INTERNATIONAL STANDARD

ISO/IEC/IEEE 24774

First edition
2021-05

Systems and software engineering — Life cycle management — Specification for process description

Ingénierie du logiciel et des systèmes — Gestion du cycle de vie — Spécification pour la description des processus

Reference number
ISO/IEC/IEEE 24774:2021(E)

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Published in Switzerland

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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 ISO/IEC 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 or www.iec.ch/members_experts/refdocs).

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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. In the IEC, see www.iec.ch/understanding-standards.

ISO/IEC/IEEE 24774 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee 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 first edition cancels and replaces ISO/IEC TR 24774:2010, which has been technically revised.

The main changes compared to ISO/IEC TR 24774:2010 are as follows:

— process definition and examples have been updated to reflect SC 7 latest standards;

— the former ISO/IEC Technical Report has been jointly revised with IEEE as an International Standard.

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.

Introduction

For an organization to function effectively, the organization has to determine and manage numerous interrelated activities and tasks to achieve its goals. An activity or a set of activities using resources and managed in order to enable the achievement of outcomes through the transformation of inputs into outputs can be considered a process. Often the output from one process forms the input to other processes. When processes are explicitly described and performed in a systematic manner, the likelihood of consistent quality in the results is improved. Thus, process descriptions and process models (frameworks of related processes) enable consistent performance and delivery of expected results.

A number of international, national and industry standards describe processes and process reference models. The process descriptions vary in format, content and level of prescription. The purpose of this document is to encourage uniformity in the description of processes. Uniform description of processes facilitates adoption, adaptation and improvement of standardized processes, as well as process assessment. The combination of processes and the development of process views from different reference models eases the development of new models and facilitates comparison of processes.

In order for users of standards to select the appropriate forms of process description and apply them in a consistent fashion, it is desirable to develop a common characterization of all of these forms of process description. This document presents requirements for the description of processes in terms of their format, content and level of prescription. The requirements of this document can be applied to any process model developed for any purpose.

This document is intended for use by all parties that define process models, for example systems and software engineers, sector or special interest groups, professional standards groups, researchers, and process assessors.

Systems and software engineering — Life cycle management — Specification for process description

1 Scope

This document provides an explanation of considerations involved in defining a process. This document gives requirements and recommendations for the description of processes by identifying elements and rules for their formulation.

This document also describes the use of process views.

This document explains how conformance to a process can be defined, when the process is described in accordance with this document.

This document does not describe how processes are composed or otherwise aggregated into larger frameworks or life cycle models. Nor does the document cover how to assess or evaluate the performance of a process, or the output (products) of a process.

NOTE Two prominent International Standards in process description for software and system engineering are ISO/IEC/IEEE 12207 and ISO/IEC/IEEE 15288. These two standards have very similar process models. The information items associated with their process definitions are given in ISO/IEC/IEEE 15289. Other International Standards provide further characterization of a single life cycle process by elaborating the process elements and levying specific requirements on the execution of the process.

This document is applicable when processes are described for various process definitions in any party, organization or standard relating to systems and software engineering processes.

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 terminological databases for use in standardization at the following addresses:

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

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

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

NOTE 1 For additional terms and definitions in the field of systems and software engineering, see ISO/IEC/IEEE 24765, which is published periodically as a "snapshot" of the SEVOCAB (Systems and software Engineering Vocabulary) database and is publicly accessible at computer.org/sevocab.

3.1
activity
set of cohesive *tasks* (3.20) of a *process* (3.8)

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.3]

3.2
base practice
activity (3.1) that, when consistently performed, contributes to achieving a specific *process purpose* (3.12)

[SOURCE: ISO/IEC 33001:2015, 3.3.2]

3.3
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 1 and 2 to entry have been removed.]

3.4
life cycle
evolution of a *system* (3.18), *product* (3.16), service, project or other human-made entity from conception through retirement

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.26]

3.5
life cycle model
framework of *processes* (3.8) and *activities* (3.1) concerned with the *life cycle* (3.4), which can be organized into *stages* (3.17), acting as a common reference for communication and understanding

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.27]

3.6
output
product (3.16), result, or service generated by a *process* (3.8)

3.7
procedure
information item (3.3) that presents an ordered series of steps to perform a *process* (3.8), *activity* (3.1), or *task* (3.20)

[SOURCE: ISO/IEC/IEEE 15289:2019, 3.1.19, modified — Notes 1 and 2 to entry have been removed.]

3.8
process
set of interrelated or interacting *activities* (3.1) that transforms inputs into *outputs* (3.6)

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.33]

3.9
process improvement
actions taken to improve the quality of the organization's *processes* (3.8) aligned with the business needs and the needs of other concerned parties

[SOURCE: ISO/IEC 33001:2015, 3.1.7]

3.10
process maturity
extent to which an organizational unit consistently implements *processes* (3.8) within a defined scope that contribute to the achievement of its business needs (current or projected)

Note 1 to entry: This term is “organizational process maturity” with the same definition in ISO/IEC 33001.

[SOURCE: ISO/IEC/IEEE 26511:2018, 3.1.23, modified — Note 1 to entry has been added.]

3.11
process outcome
observable result of the successful achievement of the *process purpose* (3.12)

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.34]

3.12
process purpose
high-level objective of performing the *process* (3.8) and the likely outcomes of effective implementation of the process

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.35, modified — Note 1 to entry has been removed.]

3.13
process reference model
model comprising definitions of *processes* (3.8) in a domain of application described in terms of *process purpose* (3.12) and outcomes, together with an architecture describing the relationships between the processes

[SOURCE: ISO/IEC 33001:2015, 3.3.16]

3.14
process tailoring
making, altering, or adapting a *process* (3.8) description for a particular end

EXAMPLE A project tailors its defined process from the organization's set of standard processes to meet the objectives, constraints, and environment of the project.

3.15
process view
description of how a specified purpose and set of outcomes can be achieved by employing the *activities* (3.1) and *tasks* (3.20) of existing *processes* (3.8)

[SOURCE: ISO/IEC/IEEE 15026-1:2019, 3.2.2, modified — "may" has been changed to "can"; note 1 to entry has been removed.]

3.16
product
result of a *process* (3.8)

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.36, modified — Note 1 to entry has been removed.]

3.17
stage
period within the *life cycle* (3.4) of an entity that relates to the state of its description or realization

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.58, modified — Notes 1 and 2 to entry have been removed.]

3.18
system
combination of interacting elements organized to achieve one or more stated purposes

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.46, modified — Notes 1, 2 and 3 to entry have been removed.]

3.19
tailoring
process (3.8) by which individual requirements in specifications, standards, and related documents are evaluated and made applicable to a specific project by selection, and in some exceptional cases, modification of existing or addition of new requirements

[SOURCE: ISO/IEC/IEEE 26513:2017, 3.38]

3.20
task
required, recommended, or permissible action, intended to contribute to the achievement of one or more outcomes of a *process* (3.8)

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.66]

3.21
view
representation of a whole *system* (3.18) from the perspective of a related set of concerns

Note 1 to entry: For further details, refer to ISO/IEC/IEEE 42020:2019, 3.24.

3.22
viewpoint
specification of the conventions for constructing and using a *view* (3.21)

Note 1 to entry: A viewpoint is a pattern or template from which to develop individual views by establishing the purposes and audiences for a view, and the techniques for its creation and analysis.

Note 2 to entry: For a detailed explanation of view and viewpoint and how they can be defined and used, see ISO/IEC/IEEE 42010.

Note 3 to entry: For further details, refer to ISO/IEC/IEEE 42020:2019, 3.25.

