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BS ISO/IEC 12207:2008

Systems and software engineering — Software life cycle processes

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National foreword

This British Standard is the UK implementation of ISO/IEC 12207:2008. It supersedes BS ISO/IEC 12207:1995 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee IST/15, Software and systems engineering.

In the opinion of the UK committee, this version of BS ISO/IEC 12207 is an improvement on the previous version and its amendment. In addition, this revised version includes an interpretation of the concepts of ISO/IEC 15288 for software intensive systems.

This standard covers the complete systems life cycle for software and software intensive systems; however, it does not address many aspects of the management of IT services and so, in the opinion of the UK committee, it is not applicable to the operation or service management of the following:

- IT services, application services, IT infrastructure services;
- service management systems;
- IT service management.

Standards that cover the management of IT and IT Services are ISO/IEC 20000, *Information technology – Service management*, the ISO/IEC 27000 series, and ISO/IEC 19770, *Software asset management*.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Systems and software engineering — Software life cycle processes

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

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ISO/IEC 12207:2008(E)
IEEE Std 12207™-2008
(Revision of
IEEE/EIA 12207.0-1996)

Systems and software engineering — Software life cycle processes

Sponsor

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Abstract: This International Standard establishes a common framework for software life cycle processes, with well-defined terminology, that can be referenced by the software industry. It applies to the acquisition of systems and software products and services, to the supply, development, operation, maintenance, and disposal of software products and the software portion of a system, whether performed internally or externally to an organization. Those aspects of system definition needed to provide the context for software products and services are included. Software includes the software portion of firmware. This revision integrates ISO/IEC 12207:1995 with its two amendments and was coordinated with the parallel revision of ISO/IEC 15288:2002 (System life cycle processes) to align structure, terms, and corresponding organizational and project processes. This standard may be used stand alone or jointly with ISO/IEC 15288, and supplies a process reference model that supports process capability assessment in accordance with ISO/IEC 15504-2 (Process assessment). An annex provides support for IEEE users and describes relationships of this International Standard to IEEE standards.

Keywords: acquisition, agreement, assessment, audit, configuration management, development, maintenance, disposal, operation, process reference model, process improvement, quality assurance, retirement, supply, validation, verification

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International Standard ISO/IEC 12207:2008(E)

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

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 document 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 12207 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

This second edition cancels and replaces the first edition (ISO/IEC 12207:1995), which has been technically revised. It also incorporates the Amendments ISO/IEC 12207:1995/Amd.1:2002 and ISO/IEC 12207:1995/Amd.2:2004.

Changes in this revision of ISO/IEC 12207 were developed in conjunction with a corresponding revision of ISO/IEC 15288. The purpose of these revisions is to better align the two International Standards to facilitate their joint use. This alignment is the first step toward harmonization of the structures and contents of the two International Standards, while supporting the requirements of the assessment community. This alignment provides the foundation to facilitate evolution to an integrated and fully harmonized treatment of life cycle processes. This International Standard was developed with the following goals:

— incorporate and rationalize both Amendments;

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

— where applicable, provide common process names and process structure between the revision of the ISO/IEC 15288 and this International Standard;

— enable the user community to evolve towards fully harmonized standards and to provide a stable standard, while maximizing backward compatibility; and

— leverage ten years of experience with the development and use of ISO/IEC 12207 and ISO/IEC 15288.

A subsequent revision is intended to achieve a fully harmonized view of the system and software life cycle processes. Identified areas to address in the future include: common process purposes and outcomes, architecture of the standards, level of prescription of activities and tasks, life cycle treatments, treatment of products and services, common verification and validation concepts, common configuration management concepts, deferred recommendations and alignment with other applicable standards.

The IEEE Computer Society collaborated with ISO/IEC JTC 1 in the development of this International Standard. *IEEE/EIA 12207.0-1996, Industry Implementation of International Standard ISO/IEC 12207:1995 Standard for Information Technology – Software Life Cycle Processes*, was one of the base documents used in the development of this International Standard.

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Introduction

ISO/IEC 12207 was published on 1 August 1995 and was the first International Standard to provide a comprehensive set of life cycle processes, activities and tasks for software that is part of a larger system, and for stand alone software products and services. That International Standard was followed in November 2002 by ISO/IEC 15288 which addressed system life cycle processes. The ubiquity of the software meant that the software and its design processes should not be considered separately from those systems, but be considered as an integral part of the system and system design processes. The ISO/IEC 12207 Amendments in 2002 and 2004 added process purpose and outcomes to the International Standard and established a Process Reference Model in accordance with the requirements of ISO/IEC 15504-2.

This International Standard, a revision of the amended ISO/IEC 12207, is an initial step in the SC7 harmonization strategy to achieve a fully integrated suite of system and software life cycle processes and guidance for their application.

This revision integrates ISO/IEC 12207:1995 with its two Amendments and applies SC7 guidelines for process definition to support consistency and improved usability. Project execution was carefully coordinated with the parallel revision of ISO/IEC 15288:2002 to align structure, terms, and corresponding organizational and project processes.

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 set of life cycle processes to its provisions.

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

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

— By organizations and assessors — to perform assessments that may be used to support organizational process improvement.

This International Standard contains requirements in four Clauses: Clause 6, which defines the requirements for the system life cycle processes, Clause 7, which defines the requirements for specific software life cycle processes, clauses of Annex A, which provides requirements for tailoring of this International Standard and clauses of Annex B, which provides a Process Reference Model (PRM) which may be used for assessment purposes.

Five informative annexes support the harmonization strategy initiated by this revision.

— Annex C expands on history and rationale for the changes, and provides high-level traceability among the International Standards which were used as the inputs to this revision.

— Annex D describes the alignment of the processes of ISO/IEC 15288 and ISO/IEC 12207 — a key focus of this revision.

— Annex E provides an example of a process view for Usability, intended to illustrate how a project might assemble processes, activities and tasks of ISO/IEC 12207 to provide focused attention to the achievement of product characteristics that have been selected as being of special interest.

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— Annex F contains some example process descriptions that are considered useful to some readers of this International Standard.

— Annex G provides support for IEEE users and describes relationships of this International Standard to IEEE standards.

Readers of this International Standard are advised to consult Clause 5 to gain understanding of the key concepts used.

NOTE A future Technical Report (ISO/IEC TR 24748) will describe the relations between this International Standard and ISO/IEC 15288:2008.

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IEEE Introduction

This introduction is not part of IEEE Std 12207™-2008, Systems and Software Engineering—Software Life Cycle Processes.

IEEE Std 12207™-2008 and IEEE Std 15288™-2008 are identical to ISO/IEC 12207:2008 and ISO/IEC 15288:2008. Therefore, all references to ISO/IEC 12207 or ISO/IEC 15288 apply equally well to their IEEE counterparts. Further details regarding relationships to IEEE standards can be found in Annex G.

This standard replaces IEEE/EIA 12207.0-1996, *Industry Implementation of International Standard ISO/IEC 12207: 1995 Standard for Information Technology – Software Life Cycle Processes*, which was an adoption with changes of ISO/IEC 12207:1995. Users of the earlier standard may be interested to know what will happen to its companions, IEEE/EIA 12207.1-1996 and IEEE/EIA 12207.2-1997. There is currently a project underway to replace IEEE/EIA 12207.1 with an adoption of ISO/IEC 15289. Completion of the current project will render IEEE/EIA 12207.2 obsolete; it will probably be withdrawn unless there is a demonstration of interest to revise it.

The original ISO/IEC 12207 was published on 1 August 1995 and was the first international standard to provide a comprehensive set of life cycle processes, activities and tasks for software that is part of a larger system, and for stand alone software products and services. That international standard was followed in November 2002 by ISO/IEC 15288 which addressed system life cycle processes.

IEEE cooperated with the Electronic Industries Alliance (EIA) in adopting ISO/IEC with changes to become IEEE/EIA 12207-1996. In 2004, IEEE performed an identical adoption of ISO/IEC 15288:2002.

