INTERNATIONAL STANDARD

ISO/IEC/IEEE 15288

First edition
2015-05-15

Systems and software engineering — System life cycle processes

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

Reference number
ISO/IEC/IEEE 15288:2015(E)

ISO copyright office
Case postale 56
CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
E-mail inmail@iec.ch
Web www.iec.ch

Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York
NY 10016-5997, USA
E-mail stds.ipr@ieee.org
Web www.ieee.org

Published in Switzerland

Contents

Page

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.

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.

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

The main task of ISO/IEC JTC 1 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 called to the possibility that implementation of this standard may require the use of subject matter covered by patent rights. By publication of this standard, no position is taken with respect to the existence or validity of any patent rights in connection therewith. ISO/IEEE is not responsible for identifying essential patents or patent claims for which a license may be required, for conducting inquiries into the legal validity or scope of patents or patent claims or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance or a Patent Statement and Licensing Declaration Form, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from ISO or the IEEE Standards Association.

ISO/IEC/IEEE 15288 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*, in cooperation with the IEEE Computer Society Systems and Software Engineering Standards Committee, under the Partner Standards Development Organization cooperation agreement between ISO and IEEE.

This first edition of ISO/IEC/IEEE 15288 cancels and replaces the ISO/IEC 15288:2008 (second edition), which has been technically revised.

Changes in this revision of ISO/IEC/IEEE 15288 were developed in conjunction with a corresponding revision of ISO/IEC/IEEE 12207, *Systems and software engineering – Software life cycle processes*. The purpose of these revisions is to accomplish the harmonization of the structures and contents of the two International Standards, while supporting the requirements of the assessment community.

This International Standard was developed with the following goals:

— provide a common terminology between the revision of the ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207,

— where applicable, provide common process names and process structure between the revision of the ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207,

— enable the user community to evolve towards fully harmonized standards, while maximizing backward compatibility.

This revision is intended to achieve a fully harmonized view of the system and software life cycle processes.

Introduction

The complexity of man-made systems has increased to an unprecedented level. This has led to new opportunities, but also to increased challenges for the organizations that create and utilize systems. These challenges exist throughout the life cycle of a system and at all levels of architectural detail. This International Standard provides a common process framework for describing the life cycle of systems created by humans, adopting a Systems Engineering approach. Systems Engineering is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining stakeholder needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem. It integrates all the disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation. It considers both the business and the technical needs of all stakeholders with the goal of providing a quality product that meets the needs of users and other applicable stakeholders. This life cycle spans the conception of ideas through to the retirement of a system. It provides the processes for acquiring and supplying systems. It helps to improve communication and cooperation among the parties that create, utilize and manage modern systems in order that they can work in an integrated, coherent fashion. In addition, this framework provides for the assessment and improvement of the life cycle processes.

The processes in this International Standard form a comprehensive set from which an organization can construct system life cycle models appropriate to its products and services. An organization, depending on its purpose, can select and apply an appropriate subset to fulfill that purpose.

This International Standard can be used in one or more of the following modes:

— By an organization — to help establish an environment of desired processes. These processes can be supported by an infrastructure of methods, procedures, techniques, tools and trained personnel. The organization may then employ this environment to perform and manage its projects and progress systems through their life cycle stages. In this mode this International Standard is used to assess conformance of a declared, established environment to its provisions.

— By a project — to help select, structure and employ the elements of an established environment to provide products and services. In this mode this International Standard is used in the assessment of conformance of the project to the declared and established environment.

— By an acquirer and a supplier — to help develop an agreement concerning processes and activities. Via the agreement, the processes and activities in this International Standard are selected, negotiated, agreed to and performed. In this mode this International Standard is used for guidance in developing the agreement.

— By process assessors — to serve as a process reference model for use in the performance of process assessments that may be used to support organizational process improvement.