4 Conformance

Full conformance to this document can be claimed if process descriptions defined using the requirements of this document clearly cover the required elements (5.2). Any of the optional elements (5.3) may also be included either as requirements, recommendations, examples or suggestions.

5 Specification of a process description and its elements

5.1 Elements of process description

This document characterizes the following elements of process description:

— name;

— purpose;

— outcomes;

— activities;

— tasks;

— inputs;

— outputs;

— controls and constraints.

5.2 Process and related concepts

As defined in 3.7, a process is a set of interrelated or interacting activities that transforms inputs into outputs. Figure 1 shows a typical representation of this transformation.

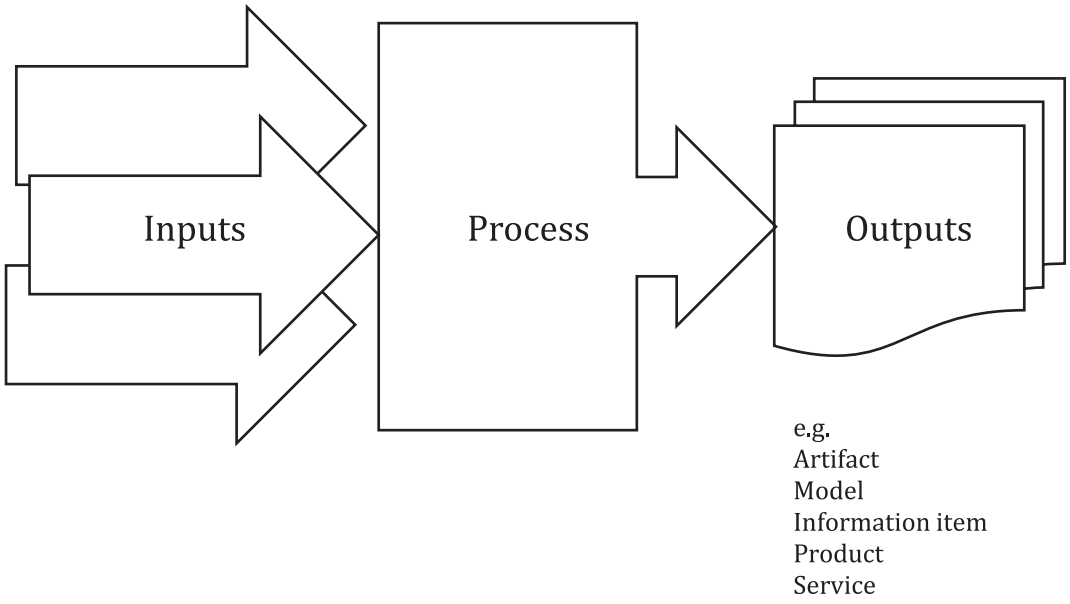


Figure 1 — Basic process

There is no fixed dividing line between what constitutes a process and what is considered as a sub-process or an activity within a process. Typically, processes are achieved through the performance of activities comprising groups of related tasks. A significant activity of interest with numerous tasks can also be described as a process if it were useful to treat the activity of interest in detail. The limits of a process generally are determined by the production of a major output and outcomes, rather than the intermediate outputs produced by activities within the process. Additionally, if processes are highly automated and require little human control or intervention, it can be appropriate to combine several processes into one process description.

NOTE 1 Often a set of processes are developed; and some processes are decomposed into more than one level. However, decomposition of processes into more than three levels is likely to be confusing and hard for humans to use.

Procedures differ from process descriptions in that procedures are written in steps to be followed in order. Procedures can be written as instructions to the persons performing the procedure. Procedures can also be written to assist an evaluator or auditor to understand the procedure, especially its controls or outputs.

NOTE 2 ISO/IEC/IEEE 82079-1 provides detailed requirements for writing instructions.

Required activities are stated in process descriptions using either the imperative (as a command), or as a 'shall' statement.

NOTE 3 Annex A shows different examples of the expression of mandatory/required process elements as used in sample process descriptions.

Complete processes generally involve several types of generic activities (Table 1).

Table 1 — Model of generic activities within a process

Generic activity	Example activities in the design definition process	Example activities/task in the implementation process
Strategize and plan (Plan)	Prepare for software system design definition	Prepare for implementation
Perform (Do)	Establish designs related to each software system element.	Perform implementation
NOTE Adapted from ISO/IEC/IEEE 24748-3:2020, Table 1.		

Table 1 *(continued)*

Generic activity	Example activities in the design definition process	Example activities/task in the implementation process
Evaluate and decide (Check)	Assess alternatives for obtaining software system elements	Evaluate software unit and affiliated data or other information according to the implementation strategy and criteria.
Manage outcomes and outputs (Act): Preserve and present artefacts and information items	Manage the design.	Manage results of implementation
NOTE Adapted from ISO/IEC/IEEE 24748-3:2020, Table 1.		

Generally, several software or systems engineering processes are performed concurrently during a life cycle stage. However, concurrent activities (e.g. installation and quality assurance inspections) are not necessarily part of the same process, since their purpose, resources, methods, outputs, and outcomes are different.

Process descriptions may be used either to describe generic processes (for example "project management process") or to describe a particular instance of a generic type (for example "project management process for project A"). For specific process descriptions, generic process descriptions may be instantiated with respect to roles or responsibilities, resources, required inputs and outputs, constraints and controls, and time. Annex A provides examples of process descriptions used to develop a process model. Annex B provides a technique for demonstration of process traceability between elements, using an example process from Annex A.

Processes are often combined to form a process model (framework of related processes). ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207, for example, provide life cycle process reference models for systems and software in which outcomes are defined and activities grouped for generic life cycle process description. Based on ISO/IEC/IEEE 15288:2015, Annex A and ISO/IEC/IEEE 12207:2017, Annex A, organizations or projects can apply process tailoring to suit the nature of the effort.

NOTE 4 ISO/PAS 19450 specifies concepts, semantics, and syntax of Object-Process Methodology as a modelling paradigm and language for producing conceptual models at various extents of detail.

Various schemas for characterizing and evaluating process maturity, capability or quality are in use. These schemas typically distinguish between levels of process performance and involve process improvement. Process levels can involve following the process repeatedly to successfully achieve its outcome or produce specified output, and automating and improving the process. The choice of details in the process description can be used to characterize the process description at a certain level of process maturity, capability or quality.

NOTE 5 ISO/IEC 33020 defines a process measurement framework for the assessment of process capability.

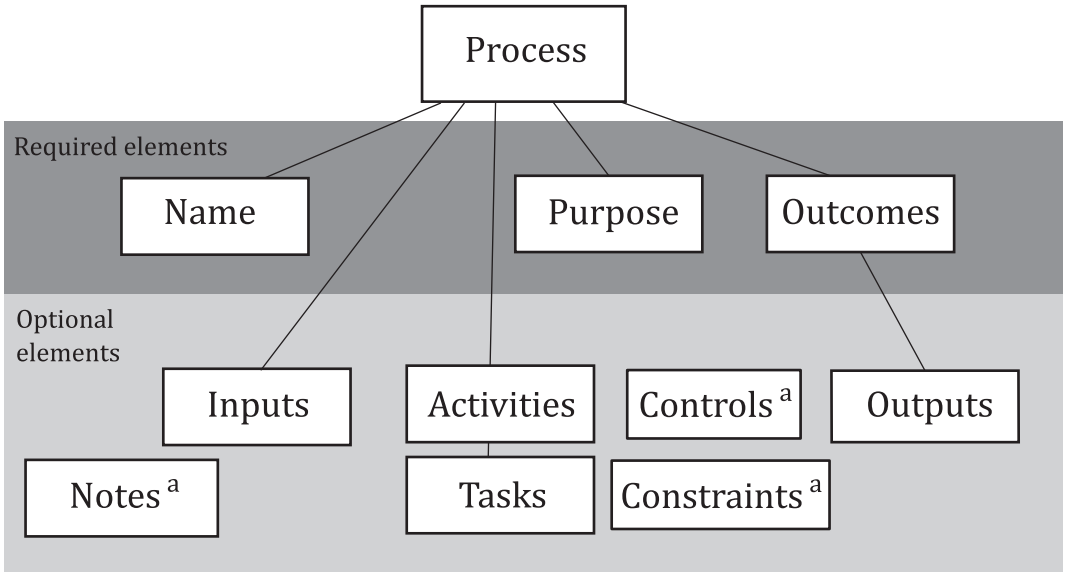
5.3 Process description – required elements

5.3.1 General

A process description can include the elements as shown in Figure 2. The minimum required elements for a process description shall be the name, purpose, and outcomes. Optional elements, such as outputs, activities, and tasks, may be included in process descriptions.

