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Systems and software engineering — Life cycle processes — Requirements engineering

Ingénierie des systèmes et du logiciel — Processus du cycle de vie — Ingénierie des exigences

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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 nongovernmental, 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.

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 ISO documents should be noted. This document was drafted in accordance with the rules given in the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. The IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and serve without compensation. While the IEEE administers the process and establishes rules to promote fairness in the consensus development process, the IEEE does not independently evaluate, test, or verify the accuracy of any of the information contained in its standards.

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Systems and software engineering*, in cooperation with the Systems and Software Engineering Standards Committee of the IEEE Computer Society, under the Partner Standards Development Organization cooperation agreement between ISO and IEEE.

This second edition cancels and replaces the first edition (ISO/IEC/IEEE 29148:2011), which has been technically revised.

Changes in this revision of ISO/IEC/IEEE 29148 were developed in response to the revision of ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207. The purpose of these revisions is to accomplish the harmonization of the structures and contents of the two documents, while supporting the requirements of the assessment community.

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.

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Introduction

This document provides a unified treatment of the processes and products involved in engineering requirements throughout the life cycle of systems and software. It provides details for the construct of well-formed textual requirements, to include characteristics and attributes, in the context of system and software engineering. This document also provides guidance for the implementation of requirements related processes from ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207. Finally, this document identifies information items related to requirements engineering and their content.

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Systems and software engineering — Life cycle processes — Requirements engineering

1 Scope

This document:

— specifies the required processes implemented in the engineering activities that result in requirements for systems and software products (including services) throughout the life cycle;

— provides guidelines for applying the requirements and requirements-related processes described in ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207;

— specifies the required information items produced through the implementation of the requirements processes;

— specifies the required contents of the required information items;

— provides guidelines for the format of the required and related information items.

This document is applicable to:

— those who use or plan to use ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207 on projects dealing with man-made systems, software-intensive systems, software and hardware products, and services related to those systems and products, regardless of the project scope, product(s), methodology, size or complexity;

— anyone performing requirements engineering activities to aid in ensuring that their application of the requirements engineering processes conforms to ISO/IEC/IEEE 15288 and/or ISO/IEC/IEEE12207;

— those who use or plan to use ISO/IEC/IEEE 15289 on projects dealing with man-made systems, software-intensive systems, software and hardware products and services related to those systems and products, regardless of the project scope, product(s), methodology, size or complexity;

— anyone performing requirements engineering activities to aid in ensuring that the information items developed during the application of requirements engineering processes conforms to ISO/IEC/IEEE 15289.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document, (including any amendments) applies.

ISO/IEC/IEEE 15288:2015, *Systems and software engineering — System life cycle processes*

ISO/IEC/IEEE 12207:2017, *Systems and software engineering — Software life cycle processes*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC/IEEE 15288, ISO/IEC/IEEE 12207 and the following apply.

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ISO, IEC and IEEE maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

— IEEE Standards Dictionary Online: available at http://dictionary.ieee.org

NOTE Definitions for other system and software engineering terms typically can be found in ISO/IEC/IEEE 24765, available at www.computer.org/sevocab.

3.1.1
acquirer
stakeholder (3.1.28) that acquires or procures a product or service from a *supplier* (3.1.31)

Note 1 to entry: Other terms commonly used for an acquirer are buyer, *customer* (3.1.9), owner, purchaser or internal/organizational sponsor.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.1]

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

Note 1 to entry: ISO 9000 distinguishes two types of attributes: a permanent characteristic existing inherently in something; and an assigned characteristic of a product, process, or system (e.g., the price of a product, the owner of a product).

[SOURCE: ISO/IEC 25000:2014, 4.1, modified — The original NOTE 1 has been removed; NOTE 2 has become Note 1 to entry.]

3.1.3
baseline
formally approved version of a configuration item, regardless of media, formally designated and fixed at a specific time during the configuration item's life cycle

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.10]

3.1.4
business requirements specification
structured collection of the *requirements* (3.1.19) (business or mission problem or opportunity definition, concepts, and required conditions of solutions) of the business or mission and its relation to the external environment

3.1.5
concept of operations
verbal and graphic statement, in broad outline, of an organization’s assumptions or intent in regard to an operation or series of operations

Note 1 to entry: The concept of operations frequently is embodied in long-range strategic plans and annual operational plans. In the latter case, the concept of operations in the plan covers a series of connected operations to be carried out simultaneously or in succession. The concept is designed to give an overall picture of the organization operations. See also *operational concept* (3.1.16).