The ISO/IEC 12207 amendments in 2002 and 2004 added process purpose and outcomes to the International Standard and established a Process Reference Model in accordance with the requirements of ISO/IEC 15504-2. IEEE did not pick up these amendments, preferring a stable base for the users of its standard.

This new revision of ISO/IEC 12207 is the product of a coordinated effort by IEEE and ISO/IEC JTC 1/SC 7. The base documents for the revision included the ISO/IEC standard and its amendments, and the IEEE/EIA standard and its unique material.

This revision integrates ISO/IEC 12207:1995 with its two Amendments and applies SC7 guidelines for process definition to support consistency and improved usability. Project execution was carefully coordinated with the parallel revision of ISO/IEC 15288:2002 to align structure, terms, and corresponding organizational and project processes.

This revised standard is a step in the SC7 harmonization strategy to achieve a fully integrated suite of system and software life cycle processes and guidance for their application. It is also an important step in the shared strategy of ISO/IEC JTC 1/SC 7 and the IEEE to harmonize their respective collections of standards. The new editions of ISO/IEC 12207 and ISO/IEC 15288, and their identical IEEE editions, will provide a single, shared baseline of systems and software life cycle processes applicable to both ISO/IEC and the IEEE standards collections.

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Systems and software engineering — Software life cycle processes

1 Overview

1.1 Scope

This International Standard establishes a common framework for software life cycle processes, with well-defined terminology, that can be referenced by the software industry. It contains processes, activities, and tasks that are to be applied during the acquisition of a software product or service and during the supply, development, operation, maintenance and disposal of software products. Software includes the software portion of firmware.

This International Standard applies to the acquisition of systems and software products and services, to the supply, development, operation, maintenance, and disposal of software products and the software portion of a system, whether performed internally or externally to an organization. Those aspects of system definition needed to provide the context for software products and services are included.

This International Standard also provides a process that can be employed for defining, controlling, and improving software life cycle processes.

The processes, activities and tasks of this International Standard—either alone or in conjunction with ISO/IEC 15288—may also be applied during the acquisition of a system that contains software.

1.2 Purpose

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

This International Standard is written for acquirers of systems and software products and services and for suppliers, developers, operators, maintainers, managers, quality assurance managers, and users of software products.

This International Standard is intended for use in a two-party situation and may be equally applied where the two parties are from the same organization. The situation may range from an informal agreement up to a legally binding contract. The International Standard may be used by a single party through a self-imposed set of processes. This clause does not prevent the use of ISO/IEC 12207 by suppliers or developers of off-the-shelf software.

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. The International Standard may require development of documents of similar class or type; various plans are an example. The International Standard, however, does not imply that such documents be developed or packaged separately or combined in some fashion. These decisions are left to the user of the International Standard.

NOTE ISO/IEC 15289 addresses the content for life cycle process information items (documentation).

This International Standard does not prescribe a specific system or software life cycle model, development methodology, method, model or technique. The parties of the International Standard are responsible for

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selecting a life cycle model for the software project and mapping the processes, activities, and tasks in this International Standard onto that model. The parties are also responsible for selecting and applying the software development methods and for performing the activities and tasks suitable for the software project.

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 Clauses 6 and 7 and Annex A. This International Standard provides requirements for a number of processes suitable for usage during the life cycle of a software product or service. 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

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

NOTE 1 When this International Standard is used to help develop an agreement between an acquirer and a supplier, clauses of this International Standard can be selected for incorporation in the agreement with or without modification. In this case, it is more appropriate for the acquirer and supplier to claim compliance with the agreement than conformance with this International Standard.

NOTE 2 Any organization (for example, national, industrial association, company) imposing this International Standard, as a condition of trade, should specify and make public the minimum set of required processes, activities, and tasks, which constitute suppliers' conformance with this International Standard.

NOTE 3 Requirements of this International Standard are marked by the use of the verb "shall." Recommendations are marked by the use of the verb "should". Permissions are marked by the use of the verb "may".

3 Normative references

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4 Terms and definitions

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

4.1
acquirer
stakeholder that acquires or procures a product or service from a supplier

NOTE The acquirer could be one of the following: buyer, customer, owner, purchaser.

4.2
acquisition
process of obtaining a system, software product or software service

4.3
activity
set of cohesive tasks of a process

4.4
agreement
mutual acknowledgement of terms and conditions under which a working relationship is conducted

4.5
audit
independent assessment of software products and processes conducted by an authorized person in order to assess compliance with requirements

4.6
baseline
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

4.7
configuration item
entity within a configuration that satisfies an end use function and that can be uniquely identified at a given reference point

4.8
contract
binding agreement between two parties, especially enforceable by law, or a similar internal agreement wholly within an organization

4.9
customer
organization or person that receives a product or service

NOTE 1 A customer can be internal or external to the organization.

NOTE 2 Adapted from ISO 9000: 2005.

NOTE 3 Other terms commonly used for customer are acquirer, buyer, and purchaser.

4.10
developer
organization that performs development tasks (including requirements analysis, design, testing through acceptance) during a life cycle process

NOTE In this International Standard, the terms developer and implementer are synonymous.

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4.11
enabling system
system that supports a system-of-interest during its life cycle stages but does not necessarily contribute directly to its function during operation

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

4.12
evaluation
systematic determination of the extent to which an entity meets its specified criteria

4.13
facility
physical means or equipment for facilitating the performance of an action, e.g. buildings, instruments, tools

4.14
firmware
combination of a hardware device and computer instructions or computer data that reside as read-only software on the hardware device

NOTE The software cannot be readily modified under program control.

4.15
implementer
organization that performs implementation tasks

NOTE In this International Standard, the terms developer and implementer are synonymous.

4.16
life cycle
evolution of a system, product, service, project or other human-made entity from conception through retirement

4.17
life cycle model
framework of processes and activities concerned with the life cycle that may be organized into stages, which also acts as a common reference for communication and understanding

4.18
maintainer
organization that performs maintenance activities

4.19
monitoring
examination of the status of the activities of a supplier and of their results by the acquirer or a third party

4.20
non-deliverable item
hardware or software product that is not required to be delivered under the contract but may be employed in the development of a software product

4.21
off-the-shelf
<product> already developed and available

4.22
operator
entity that performs the operation of a system

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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 In the context of this specific definition, the term entity means an individual or an organization.

4.23
organization
person or a group of people and facilities with an arrangement of responsibilities, authorities and relationships

NOTE 1 Adapted from ISO 9000:2005.

NOTE 2 A body of persons organized for some specific purpose, such as a club, union, corporation, or society is an organization.

NOTE 3 An identified part of an organization (even as small as a single individual) or an identified group of organizations can be regarded as an organization if it has responsibilities, authorities and relationships.

NOTE 4 A form of an organizational entity is often called an enterprise, so the organizational aspects of this International Standard would apply to an enterprise as well.

4.24
party
organization entering into a contract

NOTE In this International Standard, the agreeing parties are called the acquirer and the supplier.

4.25
process
set of interrelated or interacting activities which transforms inputs into outputs

[ISO 9000:2005]

4.26
process purpose
high level objective of performing the process and the likely outcomes of effective implementation of the process

NOTE The implementation of the process should provide tangible benefits to the stakeholders.

4.27
process outcome
observable result of the successful achievement of the process purpose

NOTE An outcome statement describes one of the following:

- production of an artefact;
- a significant change in state;
- meeting of specified constraints, e.g., requirements, goals, etc.

4.28
product
result of a process

[ISO 9000:2005]

4.29
project
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 9000:2005.

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

4.30
project portfolio
collection of projects that addresses the strategic objectives of the organization

4.31
qualification
process of demonstrating whether an entity is capable of fulfilling specified requirements

4.32
qualification requirement
set of criteria or conditions that have to be met in order to qualify a software product as complying with its specifications and being ready for use in its target environment or integration with its containing system

4.33
qualification testing
testing, conducted by the developer and witnessed by the acquirer (as appropriate), to demonstrate that a software product meets its specifications and is ready for use in its target environment or integration with its containing system

4.34
quality assurance
all the planned and systematic activities implemented within the quality system, and demonstrated as needed, to provide adequate confidence that an entity will fulfil requirements for quality

NOTE 1 There are both internal and external purposes for quality assurance:

a) Internal quality assurance: within an organization, quality assurance provides confidence to management;

b) External quality assurance: in contractual situations, quality assurance provides confidence to the customer or others.

