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Systems and software engineering — Life cycle management —

Part 1: Guidelines for life cycle management

Ingénierie des systèmes et du logiciel — Gestion du cycle de vie —

Partie 1: Lignes directrices pour la gestion du cycle de vie

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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.

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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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, SC 7, *Software and systems 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 24748-1:2018), which has been technically revised.

The main changes are as follows:

- added system of systems topics based on ISO/IEC/IEEE 21839, ISO/IEC/IEEE 21840 and ISO/IEC/IEEE 21841;
- added references for interfacing and interoperating systems and general updates from ISO/IEC/IEEE 15288:2023;
- added more recent life cycle models such as DEVOPS.

A list of all parts in the ISO/IEC/IEEE 24748 series can be found on the ISO and IEC websites.

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.

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Introduction

The purpose of this document is to facilitate the use of the process content of ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207, by providing unified and consolidated guidance on life cycle management of systems and software. This is to help ensure consistency in system concepts and life cycle concepts, models, stages, processes, process application, key points of view, adaptation and use in various domains as the two International Standards are used in combination. That in turn helps a project team design a life cycle model for the system-of-interest to facilitate managing the progress of their project. Hence, ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207 are the documents that apply the concepts found in this document to specific processes.

NOTE ISO/IEC/IEEE 16326 and ISO/IEC/IEEE 24641 also apply the concepts found in this document, in the process context for project management and model-based approaches respectively.

This document also aids in identifying and planning use of life cycle processes described in ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207 that enable the project to be completed successfully, meeting its objectives/requirements for each stage and for the overall project.

There is also increasing recognition of the importance of helping to ensure that all life cycle stages and all aspects within each stage are supported with thorough guidance to enable alignment with any process documents that can be created later that focus on areas besides systems and software, including hardware, humans, data, processes (e.g. review process), procedures (e.g. operator instructions), facilities and naturally occurring entities (e.g. water, organisms, minerals).

By addressing these needs specifically in this document, the users of the process-focused ISO/IEC/IEEE 12207 and ISO/IEC/IEEE 15288 benefit not only from having one complementary document that addresses the management of life cycles of systems that provide products or services, but also from a framework that links life cycle management aspects to more than just the systems or software aspects of products or services. Additional discussion for system of systems can be found in ISO/IEC/IEEE 21839, ISO/IEC/IEEE 21840 and ISO/IEC/IEEE 21841.

In the context of this document, ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207, there is a continuum of human-made systems from those that use little to no software to those in which software is the primary interest. When software is the predominant system or element of interest, ISO/IEC/IEEE 12207 should be used. Both documents have the same process model, share most activities and tasks and differ primarily in descriptive notes. The determination of the applicability of ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207 should be decided by the nature of the system and its enabling systems. Often, a mixed tailoring of each standard can be appropriate.

ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207 also have published guidance documents (ISO/IEC/IEEE 24748-2 and ISO/IEC/IEEE 24748-3), respectively, to support use of the two International Standards individually.

Systems and software engineering — Life cycle management —

Part 1: Guidelines for life cycle management

1 Scope

This document provides guidance for the life cycle management of systems and software, complementing the processes described in ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207. This document:

- addresses systems concepts and life cycle concepts, models, stages, processes, process application, key points of view, adaptation and use in various domains and by various disciplines;
- establishes a common framework for describing life cycles, including their individual stages, for the management of projects that provide or acquire either products or services;
- defines the concept of a life cycle;
- supports the use of the life cycle processes within an organization or a project; organizations and projects can use these life cycle concepts when acquiring and supplying either products or services;
- provides guidance on adapting a life cycle model and the content associated with a life cycle or a part of a life cycle;
- describes the relationship between life cycles and their use in applying the processes in ISO/IEC/IEEE 15288 (systems aspects) and ISO/IEC/IEEE 12207 (software systems aspects);
- shows the relationships of life cycle concepts to the hardware, human, services, process, procedure, facility and naturally occurring entity aspects of projects;
- describes how its concepts relate to detailed process standards, for example, in the areas of measurement, project management, risk management and model-based systems and software engineering.