IEEE Introduction

This introduction is not part of IEEE Std 15288™-2015, Systems and Software Engineering — Systems Life Cycle Processes.

This standard replaces ISO/IEC/IEEE Std 15288™-2008, Systems and software engineering—System life cycle processes. That standard replaced IEEE Std 15288™-2004, Adoption of ISO/IEC 15288:2002, Systems and software engineering—System life cycle processes. The original ISO/IEC 15288 was published in November 2002 and was the first international standard to provide a comprehensive set of life cycle processes for systems.

This new revision of ISO/IEC/IEEE 15288 is the product of a coordinated effort by IEEE and ISO/IEC JTC 1/SC 7. The base document for the revision is the ISO/IEC/IEEE standard. Development of this revision was carefully coordinated with the parallel revision of ISO/IEC/IEEE 12207:2015 to align structure, terms, and corresponding organizational and project processes.

This revised standard is a step in the SC7 harmonization strategy to achieve a fully integrated suite of system and software life cycle processes and guidance for their application. It is also an important step in the shared strategy of ISO/IEC JTC 1/SC 7 and the IEEE to harmonize their respective collections of standards.

Notice to users

Errata

Errata, if any, for this and all other standards can be accessed at the following URL: http://standards.ieee.org/reading/ieee/updates/errata/index.html. Users are encouraged to check this URL for errata periodically.

Interpretations

Current interpretations can be accessed at the following URL: http://standards.ieee.org/reading/ieee/interp/index.html.

Systems and software engineering — System life cycle processes

1 Overview

1.1 Scope

This International Standard establishes a common framework of process descriptions for describing the life cycle of systems created by humans. It defines a set of processes and associated terminology from an engineering viewpoint. These processes can be applied at any level in the hierarchy of a system's structure. Selected sets of these processes can be applied throughout the life cycle for managing and performing the stages of a system's life cycle. This is accomplished through the involvement of all stakeholders, with the ultimate goal of achieving customer satisfaction.

This International Standard also provides processes that support the definition, control and improvement of the system life cycle processes used within an organization or a project. Organizations and projects can use these processes when acquiring and supplying systems.

This International Standard concerns those systems that are man-made and may be configured with one or more of the following system elements: hardware, software, data, humans, processes (e.g., processes for providing service to users), procedures (e.g., operator instructions), facilities, materials and naturally occurring entities.

When a system element is software, the software life cycle processes in ISO/IEC/IEEE 12207:2015 may be used to implement that system element. The two standards are harmonized for concurrent use on a single project or in a single organization.

1.2 Purpose

The purpose of this International Standard is to provide a defined set of processes to facilitate communication among acquirers, suppliers and other stakeholders in the life cycle of a system.

This International Standard applies to organizations in their roles as both acquirers and suppliers. It can be used by a single organization in a self-imposed mode or in a multi-party situation. Parties can be from the same organization or from different organizations and the situation can range from an informal agreement to a formal contract.

The processes in this International Standard can be used as a basis for establishing business environments, e.g., methods, procedures, techniques, tools and trained personnel. Annex A provides normative direction regarding the tailoring of these system life cycle processes.

1.3 Field of application

This International Standard applies to the full life cycle of systems, including conception, development, production, utilization, support and retirement of systems, and to the acquisition and supply of systems, whether performed internally or externally to an organization. The life cycle processes of this International Standard can be applied concurrently, iteratively and recursively to a system and incrementally to its elements.

There is a wide variety of systems in terms of their purpose, domain of application, complexity, size, novelty, adaptability, quantities, locations, life spans and evolution. This International Standard describes the processes that comprise the life cycle of man-made systems. It therefore applies to one-of-a-kind systems, mass-produced systems and customized, adaptable systems. It also applies to a complete stand-alone system and to systems that are embedded and integrated into larger more complex and complete systems.