NOTE 2 Some quality control and quality assurance actions are interrelated.

NOTE 3 Unless requirements for quality fully reflect the needs of the user, quality assurance may not provide adequate confidence.

4.35
release
particular version of a configuration item that is made available for a specific purpose (for example, test release)

4.36
request for proposal
tender
document used by the acquirer as the means to announce its intention to potential bidders to acquire a specified system, software product or software service

4.37
resource
asset that is utilized or consumed during the execution of a process

4.38
retirement
withdrawal of active support by the operation and maintenance organization, partial or total replacement by a new system, or installation of an upgraded system

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4.39
security
protection of information and data so that unauthorized persons or systems cannot read or modify them and authorized persons or systems are not denied access to them

4.40
service
performance of activities, work, or duties associated with a product

4.41
software item
item
source code, object code, control code, control data, or a collection of these items

NOTE A software item can be viewed as a system element of ISO/IEC 15288:2008.

4.42
software product
set of computer programs, procedures, and possibly associated documentation and data

4.43
software unit
separately compilable piece of code

4.44
stage
period within the life cycle of an entity that relates to the state of its description or realization

NOTE 1 As used in this International Standard, stages relate to major progress and achievement milestones of the entity through its life cycle.

NOTE 2 Stages may be overlapping.

4.45
stakeholder
individual or organization having a right, share, claim or interest in a system or in its possession of characteristics that meet their needs and expectations

4.46
statement of work
document used by the acquirer as the means to describe and specify the tasks to be performed under the contract

4.47
supplier
organization or individual that enters into an agreement with the acquirer for the supply of a product or service

NOTE 1 The "supplier" could be a contractor, producer, seller, or vendor.

NOTE 2 Sometimes the acquirer and the supplier are part of the same organization.

4.48
system
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.

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4.49
system element
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. A system element can be hardware, software, data, humans, processes (e.g. processes for providing service to users), procedures (e.g., operator instructions), facilities, materials, and naturally occurring entities (e.g., water, organisms, minerals), or any combination.

4.50
task
requirement, recommendation, or permissible action, intended to contribute to the achievement of one or more outcomes of a process

4.51
test coverage
extent to which the test cases test the requirements for the system or software product

4.52
testability
extent to which an objective and feasible test can be designed to determine whether a requirement is met

4.53
user
individual 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.

4.54
validation
confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled

[ISO 9000:2005]

NOTE Validation in a 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.

4.55
verification
confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

[ISO 9000:2005]

NOTE Verification in a life cycle context is a set of activities that compares a product of the 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.

4.56
version
identified instance of an item

NOTE Modification to a version of a software product, resulting in a new version, requires configuration management action.

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5 Application of this International Standard

This clause presents an overview of the software life cycle processes that can be employed to acquire, supply, develop, operate, maintain, and dispose of software products and services. The objective is to provide a road map for the users of this International Standard so that they can orient themselves in it and apply it judiciously.

5.1 Key concepts of this International Standard

This subclause introduces key concepts useful in reading and applying this International Standard. In a few cases, commonly used words are used in a special way in this International Standard. This subclause will also describe those special usages. Further elaboration of these concepts can be found in ISO/IEC TR 15271, *A Guide for the application of ISO/IEC 12207 Software life cycle processes*.

NOTE A future Technical Report (ISO/IEC TR 24748, *Guide for life cycle management*) will also provide further elaboration.

5.1.1 Relationship of software products and software services

In general, this International Standard applies to both software products and software services. The provisions of specific processes state their applicability.

NOTE ISO/IEC 20000 provides processes, requirements, and guidance to service providers for the delivery of managed services.

5.1.2 Relationship between systems and software

This International Standard establishes a strong link between a system and its software. It is based upon the general principles of systems engineering. Software is treated as an integral part of the total system and performs certain functions in that system. This is implemented by extracting the software requirements from the system requirements and design, producing the software, and integrating it into the system. It is a fundamental premise of this standard that software always exists in the context of a system, even if the system consists of only the processor upon which the software is executed. Therefore, a software product or service is always treated as one item in a system. For example, the standard makes a distinction between system requirements analysis and software requirements analysis, because, in the general case, system architectural design will allocate the system requirements to various items of the system and software requirements analysis will derive software requirements from the system requirements allocated to each software item. Of course, in some cases, the non-software items of a system may be so minimal that it may not be necessary to perform distinct system and software analyses.

This standard has a strong relationship with ISO/IEC 15288:2008, *System Life Cycle Processes*, and may be used in conjunction with it. In many cases, the processes of this International Standard directly correspond to processes of ISO/IEC 15288 but with some specialization for software products and services. A notable example is that the Software Implementation process of this standard is a specialization — a detailed specialization — of the Implementation Process of ISO/IEC 15288.

In the case where the system has important non-software elements, an organization may wish to apply ISO/IEC 15288 to provide the appropriate life cycle processes. For each software element of the system, the organization would apply the Software Implementation Process of this standard to create the software element.

In the case where the non-software portions of the system are minimal, an organization may wish to apply this standard without reference to ISO/IEC 15288. This standard contains the additional system-level process — albeit specialized to the needs of software — to provide the minimum appropriate system context for the software.

When applying this standard in conjunction with ISO/IEC 15288, one minor mismatch in terminology must be considered. ISO/IEC 15288 decomposes a system into a set of system "elements". Some of those elements may be determined to be software products to be implemented using this standard. This standard uses the term "item" to refer to a major element of the system. In short, this standard uses the term "item" where ISO/IEC 15288 would use the term "element of software".

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Some of the items may eventually be designated as being subject to configuration management; they are then called "configuration items". The Software Architectural Design Process transforms items into "components" and the Software Detailed Design Process refines components into "units".

5.1.3 Organizations and parties

In this standard, the terms "organization" and "party" are closely related. An organization is a body of persons with identified responsibilities and authorities organized for some specific purpose, such as a club, union, corporation, or society. When an organization, as a whole or a part, enters into a contract, it is a party. Parties may be from the same organization or from separate organizations. An individual is an example of an organization, if the individual is assigned responsibilities and authorities.

An organization or a party derives its name from the process for which it is responsible. For example, it is called an acquirer when it performs the Acquisition Process. So, when the following terms are used in this standard, they do not have their generic meaning, but instead, refer to the organization or party responsible for executing the process with a similar name: acquirer, supplier, implementer, maintainer, and operator.

A few other terms are applied to organizations in this standard: "user" can be the organization that benefits from the utilization of the software product or service; "customer" refers to the user and acquirer collectively; and "stakeholder" refers to an organization with an interest in the success of the project.

The processes and organizations (or parties) are only related functionally. The standard does not dictate or imply a structure for an organization (or a party).

The processes in this standard form a comprehensive set to serve various organizations. An organization, small or large, depending on its business purpose or its acquisition strategy, can select an appropriate set of the processes (and associated activities and tasks) to fulfil that purpose. An organization may perform one process or more than one process. Under one contract or application of this standard, a given party should not perform both the Acquisition Process and the Supply Process, but it can perform other processes. A process may be performed by one organization or more than one organization. An example of a process performed by more than one organization is the Software Review process.

This standard is intended to be applied by an organization internally or externally by two or more organizations. When applied internally, the two agreeing parties typically act under the terms of an agreement that may vary in formality under different circumstances. When applied externally, the two agreeing parties typically act under the terms of a contract. In order to facilitate application of this standard either internally or contractually, the tasks are expressed in contractual language. When applied internally, the contractual language is to be interpreted as self-imposed discipline.