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

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEEE Standards Dictionary Online: available at <https://dictionary.ieee.org/>

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

**3.1
acquirer**

stakeholder (3.49) that acquires or procures a *system* (3.51), *product* (3.33) or *service* (3.45) from a *supplier* (3.50)

Note 1 to entry: Other terms commonly used for an acquirer are *buyer*, *customer* (3.13), *owner*, *purchaser*, or *internal/organizational sponsor*.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.1]

**3.2
acquisition**

process (3.30) of obtaining a *system* (3.51), *product* (3.33) or *service* (3.45)

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.2]

**3.3
activity**

set of cohesive *tasks* (3.56) of a *process* (3.30)

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.3]

**3.4
agile**

development approach based on iterative development, frequent inspection and adaptation, and incremental deliveries in which *requirements* (3.39) and solutions evolve through collaboration in cross-functional teams and through continual *stakeholder* (3.49) feedback

[SOURCE: ISO/IEC/IEEE 26515:2018, 3.1, modified — The defined term has been changed from "agile development" to "agile"; note 1 to entry has been removed.]

**3.5
agreement**

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

EXAMPLE Contract, memorandum of agreement.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.4]

**3.6
architecture**

fundamental concepts or properties of a *system* (3.51) in its *environment* (3.18) and governing principles for the realization and evolution of this system and its related *life cycle* (3.24) *processes* (3.30)

[SOURCE: ISO/IEC/IEEE 42020:2019, 3.3, modified — "entity" has been replaced with "system"; notes to entry have been removed.]

**3.7
artefact**

work *product* (3.33) that is produced and used during a project to capture and convey information

[SOURCE: ISO 19014-4:2020, 3.9, modified — The definition has been made singular.]

**3.8
audit**

independent examination of a work *product* (3.33) or set of work products to assess compliance with specifications, standards, contractual *agreements* (3.5), or other criteria

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.7]

3.9 baseline

formally approved version of a *configuration item* (3.12), regardless of media, formally designated and fixed at a specific time during the configuration item's *life cycle* (3.24)

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.8]

3.10 concept of operations

verbal and graphic statement, in broad outline, of an *organization's* (3.28) assumptions or intent in regard to an operation or series of operations of new, modified, or existing organizational *systems* (3.51)

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 to achieve an organizational performance objective. See also *operational concept* (3.26).

Note 2 to entry: The concept of operations provides the basis for bounding the operating space, system capabilities, *interfaces* (3.22) and operating *environment* (3.18).

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.9]

3.11 concern

matter of interest or importance to a *stakeholder* (3.49)

Note 1 to entry: A concern pertains to any influence on a *system* (3.51) in its *environment* (3.18), including developmental, technological, business, operational, organizational, political, economic, legal, regulatory, ethical, ecological and social influences.

[SOURCE: ISO/IEC/IEEE 42020:2019, 3.8, modified — EXAMPLE has been removed; note 1 to entry has been added.]

3.12 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* (3.30)

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.11]

3.13 customer

organization (3.28) or person that receives a *product* (3.33) or *service* (3.45)

EXAMPLE Consumer, client, *user* (3.60), *acquirer* (3.1), buyer, or purchaser.

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

[SOURCE: ISO /IEC/IEEE 15288:2023, 3.12]

3.14 design, noun

specification of *system elements* (3.52) and their relationships, that is sufficiently complete to support a compliant implementation of the *architecture* (3.6)

Note 1 to entry: Design provides the detailed implementation-level physical structure, behaviour, temporal relationships and other attributes of system elements.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.13]

3.15 design characteristics

design attributes or distinguishing features that pertain to a measurable description of a *product* (3.33) or *service* (3.45)

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.14]

3.16 DevOps development and operations

set of principles and practices which enable better communication and collaboration between relevant *stakeholders* (3.49) for the purpose of specifying, developing, and operating software and *systems* (3.51), *products* (3.33) and *services* (3.45), and continuous improvements in all aspects of the *life cycle* (3.24)

Note 1 to entry: Extensions include DevSecOps which addresses *concerns* (3.11) related to *security* (3.44) throughout development and operations.

[SOURCE: IEEE 2675:2021, 3.1, modified — Note 1 to entry has been added.]

