INTERNATIONAL STANDARD



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Systems engineering — System life cycle processes

Ingénierie systèmes — Processus de cycle de vie des systèmes

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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 3.

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 International Standard 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 15288 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and system engineering*, TANDARD PREVIEW

Annex A forms a normative part of this International Standard, Annexes B, C and D are for information only.

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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 structural detail. They arise from several sources:

- there are inherent differences among the hardware, software and human elements from which systems are constructed.
- almost every present-day system contains, and/or is modelled and supported by computer-based technology.
- there is a lack of harmonization and integration of the involved disciplines, including science, engineering, management and finance.

There is therefore a need for a common framework to improve communication and co-operation among the parties that create, utilize and manage modern systems in order that they can work in an integrated, coherent fashion.

This International Standard provides a common process framework covering the life cycle of man-made systems. This life cycle spans the conception of ideas through to the retirement of a system. It provides the processes for acquiring and supplying systems. 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 fulfil that purpose. 15288-2002

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.

This International Standard contains requirements in three Clauses: Clause 5, that defines the requirements for the system life cycle processes, Clause 6, that defines the requirements for stages in a life cycle, and Annex A, that provides requirements for tailoring of this International Standard. Three informative annexes are also contained in this International Standard: Annex B, that provides an example of the use of stages in life cycles, Annex C, that shows its relationship with ISO/IEC 12207:1995/AMD.1:2002 Information technology — Software life cycle processes, and Annex D, that describes the key concepts that it uses. Readers new to this International Standard are advised to consult Annex D to gain an appreciation of these concepts.

Systems engineering — System life cycle processes

1 Scope

1.1 Purpose

This International Standard establishes a common framework for describing the life cycle of systems created by humans. It defines a set of processes and associated terminology. 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 interested parties with the ultimate goal of achieving customer satisfaction.

This International Standard also provides processes that support the definition, control and improvement of the life cycle processes used within an organization or a project. Organizations and projects can use these life cycle 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: hardware, software, humans, processes (e.g. review process), procedures (e.g. operator instructions), facilities and naturally occurring entities (e.g. water, organisms, minerals).

1.2 Field Of Application

ISO/IEC 15288:2002

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 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 any man-made system. It therefore applies to one-of-a-kind systems, mass-produced systems and customized, adaptable systems.

This International Standard applies to organizations in their role as both acquirers and suppliers. It can be used by a single party 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, techniques, tools and trained personnel. It provides a process reference model characterized in terms of the process purpose and the process outcomes that result from their successful implementation. This International Standard can therefore be used as a reference model to support process assessment as specified in ISO/IEC TR 15504-2.

1.3 Limitations

This International Standard does not detail the life cycle processes in terms of methods or procedures required to meet the requirements and outcomes of a process.

This International Standard does not detail documentation in terms of name, format, explicit content and recording media.

This International Standard is not intended to be in conflict with any organization's policies, procedures, and standards or with any national laws and regulations. Any such conflict should be resolved before using this International Standard.

2 Conformance

2.1 Intended Usage

The requirements in this International Standard are contained in Clause 5, 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. 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 a set of processes suitable to the organization or project. There are two ways that an implementation can be claimed to conform with the provisions of this International Standard. Any claim of conformance is cited in only one of the two forms below.

2.2 Full Conformance

A claim of full conformance declares the set of processes for which conformance is claimed. Full conformance is achieved by demonstrating that all of the requirements of the declared set of processes have been satisfied using the outcomes as evidence.

2.3 Tailored Conformance Teh STANDARD PREVIEW

When this 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 requirements for the processes, as tailored, have been satisfied using the outcomes as evidence://standards.iteh.ai/catalog/standards/sist/f34d265b-87b4-4bf4-99be-

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NOTE When this 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.

3 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 12207:1995/AMD.1:2002 Information technology — Software life cycle processes — Amendment 1

4 Terms and definitions

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

4.1

acquirer

the stakeholder that acquires or procures a product or service from a supplier

NOTE Other terms commonly used for an acquirer are buyer, customer, purchaser. The acquirer may at the same time be the owner, user or operating organization.