For the purpose of this standard, any project is assumed to be conducted within the context of an organization. This is important because a software project is dependent upon various outcomes produced by the business processes of the organization, e.g., employees to staff the project and facilities to house the project. For this purpose, this standard provides a set of “Organizational Project-Enabling” processes. These processes are not assumed to be adequate to operate a business, nor is any individual Project Process assumed to be completely defined. Instead, the processes, considered as a collection, are intended to state the minimum set of dependencies that the project places upon the organization

5.1.4 Organization-level and project-level adoption

Modern software businesses strive to develop a robust set of software life cycle processes that are applied repeatedly to the software projects of the business. Therefore, this standard is intended to be useful for adoption at either the organization level or at the project level. An organization would adopt the standard and supplement it with appropriate procedures, practices, tools and policies. A software project of the organization would typically conform to the organization's processes rather than conform directly to this standard.

In some cases, projects may be executed by an organization that does not have an appropriate set of processes adopted at the organizational level. Such a project may apply the provisions of this standard directly to the project.

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5.1.5 Tailoring

Annex A, which is normative, defines the basic activities needed to perform tailoring of this International Standard.

It should be noted that tailoring may diminish the perceived value of a claim of conformance to this standard. This is because it is difficult for other organizations to understand the extent to which tailoring may have deleted desirable provisions. An organization asserting a single-party claim of conformance to this standard may find it advantageous to claim absolute conformance to a smaller list of processes rather than tailored conformance to a larger list of processes.

5.1.6 Temporal relationships among the processes

In this standard, the processes and their activities and tasks are arranged in a sequence suitable for exposition. This positional sequence does not prescribe or dictate any time-dependent sequence. For lack of consensus on or use of a universal time-dependent sequence, the user of this standard may select and order the processes, activities, and tasks as appropriate and effective. This standard encourages iteration among the activities and recursion within an activity to offset the effects of any implied sequence of activities and tasks. The parties of this standard are responsible for selecting a life cycle model for the project and mapping the processes, activities, and tasks onto that model.

5.1.7 Evaluation versus verification, and validation

Organizations that are involved in any process of the life cycle conduct evaluations of the products of that task. The Software Verification and Software Validation processes provide the opportunity for additional evaluations. These processes are conducted by the acquirer, the supplier, or an independent party to verify and validate the products in varying depth depending on the project. These evaluations do not duplicate or replace other evaluations, but supplement them. Additional opportunities for evaluation are provided by the Software Review, Software Audit, Software Quality Assurance and the Life Cycle Model Management Processes.

5.1.8 Criteria for processes

This standard establishes a framework for the life cycle of software. The life cycle begins with an idea or a need that can be satisfied wholly or partly by software and ends with the retirement of the software. The architecture is built with a set of processes and interrelationships among these processes. The determination of the life cycle processes is based upon two basic principles: cohesion and responsibility.

> Cohesion: The life cycle processes are cohesive and coupled to the optimum extent deemed practical and feasible.
>
> Responsibility: A process is placed under the responsibility of an organization or a party in the software life cycle.

5.1.9 Description of processes

The processes of this standard are described in a manner that is similar to ISO/IEC 15288 in order to facilitate the use of both standards in a single organization or project.

Each process of this standard is described in terms of the following attributes:

— The title conveys the scope of the process as a whole

— The purpose describes the goals of performing the process

— The outcomes express the observable results expected from the successful performance of the process

— The activities are a list of actions that are used to achieve the outcomes

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— The tasks are requirements, recommendations, or permissible actions intended to support the achievement of the outcomes.

Additional detail regarding this form of description can be found in ISO/IEC 24774, *System and Software Engineering — Life Cycle Management — Guidelines for process definition*.

5.1.10 General Characteristics of processes

The attributes described in subclause 5.1.9 characterize the specificity of each process. When an implemented process conforms to these attributes, the process' specifically defined purpose and outcomes are achieved through the implementation of its defined activities.

In addition to these basic attributes, processes may be characterized by other attributes common to all processes. ISO/IEC 15504-2 identifies common process attributes which characterize 6 levels of achievement within a measurement framework for process capability. Annex B of this International Standard includes the list of process attributes which contribute to the achievement of higher levels of process capability as defined in ISO/IEC 15504-2.

5.1.11 Decomposition of processes

Each process of this standard satisfies the criteria described above. For the purpose of clear description, processes are sometimes decomposed into smaller pieces. Some processes are decomposed into activities and/or lower-level processes. A lower-level process is described when the decomposed portion of the process itself satisfies the criteria to be a process. An activity is used when the decomposed unit does not qualify as a process. An activity can be considered as simply a collection of tasks (see below).

It is sometimes useful to decompose processes into lower-level processes at a finer level of detail. Some lower-level processes are described solely for the purpose of assessment. These lower-level processes are not described in the body of the standard, but are provided in an annex. In each case, the lower-level assessment process described in the annex is an elaboration of one activity of the associated process in the body of the standard.

A task is expressed in the form of a requirement, recommendation, or permissible action, intended to support the achievement of the outcomes of a process. For this purpose, this standard carefully employs certain auxiliary verbs (shall, should, and may) to differentiate between the distinct forms of a task. "Shall" is used to express a provision required for conformance, "should" to express a recommendation among other possibilities, and "may" to indicate a course of action permissible within the limits of this standard.

Additional informative material is provided in the form of non-normative notes or non-normative annexes.

5.1.12 Life cycle models and stages

The life of a system or a software product can be modelled by a life cycle model consisting of stages. Models may be used to represent the entire life from concept to disposal or to represent the portion of the life corresponding to the current project. The life cycle model is comprised of a sequence of stages that may overlap and/or iterate, as appropriate for the project's scope, magnitude, complexity, changing needs and opportunities. Each stage is described with a statement of purpose and outcomes. The life cycle processes and activities are selected and employed in a stage to fulfil the purpose and outcomes of that stage. Different organizations may undertake different stages in the life cycle. However, each stage is conducted by the organization responsible for that stage with due consideration of the available information on life cycle plans and decisions made in preceding stages. Similarly, the organization responsible for that stage records the decisions made and records the assumptions regarding subsequent stages in the life cycle.

This International Standard does not require the use of any particular life cycle model. However, it does require that each project define a suitable life cycle model, preferably one that has been defined by the organization for use on a variety of projects. Application of a life cycle model provides the means to establish the time-dependent sequence necessary for project management.

Furthermore, this International Standard does not require the use of any particular set of stages. An example set of stages for the life cycle of a system includes: concept, development, production, utilization, support and

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retirement. An example set of stages for the life cycle of a software product is development, operation and maintenance.

Various types or classes of life cycle models have been described. Examples of these types are known by names such as waterfall, incremental development, evolutionary development, and spiral. It should be noted that simply selecting the name of a type of model does not satisfy the requirement to define a model comprised of stages with defined purpose and outcomes accomplished via the processes of this International Standard.

NOTE A future Technical Report (ISO/IEC TR 24748) provides additional detail regarding life cycle models and stages.

5.2 Organization of this International Standard

5.2.1 Categories of Life Cycle Processes

This International Standard groups the activities that may be performed during the life cycle of a software system into seven process groups. Each of the life cycle processes within those groups is described in terms of its purpose and desired outcomes and lists activities and tasks which need to be performed to achieve those outcomes.

a) Agreement Processes — two processes (subclauses 5.2.2.1.1 and 6.1)

b) Organizational Project-Enabling Processes — five processes (subclauses 5.2.2.1.2 and 6.2)

c) Project Processes — seven processes (subclauses 5.2.2.1.3 and 6.3)

d) Technical Processes — eleven processes (subclauses 5.2.2.1.4 and 6.4)

e) Software Implementation Processes — seven processes (subclauses 5.2.2.2.1and 7.1)

f) Software Support Processes — eight processes (subclauses 5.2.2.2.2 and 7.2)

g) Software Reuse Processes — three processes (subclauses 5.2.2.2.3 and 7.3)

The purposes and outcomes of the life cycle processes constitute a Process Reference Model.