The goals and objectives of performing a process shall be described by using the elements of name, purpose, and outcomes. These elements are used to describe intended results without the necessity of performing structural decomposition of the process. Processes defined using name, purpose, and outcomes provide a common starting point for process implementation and process assessment.

NOTE ISO/IEC/IEEE 15288:2015, Figure D.1 and ISO/IEC/IEEE 12207:2017, Figure D.1 show a process construct. ISO/IEC/IEEE 24748-1:2018, Annex A also describes process elements.



[a] Element of a process description that can be used with any other element.

Figure 2 — Process description elements

To enable uniform description, 5.3.2 to 5.3.4 contain additional requirements for the process elements.

5.3.2 Process name

The name of a process description shall be stated as a short noun phrase that presents a descriptive heading for the process. The name identifies the principal concern of the process and distinguishes the process from other processes in the model. Because of the latter criterion, it may sometimes be necessary to tailor the name of a process. For example, one may have a "software architecture process" which is later refined as a "software detailed design process" or "data architecture process" or "interface architecture process." Process names should end in the word process.

Wordy noun-verb or verb-noun phrases can get confused with process activities and often represent an attempt to summarize the purpose or process so that the name can stand for the purpose. A descriptive noun phrase - the name of the process - is more useful. The intent is to give a name, not a summary.

NOTE Although the term "process name" is preferred and used throughout this document, “process title” is an acceptable alternative.

5.3.3 Process purpose

The purpose element of the process shall be stated as one or more related high-level goals for performing the process. In cases where processes seem to overlap, the purpose element should be used to characterize the scope or bounds of the process.

Whenever possible, the purpose element should be succinctly captured in a single sentence. Summarizing the activities or outcomes of the process in the purpose statement should be avoided. Use of the conjunction “and” to connect multiple clauses should be avoided as it would indicate that the description is being written as an aggregation of marginally related outcomes rather than as a statement of a single purpose. The purpose element shall begin with the words, “The purpose of the xxx process is… “. The phrase, “in order to” may be useful in recording the objective of the process.

Further explanations of the purpose of a process can be placed in informative text or notes.

5.3.4 Process outcomes

Process outcomes are measurable, tangible, technical or business results that are achieved by a process. For example, the results are used by other processes. Outcomes are observable and assessable. Outcomes are distinguished from outputs and are not stated as the production of a document, record, or other information item.

An outcome shall be phrased as a declarative sentence using a verb in the present tense. For example, if the preceding sentence is phrased as an outcome, the preceding sentence states, “Outcomes are phrased as declarative sentences using verbs in the present tense.”

Outcomes shall be expressed in terms of a positive, observable objective, e.g. the provision of a service, a significant change of state, the successful maintenance of a desired state (e.g. safety), or the meeting of specified objectives (such as requirements, goals).

An outcome shall express a single result. Hence, the use of the word “and” or “and/or” to conjoin clauses shall be avoided; such constructions are better expressed as multiple outcomes.

Outcomes of generic processes shall be written in a manner that is meaningful for any scope of applicability, e.g. for organizations of any relevant domain or size.

As a test of completeness, the set of outcomes shall be sufficient to achieve the stated purpose of the process.

As a test of relevancy, each outcome shall be phrased so that it is necessary to the achievement of the purpose of the process.

Outcomes shall avoid requiring any specific method, technique or tool.

Outcomes shall avoid requiring any specific process measures or management methods.

Outcomes shall avoid presuming any particular sequence of execution; and the process user shall not be expected to presume any sequence.

Outcome statements should be no longer than two lines of text, about 20 words.

A process should have from three to seven outcomes, but may have only one or two outcomes.

Outcomes should be differentiated from benefits, which are positive achievements from the execution of a process, often spread broadly across the business and not necessarily related to the technical or business intent of executing a process. Benefits are not usually assessable, or at least not assessable using process assessment approaches. A benefit may provide the motivation to execute a process, but it may not be the primary reason to do so. Benefits may be described in an informative Note to the purpose statement.

The list of outcomes associated with a process should be prefaced by the text, “As a result of successful implementation of this process…”

There is no need for a one-to-one correspondence between outcomes and activities; in particular, it is not necessary to specify an activity for every outcome of a process or an outcome for every activity. The execution of the activities, considered as a group, shall produce the set of outcomes, considered as a group.

Outcomes should be meaningful and understandable when considered individually. They may be based on terminology and concepts that are further explained by other material included in the process description.

5.4 Process description – optional elements

5.4.1 General

In many areas of application, a description needs to allow for a range of approaches to achieving outcomes and in these cases a typical set of activities may be described. Alternatively, where conformance to a set of tasks is required or recommended, the activities and tasks may also be described.

5.4.2 Process activities

Rather than describing the results of executing a process, activities describe a set of actions that can be required, recommended, or permissible or typically undertaken to achieve or execute the process.

NOTE 1 ISO/IEC 33001 describes "typical activities" as "base practices" to be considered in a process assessment.

NOTE 2 ISO/IEC/IEEE 12207 and ISO/IEC/IEEE 15288 treat the activities and tasks in their process descriptions as required for "full conformance to tasks". They also allow the alternative of "full conformance to outcomes."

Activities are constructs for grouping together related tasks. The activities provide a means to look at related tasks within the process to improve understanding and communication of the process. If an activity is cohesive enough and sufficiently elaborated, it may be helpful to consider the activity as a lower-level process with its own purpose and set of outcomes.

The set of lower-level processes and activities associated with a process shall be complete. In other words, the set of lower-level processes and activities shall, when considered as a group, address the achievement of all process outcomes and the satisfaction of the purpose of the process. Alternatively stated, any action falling within the purpose and scope of a process necessarily falls within the scope of one or more of the activities of the process.

Ideally, the definition of the activities of a process achieves a goal of "cohesion" in the same sense as that term applies to software design. The tasks within a single activity should be strongly related to each other and weakly related to those of other activities or processes.

Placing timing, scheduling, ordering or sequencing requirements on process activities should be avoided because these limit application of the standards in alternative life cycle models. However, if timing or sequencing constraints are necessary, they shall be explicitly stated. Synchronous process description is sometime mandatory and considered as "state of the art "in some domains. In the absence of any explicit statements, the reader shall not be expected to assume any timing or sequencing. Thus, activities are not to be regarded as the "steps" in performing a procedure. Instead, they are to be regarded as continuing or recurring responsibilities, but with a scope smaller than that of the entire process. Specifying a set of activities can result in requiring the achievement of capabilities beyond those associated with a minimal process maturity, capability or quality. The set of activities defined for a process may thus go beyond the minimal achievement of process purpose. In other words, the set of activities for a process should be sufficient to address all of the process outcomes, but may go beyond the minimum set necessary for this. For example, the set of activities may include those associated with planning, monitoring and controlling process performance.