3.17 enabling system

system (3.51) that supports a *system-of-interest* (3.53) during its *life cycle* (3.24) *stages* (3.48) but does not necessarily contribute directly to its function during operation

EXAMPLE Production-enabling system, which is required when a system-of-interest enters the production stage.

Note 1 to entry: Each enabling system has a life cycle of its own.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.15, modified — The second sentence of note 1 to entry has been removed.]

3.18 environment

<system> context determining the setting and circumstances of all influences upon a *system* (3.51)

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.16]

3.19 incident

anomalous or unexpected event, set of events, condition, or situation at any time during the *life cycle* (3.24) of a *project* (3.34), *product* (3.33), *service* (3.45), or *system* (3.51)

Note 1 to entry: An incident is elevated and treated as a *problem* (3.29) when the cause of the incident needs to be analysed and corrected to prevent reoccurrence to avoid or minimise loss of life, or damage of property or natural resources.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.17]

3.20 information item

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

[SOURCE: ISO/IEC/IEEE 15289:2019, 3.1.12, modified — The preferred term “information product” has been removed; notes to entry have been removed.]

3.21 iteration

<process> repeating the application of the same *process* (3.30) or set of processes on the same level of the *system* (3.51) structure

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.28]

3.22**interface**

point at which two or more logical, physical, or both, *system elements* (3.52) or software system elements meet and act on or communicate with each other

[SOURCE: ISO/IEC/IEEE 24748-6:2023, 3.1.3]

3.23**interoperating system**

system (3.51) that exchanges information with the *system-of-interest* (3.53) and uses the information that has been exchanged

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.20]

3.24**life cycle**

evolution of a *system* (3.51), *product* (3.33), *service* (3.45), *project* (3.34) or other human-made entity from conception through *retirement* (3.41)

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.21]

3.25**life cycle model**

framework of *processes* (3.30) and *activities* (3.3) concerned with the *life cycle* (3.24) which can be organized into *stages* (3.48), acting as a common reference for communication and understanding

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.22]

3.26**operational concept**

verbal and graphic statement of an *organization's* (3.28) assumptions or intent in regard to an operation or series of operations of a specific *system* (3.51) or a related set of 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* (3.18) from the *users'* (3.60) and *operators'* (3.27) perspective. See also *concept of operations* (3.10).

Note 2 to entry: The operational concept is about systems, while a concept of operations typically refers to organizations.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.23]

3.27**operator**

individual or *organization* (3.28) that performs the operations of a *system* (3.51)

Note 1 to entry: The role of operator and the role of *user* (3.60) may 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 15288:2023, 3.24]

3.28

organization

person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives

EXAMPLE Company, corporation, firm, enterprise, manufacturer, institution, charity, sole trader, association, or parts or combination thereof.

[SOURCE: ISO 9000:2015, 3.2.1, modified — Notes to entry have been removed; EXAMPLE has been added.]

3.29

problem

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

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.26]

3.30

process

set of interrelated or interacting *activities* (3.3) that transforms inputs into outputs

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.27]

3.31

process outcome

observable result of the successful achievement of the *process purpose* (3.32)

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.30]

3.32

process purpose

high-level objective of performing the *process* (3.30) 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* (3.49).

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.29, modified — The term "high-level" has been hyphenated.]

3.33

product

output of an *organization* (3.28) that can be produced without any transaction taking place between the organization and the *customer* (3.13)

Note 1 to entry: The dominant element of a product is that it is generally tangible.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.32]

3.34

project

endeavour with defined start and finish criteria undertaken to create a *product* (3.33) or *service* (3.45) in accordance with specified *resources* (3.40) and *requirements* (3.39)

Note 1 to entry: A project is sometimes viewed as a unique *process* (3.30) comprising co-coordinated and controlled *activities* (3.3) and composed of activities from the *technical management* (3.58) and technical processes defined in ISO/IEC/IEEE 12207 and ISO/IEC/IEEE 15288.

Note 2 to entry: Continuous development approaches such as *agile* (3.4) and *DevOps* (3.16) can use different terminology for the creation of product and services.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.33, modified — Note 1 to entry has been updated to reference ISO/IEC/IEEE 12207 and ISO/IEC/IEEE 15288.]