This International Standard provides a process reference model characterized in terms of the process purpose and the process outcomes that result from the successful execution of the activity tasks. Annex B lists examples of artifacts and information items that may be associated with various processes. This International Standard can therefore be used as a reference model to support process assessment as specified in ISO/IEC

15504-2:2003. Annex C provides information regarding the use of the system life cycle processes as a process reference model. Annex D describes the process constructs for use in the process reference model.

1.4 Limitations

This International Standard does not prescribe a specific system life cycle model, development methodology, method, model or technique. The users of this International Standard are responsible for selecting a life cycle model for the project and mapping the processes, activities, and tasks in this International Standard into that model. The parties are also responsible for selecting and applying appropriate methodologies, methods, models and techniques suitable for the project.

Although this International Standard does not establish a management system, it is intended to be compatible with the quality management system provided by ISO 9001, the service management system provided by ISO/IEC 20000-1:2011 (IEEE Std 20000-1-2013), and the information security management system provided by ISO/IEC 27000.

This International Standard does not detail information items in terms of name, format, explicit content and recording media. ISO/IEC/IEEE 15289 addresses the content for life cycle process information items (documentation).

2 Conformance

2.1 Intended usage

The requirements in this International Standard are contained in Clause 6 and Annex A. This International Standard provides requirements for a number of processes suitable for usage during the life cycle of a system or product. It is recognized that particular projects or organizations may not need to use all of the processes provided by this International Standard. Therefore, implementation of this International Standard typically involves selecting and declaring a set of processes suitable to the organization or project. There are two ways that an implementation can be claimed to conform to the provisions of this International Standard – full conformance and tailored conformance.

There are two criteria for claiming full conformance. Achieving either criterion suffices for conformance, although the chosen criterion (or criteria) is to be stated in the claim. Claiming "full conformance to tasks" asserts that all of the requirements of the activities and tasks of the declared set of processes are achieved. Alternatively, claiming "full conformance to outcomes" asserts that all of the required outcomes of the declared set of processes are achieved. Full conformance to outcomes permits greater freedom in the implementation of conforming processes and may be useful for implementing processes to be used in the context of an innovative life cycle model.

NOTE 1 Options for conformance are provided for needed flexibility in the application of this International Standard. Each process has a set of objectives (phrased as "outcomes") and a set of activities and tasks that represent one way to achieve the objectives.

NOTE 2 Users who implement the activities and tasks of the declared set of processes can assert full conformance to tasks of the selected processes. Some users, however, might have innovative process variants that achieve the objectives (i.e., the outcomes) of the declared set of processes without implementing all of the activities and tasks. These users can assert full conformance to the outcomes of the declared set of processes. The two criteria—conformance to task and conformance to outcome—are necessarily not equivalent since specific performance of activities and tasks may require, in some cases, a higher level of capability than just the achievement of outcomes.

NOTE 3 When this International Standard is used to help develop an agreement between an acquirer and a supplier, clauses of this International Standard can be selected for incorporation in the agreement with or without modification. In this case, it is more appropriate for the acquirer and supplier to claim compliance with the agreement than conformance with this International Standard.

NOTE 4 An organization (for example, national, industrial association, company) imposing this International Standard as a condition of trade can specify and make public the minimum set of required processes, outcomes, activities, and tasks, which constitute suppliers' compliance with the conditions of trade.

NOTE 5 Requirements of this International Standard are marked by the use of the verb "shall". Recommendations are marked by the use of the verb "should". Permissions are marked by the use of the verb "may". However, despite the verb that is used, the requirements for conformance are selected as described previously.

2.2 Full conformance

2.2.1 Full conformance to outcomes

A claim of full conformance declares the set of processes for which conformance is claimed. Full conformance to outcomes is achieved by demonstrating that all of the outcomes of the declared set of processes have been achieved. In this situation, the provisions for activities and tasks of the declared set of processes are guidance rather than requirements, regardless of the verb form that is used in the provision.