Some processes, such as design and implementation, have multiple methods and techniques to achieve acceptable results. It can be preferable to require compliance only to outcomes rather than to specific activities or tasks, and to avoid specifying detailed methods unless they are indeed required for conformance.

5.4.3 Process tasks

Tasks are written to define specific requirements or provide recommendations on the execution of a conforming process.

A task is expressed in the form of a requirement, recommendation, permissible or typically undertaken action, intended to support the achievement of the outcomes of a process.

Unlike the process/activity relationship, the set of tasks within an activity is not required to "cover" the activity. (If it were, then the writers of process models would have to write a task regarding every item conceivable within the scope of an activity.) If we think in terms of Venn diagrams, then the total areas of all of the lower-level processes and activities equal the area of the process. The tasks, however, are points within the processes.

When providing additional tasks, informative mappings or other information explaining the role of the additional tasks may be helpful. Examples include conformance requirements and achievement of higher levels of capability (on any scale).

Placing timing or sequencing requirements on tasks should be avoided because this limits application of the standards in alternative life cycle models. However, if timing or sequencing constraints are necessary, they should be explicitly stated. In the absence of any explicit statements, the user is not expected to assume any timing or sequencing requirements for the tasks.

5.4.4 Notes

Notes are used to describe the intent or mechanics of a process or process element. Notes provide insight regarding related processes frequently performed at the same stage in the project life cycle, potential implementation methods, constraints, or areas of applicability.

Process descriptions may also contain brief examples (longer specialized forms are typically procedures, instructions, or process views).

5.4.5 Process inputs

Process inputs are those items transformed by the process to outputs. Human or automated resources that perform the process are not considered as inputs. Inputs can come from other processes being executed in a project, the organizational processes and resources, suppliers, or other external sources. Specifying required or typical process inputs is helpful but optional, unless a closed-loop life cycle model is used (where every output is an input to another process).

NOTE Process descriptions rarely specify required process inputs, because it is difficult to check conformance, i.e., to prove that the organization considered and did not ignore specified inputs.

The widespread use of iterative or recursive life cycle models mean that outputs are being frequently modified or improved, resulting in changes to the inputs of other concurrent or subsequent processes. Major inputs and outputs of systems and software engineering processes, such as the requirements, design, and information items, are thus repeatedly changed.

5.4.6 Process outputs

Depending on the method of evaluating process compliance or conformance, specifying process outputs in the process description is optional, as long as it can be demonstrated that the process outcomes have been achieved. Some process outputs are essential to build the end product or service deliverable. Other process outputs are intermediate work products, produced only for customer validation or inspection by auditors. Outputs frequently become organizational assets for use in other products and processes.

Process outputs are of two main types: artefacts and information items. Artefacts include prototypes, models, system components and elements, as well as finished products and services. A work product is an artefact associated with the execution of a process. There are four generic work product categories: services (e.g. operation); software (e.g. computer program, documents, information, contents); hardware (e.g. computer, device); and processed materials.

The description of an information item consists of a name and a set of characteristics.

— **Information item name:** The name associated with the information item characteristics. This name is provided as an identifier of the type of information item that the practice or process may produce. Organizations may call these information items by different names. The name of the information item in the organization is not significant. Similarly, organizations may have several equivalent information items which contain the characteristics defined in one information item type. The formats for the information items can vary.

— **Information item characteristics:** The potential characteristics associated with the information item type. Characteristics may relate to the purpose and use of an information item, and its contents, format and quality.

The use of generic types to classify information items simplifies the application of consistent structure, content and format of similar information items, and supports the usability of process models. The set of generic types used in ISO/IEC/IEEE 15289 to describe the information items implied in ISO/IEC/IEEE 12207 and ISO/IEC/IEEE 15288 is given in Table 2.

Table 2 — Generic information item types

Information item name	Information item characteristics
Description	A representation of a proposed or actual object or concept. It may include a textual, pictorial, graphical or mathematical representation. It may be in a standardised form for human interpretation. It may establish order, structure, grouping or classification.
Plan	A proposed scheme or systematic course of action for achieving a declared purpose. It defines when, how, and by whom specific processes or activities are to be performed. predicts how to successfully accomplish objectives in terms of specific actions, undertaken at defined times and employing defined resources. It may apply to technical, project or enterprise actions.
Policy	A statement of an organization's high-level intention and approach to achieve objectives for, and ensuring effective control of, a service, process, or management system.
Procedure	A declared way of formally conducting a customary course of action. It defines an established and approved way or mode of conducting business in an organization. It may detail a permissible or recommended method in order to achieve technical or managerial goals or outcomes, including the tools needed.
Record	A permanent, readable (either human or machine-readable) form of data, information or knowledge. Accessible and maintained evidence of the existence or occurrence of facts, events or transactions. It may take the form of a journal chronicle, register or archive. If possible, include the name or role of a focal point for further details. It may contain the information to confirm achievement of performance, fiscal or legal conditions or obligations.
Report	An account prepared for interested parties in order to communicate status, results or outcomes. It is a result of information gathering, observation, investigation or assessments, and it may impart situation, effects, progress, or achievement. It may communicate decisions taken or recommend decisions. It may communicate decisions taken or recommend decisions or be used to escalate issues.
Request	A communication that solicits a defined response, course of action, or change in order to fulfil a need or obtain a resource, product, service or an approval to act.
Specification	Description for a required service, product, or process. Criteria or conditions that place limits or restrictions on actions, attributes or qualities. It establishes measures or qualities for determining acceptability, conformance or merit. It may be required as part of an agreement or contract.
NOTE See ISO/IEC/ IEEE 15289.	

5.4.7 Process controls and constraints

Controls and constraints direct or limit the performance of a process. Controls may arise from legal or regulatory authorities, organizational policy, adherence to voluntary standards, and agreements with suppliers and customers. Constraints can be associated with external environmental or business

factors. Controls and constraints can be identified in a separate section of the process description, or mentioned in notes to other elements.

NOTE Controls and constraints are not shown in Figure 1 to retain simplicity of a process. In some models these would be included.

6 Process views and viewpoints

6.1 The process view concept

A process view provides visibility to a significant concept or specific purpose across several processes. A process view includes selected, adapted or new activities and tasks with additional details and explanations clarifying their applicability to the concept. Process views advise users of a standard or other process reference model how to apply those processes, activities and tasks for their purpose, even though the original processes do not explicitly address their specific concerns.

Process views may involve selected processes or every process in a process model. The process view typically is used to emphasize the application of specific domains or concerns in generic process descriptions. Rather than working from generic process descriptions, it can be helpful for special interests to group their set of relevant activities and particular outcomes. Using process views reduces the proliferation of special-interest process models and supports consistency of implementation and assessment.

NOTE The relationships between stakeholder, concern, view, viewpoint and model are further detailed in ISO/IEC/IEEE 42010.

6.2 Process viewpoint

A process view conforms to a process viewpoint. The process viewpoint provided here can be used to create process views. It is important to establish the set of concerns being addressed by the process viewpoint (and therefore by a process view), and the likely ("generic") stakeholders for such a view who would have these concerns.

The process viewpoint is defined by the following:

— the stakeholders, the affected users of the standard (generic stakeholders include process authors, process users, and process evaluators);

— the concerns being framed.

6.3 Contents of a process view

A process view shall include a name, a statement of purpose, and outcomes. A process view includes specification and guidance explaining how the outcomes can be achieved by employing the activities and tasks of the various processes in an existing process model or models.

