itself does not initiate change. Measurement should lead to action and not be employed purely to accumulate data. Measurements should have a clearly defined purpose.

This International Standard defines a measurement process applicable to system and software engineering and management disciplines. The process is described through a model that defines the activities of the measurement process that are required to adequately specify what measurement information is required, how the measures and analysis results are to be applied, and how to determine if the analysis results are valid. The measurement process is flexible, tailorable, and adaptable to the needs of different users.

The measurement process defined in this International Standard, while written for system and software domains, can be applied in other domains.

Systems and software engineering — Measurement process

1 Scope

1.1 Purpose

This International Standard identifies the activities and tasks that are necessary to successfully identify, define, select, apply and improve measurement within an overall project or organizational measurement structure. It also provides definitions for measurement terms commonly used within the system and software industries.

This International Standard does not catalogue measures, nor does it provide a recommended set of measures to apply on projects. It does identify a process that supports defining a suitable set of measures that address specific information needs.

1.2 Field of application

This International Standard is intended to be used by suppliers and acquirers. Suppliers include personnel performing management, technical and quality management functions in system and software development, maintenance, integration and product support organizations. Acquirers include personnel performing management, technical and quality management functions in procurement and user organizations.

The following are examples of how this International Standard can be used:

- by a supplier to implement a measurement process to address specific project or organizational information requirements;
- by an acquirer (or third-party agents) for evaluating conformance of the supplier's measurement process to this International Standard;
- by an acquirer (or third-party agents) to implement a measurement process to address specific technical and project management information requirements related to the acquisition;
- in a contract between an acquirer and a supplier as a method for defining the process and product measurement information to be exchanged.

1.3 Tailoring this International Standard

This International Standard contains a set of activities and tasks that comprise a measurement process that meets the specific needs of organizations, enterprises and projects. The tailoring process consists of modifying the non-normative descriptions of the tasks to achieve the purpose and outcomes of the measurement process. All normative clauses need to be satisfied. New activities and tasks not defined in this International Standard may be added as part of tailoring.

1.4 Conformance

Conformance to this International Standard is defined as satisfying the purpose and outcomes of the measurement process and all of the normative clauses within the tasks in Clause 4. Any organization imposing this International Standard as a condition of trade is responsible for specifying and making public all task-specific criteria to be imposed in conjunction with this International Standard.

Throughout this International Standard, “shall” is used to express a provision that is binding on the party that is applying this International Standard, “should” to express a recommendation among other possibilities, and “may” to indicate a course of action permissible within the limits of the International Standard.

It is the responsibility of the organization to maintain appropriate evidence of satisfaction of the normative clauses for the purposes of demonstrating conformance.

1.5 Limitations

This International Standard does not assume or prescribe an organizational model for measurement. The user of this International Standard should decide, for example, whether a separate measurement function is necessary within the organization and whether the measurement function should be integrated within individual projects or across projects, based on the current organizational structure, culture and prevailing constraints.

This International Standard is not intended to prescribe the name, format or explicit content of the documentation to be produced. This International Standard does not imply that documents be packaged or combined in some fashion. These decisions are left to the user of this International Standard.

The measurement process should be appropriately integrated with the organizational quality system. Not all aspects of internal audits and non-compliance reporting are covered explicitly in this International Standard as they are assumed to be in the domain of the quality system.

This International Standard is not intended to conflict with any organizational policies, standards or procedures that are already in place. However, any conflict should be resolved and any overriding conditions and situations need to be cited in writing as exceptions to the application of this International Standard.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
acquirer
stakeholder that acquires or procures a product or service from a supplier

[ISO/IEC 15288:2002]

NOTE Other terms commonly used for an acquirer are buyer, customer, owner and purchaser.

2.2
attribute
property or characteristic of an entity that can be distinguished quantitatively or qualitatively by human or automated means

2.3
base measure
measure defined in terms of an attribute and the method for quantifying it

NOTE 1 A base measure is functionally independent of other measures.

NOTE 2 Based on the definition of “base quantity” in the International Vocabulary of Basic and General Terms in Metrology, 1993.