NOTE One intended use of this International Standard is to facilitate process assessment and improvement. For this purpose, the objectives of each process are written in the form of 'outcomes' compatible with the provisions of ISO/IEC 15504-2 and ISO/IEC 33002. Those standards provide for the assessment of the processes of this International Standard, providing a basis for improvement. Users intending process assessment and improvement may use the process outcomes written in this International Standard as the "process reference model" required by ISO/IEC 15504-2 and ISO/IEC 33002.

2.2.2 Full conformance to tasks

A claim of full conformance declares the set of processes for which conformance is claimed. Full conformance to tasks is achieved by demonstrating that all of the requirements of the activities and tasks of the declared set of processes have been achieved. In this situation, the provisions for the outcomes of the declared set of processes are guidance rather than requirements, regardless of the verb form that is used in the provision.

NOTE A claim of full conformance to tasks may be appropriate in contractual situations where an acquirer or a regulator requires detailed understanding of the suppliers' processes.

2.3 Tailored conformance

When this International Standard is used as a basis for establishing a set of processes that do not qualify for full conformance, the clauses of this International Standard are selected or modified in accordance with the tailoring process prescribed in Annex A. The tailored text, for which tailored conformance is claimed, is declared. Tailored conformance is achieved by demonstrating that the outcomes, activities, and tasks, as tailored, have been achieved.

3 Normative references

None.

4 Terms, definitions, and abbreviated terms

4.1 Terms and definitions

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

NOTE Definitions for other terms typically can be found in ISO/IEC/IEEE 24765, available at <www.computer.org/sevocab>.

4.1.1
acquirer
stakeholder that acquires or procures a product or service from a supplier

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

4.1.2
acquisition
process of obtaining a system, product or service

4.1.3
activity
set of cohesive tasks of a process

4.1.4
agreement
mutual acknowledgement of terms and conditions under which a working relationship is conducted

EXAMPLE Contract, memorandum of agreement.

4.1.5
architecture
<system> fundamental concepts or properties of a system in its environment embodied in its elements, relationships, and in the principles of its design and evolution

[SOURCE: ISO/IEC/IEEE 42010:2011]

4.1.6
architecture framework
conventions, principles and practices for the description of architectures established within a specific domain of application and/or community of stakeholders

EXAMPLE 1 Generalized Enterprise Reference Architecture and Methodologies (GERAM) [ISO 15704] is an architecture framework.

EXAMPLE 2 Reference Model of Open Distributed Processing (RM-ODP) [ISO/IEC 10746] is an architecture framework.

[SOURCE: ISO/IEC/IEEE 42010:2011]

4.1.7
architecture view
work product expressing the architecture of a system from the perspective of specific system concerns

[SOURCE: ISO/IEC/IEEE 42010:2011]

4.1.8
architecture viewpoint
work product establishing the conventions for the construction, interpretation and use of architecture views to frame specific system concerns

[SOURCE: ISO/IEC/IEEE 42010:2011]

4.1.9
audit
independent examination of a work product or set of work products to assess compliance with specifications, standards, contractual agreements, or other criteria

[SOURCE: ISO 24765:2010]

4.1.10
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: IEEE Std 828-2012]

4.1.11
concept of operations
verbal and/or 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.

Note 2 to entry: It provides the basis for bounding the operating space, system capabilities, interfaces and operating environment.

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

4.1.12
concern
<system> interest in a system relevant to one or more of its stakeholders

Note 1 to entry: A concern pertains to any influence on a system in its environment, including developmental, technological, business, operational, organizational, political, economic, legal, regulatory, ecological and social influences.

[SOURCE: ISO/IEC/IEEE 42010:2011]

4.1.13
configuration item
item or aggregation of hardware, software, or both, that is designated for configuration management and treated as a single entity in the configuration management process

[SOURCE: ISO/IEC/IEEE 24765:2010, modified to include “item”]

4.1.14
customer
organization or person that receives a product or service

EXAMPLE Consumer, client, user, acquirer, buyer, or purchaser.