Within this International Standard clauses numbering:

— 6.a and 7.a denote a process group

— 6.a.b and 7.a.b denote a process (or lower-level process) within that group

— 6.a.b.1 and 7.a.b.1 describe the purpose of the process

— 6.a.b.2 and 7.a.b.2 describe the outcome of the process

— 6.a.b.3.c and 7.a.b.3.c list activities of the process and clauses

— 6.a.b.3.c.d and 7.a.b.3.c.d list tasks of the activity 'c'

These life cycle process groups are introduced below and depicted in Figure 1.

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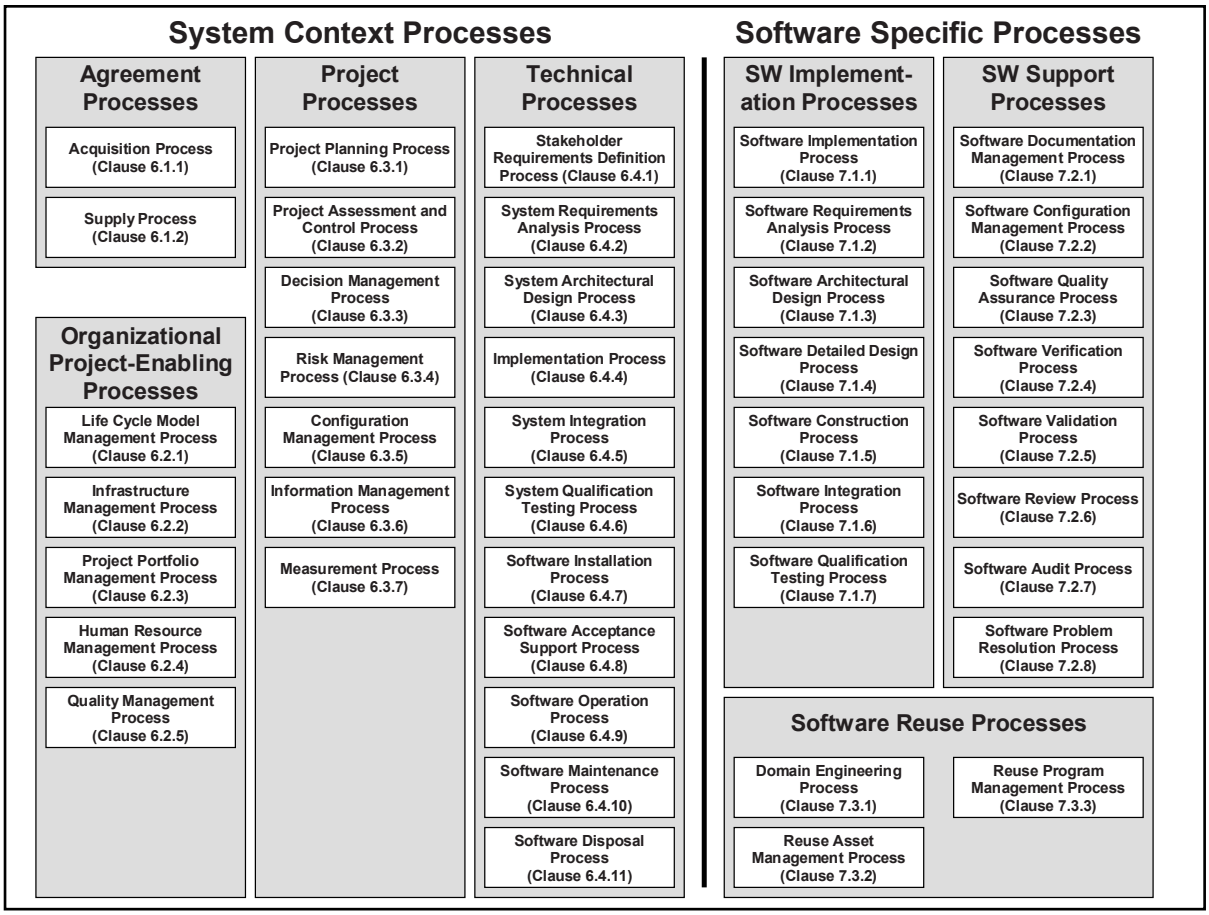

Figure 1 — Life Cycle Process groups

The Process Reference Model does not represent a particular process implementation approach nor does it prescribe a system/software life cycle model, methodology or technique. Instead the reference model is intended to be adopted by an organization based on its business needs and application domain. The organization's defined process is adopted by the organization's projects in the context of the customer requirements.

Process outcomes are used to demonstrate successful achievement of the purpose of a process. This helps process assessors to determine the capability of the organization's implemented process and to provide source material to plan organizational process improvement.

5.2.2 Summary of Life Cycle Processes

There are two major sub-divisions of process in this International Standard. Clause 6 provides a system context for dealing with a standalone software product or service or a software system. Clause 7 contains the software-specific processes for use in implementing a software product or service that is an element of a larger system.

To aid the concurrent use of ISO/IEC 15288 and ISO/IEC 12207, corresponding processes of Clause 6 have the same subclause number (at the 6.x.x level).

In general, the collection of processes provided in this International Standard are software-appropriate specializations, or contributions to the outcomes of the processes provided in ISO/IEC 15288. Many of the ISO/IEC 15288 processes seem similar to software-specific process implementations, but they preserve crucial distinctions based on the purpose, outcomes and audiences. Users of both ISO/IEC 15288 and ISO/IEC 12207 should be sure to consider the distinct explanations and notes in each specific process.

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5.2.2.1 System Context Processes

5.2.2.1.1 Agreement Processes

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.

In general, the Agreement Processes provided in this International Standard are software-appropriate specializations of the Agreement Processes provided in ISO/IEC 15288.

5.2.2.1.2 Organizational Project-Enabling Processes

The Organizational Project-Enabling 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 management of the organization's business.

The Organizational Project-Enabling Processes consist of the following:

a) Life Cycle Model Management Process;

b) Infrastructure Management Process;

c) Project Portfolio Management Process;

d) Human Resource Management Process;

e) Quality Management Process.

In general, the Organizational Project-Enabling Processes provided in this International Standard are software-appropriate specializations of the corresponding set of processes provided in ISO/IEC 15288.

5.2.2.1.3 Project Processes

In this International Standard, the project has been chosen as the context for describing processes concerned with planning, assessment and control. The principles related to these processes can be applied in any area of an organization's management.

There are two categories of Project Processes. The Project Management Processes are used to plan, execute, assess and control the progress of a project. The Project Support Processes support specialized management objectives. Both are described below.

The Project Management Processes are used to establish and evolve project plans, to assess actual achievement and progress against the plans and to control execution of the project through to fulfilment. Individual Project Management Processes may be invoked at any time in the life cycle and at any level in a hierarchy of projects, as required by project plans or unforeseen events. The Project Management Processes are applied with a level of rigor and formality that depends on the risk and complexity of the project.

a) Project Planning Process

b) Project Assessment and Control Process

The Project Support Processes provide a specific focused set of tasks for performing a specialized management objective. They are all evident in the management of any undertaking, ranging from a complete organization down to a single life cycle process and its tasks.

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a) Decision Management Process;

b) Risk Management Process;

c) Configuration Management Process;

d) Information Management Process;

e) Measurement Process.

In general, the Project Support Processes provided in this International Standard are identical to the Project Support Processes provided in ISO/IEC 15288, aside from some differences in formatting. In several cases, Software Supporting Processes may have a relationship to Project Supporting Processes.

5.2.2.1.4 Technical Processes

The Technical Processes are used to define the requirements for a system, to transform the requirements into an effective product, to permit consistent reproduction of the product where necessary, to use the product, to provide the required services, to sustain the provision of those services and to dispose of the product when it is retired from service.

The Technical Processes define the activities that enable organizational and project functions to optimize the benefits and reduce the risks that arise from technical decisions and actions. These activities enable products and services to possess the timeliness and availability, the cost effectiveness, and the functionality, reliability, maintainability, producibility, usability and other qualities required by acquiring and supplying organizations. They also enable products and services to conform to the expectations or legislated requirements of society, including health, safety, security and environmental factors.