Note 2 to entry: The concept of operations provides the basis for bounding the operating space, system capabilities, interfaces and operating environment.

Note 3 to entry: The concept of operations includes how an enterprise or organization intends to employ available human and technological resources to achieve one or more outcomes.

[SOURCE: ANSI/AIAA G-043A-2012e]

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3.1.6
condition
measurable qualitative or quantitative *attribute* (3.1.2) that is stipulated for a *requirement* (3.1.19) and that indicates a circumstance or event under which a requirement applies

3.1.7
constraint
externally imposed limitation on the system, its design, or implementation or on the process used to develop or modify a system

Note 1 to entry: A constraint is a factor that is imposed on the solution by force or compulsion and may limit or modify the design.

3.1.8
context of use
users (3.1.35), tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used

[SOURCE: ISO/IEC 25000:2014, 4.2]

3.1.9
customer
person or organization that could or does receive a product or a service that is intended for or required by this person or organization

Note 1 to entry: Customers are a subset of *stakeholders* (3.1.28).

Note 2 to entry: A customer can be internal or external to the organization.

[SOURCE: ISO 9000:2015, 3.2.4, modified — The original Note 1 to entry has become Note 2 to entry; a new Note 1 to entry has been introduced and the EXAMPLE has been removed.]

3.1.10
derived requirement
requirement (3.1.19) deduced or inferred from the collection and organization of requirements into a particular system configuration and solution

Note 1 to entry: The next higher level requirement is referred to as a "parent" requirement while the derived requirement from this parent is called a "child" requirement.

Note 2 to entry: A derived requirement is typically identified during the elicitation of *stakeholder* (3.1.28) requirements, requirements analysis, trade studies or *validation* (3.1.36).

3.1.11
developer
individual or organization that performs development activities (including requirements analysis, design, testing through acceptance) during the system or software life-cycle process

Note 1 to entry: Developers are a subset of *stakeholders* (3.1.28).

[SOURCE: ISO/IEC 25000:2014, 4.6, modified — Note 1 to entry has been added.]

3.1.12
document
uniquely identified unit of information for human use

EXAMPLE report, specification, manual or book in printed or electronic form.

Note 1 to entry: A document can be a single *information item* (3.1.14), or part of a larger *information item* (3.1.14).

Note 2 to entry: Documents include both paper and electronic documents.

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Note 3 to entry: The use of the term document is not intended to preclude interpretation in the broader sense of "documentation", especially as it applies to model-based engineering or conformance.

[SOURCE: ISO/IEC/IEEE 15289:2017, 3.1.10, modified – Notes 2 and 3 to entry have been added.]

3.1.13
human systems integration
interdisciplinary technical and management processes for integrating human considerations within and across all system elements

[SOURCE: INCOSE SEHbk 4:2015]

3.1.14
information item
separately identifiable body of information that is produced, stored, and delivered for human use

[SOURCE: ISO/IEC/IEEE 15289:2017, 3.1.13, modified – Notes 1 and 2 to entry have been removed.]

3.1.15
level of abstraction
view at a specific level of detail in a description of a system

3.1.16
operational concept
verbal and graphic statement of an organization's assumptions or intent in regard to an operation or series of operations of a specific system or a related set of specific new, existing or modified systems

Note 1 to entry: The operational concept is designed to give an overall picture of the operations using one or more specific systems, or set of related systems, in the organization's operational environment from the *users*' (3.1.35) and *operators*' (3.1.18) perspective. It is what the enterprise or organization intends to achieve. See also *concept of operations* (3.1.5).

[SOURCE: ANSI/AIAA G-043A-2012e]

3.1.17
operational scenario
description of an imagined sequence of events or activities that includes the interaction of the product or service with its environment and *users* (3.1.35), as well as interaction among its product or service components when there is end-use significance

Note 1 to entry: Operational scenarios are used to evaluate the *requirements* (3.1.19) and design of the system and to verify and validate the system.