The contents of resulting process views should include identification and description of the processes, activities and tasks which implement the process view

The resulting process view may delineate the following:

— the processes needed to reflect a particular interest with its concerns;

— the connections between processes (e.g. if outputs of one process are inputs of another process);

— the sources of the process(es), such as standards or processes that an organization has created or tailored.

Annex C contains an example process view.

7 Claims of conformance to a process

Conformance to a process or set of processes, as described in accordance with this document, shall be claimed according to either or both of two criteria: conformance to outcomes or conformance to tasks. The two criteria — conformance to outcomes and conformance to tasks— are not necessarily equivalent. Specific performance of activities and tasks can require, in some cases, a higher level of capability than just the achievement of outcomes.

Claiming "full conformance to outcomes" asserts that all of the required outcomes of the declared process are achieved. Full conformance to outcomes permits greater freedom in the implementation of conforming processes and can be useful for implementing processes to be used in the context of an innovative life cycle model. In this situation, the activities and tasks of the declared set of processes are guidance rather than requirements, regardless of the verb form that is used.

Claiming "full conformance to tasks" asserts that all of the requirements of the activities and tasks of the declared set of processes are fulfilled. In this situation, the outcomes of the declared set of processes are guidance rather than requirements, regardless of the verb form that is used in the provision.

Irrespective of tailoring, organizations and projects are always permitted to implement processes that achieve additional outcomes or implement additional activities and tasks beyond those required for conformance to a standard.

NOTE ISO/IEC/IEEE 12207:2017, Annex A and ISO/IEC/IEEE 15288:2015, Annex A explain the tailoring process and claiming conformance to the tailored process.

Annex A
(informative)

Example process descriptions

A.1 General

This annex includes three example process descriptions from existing ISO standards:

a) the institutionalize human-centred quality process from ISO 9241-220:2019, 9.2.1, showing the specification of an exemplar process;

b) the decision management process from ISO/IEC/IEEE 12207:2017, 6.3.3, showing mandatory tasks for defined activities;

c) the test monitoring and control process from ISO/IEC/IEEE 29119-2:2013, 7.3, showing individual mandatory tasks.

NOTE Where an existing process example does not meet the requirements specified in the main part of this document, a correction is made here in italics.

A.2 Institutionalize human-centred quality process

Table A.1 describes the purpose, benefits, outcomes and process activities to be conducted within the Institutionalize human-centred quality process (HCP.1.2).

Table A.1 — Purpose, benefits, outcomes and activities of HCP.1.2

Process purpose	Establish and maintain a human-centred approach as normal practice in the organization.
Process benefits	The organization takes account of human-centred quality.
Process outcomes	a) Top management promotes a human-centred approach to system design, operation and procurement. b) The organization has a strategic vision for the value of taking account of user experience both for its products and systems for staff use. c) The extent to which targets for human-centred quality need to be achieved for different products or market segments is known. d) Human-centred design is applied in the development of interactive systems. e) The enterprise is responsive to changes in how their interactive systems are used.
Process activities (typical)	1) Designate a suitable member of the executive board to be responsible for championing a human-centred approach and getting top management endorsement. [a] 2) Establish and communicate a policy for achieving required levels of human-centred quality in the organization. [a] 3) Establish a continuous improvement program for human-centred quality in the organization. [a] 4) Establish and maintain awareness of the importance of human-centred quality. [b] 5) Assess and define the importance of human-centred quality in different market segments, taking account of the expectations for human-centred quality of the products in those market segments. [c] 6) Ensure acceptance of human-centred activities in the organization. [d] 7) Develop the systems strategy to take account of user, other stakeholder and organizational requirements. [e]

A.3 Decision management process

A.3.1 Purpose

The purpose of the decision management process is to provide a structured, analytical framework for objectively identifying, characterizing and evaluating a set of alternatives for a decision at any point in the life cycle and select the most beneficial course of action.

This process is used to resolve technical or project issues and respond to requests for decisions encountered during the software life cycle, in order to identify the alternative(s) that provides the preferred outcomes for the situation. The methods most frequently used for decision management are the trade study and engineering analysis. Each of the alternatives is assessed against the decision criteria (e.g. cost impact, schedule impact, programmatic constraints, regulatory implications, technical performance characteristics, critical quality characteristics, and risk). Results of these comparisons are ranked, via a suitable selection model, and are then used to decide on an optimal solution. Key study data (e.g. assumptions and decision rationale) are typically maintained to inform decision-makers and support future decision-making.

NOTE When it is necessary to perform a detailed assessment of a parameter for one of the criteria, the system analysis process can be employed to perform the assessment.

A.3.2 Outcomes

As a result of the successful implementation of the decision management process:

a) Decisions requiring alternative analysis are identified.

b) Alternative courses of action are identified and evaluated.

c) A preferred course of action is selected.

d) The resolution, decision rationale and assumptions are identified.

A.3.3 Activities and tasks

The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the decision management process.

a) **Prepare for decisions.** This activity consists of the following tasks:

1) Define a decision management strategy.

NOTE 1 A decision management strategy includes the identification of roles, responsibilities, accountabilities, and authorities. The strategy considers the need for obtaining information input and for returning a timely decision. The strategy includes the identification of decision categories and a prioritization scheme. Decisions often arise as a result of an effectiveness assessment, a technical trade-off, a problem needing to be solved, an action needed as a response to risk exceeding the acceptable threshold, or a new opportunity or approval for project progression to the next life cycle stage. Organization or project guidelines determine the degree of rigor and formality to apply to the decision analysis.

2) Identify the circumstances and need for a decision.

NOTE 2 Problems or opportunities and the alternative courses of action that will resolve their outcome are recorded, categorized and reported.

3) Involve relevant stakeholders in the decision-making in order to draw on experience and knowledge.

NOTE 3 It is good practice to identify the subject matter expertise needed for the analysis and the decision.

b) **Analyse the decision information.** This activity consists of the following tasks:

1) Select and declare the decision management strategy for each decision.

NOTE 4 The degree of rigor required to resolve these problems or opportunities is determined, as well as the data and system analysis needed for evaluating the alternatives. The timeframe to reach a decision is defined.

2) Determine desired outcomes and measurable selection criteria.

NOTE 5 The desired value for quantifiable criteria and the threshold value(s) beyond which the attribute will be unsatisfactory are determined, as well as weighting factors for the criteria.

3) Identify the trade space and alternatives.

NOTE 6 If a large number of alternatives exist, they are qualitatively screened to reduce alternatives to a manageable number for further detailed systems analysis. This screening is often based on qualitative assessments of such factors as risk, cost, schedule, and regulatory impacts.

4) Evaluate each alternative against the criteria.

NOTE 7 The system analysis process is used, as necessary, to quantify specific criteria for each trade alternative to be evaluated. This includes new design parameters, different architecture characteristics, and range of values for critical quality characteristics. The system analysis process assesses the range of parameter variations in order to obtain a sensitivity analysis for each of the trade alternatives evaluated. These results are used to establish the feasibility of the various trade alternatives.

c) **Make and manage decisions.** This activity consists of the following tasks:

1) Determine preferred alternative for each decision.

NOTE 8 Alternatives are evaluated quantitatively, using the selection criteria. The selected alternative generally provides an optimization of, or improvement in, an identified decision.

2) Record the resolution, decision rationale, and assumptions.

3) Record, track, evaluate and report decisions.

NOTE 9 This includes records of problems and opportunities and their disposition, as stipulated in agreements or organizational procedures and in a manner that permits auditing and learning from experience.