4.2

activity

a set of actions that consume time and resources and whose performance is necessary to achieve, or contribute to, the realization of one or more outcomes

4.3

agreement

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

4.4

baseline

a specification or product that has been formally reviewed and agreed upon, that thereafter serves as the basis for further development, and that can be changed only through formal change control procedures

4.5

enabling system

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

NOTE 1 For example, when a system-of-interest enters the production stage, an enabling production system is required.

NOTE 2 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. ARD PREVIEW

4.6

enterprise

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that part of an organization with responsibility to acquire and to supply products and/or services according to agreements ISO/IEC 15288:2002

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NOTE An organization may be involved in several enterprises and an enterprise may involve one or more organizations.

4.7

facility

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

4.8

life cycle model

a framework of processes and activities concerned with the life cycle, which also acts as a common reference for communication and understanding

4.9

operator

an individual who, or an organization that, contributes to the functionality of a system and draws on knowledge, skills and procedures to contribute the function

NOTE 1 The role of operator and the role of user may be vested, simultaneously or sequentially, in the same individual or organization.

NOTE 2 An individual operator combined with knowledge, skills and procedures may be considered as an element of the system.

4.10

organization

a group of people and facilities with an arrangement of responsibilities, authorities and relationships

[ISO 9000:2000]

4.11

process

set of interrelated or interacting activities which transforms inputs into outputs

[ISO 9000:2000]

4.12

project

an 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: 2000 and the PMBOK Guide(2000).

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

4.13

resource

an asset that is utilized or consumed during the execution of a process

NOTE 1 Resources may include diverse entities such as personnel, facilities, capital equipment, tools, and utilities such as power, water, fuel and communication infrastructures.

NOTE 2 Resources may be reusable, renewable or consumable.

4.14

stage

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a period within the life cycle of a system that relates to the state of the system description or the system itself

NOTE 1 Stages relate to major progress and achievement milestones of the system through its life cycle.

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NOTE 2 Stages may be overlappingandards.iteh.ai/catalog/standards/sist/f34d265b-87b4-4bf4-99be-

4.15

stakeholder

a party having a right, share or claim in a system or in its possession of characteristics that meet that party's needs and expectations

4.16

supplier

an organization or an individual that enters into an agreement with the acquirer for the supply of a product or service

4.17

system

a combination of interacting elements organized to achieve one or more stated purposes

NOTE 1 A system may be considered as a product or as the services it provides.

NOTE 2 In practice, the interpretation of its meaning is frequently clarified by the use of an associative noun, e.g. aircraft system. Alternatively the word system may be substituted simply by a context dependent synonym, e.g. aircraft, though this may then obscure a system principles perspective.

4.18

system element

a member of a set of elements that constitutes a system

NOTE A system element is a discrete part of a system that can be implemented to fulfil specified requirements

4.19

system-of-interest

the system whose life cycle is under consideration in the context of this International Standard

4.20

system life cycle

the evolution with time of a system-of-interest from conception through to retirement

4.21

trade-off

decision-making actions that select from various requirements and alternative solutions on the basis of net benefit to the stakeholders

4.22

user

individual who or group that benefits from a system during its utilization

NOTE The role of user and the role of operator may be vested, simultaneously or sequentially, in the same individual or organization.

4.23

validation

confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled

[ISO 9000: 2000]

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NOTE Validation in a system life cycle context is the set of activities ensuring and gaining confidence that a system is able to accomplish its intended use, goals and objectives.

4.24

ISO/IEC 15288:2002

verification https://standards.iteh.ai/catalog/standards/sist/f34d265b-87b4-4bf4-99be-

confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

[ISO 9000: 2000]

NOTE 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.

5 System Life Cycle Processes

5.1 Introduction

This clause describes the requirements for the life cycle processes. It defines their purposes and outcomes, and the activities required to achieve them. An organization conducts the life cycle processes selectively to fulfil the purpose and outcomes of life cycle stages.

The life cycle processes are described in four process groups as follows:

Agreement processes;

Enterprise processes;

Project processes;

Technical processes.

NOTE Each life cycle process may be invoked, as required, at any time throughout the life cycle and there is no definitive order in their use. Any life cycle process may be executed concurrently with any other life cycle process. Any life cycle process may apply at any level in the hierarchical representation of a system's structure. Therefore, in the following description of the system life cycle processes, the order that the processes are presented and the process groups used do not imply any precedence in, or sequence of application of, processes during the life cycle of a system. The process groups, however, do reflect underlying concepts used in this International Standard and these are described in Annex D.