The Technical Processes consist of the following processes:

a) Stakeholder Requirements Definition (a specialization of the Stakeholder Requirements Definition Process of ISO/IEC 15288);

b) System Requirements Analysis (a specialization of the Requirements Analysis Process of ISO/IEC 15288);

c) System Architectural Design (a specialization of the Architectural Design Process of ISO/IEC 15288);

d) Implementation Process (a specialization of the Implementation Process of ISO/IEC 15288 and further elaborated in Clause 7 of this International Standard as the Software Implementation Process);

e) System Integration Process (a specialization of the Integration Process of ISO/IEC 15288);

f) System Qualification Testing Process (a process that contributes to achieving the outcomes of the Verification Process of ISO/IEC 15288);

g) Software Installation Process (a process that contributes to achieving the outcomes of the Transition Process of ISO/IEC 15288);

h) Software Acceptance Support Process (a process that contributes to achieving the outcomes of the Transition Process of ISO/IEC 15288);

i) Software Operation Process (a specialization of the Operation Process of ISO/IEC 15288);

j) Software Maintenance Process (a specialization of the Maintenance Process of ISO/IEC 15288);

k) Software Disposal Process (a specialization of the Disposal Process of ISO/IEC 15288).

In general, the Technical Processes provided in this International Standard are software-appropriate specializations or contributions to the outcomes of the Technical Processes provided in ISO/IEC 15288. Many

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seem similar to Software Implementation Processes but preserve crucial distinctions, e.g., System Requirements Analysis and Software Requirements Analysis start from different points and have different audiences.

5.2.2.2 Software-Specific Processes

5.2.2.2.1 Software Implementation Processes

The Software Implementation Processes are used to produce a specified system element (software item) implemented in software. Those processes transform specified behaviour, interfaces and implementation constraints into implementation actions resulting in a system element that satisfies the requirements derived from the system requirements.

The umbrella process is the Software Implementation Process, a software-specific specialization of the Implementation Process of ISO/IEC 15288.

The Software Implementation Process has several software-specific lower-level processes:

a) Software Requirements Analysis Process;

b) Software Architectural Design Process;

c) Software Detailed Design Process;

d) Software Construction Process;

e) Software Integration Process;

f) Software Qualification Testing Process.

5.2.2.2.2 Software Support Processes

The Software Support Processes provide a specific focused set of activities for performing a specialized software process. A supporting process assists the Software Implementation Process as an integral part with a distinct purpose, contributing to the success and quality of the software project. There are eight of these processes:

a) Software Documentation Management Process;

b) Software Configuration Management Process;

c) Software Quality Assurance Process;

d) Software Verification Process;

e) Software Validation Process;

f) Software Review Process;

g) Software Audit Process;

h) Software Problem Resolution Process.

5.2.2.2.3 Software Reuse Processes

The Software Reuse Process Group consists of three processes that support an organization's ability to reuse software items across project boundaries. These processes are unique because, by their nature, they operate outside the bounds of any particular project.

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The Software Reuse Processes are:

a) Domain Engineering Process;

b) Reuse Asset Management Process;

c) Reuse Program Management Process.

5.2.3 Process Reference Model

Annex B defines a Process Reference Model (PRM) at a level of abstraction higher than that of the detailed requirements contained in the main text of this International Standard. The PRM is applicable to an organization that is assessing its processes in order to determine the capability of these processes. The purpose and outcomes are a statement of the goals of the performance of each process. This statement of goals permits assessment of the effectiveness of the processes in ways other than simple conformity evaluation. For example, novel process definitions can be evaluated against the statements of Purpose and Outcomes in Annex B rather than against the detailed provisions in the main text of this International Standard.

NOTE 1 In this International Standard, the term “Process Reference Model” is used with the same meaning as ISO/IEC 15504-2.

NOTE 2 The PRM is intended to be used to develop assessment model(s) for assessing processes using ISO/IEC 15504-2.

6 System Life Cycle Processes

6.1 Agreement Processes

6.1.1 Acquisition Process

6.1.1.1 Purpose

The purpose of the Acquisition Process is to obtain the product and/or service that satisfies the need expressed by the acquirer. The process begins with the identification of customer needs and ends with the acceptance of the product and/or service needed by the acquirer.

6.1.1.2 Outcomes

As a result of successful implementation of the Acquisition Process:

a) acquisition needs, goals, product and/or service acceptance criteria and acquisition strategies are defined;

b) an agreement is developed that clearly expresses the expectation, responsibilities and liabilities of both the acquirer and the supplier;

c) one or more suppliers is selected;

d) a product and/or service is acquired that satisfies the acquirer’s stated need;

e) the acquisition is monitored so that specified constraints such as cost, schedule and quality are met;

f) supplier deliverables are accepted; and

g) any identified open items have a satisfactory conclusion as agreed to by the acquirer and the supplier.

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6.1.1.3 Activities and tasks

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

NOTE The activities and tasks in this process can apply to one or more suppliers.

6.1.1.3.1 Acquisition preparation. This activity consists of the following tasks:

6.1.1.3.1.1 The acquirer begins the acquisition process by describing a concept or a need to acquire, develop, or enhance a system, software product or software service.

6.1.1.3.1.2 The acquirer shall define and analyze the system requirements. The system requirements should include business, organizational and user as well as safety, security, and other criticality requirements along with related design, testing, and compliance standards and procedures.

6.1.1.3.1.3 The acquirer may perform the definition and analysis of software requirements by itself or may retain a supplier to perform this task.

6.1.1.3.1.4 If the acquirer retains a supplier to perform system or software requirements analysis, the acquirer shall retain approval authority for the analyzed requirements.

6.1.1.3.1.5 The Technical Processes (subclause 6.4) should be used to perform the tasks in subclauses 6.1.1.3.1.2 and 6.1.1.3.1.4. The acquirer may use the Stakeholder Requirements Definition Process to establish the customer requirements.

6.1.1.3.1.6 The acquirer shall consider options for acquisition against analysis of appropriate criteria to include risk, cost and benefits for each option. Options include:

a) Purchase an off-the-shelf software product that satisfies the requirements.

b) Develop the software product or obtain the software service internally.

c) Develop the software product or obtain the software service through contract.

d) A combination of a, b, and c above.

e) Enhance an existing software product or service.

6.1.1.3.1.7 When an off-the-shelf software product is to be acquired, the acquirer shall ensure the following conditions are satisfied:

a) The requirements for the software product are satisfied.

b) The required documentation is available.

c) Proprietary, usage, ownership, warranty and licensing rights are satisfied.

d) Future support for the software product is planned.

6.1.1.3.1.8 The acquirer should prepare, document and execute an acquisition plan. The plan should contain the following:

a) Requirements for the system.

b) Planned employment of the system.

c) Type of contract to be employed.

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d) Responsibilities of the organizations involved.

e) Support concept to be used.

f) Risks considered as well as methods to manage the risks.

6.1.1.3.1.9 The acquirer shall define and document the acceptance strategy and conditions (criteria).

6.1.1.3.1.10 The acquirer should document the acquisition requirements (e.g., request for proposal), the content of which depends upon the acquisition option selected in subclause 6.1.1.3.1.6. The acquisition documentation should include, as appropriate:

a) System requirements.

b) Scope statement.

c) Instructions for bidders.

d) List of software products.

e) Terms and conditions.

f) Control of subcontracts.

g) Technical constraints (e.g., target environment).

6.1.1.3.1.11 The acquirer should determine which processes of this International Standard are appropriate for the acquisition and specify any acquirer requirements for tailoring those processes. The acquirer should specify if any of the processes are to be performed by parties other than the supplier, so that suppliers may, in their proposals, define their approach to supporting the work of other parties. The acquirer shall define the scope of those tasks that reference the contract.

6.1.1.3.1.12 The acquisition documentation shall also define the contract milestones at which the supplier's progress shall be reviewed and audited as part of monitoring the acquisition (see subclauses 7.2.6 and 7.2.7).

6.1.1.3.1.13 The acquisition requirements should be given to the organization selected for performing the acquisition activities.