NOTE 10 This allows the organization to confirm that problems have been effectively resolved, that adverse trends have been reversed, and that advantage has been taken of opportunities.

A.4 Test monitoring and control process

A.4.1 Overview

The *test monitoring and control process* as shown in ISO/IEC/IEEE 29119-2:2013, Figure 7 scrutinizes whether testing progresses in accordance with the test plan and the organizational test specifications, such as the organizational test policy and the organizational test practices. If there are significant departures from planned progress, activities, or other aspects of the test plan, activities will be initiated to correct or compensate for the resultant variances.

This process can be applied to the management of a whole project (normally made up of a number of test levels and test types) or to the management of the testing of a single test phase (e.g. system testing) or test type (e.g. performance testing). In the latter case it is applied as part of the monitoring and control of dynamic testing described by the *dynamic test processes*. When applied as part of the monitoring and control of the testing for a complete project then it will interact directly with the test management processes being used to manage the individual test phases and test types of the project.

A.4.2 Purpose

The purpose of the *test monitoring and control process* is to determine whether testing progresses in accordance with the test plan and with organizational test specifications (e.g. the organizational test policy and the organizational test practices). It also initiates control actions as necessary and identifies necessary updates to the test plan (e.g. revise completion criteria or identify new actions to compensate for deviations from the test plan).

The process is also used to determine whether testing progresses in accordance with higher level test plans, such as the project test plan, and to manage the testing performed at specific test phases (e.g. system testing) or for specific test types (e.g. performance testing).

A.4.3 Outcomes

As a result of the successful implementation of the test monitoring and control process:

a) The means of collecting suitable measures to monitor test progress and changing risk are set up.

b) Progress against the test plan is monitored.

c) New and changed test-related risks are identified, analysed and necessary action(s) invoked.

d) Necessary control actions are identified.

e) Necessary control actions are communicated to the relevant stakeholders.

f) The decision to stop testing is approved.

g) Test progress and changes to the risks are reported to stakeholders.

A.4.4 Activities and tasks

A.4.4.1 General

The person(s) responsible for test monitoring and control will implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the *test monitoring and control process.*

A.4.4.2 Set-up (TMC1)

This activity consists of the following tasks:

a) Suitable measures for monitoring progress against the test plan should be identified if these measures are not already defined in the test plan or the organizational test practices document.

b) Suitable means of identifying new and changing risks should be identified if these are not already defined in the test plan or the organizational test practices document.

c) Monitoring activities, such as test status reporting and test metrics collection, shall be put in place to collect the measures identified in tasks a) and b) above, and in the test plan and the organizational test practices document.

A.4.4.3 Monitor (TMC2)

This activity consists of the following tasks:

a) The test measures shall be collected and recorded.

b) Progress against the test plan shall be monitored using the collected test measures.

EXAMPLE 1 By examining test status reports, analysing test measures and meeting with stakeholders.

c) Divergence from planned testing activities shall be identified and any factors blocking progress recorded.

e) New risks shall be identified and analysed to identify those that require mitigation by testing and those that need to be communicated to other stakeholders.

f) Changes to known risks shall be monitored to identify those that require mitigation by testing and those that need to be communicated to other stakeholders.

EXAMPLE 2 Communicate risks that require testing as mitigation to the project manager.

NOTE Tasks a) to e) above are repeated on a regular basis, until it is determined that the testing specified in the test plan can be terminated or is complete, which would typically be done by checking whether the completion criteria have been achieved.

A.4.4.4 Control (TMC3)

This activity consists of the following tasks:

a) Those actions necessary to implement the test plan shall be performed.

EXAMPLE 1 Assigning responsibility for testing activities to testers.

b) Those actions necessary to implement control directives received from higher level management processes shall be performed.

EXAMPLE 2 Actions from the project test manager if a specific phase of testing is being managed.

c) Those actions necessary to manage the divergence of actual testing from planned testing shall be identified.

NOTE 1 These control actions can require changes to the testing, the test plan, test data, test environment, staffing and/or changes in other areas, such as development.

d) Means of treating newly identified and changed risks shall be identified.

NOTE 2 This can include assigning more staff to specific tasks and changing test completion criteria.

e) As appropriate:

1) control directives shall be issued to make changes to the way testing is performed;

2) changes to the test plan shall be in the form of test plan updates;

3) recommended changes shall be communicated to the relevant stakeholders.

EXAMPLE 3 IT support for test environments.

f) Readiness for commencing any assigned test activity shall be established before commencing that activity, if not already done.

NOTE 3 This can typically be performed by checking against entry criteria described in the test plan.

NOTE 4 Assigned test activity can be test execution.

NOTE 5 Readiness can have been established in the test design and implementation process and/or the test environment and data management process.

g) Approval shall be granted at the completion of assigned test activities.

EXAMPLE 4 Completion of a lower level of testing.

NOTE 6 This will typically be performed by checking against exit criteria described in the test plan.

h) When the testing has met its completion criteria, approval for the test completion decision shall be obtained.

A.4.4.5 Report (TMC4)

This activity consists of the following tasks:

a) Testing progress against the test plan shall be communicated to stakeholders in a test status report for the specified reporting period.

b) New risks and changes to existing risks shall be updated in the risk register and communicated to the relevant stakeholders.

A.4.5 Information items

As a result of carrying out this process, the following information items shall be produced:

a) Test status reports.

b) Test plan updates.

c) Control directives (e.g. changes to the testing, the test plan, test data, test environment and staffing).

d) Project and product risk information.

NOTE Risk information can be held in the project risk register or locally in the test plan.

Annex B
(Informative)

Process description traceability between elements

B.1 Traceability between model elements

The linkages between model elements (i.e. outcomes, activities, tasks and information items) should be identified.

These linkages serve the following purposes:

a) provide a basis for demonstrating the integrity of the relationships between the model elements;

b) provide a basis for implementing tools that support model application i.e. for process assessment purposes.

B.2 Demonstration of traceability

One method of demonstrating the linkages (i.e. traceability) between model elements is shown in Table B.1. The linkages between tasks and outcomes is demonstrated. Table B.1 shows the relationship between inputs, outputs and outcomes for the example process in A.3.

Table B.1 — Traceability of decision management process elements

Process ID	ISO/IEC/IEEE 12207:2017, 6.3.3
Name	Decision management process
Purpose	The purpose of the decision management process is to provide a structured, analytical framework for objectively identifying, characterizing and evaluating a set of alternatives for a decision at any point in the life cycle and select the most beneficial course of action.
Outcomes	As a result of successful implementation of this process: a) Decisions requiring alternative analysis are identified. b) Alternative courses of action are identified and evaluated. c) A preferred course of action is selected. d) The resolution, decision rationale and assumptions are identified.4
Task Requirements Traceability to Outcomes	ISO/IEC/IEEE 12207:2017, 6.3.3.3 a) **Prepare for decisions** 1. Define a decision management strategy. [Outcome b] 2. Identify the circumstances and need for a decision.[Outcome a] 3. Involve relevant stakeholders in the decision-making in order to draw on experience and knowledge. [Outcome b] ISO/IEC/IEEE 12207:2017, 6.3.3.3 b) **Analyse the decision information** 1. Select and declare the decision management strategy for each decision. [Outcome b] 2. Determine desired outcomes and measurable selection criteria. [Outcome b] 3. Identify the trade space and alternatives. [Outcome b] 4. Evaluate each alternative against the criteria. [Outcome b] ISO/IEC/IEEE 12207:2017, 6.3.3.3 c) **Make and manage decisions** 1. Determine preferred alternative for each decision. [Outcome c] 2. Record the resolution, decision rationale, and assumptions. [Outcome d] 3. Record, track, evaluate and report decisions. (Outcome d]
Inputs	
Decision alternatives [Outcome c] [Outcome d] The following informational inputs for the decision management process are identified in ISO/ IEC/ IEEE 15289: Organizational procedures, contracts, problem records, analysis results, monitoring and control results, assessment reports, review minutes.	
Outputs	
Issue requiring decision [Outcome a] Decision (Decision-analysis solution selected, Decision-analysis evaluation result) [Outcome c] Decision-analysis instance evaluation criteria [Outcome b] Decision-making strategy [Outcome b]	

B.3 Applicable work products (outputs)

Information items that are recognized as outputs of the decision management process in ISO/IEC/IEEE 12207:2017 are identified in Table B.2.