5.2 Agreement Processes

5.2.1 Introduction

This subclause specifies the requirements for the establishment of agreements with organizational entities external and internal to the organization.

The Agreement Processes consist of the following:

- a) Acquisition Process used by organizations for acquiring products or services;
- b) Supply Process used by organizations for supplying products or services.

These processes define the activities necessary to establish an agreement between two organizations. If the Acquisition Process is invoked, it provides the means for conducting business with a supplier of products that are supplied for use as an operational system, of services in support of an operational system, or of elements of a system being developed by a project. If the Supply Process is invoked, it provides the means for conducting a project in which the result is a product or service that is delivered to the acquirer.

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5.2.2 Acquisition Process

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5.2.2.1 Purpose of the Acquisition Process ISO/IEC 15288:2002

The purpose of the Acquisition Processitis atoa obtain a product or service the accordance with the acquirer's requirements. 677617ebb672/iso-iec-15288-2002

5.2.2.2 Acquisition Process Outcomes

As a result of the successful implementation of the Acquisition Process:

- a) A strategy for the acquisition is established.
- b) A supplier is selected.
- c) Communication with the supplier is maintained.
- d) A justification for the selection is declared.
- e) An agreement to acquire a product or service according to defined acceptance criteria is established.
- f) A product or service complying with the agreement is accepted.
- g) Payment or other consideration is rendered.

5.2.2.3 Acquisition Process Activities

The acquirer shall implement the following activities in accordance with applicable organizational policies and procedures with respect to the Acquisition Process.

a) Establish a plan for how the acquisition will be conducted.

NOTE This plan includes reference to the life cycle model, a schedule of milestones and selection criteria if the supplier is external to the acquiring organization.

b) Prepare a request for the supply of a product or service.

NOTE Provide a definition of requirements to one or more suppliers. If a supplier is external to organization, then the request can include the business practices with which a supplier is expected to comply and the criteria for selecting a supplier.

c) Communicate the request for the supply of a product or service to identified suppliers.

NOTE This may include supply chain management partnering which exchanges information with related suppliers and acquirers to achieve a harmonized or collective approach to common technical and commercial issues.

d) Select a supplier.

NOTE To obtain competitive solicitations, proposals to supply are evaluated and compared against the selection criteria. Where proposals include offerings that are not covered by the criteria, then the proposals are compared with each other to determine their order of suitability and thus supplier preference. The justification for rating each proposal is declared and suppliers may be informed why they were or were not selected.

e) Negotiate an agreement with the supplier.

NOTE This agreement may range in formality from a written contract to a verbal understanding. Appropriate to the level of formality, the agreement establishes requirements, development and delivery milestones, verification, validation and acceptance conditions, exception handling procedures, change control procedures and payment schedules, so that both parties of the agreement understand the basis for executing the agreement. Rights and restrictions associated with technical data and intellectual property are noted in the agreement. The regotiation is complete when the acquirer accepts the terms of an agreement offered by the supplier.

f) Assess the execution of the agreement.

NOTE This includes confirmation that both parties are meeting their responsibilities according to the agreement. Projected cost, performance and schedule risks are monitored, and the impact of undesirable outcomes on the organization is evaluated regularly. Variations to the terms of the agreement are negotiated as necessary.

g) Confirm that the delivered product or service complies with the agreement.

NOTE Exceptions that arise during the conduct of the agreement or with the delivered product or service are resolved according to the procedures established in the agreement.

h) Make payment or provide other agreed consideration to the supplier for the product or service rendered.

NOTE When the supplied product or service has satisfied the conditions of the agreement, the acquirer concludes the agreement by rendering payment or other agreed consideration.

5.2.3 Supply Process

5.2.3.1 Purpose of the Supply Process

The purpose of the Supply Process is to provide an acquirer with a product or service that meets agreed requirements.

5.2.3.2 Supply Process Outcomes

As a result of the successful implementation of the Supply Process:

- a) An acquirer for a product or service is identified.
- b) A response to the acquirer's request is made.