3.1.18
operator
individual or organization that performs the operations of a system

Note 1 to entry: The role of operator and the role of *user* (3.1.35) can be vested, simultaneously or sequentially, in the same individual or organization.

Note 2 to entry: An individual operator combined with knowledge, skills and procedures can be considered as an element of the system.

Note 3 to entry: An operator may perform operations on a system that is operated, or of a system that is operated, depending on whether or not operating instructions are placed within the system boundary.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.26]

3.1.19
requirement
statement which translates or expresses a need and its associated *constraints* (3.1.7) and *conditions* (3.1.6)

Note 1 to entry: Requirements exist at different levels in the system structure.

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Note 2 to entry: A requirement is an expression of one or more particular needs in a very specific, precise and unambiguous manner.

Note 3 to entry: A requirement always relates to a system, software or service, or other item of interest.

3.1.20
requirements elicitation
use of systematic techniques, such as prototyping and structured surveys, to proactively identify and document *customer* (3.1.9) and end *user* (3.1.35) needs

3.1.21
requirements engineering
interdisciplinary function that mediates between the domains of the *acquirer* (3.1.1) and *supplier* (3.1.31) to establish and maintain the *requirements* (3.1.19) to be met by the system, software or service of interest

Note 1 to entry: Requirements engineering is concerned with discovering, eliciting, developing, analyzing, verifying, validating, communicating, documenting and managing requirements.

3.1.22
requirements management
activities that identify, document, maintain, communicate, trace and track *requirements* (3.1.19) throughout the life cycle of a system, product or service

3.1.23
requirements traceability
identification and documentation of the derivation path (upward) and allocation/flow-down path (downward) of *requirements* (3.1.19) in the requirements set

Note 1 to entry: One or more requirements upward from which a requirement is derived are called parent requirements. A requirement downward that is derived from one or more parent requirements is called a child requirement.

3.1.24
requirements traceability matrix
structured information artifact that links *requirements* (3.1.19) to their higher level requirements or needs or to lower level implementation

3.1.25
requirements validation
confirmation that *requirements* (3.1.19) (individually and as a set) define the right system as intended by the *stakeholders* (3.1.28)

[SOURCE: EIA 632:1999, modified]

3.1.26
requirements verification
confirmation by examination that *requirements* (3.1.19) (individually and as a set) are well-formed

Note 1 to entry: This means that a requirement or a set of requirements has been reviewed to help ensure the characteristics of good requirements are achieved and the requirements set is well organized.

[SOURCE: EIA 632:1999, modified]

3.1.27
software requirements specification
structured collection of the essential *requirements* (3.1.19) [functions, performance, design *constraints* (3.1.7) and *attributes* (3.1.2)] of the software and its external interfaces

[SOURCE: IEEE Std 1012:2016, modified — 'documentation' has become 'structured collection'.]

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3.1.28
stakeholder
individual or organization having a right, share, claim or interest in a system or in its possession of characteristics that meet their needs and expectations

Note 1 to entry: Stakeholders include, but are not limited to, end *users* (3.1.35), end user organizations, supporters, *developers* (3.1.11), producers, trainers, maintainers, disposers, *acquirers* (3.1.1), *customers* (3.1.9), *operators* (3.1.18), supplier organizations, accreditors and regulatory bodies.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.44, modified — EXAMPLE and Note 1 to entry have been removed; new Note 1 to entry has been added.]

3.1.29
stakeholder requirements specification
structured collection of the *requirements* (3.1.19) [characteristics, context, concepts, *constraints* (3.1.7) and priorities] of the *stakeholder* (3.1.28) and the relationship to the external environment

3.1.30
state
condition (3.1.6) that characterizes the behaviour of a function, subfunction or element at a point in time

Note 1 to entry: A state may be used to define sets of functions or system characteristics that can vary with time.

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.3958, modified — Definition 4 has been kept; all other definitions have been removed: new Note 1 to entry has replaced the original Note 1 to entry.]

3.1.31
supplier
organization or individual that enters into an agreement with the *acquirer* (3.1.1) for the supply of a product or service

Note 1 to entry: Suppliers are a subset of *stakeholders* (3.1.28).

Note 2 to entry: Other terms commonly used for supplier are contractor, producer, seller or vendor.