Table B.2 — Mapping of ISO/IEC/IEEE 12207:2017 subclauses to information items for decision management

Typical input information items ISO/IEC/IEEE 12207:2017	ISO/IEC/IEEE 12207:2017 reference	Output information item
Organizational procedure, contract, problem records	6.3.3.3 a) 2)	Problem report
Analysis results, monitoring and control results, assessment report, review minutes	6.3.3.3 a) 2), B.1	Decision request
Organizational procedure, contract	6.3.3.3 c)	Report
NOTE See ISO/IEC/IEEE 15289:2019, Table 2.		

The contents of a decision record are identified (Table B.3).

Table B.3 — Decision Record output traceable to process tasks

Record	Process	Reference	Record contents
Decision record	Decision management	ISO/IEC/IEEE 12207:2017, 6.3.3.3 c), B.1	Decision, assumptions, and rationale; outstanding actions.
NOTE See ISO/IEC/IEEE 15289:2019, Table 3.			

A decision-making strategy can also be identified as an output of decision management process tasks. The following is an extended description of contents of the decision-making strategy.

Decision-making strategy

Related task: ISO/IEC/ IEEE 12207:2017: 6.3.3.3 a) 1), 6.3.3.3 a) 2).

A decision management strategy includes the identification of roles, responsibilities, accountabilities, and authorities. The strategy considers the need for obtaining information input and for returning a timely decision. The degree of rigor required to evaluate and agree to a decision is determined, as well as the data and system analysis needed for evaluating the alternatives. The strategy includes the identification of decision categories and a prioritization scheme. Desired outcomes and measurable selection criteria are determined. The desired value for quantifiable criteria and the threshold value(s) beyond which the attribute will be unsatisfactory are determined, as well as weighting factors for the criteria. Organization or project guidelines determine the degree of rigor and formality to apply to the decision analysis. The subject matter expertise needed for the analysis and the decision are identified.

Annex C
(informative)

Example process view description

C.1 General

This annex provides an example of applying the process viewpoint to yield a process view for speciality engineering, intended to illustrate how a project may assemble processes, activities and tasks to provide focused attention to the achievement of product characteristics that have been selected as being of special interest. This example is from ISO/IEC/IEEE 15288:2015, E.4.

NOTE Other examples can be found in e.g. ISO/IEC/IEEE 24748-1 which provides commentary at the process group level, ISO/IEC/IEEE 21840 which provides guidance at the outcome level but doesn't call it a process view, ISO/IEC 15026-4 which provides a table view of applicable processes, plus a mapping at the process and task level (activity layer omitted). ISO/IEC 15026-4 also provides guidance at the process, activity, and task levels.

C.2 Process view for speciality engineering

C.2.1 General

This example treats the cluster of interests, generally called speciality engineering, which includes but is not limited to such areas as availability, maintainability, reliability, safety, security, human factors, and usability. Within ISO/IEC/IEEE 15288, these "ilities" requirements are referred to as "critical quality characteristics". These characteristics determine how well the product meets its specified requirements in a specific area selected for focus.

NOTE This is a generalized instance of a process view that covers a broad set of functional and non-functional characteristics related to speciality engineering. It provides a broad view across the processes. If a specific critical quality characteristic has a high priority relative to other characteristics, a specific process view can be created for that characteristic, including more detailed information and requirements.

C.2.2 Name: speciality engineering process view

C.2.2.1 Purpose

The purpose of the speciality engineering process view is to provide objective evidence that the system achieves satisfactory levels of certain critical quality characteristics selected for special attention.

C.2.2.2 Outcomes

a) Product critical quality characteristics are selected for special attention.

b) Requirements for the achievement of the critical quality characteristics are defined.

c) Measures for the requirements are selected and related to the desired critical quality characteristics.

d) Approaches for achieving the desired critical quality characteristics are defined and implemented.

e) The extent of achievement of the requirements is continually monitored.

f) The extent of achievement of the critical quality characteristics are specified and developed.

The outcomes permit the possibility that the desired critical quality characteristics cannot be directly measured but instead may be argued and inferred based on other product or process characteristics that can be measured.

C.2.2.3 Processes, activities and tasks

This process view can be implemented using the following processes, activities, and tasks from ISO/ IEC/ IEEE 15288:

NOTE 1 ISO/IEC 25030 can be useful in specifying software product quality requirements.

NOTE 2 INCOSE Systems Engineering Handbook contains descriptions and elaboration about many of the speciality engineering areas and the associated critical quality characteristics.

a) The business and mission analysis process (ISO/IEC/IEEE 15288:2015, 6.4.1) provides for the definition of the problem space and characterization of the solution space, including the relevant trade-space factors and preliminary life cycle concepts. This includes developing an understanding of the context and any key parameters, such as the critical quality characteristics (e.g. security threats, safety hazards, human interfaces, operational characteristics, and system assurance context). Relevant activities and tasks include (b)(1) and (2); (c)(1); and (d)(1)

b) The stakeholder needs and requirements definition process (ISO/IEC/IEEE 15288:2015, 6.4.2) provides for the selection and definition of characteristics, including critical quality characteristics, and associated information items. The activities and the documentation are useful in identifying, prioritizing, defining, and recording requirements for the critical quality characteristics. Relevant activities and tasks include (a)(1) and (2); (b)(2), (3) and (4); (c)(1) and (2); (d) all tasks; and (e)(2).

c) The system requirements definition process (ISO/IEC/IEEE 15288:2015, 6.4.2) provides for the specification of parameters for the critical quality characteristics and the selection of measures for tracking the achievement of these requirements with respect to the specific system to be developed. Relevant activities and tasks include (a)(1); (b) all tasks; and (c)(2).

d) The architecture definition process (ISO/IEC/IEEE 15288:2015, 6.4.4) provides for the identification of stakeholder concerns from an architecture perspective. These concerns often translate into expectations or constraints across the life cycle stages that relate to the critical quality characteristics, such as utilization (e.g. availability, security, effectiveness, usability), support (e.g. reparability, obsolescence management), evolution of the system and of the environment (e.g. adaptability, scalability, survivability), production (e.g. manufacturability, testability), retirement (e.g. environmental impact, transportability). This process further addresses those critical quality characteristic requirements that drive the architecture decisions, including the assessment of the architecture with respect to the concerns and associated characteristics. Relevant activities and tasks include (a)(2) and (4); (b)(1); (c)(2), (3), (4), and (5); (d)(1); and (e)(2),

e) The design definition process (ISO/IEC/IEEE 15288:2015, 6.4.5) provides for the determination of necessary design characteristics, which includes the critical quality characteristics, such as security of design criteria for the speciality characteristics and the evaluation of alternative designs with respect to those criteria. Relevant activities and tasks include (a)(2); (b)(1), (2), (3) (4) and (6); and (c)(2).