- c) An agreement to supply a product or service according to defined acceptance criteria is established.
- d) Communication with the acquirer is maintained.
- e) A product or service conforming to the agreement is supplied according to agreed delivery procedures and conditions.
- f) Responsibility for the acquired product or service, as directed by the agreement, is transferred.
- g) Payment or other agreed consideration is received.

5.2.3.3 Supply Process Activities

The supplier shall implement the following activities in accordance with applicable organizational policies and procedures with respect to the Supply Process.

a) Determine the existence and identity of an acquirer who has, or who represents a party or parties having, a need for a product or service.

NOTE For a product or service developed for consumers, an agent, e.g. a marketing function within the supplier organization, may represent the acquirer.

- b) Evaluate a request for the supply of a product or service to determine feasibility and how to respond.
- c) Prepare a response that satisfies the solicitation. DARD PREVIEW
- d) Negotiate an agreement with the acquirer (standards.iteh.ai)

NOTE This agreement may range in formality from a written contract to a verbal understanding. Negotiate the differences, where applicable, between the acquisition request or tasking statement and the capability expressed in the response. The Supplier confirms that the requirements, delivery milestones and acceptance conditions are achievable, that exception handling and change control procedures and payment schedules are acceptable, and that they establish a basis for executing the agreement without unnecessary risks.

e) Execute the agreement according to the Supplier's established project plans and in accordance with the agreement.

NOTE A supplier may adopt, or agree to use, acquirer processes.

f) Assess the execution of the agreement.

NOTE Projected cost, performance and schedule risks are monitored and communicated to the acquirer as appropriate. The impact of undesirable outcomes on the organization is evaluated.

- g) Deliver the product or service in accordance with the agreement criteria.
- h) Accept and acknowledge payment or other agreed consideration.
- i) Transfer the responsibility for the product or service to the acquirer, or other party, as directed by the agreement.

5.3 Enterprise Processes

5.3.1 Introduction

The Enterprise Processes manage the organization's capability to acquire and supply products or services through the initiation, support and control of projects. They provide resources and infrastructure necessary to support projects and ensure the satisfaction of organizational objectives and established agreements. They are not intended to be a comprehensive set of business processes that enable strategic management of the organization's business.

The Enterprise Processes consist of the following:

- a) Enterprise Environment Management Process;
- b) Investment Management Process;
- c) System Life Cycle Processes Management Process;
- d) Resource Management Process;
- e) Quality Management Process.

5.3.2 Enterprise Environment Management Process

5.3.2.1 Purpose of the Enterprise Environment Management Process

The purpose of the Enterprise Environment Management Process is to define and maintain the policies and procedures needed for the organization's business with respect to the scope of this International Standard.

5.3.2.2 Enterprise Environment Management Process Outcomes

As a result of the successful implementation of the Enterprise Environment Management Process:

- a) Policies and procedures for the strategic management of system life cycles are provided.
- b) Accountability and authority for system life cycle management are defined.
- c) A policy for the improvement of system life cycle processes is provided.
- c) A policy for the improvement of system in cycle-processes is provided

5.3.2.3 Enterprise Environment Management Process Activities

The organization shall implement the following activities in accordance with applicable organization policies and procedures with respect to the Enterprise Environment Management Process.

a) Establish plans for each business area.

NOTE Identify the short-term objectives that contribute to achieving strategic objectives and the projects that will be undertaken to accomplish the strategic objectives.

b) Prepare system life cycle policies and procedures that implement the requirements of this International Standard and are consistent with enterprise strategic and business area plans.

NOTE The actual range and detail of the system life cycle implementation within a project will be dependent upon the complexity of the work, the methods used, and the skills and training of personnel involved in performing the work. A project tailors policies and procedures according to its requirements and needs. Relevant policies and procedures include risk management, quality management and resource management.

- c) Define, integrate, and communicate the roles, responsibilities and authorities to facilitate implementation of system life cycle processes and the strategic management of system life cycles.
- d) Define business criteria that control progression through the system life cycle.

NOTE Establish the decision-making criteria regarding entering and exiting each life cycle stage, and for other key milestones. Express these in terms of business achievement.

e) Conduct periodic reviews of the system life cycle model used by a project.