6.1.1.3.2 Acquisition advertisement. This activity consists of the following task:

6.1.1.3.2.1 The acquirer shall 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.

6.1.1.3.3 Supplier selection. This activity consists of the following tasks:

6.1.1.3.3.1 The acquirer should establish a procedure for supplier selection including proposal evaluation criteria and requirements compliance weighting.

6.1.1.3.3.2 The acquirer should select a supplier based upon the evaluation of the suppliers' proposals, capabilities, and in accordance with the acquirer's acceptance strategy and conditions.

6.1.1.3.4 Contract agreement. This activity consists of the following tasks:

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6.1.1.3.4.1 The acquirer may involve other parties, including potential suppliers or any necessary third parties (such as regulators), before contract award, in determining the acquirer's requirements for tailoring of this International Standard for the project. In making this determination, the acquirer shall consider the effect of the tailoring requirements upon the supplier's organizationally-adopted processes. The acquirer shall include or reference the tailoring requirements in the contract.

6.1.1.3.4.2 The acquirer shall then prepare and negotiate a contract with the supplier that addresses the acquisition requirements, including the cost and schedule, of the software product or service to be delivered. The contract shall address proprietary, usage, ownership, warranty and licensing rights associated with the reusable off-the-shelf software products.

6.1.1.3.4.3 Once the contract is underway, the acquirer shall control changes to the contract through negotiation with the supplier as part of a change control mechanism. Changes to the contract shall be investigated for impact on project plans, costs, benefits, quality, and schedule.

NOTE 1 The acquirer determines whether the term "contract" or "agreement" is to be used in the application of this International Standard.

NOTE 2 The agreement between the acquirer and the supplier should clearly express the expectation, responsibilities and liabilities of both.

NOTE 3 The contract change control mechanism should address the change management roles and responsibilities, level of formality of the proposed change requests and contract renegotiation, and communication to the affected stakeholders. An informative Annex F contains a sample contract change management process that may be utilized to support this.

6.1.1.3.5 Agreement monitoring. This activity consists of the following tasks:

6.1.1.3.5.1 The acquirer shall monitor the supplier's activities in accordance with the Software Review Process (subclause 7.2.6) and the Software Audit Process (subclause 7.2.7). The acquirer should supplement the monitoring with the Software Verification Process (subclause 7.2.4) and the Software Validation Process (subclause 7.2.5) as needed.

6.1.1.3.5.2 The acquirer shall cooperate with the supplier to provide all necessary information in a timely manner and resolve all pending items.

6.1.1.3.6 Acquirer acceptance. This activity consists of the following tasks:

6.1.1.3.6.1 The acquirer should prepare for acceptance based on the defined acceptance strategy and criteria. The preparation of test cases, test data, test procedures, and test environment should be included. The extent of supplier involvement should be defined.

6.1.1.3.6.2 The acquirer shall conduct acceptance review and acceptance testing of the deliverable software product or service and shall accept it from the supplier when all acceptance conditions are satisfied. The acceptance procedure should comply with the provisions of subclause 6.1.1.3.1.9.

6.1.1.3.6.3 After acceptance, the acquirer should take the responsibility for the configuration management of the delivered software product (see subclause 7.2.2).

NOTE The acquirer may install the software product or perform the software service in accordance with instructions defined by the supplier.

6.1.1.3.7 Closure. This activity consists of the following tasks:

6.1.1.3.7.1 The acquirer shall make payment or provide other agreed consideration to the supplier for the product or service rendered.

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NOTE 1 When the supplied product or service has satisfied the conditions of the agreement and identified open items have been satisfactorily closed, the acquirer concludes the agreement by rendering payment or other agreed consideration and notification of conclusion of the agreement.

NOTE 2 A product or service may be supplied incrementally and payment or other agreed consideration may be provided in increments.

6.1.2 Supply Process

6.1.2.1 Purpose

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

6.1.2.2 Outcomes

As a result of successful implementation of the Supply Process:

a) an acquirer for a product or service is identified;

b) a response to an acquirer's request is produced;

c) an agreement is established between the acquirer and the supplier for developing, maintaining, operating, packaging, delivering, and installing the product and/or service;

d) a product and/or service that meets the agreed requirements are developed by the supplier;

e) the product and/or service is delivered to the acquirer in accordance with the agreed requirements; and

f) the product is installed in accordance with the agreed requirements.

6.1.2.3 Activities and tasks

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

6.1.2.3.1 Opportunity identification. This activity consists of the following task:

6.1.2.3.1.1 The supplier should determine the existence and identity of an acquirer who has, or who represents an organization or organizations 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.

6.1.2.3.2 Supplier tendering. This activity consists of the following tasks:

6.1.2.3.2.1 The supplier should conduct a review of requirements in the request for proposal taking into account organizational policies and other regulations.

6.1.2.3.2.2 The supplier should make a decision to bid or accept the contract.

6.1.2.3.2.3 The supplier shall prepare a proposal in response to the request for proposal.

6.1.2.3.3 Contract agreement. This activity consists of the following tasks:

6.1.2.3.3.1 The supplier shall negotiate and enter into a contract with the acquirer to provide the software product or service.

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6.1.2.3.3.2 The supplier may request modification to the contract as part of the change control mechanism.

6.1.2.3.4 Contract execution. This activity consists of the following tasks:

6.1.2.3.4.1 The supplier shall conduct a review of the acquisition requirements to define the framework for managing and assuring the project and for assuring the quality of the deliverable software product or service.

6.1.2.3.4.2 If not stipulated in the contract, the supplier shall define or select a life cycle model appropriate to the scope, magnitude, and complexity of the project. The life cycle model shall be comprised of stages and the purpose and outcomes of each stage. The processes, activities, and tasks of this International Standard shall be selected and mapped onto the life cycle model.

NOTE Ideally, this is performed by using an organizationally-defined life cycle model.

6.1.2.3.4.3 The supplier shall establish requirements for the plans for managing and assuring the project and for assuring the quality of the deliverable software product or service. Requirements for the plans should include resource needs and acquirer involvement.

6.1.2.3.4.4 Once the planning requirements are established, the supplier shall consider the options for developing the software product or providing the software service against an analysis of risks associated with each option. Options include:

a) Develop the software product or provide the software service using internal resources.

b) Develop the software product or provide the software service by subcontracting.

c) Obtain off-the-shelf software products from internal or external sources.

d) A combination of a, b, and c above.

6.1.2.3.4.5 The supplier shall develop and document project management plan(s) based upon the planning requirements and options selected in subclause 6.1.2.3.4.4.

NOTE Items to be considered in the plan include but are not limited to the following:

a) Project organizational structure and authority and responsibility of each organizational unit, including external organizations.

b) Engineering environment (for development, operation, or maintenance, as applicable), including test environment, library, equipment, facilities, standards, procedures, and tools.

c) Work breakdown structure of the life cycle processes and activities, including the software products, software services and non-deliverable items, to be performed together with budgets, staffing, physical resources, software size, and schedules associated with the tasks.

d) Management of the quality characteristics of the software products or services. Separate plans for quality may be developed.

e) Management of the safety, security, and other critical requirements of the software products or services. Separate plans for safety and security may be developed.

f) Subcontractor management, including subcontractor selection and involvement between the subcontractor and the acquirer, if any.

g) Quality assurance (see subclause 7.2.3).

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h) Verification (see subclause 7.2.4) and validation (see subclause 7.2.5), including the approach for interfacing with the verification and validation agent, if specified.

i) Acquirer involvement; that is, by such means as reviews (see subclause 7.2.6), audits (see subclause 7.2.7), informal meetings, reporting, modification and change; implementation, approval, acceptance, and access to facilities.

j) User involvement; by such means as requirements setting exercises, prototype demonstrations and evaluations.

k) Risk management; that is, management of the areas of the project that involve potential technical, cost, or schedule risks.

l) Security policy; that is, the rules for need-to-know and access-to-information at each project organization level.

m) Approval required by such means as regulations, required certifications, proprietary, usage, ownership, warranty and licensing rights.

n) Means for scheduling, tracking, and reporting.

o) Training of personnel (see subclause 6.2.4).