f) The system analysis process (ISO/IEC/IEEE 15288:2015, 6.4.6) provides for the level of analysis needed to understand the trade space with respect to the critical quality characteristics through the conduct of mathematical analysis, modelling, simulation, experimentation, and other techniques. The analysis results are input to trades made through the decision management process in support of other technical processes. Relevant activities and tasks include (a) all tasks; and (b) all tasks.

g) The implementation process (ISO/IEC/IEEE 15288:2015, 6.4.7) provides for recording the evidence that critical quality requirements have been met. Relevant activities and tasks include (b)(3).

h) The integration process (ISO/IEC/IEEE 15288:2015, 6.4.8) provides for planning the integration, including the considerations for critical quality characteristics, and the assurance that the

achievement of the characteristics is determined and recorded. Relevant activities and tasks include (a)(1); (b)(3); and (c)(1).

i) The verification process (ISO/IEC/IEEE 15288:2015, 6.4.9), provides for the planning and execution of a strategy to perform verification, including the critical quality characteristics. The selected verification strategy may introduce design constraints that can affect the achievement of the characteristics. Relevant activities and tasks include (a)(1) and (3); (b)(1), (2); and (c)(1) and (2).

j) The transition process (ISO/IEC/IEEE 15288:2015, 6.4.10) provides for installing the system in its operational environment. Because some speciality properties involve a trade-off between design constraints and operational constraints, attention to installation is often important. Relevant activities and tasks include (a)(4); and (b) (4), (6), and (7).

k) The validation process (ISO/IEC/IEEE 15288:2015, 6.4.11) provides evidence that the services provided by the system meet the stakeholders' needs, including the critical quality characteristics. Relevant activities and tasks include (a)(1) and (3); (b)(1) and (2); (c)(1) and (2).

l) The operation process (ISO/IEC/IEEE 15288:2015, 6.4.12) provides for usage of the system. Assuring that critical quality characteristics are appropriately achieved involves monitoring the operation of the system. Relevant activities and task include (b)(3) and (4); (c)(1) and (2); and (d)(1) and (2).

m) The maintenance process (ISO/IEC/IEEE 15288:2015, 6.4.13) sustains the capabilities of the system, helping to ensure its ongoing availability to provide its functions, including its critical quality characteristics. This includes failure analysis, maintenance tasks, and logistics tasks needed to ensure continued operation of the system. Relevant activities and tasks include (b) all tasks; (c) all tasks; and (d)(1) and (2).

n) The disposal process (ISO/IEC/IEEE 15288:2015, 6.4.14) ends the existence of a system. The inherent need to anticipate disposal may place constraints on development. In fact, these constraints may themselves be critical quality characteristics. Relevant activities and tasks include (a)(2); (b)(1) and (2) and (c)(3).

o) The project assessment and control process (ISO/IEC/IEEE 15288:2015, 6.3.2) provides for monitoring the extent of achievement of the requirements and critical quality characteristics and communicating the results to stakeholders and managers. Relevant activities and tasks include (b) (6), (7), (9) and (10).

p) The Decision Management process (ISO/IEC/IEEE 15288:2015, 6.3.3) provides assessment of alternative requirements, architecture characteristics and design characteristics against the decision criteria, including the critical quality characteristics. Results of these comparisons are ranked, via a suitable selection model, and are then used to decide on an optimal solution. Relevant activities and tasks include (b) all tasks; and (c)(1).

q) The risk management process (ISO/IEC/IEEE 15288:2015, 6.3.4), in its entirety, provides for identifying, evaluating, and handling risks of the system, including those related to meeting the critical quality characteristics.

r) The information management process (ISO/IEC/IEEE 15288:2015, 6.3.6), in its entirety, provides for the specification, development and maintenance of information items for documenting and communicating the extent of achievement. It should be noted that information items used for the purpose of critical quality characteristics are sometimes specialized in nature. Sources for the description of these information items include industry associations, regulators, and specific standards.

s) The measurement process (ISO/IEC/IEEE 15288:2015, 6.3.7), in its entirety, provides for defining an approach that relates measures to the required critical quality characteristics.

t) The quality assurance process (ISO/IEC/IEEE 15288:2015, 6.3.8) addresses identified anomalies (incident and problems) that relate to the achievement of critical quality characteristics.

Bibliography

[1] ISO 9000, *Quality management systems — Fundamentals and vocabulary*

[2] ISO 9241-220, *Ergonomics of human-system interaction — Part 220: Processes for enabling, executing and assessing human-centred design within organizations*

[3] ISO/IEC 25030, *Systems and software engineering — Systems and software quality requirements and evaluation (SQuaRE) — Quality requirements framework*

[4] ISO/IEC 33001:2015, *Information technology — Process assessment — Concepts and terminology*

[5] ISO/IEC 33020, *Information technology — Process assessment — Process measurement framework for assessment of process capability*

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

[7] ISO/IEC/IEEE 15026-1:2019, *Systems and software engineering — Systems and software assurance — Part 1: Concepts and vocabulary*

[8] ISO/IEC 15026-4, *Systems and software engineering — Systems and software assurance — Part 4: Assurance in the life cycle*

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

[10] ISO/IEC/IEEE 15289:2019, *Systems and software engineering — Content of life-cycle information items (documentation)*

[11] ISO/IEC/IEEE 15939, *Systems and software engineering — Measurement process*

[12] ISO/IEC/IEEE 16085, *Systems and software engineering — Life cycle processes — Risk management*

[13] ISO/IEC/IEEE 21840, *Systems and software engineering — Guidelines for the utilization of ISO/IEC/IEEE 15288 in the context of system of systems (SoS)*

[14] ISO/IEC/IEEE 24748-1:2018, *Systems and software engineering — Life cycle management — Part 1: Guidelines for life cycle management*

[15] ISO/IEC/IEEE 24748-3:2020, *Systems and software engineering — Life cycle management — Part 3: Guidelines for the application of ISO/IEC/IEEE 12207 (software life cycle processes)*

[16] ISO/IEC/IEEE 24765, *Systems and software engineering — Vocabulary*

[17] ISO/IEC/IEEE 26511:2018, *Systems and software engineering — Requirements for managers of information for users of systems, software, and services*

[18] ISO/IEC/IEEE 26513:2017, *Systems and software engineering — Requirements for testers and reviewers of information for users*

[19] ISO/IEC/IEEE 29119-2, *Systems and software engineering – Software testing – Part 2: Test processes*

[20] ISO/IEC/IEEE 42010, *Systems and software engineering —Architecture description*

[21] ISO/IEC/IEEE 42020:2019, *Software, systems and enterprise — Architecture processes*

[22] ISO/IEC/IEEE 82079-1, *Preparation of information for use (instructions for use) of products*

[23] ISO/PAS 19450, *Automation systems and integration — Object-Process Methodology*

[24] INCOSE Systems Engineering Handbook: *A Guide for System Life Cycle Processes and Activities, version 4.0. Hoboken, NJ, USA: John Wiley and Sons, Inc*

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Abstract

A number of international, national and industry standards describe processes and process models. Process models are developed for a range of purposes including process implementation and assessment. In order for users of standards to select the appropriate forms of process description and apply them in a consistent fashion, it is desirable to develop a common characterization of all of these forms of process description. This document presents requirements for the description of processes in terms of their format, content and level of prescription. Because of the wide usage of process descriptions, process elements are categorized as "Required" or "Optional".

Although developed within ISO/IEC/JTC1/SC7 – Systems and software engineering, the requirements of this document can be applied to any process model or description developed for any purpose.

ICS 35.080; 35.080

ISBN 978-1-5044-7495-5 STD24656 (PDF); 978-1-5044-7496-2 STDPD24656 (Print)

Price based on 28 pages