Note 3 to entry: The *acquirer* (3.1.1) and the supplier sometimes are part of the same organization.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.45, modified — New Note 1 to entry has been added; other Notes to entry renumbered.]

3.1.32
system-of-interest
system whose life cycle is under consideration in the context of this document

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.48 modified — 'document' has replaced 'International Standard'.]

3.1.33
system requirements specification
structured collection of the *requirements* (3.1.19) [functions, performance, design *constraints* (3.1.7), and other *attributes* (3.1.2)] for the system and its operational environments and external interfaces

3.1.34
trade-off
decision-making actions that select from various *requirements* (3.1.19) and alternative solutions on the basis of net benefit to the *stakeholders* (3.1.28)

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3.1.35
user
individual or group that interacts with a system or benefits from a system during its utilization

Note 1 to entry: The role of user and *operator* (3.1.18) may be vested, simultaneously or sequentially, in the same individual or organization.

Note 2 to entry: Users are a subset of *stakeholders* (3.1.28).

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.52, modified — Note 2 to entry has been added.]

3.1.36
validation
confirmation, through the provision of objective evidence, that the *requirements* (3.1.19) for a specific intended use or application have been fulfilled

Note 1 to entry: Validation in a system life cycle context is a set of activities ensuring and gaining confidence that a system is able to accomplish its intended use, goals and objectives. The right system has been built.

[SOURCE: ISO 9000:2015, 3.8.13, modified — Notes 1, 2 and 3 to entry have been removed; new Note 1 to entry has been added.]

3.1.37
verification
confirmation, through the provision of objective evidence, that specified *requirements* (3.1.19) have been fulfilled

Note 1 to entry: Verification in a system life cycle context is a set of activities that compares a product of the system life cycle against the required characteristics for that product. This may include, but is not limited to, specified requirements, design description and the system itself. The system has been built right.

[SOURCE: ISO 9000:2015, 3.8.12, modified — Notes 1, 2 and 3 to entry have been removed; new Note 1 to entry has been added.]

3.2 Abbreviated terms

BABOK	Business Analysis Book of Knowledge
BRS	Business Requirements Specification
ConOps	Concept of Operations
FSM	Functional Size Measurement
HSI	Human Systems Integration
MDD	Model Driven Development
MOP	Measures of Performance
OpsCon	Operational Concept
RTM	Requirements Traceability Matrix
SRS	Software Requirements Specification
StRS	Stakeholder Requirements Specification
SyRS	System Requirements Specification
TBD	To Be Determined

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TBR To be Resolved, To be Revised

TBS To be Supplied, To be Specified.

TPM Technical Performance Measure

4 Conformance

4.1 Intended usage

This document provides guidance for the execution of the ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207 processes that deal with requirements engineering. This document also provides normative definition of the content and recommendations for the format of the information items or documentation that result from the implementation of these processes. Users of this document can claim conformance to the process provisions or to the information item provisions, or both.

4.2 Full conformance

A claim of full conformance to this document is equivalent to claiming conformance:

— to the provisions contained in 5.2.4, 5.2.5, 5.2.6, and 5.2.7;

— to the requirements-engineering-related processes of ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207 cited in 6.1;

— to the information items specified in Clause 7; and

— to the required content of the information items in Clause 9 and Annex A of this document.

4.3 Conformance to processes

This document provides requirements for a number of requirements engineering processes suitable for usage during the life cycle of a system, a product or a service.

The requirements for processes in this document are contained in 6.1.

4.4 Conformance to information item content

This document provides requirements for a number of requirements engineering information items to be produced during the life cycle of a system, a product or a service. A claim of conformance to the information item provisions of this document means that:

— the required information items stated in this document are produced; and

— it is demonstrated that the information items produced during the requirements engineering activities conform to the content requirements defined in this document.

The requirements for information items in this document are contained in Clause 7. The requirements for the content of information items in this document are contained in Clause 9 and Annex A.

NOTE 1 If a user of this document claims full conformance to ISO/IEC/IEEE 15289, it does not imply that the user can claim conformance to the information items and information item content in this document. The reason is that this document adds additional information items.

NOTE 2 In this document, for simplicity of reference, each information item is described as if it were published as a separate document. However, information items can be considered as conforming if they are unpublished but available in a repository for reference, divided into separate documents or volumes, or combined with other information items into one document.

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