6.1.2.3.4.6 The supplier shall implement and execute the project management plan(s) developed under subclause 6.1.2.3.4.5.

6.1.2.3.4.7 The supplier shall:

a) Develop the software product in accordance with the Technical Processes (subclause 6.4).

b) Operate the software product in accordance with the Software Operation Process (subclause 6.4.9).

c) Maintain the software product in accordance with the Software Maintenance Process (subclause 6.4.10).

6.1.2.3.4.8 The supplier shall monitor and control the progress and the quality of the software products or services of the project throughout the contracted life cycle. This shall be an ongoing, iterative task, which shall provide for:

a) Monitoring progress of technical performance, costs, and schedules and reporting of project status.

b) Problem identification, recording, analysis, and resolution.

6.1.2.3.4.9 The supplier shall manage and control the subcontractors in accordance with the Acquisition Process (subclause 6.1.1). The supplier shall pass down all contractual requirements necessary to ensure that the software product or service delivered to the acquirer is developed or performed in accordance with the prime-contract requirements.

6.1.2.3.4.10 The supplier shall interface with the independent verification, validation, or test agent as specified in the contract and project plans.

6.1.2.3.4.11 The supplier shall interface with other parties as specified in the contract and project plans.

6.1.2.3.4.12 The supplier should coordinate contract review activities, interfaces, and communication with the acquirer's organization.

6.1.2.3.4.13 The supplier shall conduct or support the informal meetings, acceptance review, acceptance testing, joint reviews, and audits with the acquirer as specified in the contract and project plans. The joint reviews shall be conducted in accordance with subclause 7.2.6, audits in accordance with subclause 7.2.7.

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6.1.2.3.4.14 The supplier should perform verification and validation in accordance with subclauses 7.2.4 and 7.2.5 respectively to demonstrate that the software products or services and processes fully satisfy their respective requirements.

6.1.2.3.4.15 The supplier shall make available to the acquirer the reports of evaluation, reviews, audits, testing, and problem resolutions as specified in the contract.

6.1.2.3.4.16 The supplier shall provide the acquirer access to the supplier's and subcontractors' facilities for review of software products or services as specified in the contract and project plans.

6.1.2.3.4.17 The supplier shall perform quality assurance activities in accordance with subclause 7.2.3.

6.1.2.3.5 Product/service delivery and support. This activity consists of the following tasks:

6.1.2.3.5.1 The supplier shall deliver the software product or service as specified in the contract.

NOTE When required by the agreement, the supplier should install the product in accordance with established requirements.

6.1.2.3.5.2 The supplier shall provide assistance to the acquirer in support of the delivered software product or service as specified in the contract.

6.1.2.3.6 Closure. This activity consists of the following tasks:

6.1.2.3.6.1 The supplier shall accept and acknowledge payment or other agreed consideration.

6.1.2.3.6.2 The supplier shall transfer the responsibility for the product or service to the acquirer, or other party, as directed by the agreement.

NOTE The agreement should address terms and authorization for initiating closure of the project.

6.2 Organizational Project-Enabling Processes

6.2.1 Life Cycle Model Management Process

6.2.1.1 Purpose

The purpose of the Life Cycle Model Management Process is to define, maintain, and assure availability of policies, life cycle processes, life cycle models, and procedures for use by the organization with respect to the scope of this International Standard.

This process provides life cycle policies, processes, and procedures that are consistent with the organization's objectives, that are defined, adapted, improved and maintained to support individual project needs within the context of the organization, and that are capable of being applied using effective, proven methods and tools.

6.2.1.2 Outcomes

As a result of the successful implementation of the Life Cycle Model Management Process:

a) policies and procedures for the management and deployment of life cycle models and processes are provided;

b) responsibility, accountability and authority for life cycle management are defined;

c) life cycle processes, models and procedures for use by the organization are defined, maintained and improved; and

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d) prioritized process improvements are implemented.

6.2.1.3 Activities and tasks

The organization shall implement the following activities in accordance with applicable organization policies and procedures with respect to the Life Cycle Model Management Process.

6.2.1.3.1 Process establishment. This activity consists of the following task:

6.2.1.3.1.1 The organization shall establish a suite of organizational processes for all software life cycle processes and life cycle models as they apply to its business activities. The processes and their application to specific cases shall be documented in the organization's publications. As appropriate, a process control mechanism should be established to develop, monitor, control, and improve the process(es).

NOTE Establishing the process control mechanism includes the definition of responsibility, accountability and authority for life cycle management.

6.2.1.3.2 Process assessment. This activity consists of the following tasks:

6.2.1.3.2.1 The organization should develop, document and apply a process assessment procedure. Assessment records should be produced and maintained.

6.2.1.3.2.2 The organization shall plan and carry out reviews of the processes at appropriate intervals to ensure their continuing suitability and effectiveness in the light of assessment results.

6.2.1.3.3 Process improvement. This activity consists of the following tasks:

6.2.1.3.3.1 The organization shall effect such improvements to its processes as it determines to be necessary as a result of process assessment and review. Process documentation should be updated to reflect improvement in the organizational processes.

6.2.1.3.3.2 Historical, technical, and evaluation data should be collected and analyzed to gain an understanding of the strengths and weaknesses of the employed processes. These analyses should be used as feedback to improve these processes, to recommend changes in the direction of the projects (or subsequent projects), and to determine technology advancement needs.

6.2.1.3.3.3 Quality cost data should be collected, maintained, and used to improve the organization's processes as a management activity. These data shall serve the purpose of establishing the cost of both the prevention and resolution of problems and non-conformity in software products and services.

6.2.2 Infrastructure Management Process

6.2.2.1 Purpose

The purpose of the Infrastructure Management Process is to provide the enabling infrastructure and services to projects to support organization and project objectives throughout the life cycle.

This process defines, provides and maintains the facilities, tools, and communications and information technology assets needed for the organization’s business with respect to the scope of this International Standard.

6.2.2.2 Outcomes

As a result of the successful implementation of the Infrastructure Management Process:

a) the requirements for infrastructure to support processes are defined;

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b) the infrastructure elements are identified and specified;

c) infrastructure elements are acquired;

d) the infrastructure elements are implemented; and

e) a stable and reliable infrastructure is maintained and improved.

NOTE The infrastructure elements may include hardware, software, methods, tools, techniques, standards, and facilities for development, operation, or maintenance.

6.2.2.3 Activities and tasks

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

6.2.2.3.1 Process implementation. This activity consists of the following tasks:

6.2.2.3.1.1 The infrastructure should be defined and documented to meet the requirements of the process employing this process, considering the applicable procedures, standards, tools, and techniques.

6.2.2.3.1.2 The establishment of the infrastructure should be planned and documented.

6.2.2.3.2 Establishment of the infrastructure. This activity consists of the following tasks:

6.2.2.3.2.1 The configuration of the infrastructure should be planned and documented. Functionality, performance, safety, security, availability, space requirements, equipment, costs, and time constraints should be considered.

6.2.2.3.2.2 The infrastructure shall be installed in time for execution of the relevant process.

6.2.2.3.3 Maintenance of the infrastructure. This activity consists of the following task:

6.2.2.3.3.1 The infrastructure shall be maintained, monitored, and modified as necessary to ensure that it continues to satisfy the requirements of the process employing this process. As part of maintaining the infrastructure, the extent to which the infrastructure is under configuration management shall be defined.

6.2.3 Project Portfolio Management Process

6.2.3.1 Purpose

The purpose of the Project Portfolio Management Process is to initiate and sustain necessary, sufficient and suitable projects in order to meet the strategic objectives of the organization.

This process commits the investment of adequate organization funding and resources, and sanctions the authorities needed to establish selected projects. It performs continued qualification of projects to confirm they justify, or can be redirected to justify, continued investment.

6.2.3.2 Outcomes

As a result of the successful implementation of the Project Portfolio Management Process:

a) business venture opportunities, investments or necessities are qualified, prioritized and selected;

b) resources and budgets for each project are identified and allocated;

c) project management accountability and authorities are defined;

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