2.4
data
collection of values assigned to base measures, derived measures and/or indicators

2.5
data provider
individual or organization that is a source of data

2.6
data store
organized and persistent collection of data and information that allows for its retrieval

2.7
decision criteria
thresholds, targets, or patterns used to determine the need for action or further investigation, or to describe the level of confidence in a given result

2.8
derived measure
measure that is defined as a function of two or more values of base measures

NOTE Adapted from the definition of “derived quantity” in the International Vocabulary of Basic and General Terms in Metrology, 1993.

2.9
entity
object that is to be characterized by measuring its attributes

NOTE An entity can be a process, product, project or resource.

2.10
indicator
measure that provides an estimate or evaluation of specified attributes derived from a model with respect to defined information needs

2.11
indicator value
numerical or categorical result assigned to an indicator

2.12
information need
insight necessary to manage objectives, goals, risks and problems

2.13
information product
one or more indicators and their associated interpretations that address an information need

EXAMPLE A comparison of a measured defect rate to planned defect rate along with an assessment of whether or not the difference indicates a problem.

2.14
measurable concept
abstract relationship between attributes of entities and information needs

2.15
measure, noun
variable to which a value is assigned as the result of measurement

NOTE The plural form “measures” is used to refer collectively to base measures, derived measures and indicators.

2.16
measure, verb
make a measurement

[ISO/IEC 14598-1:1999]

2.17
measurement
set of operations having the object of determining a value of a measure

NOTE Adapted from the International Vocabulary of Basic and General Terms in Metrology, 1993.

2.18
measurement analyst
individual or organization that is responsible for the planning, performance, evaluation and improvement of measurement

2.19
measurement experience base
data store that contains the evaluation of the information products and the measurement process as well as any lessons learned during the measurement process

2.20
measurement function
algorithm or calculation performed to combine two or more base measures

2.21
measurement librarian
individual or organization that is responsible for managing the measurement data store(s)

2.22
measurement method
logical sequence of operations, described generically, used in quantifying an attribute with respect to a specified scale

NOTE 1 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 Based on the definition of “method of measurement” in the International Vocabulary of Basic and General Terms in Metrology, 1993.

2.23
measurement procedure
set of operations, described specifically, used in the performance of a particular measurement according to a given method

[International Vocabulary of Basic and General Terms in Metrology, 1993]

2.24
measurement process
process for establishing, planning, performing and evaluating measurement within an overall project, enterprise or organizational measurement structure

2.25
measurement process owner
individual or organization responsible for the measurement process

2.26
measurement sponsor
individual or organization that authorizes and supports the establishment of the measurement process

2.27
measurement user
individual or organization that uses the information products

2.28
model
algorithm or calculation combining one or more base and/or derived measures with associated decision criteria

2.29
observation
instance of applying a measurement procedure to produce a value for a base measure

2.30
operator
entity that performs the operation of a system

2.31
organizational unit
part of an organization that is the subject of measurement

NOTE Adapted from ISO/IEC 15504-1:2004.

2.32
process
set of interrelated or interacting activities which transforms inputs into outputs

[ISO 9000:2005]

2.33
product
result of a process

[ISO 9000:2005]

NOTE There are four agreed generic product categories: hardware (e.g. engine mechanical part), software (e.g. computer program), services (e.g. transport), and processed materials (e.g. lubricant). Hardware and processed materials are generally tangible products, while software or services are generally intangible. Most products comprise elements belonging to different generic product categories. Whether the product is then called hardware, processed material, software or service depends on the dominant element.

2.34
project
endeavour with defined start and finish dates undertaken to create a product or service in accordance with specified resources and requirements

NOTE 1 Adapted from ISO 9000:2005.

NOTE 2 A project may be viewed as a unique process comprising coordinated and controlled activities and may be composed of activities from the Project Processes and Technical Processes defined in this International Standard.

2.35
scale
ordered set of values, continuous or discrete, or a set of categories to which the attribute is mapped

NOTE 1 The type of scale depends on the nature of the relationship between values on the scale. Four types of scale are commonly defined:

— nominal: the measurement values are categorical;

— ordinal: the measurement values are rankings;