Note 1 to entry: A customer can be internal or external to the organization.

[SOURCE: ISO 9000:2005, modified – added “service”]

4.1.15
design, verb
<process> to define the architecture, system elements, interfaces, and other characteristics of a system or system element

[SOURCE: ISO/IEC/IEEE 24765:2010, modified – changed 'components' to 'system elements]

4.1.16
design, noun
result of the process in 4.1.15

Note 1 to entry: Information, including specification of system elements and their relationships, that is sufficiently complete to support a compliant implementation of the architecture.

Note 2 to entry: Design provides the detailed implementation-level physical structure, behavior, temporal relationships, and other attributes of system elements.

[SOURCE: ISO/IEC/IEEE 24765:2010]

4.1.17
design characteristic
design attributes or distinguishing features that pertain to a measurable description of a product or service

[SOURCE: ISO/IEC/IEEE 24765:2010]

4.1.18
enabling system
system that supports a system-of-interest during its life cycle stages but does not necessarily contribute directly to its function during operation

EXAMPLE When a system-of-interest enters the production stage, a production-enabling system is required.

Note 1 to entry: Each enabling system has a life cycle of its own. This International Standard is applicable to each enabling system when, in its own right, it is treated as a system-of-interest.

4.1.19
environment
<system> context determining the setting and circumstances of all influences upon a system

[ISO/IEC/IEEE 42010:2011]

4.1.20
facility
physical means or equipment for facilitating the performance of an action, e.g., buildings, instruments, tools

4.1.21
incident
anomalous or unexpected event, set of events, condition, or situation at any time during the life cycle of a project, product, service, or system

4.1.22
information item
separately identifiable body of information that is produced, stored, and delivered for human use

[SOURCE: ISO/IEC/IEEE 15289:2011]

4.1.23
life cycle
evolution of a system, product, service, project or other human-made entity from conception through retirement

4.1.24
life cycle model
framework of processes and activities concerned with the life cycle that may be organized into stages, which also acts as a common reference for communication and understanding

4.1.25
operational concept
verbal and graphic statement of an organization's assumptions or intent in regard to an operation or series of operations of a system or a related set of 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' and operators' perspective. See also concept of operations.

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

4.1.26
operator
individual or organization that performs the operations of a system

Note 1 to entry: The role of operator and the role of user 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.

4.1.27
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.

Note 1 to entry: An identified part of an organization (even as small as a single individual) or an identified group of organizations can be regarded as an organization if it has responsibilities, authorities and relationships. A body of persons organized for some specific purpose, such as a club, union, corporation, or society, is an organization.

[SOURCE: ISO 9000:2005, modified – Note 1 to entry has been added]

4.1.28
party
organization entering into an agreement

Note 1 to entry: In this International Standard, the agreeing parties are called the acquirer and the supplier.

4.1.29
problem
difficulty, uncertainty, or otherwise realized and undesirable event, set of events, condition, or situation that requires investigation and corrective action

4.1.30
process

set of interrelated or interacting activities that transforms inputs into outputs

[SOURCE: ISO 9000:2005]

4.1.31
process purpose
high level objective of performing the process and the likely outcomes of effective implementation of the process

Note 1 to entry: The purpose of implementing the process is to provide benefits to the stakeholders.

4.1.32
product
result of a process

Note 1 to entry: 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.

[SOURCE: ISO 9000:2005]

4.1.33
project
endeavour with defined start and finish criteria undertaken to create a product or service in accordance with specified resources and requirements

Note 1 to entry: A project is sometimes viewed as a unique process comprising co-coordinated and controlled activities and composed of activities from the Project Processes and Technical Processes defined in this International Standard.

4.1.34
quality assurance
part of quality management focused on providing confidence that quality requirements will be fulfilled

[SOURCE: ISO 9000:2005]