
**Systems and software engineering — Life
cycle management —**

Part 3:

**Guide to the application of ISO/IEC 12207
(Software life cycle processes)**

iTeh STANDARD PREVIEW
*Ingénierie des systèmes et du logiciel — Gestion du cycle de vie —
Partie 3: Guide pour l'application de l'ISO/CEI 12207 (Processus du
cycle de vie du logiciel)*
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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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

In exceptional circumstances, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide to publish a Technical Report. A Technical Report is entirely informative in nature and shall be subject to review every five years in the same manner as an International Standard.

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 TR 24748-3 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

This first edition of ISO/IEC TR 24748-3 cancels and replaces ISO/IEC TR 15271:1998, which has been technically revised.

ISO/IEC TR 24748 consists of the following parts, under the general title *Systems and software engineering — Life cycle management*:

- *Part 1: Guide for life cycle management*
- *Part 2: Guide to the application of ISO/IEC 15288 (System life cycle processes)*
- *Part 3: Guide to the application of ISO/IEC 12207 (Software life cycle processes)*

Introduction

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) currently have two International Standards that focus on life cycle processes:

- ISO/IEC 15288:2008, *Systems and software engineering — System life cycle processes*, and
- ISO/IEC 12207:2008, *Systems and software engineering — Software life cycle processes*.

In addition, ISO and IEC have a multi-part International Standard that promotes the adoption of an integrated process approach when establishing, implementing, operating, monitoring, reviewing, maintaining and improving a Service Management System (SMS), to deliver services which meet business needs and customer requirements:

- ISO/IEC 20000, *Information technology — Service management*.

This service management standard may be used in conjunction with ISO/IEC 15288 and ISO/IEC 12207 for the delivery of system services and software services.

The purpose of this part of ISO/IEC TR 24748 is to provide guidance on the application of the software life cycle processes standard, ISO/IEC 12207:2008. Taken together, the parts of ISO/IEC TR 24748 are intended to facilitate the joint usage of the process content of the two high-level life cycle process standards, which in turn may be used together with related standards such as the one for service management, and various other lower-level process standards. In this way, ISO/IEC TR 24748 provides unified and consolidated guidance on the life cycle management of systems and software. Its purpose is to help ensure consistency in system concepts and life cycle concepts, models, stages, processes, process application, key points of view, adaptation and use in various domains as the two standards (and others) are used in combination. It should help a project design a life cycle model for managing progress on a project.

Whereas ISO/IEC TR 24748-1 addresses in generic terms the purpose stated above of guidance for the life cycle management of systems and software, this part of ISO/IEC TR 24748 focuses in on and expands the coverage of those aspects most relevant to software. This part of ISO/IEC TR 24748 will also, in conjunction with ISO/IEC TR 24748-1, aid in identifying and planning the use of the life cycle processes described in ISO/IEC 12207:2008. The proper use of these processes will contribute to a project being completed successfully, meeting its objectives and requirements for each stage and for the overall project.

This part of ISO/IEC TR 24748 elaborates on factors that should be considered when applying ISO/IEC 12207:2008 and does this in the context of the various ways in which ISO/IEC 12207:2008 can be applied. The guidance is not intended to provide the rationale for the requirements of ISO/IEC 12207:2008. Before reading this part of ISO/IEC TR 24748, readers have to understand the relation between system and software, the concept of "system of interest", and the structure of a system. These concepts are described in ISO/IEC TR 24748-1.

Systems and software engineering — Life cycle management —

Part 3:

Guide to the application of ISO/IEC 12207 (Software life cycle processes)

1 Scope

This part of ISO/IEC TR 24748 is a guide for the application of ISO/IEC 12207:2008. It addresses system, life cycle, process, organizational, project, and adaptation concepts, principally through reference to ISO/IEC TR 24748-1 and ISO/IEC 12207:2008. It gives guidance on applying ISO/IEC 12207:2008 from the aspects of strategy, planning, application in organizations, and application on projects.

This part of ISO/IEC TR 24748 is intentionally aligned with both ISO/IEC TR 24748-1 and ISO/IEC TR 24748-2 (*Guide to the application of ISO/IEC 15288*) in its terminology, structure and content.

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2 Terms and definitions (standards.iteh.ai)

For the purposes of this document, the terms and definitions given in ISO/IEC 12207:2008, ISO/IEC 15288:2008 and ISO/IEC TR 24748-1:2010 apply.

3 Overview of ISO/IEC 12207:2008

3.1 General

ISO/IEC 12207:2008, *Systems and software engineering — Software life cycle processes*, 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, implementation, 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.

ISO/IEC 12207:2008 may be used stand alone or jointly with other International Standards, such as ISO/IEC 15288:2008, and supplies a process reference model that supports process capability assessment in accordance with ISO/IEC 15504-2, *Information technology — Process assessment — Part 2: Performing an assessment*.

The purpose of ISO/IEC 12207:2008 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. ISO/IEC 12207:2008 is written for acquirers of systems and software products and services and for suppliers, implementers, operators, maintainers, managers, quality assurance managers, and users of software products.

3.2 Structure of ISO/IEC 12207:2008

ISO/IEC 12207:2008 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 ISO/IEC 12207:2008, and
- Clauses of Annex B, which provides a Process Reference Model (PRM) which may be used for assessment purposes.

Five informative annexes support the use of ISO/IEC 12207:2008 or its harmonization with ISO/IEC 15288:2008:

- Annex C expands on the history and rationale for the changes to achieve harmonization, and provides high-level traceability among the International Standards which were used as the inputs to the revision of ISO/IEC 12207:2008.
- Annex D describes the alignment of the processes of ISO/IEC 15288:2008 and ISO/IEC 12207:2008.
- 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 12207:2008 to provide focused attention to the achievement of product characteristics that have been selected as being of special interest.
- Annex F contains some example process descriptions relating to business goals and contracting that may be considered useful to some readers of ISO/IEC 12207:2008.
- Annex G provides support for IEEE users and describes relationships of ISO/IEC 12207:2008 to IEEE standards.

Readers of ISO/IEC 12207:2008 are advised to consult clause 5 of that International Standard to gain understanding of the key concepts used.

3.3 Context of ISO/IEC 12207:2008

ISO/IEC 12207:2008 has a focus on the processes that are used by or for software-centred projects that exist in a defined relationship with the organization, other projects and enabling systems. A project is assigned responsibility that encompasses one or more life cycle stages of the software system-of-interest. ISO/IEC 12207:2008 is applicable to organizations and projects whether they act as the acquirer or the supplier of a software system and whether the system is comprised of products, services, or a combination of both.

The context of ISO/IEC 12207:2008 is illustrated in Figure 1.

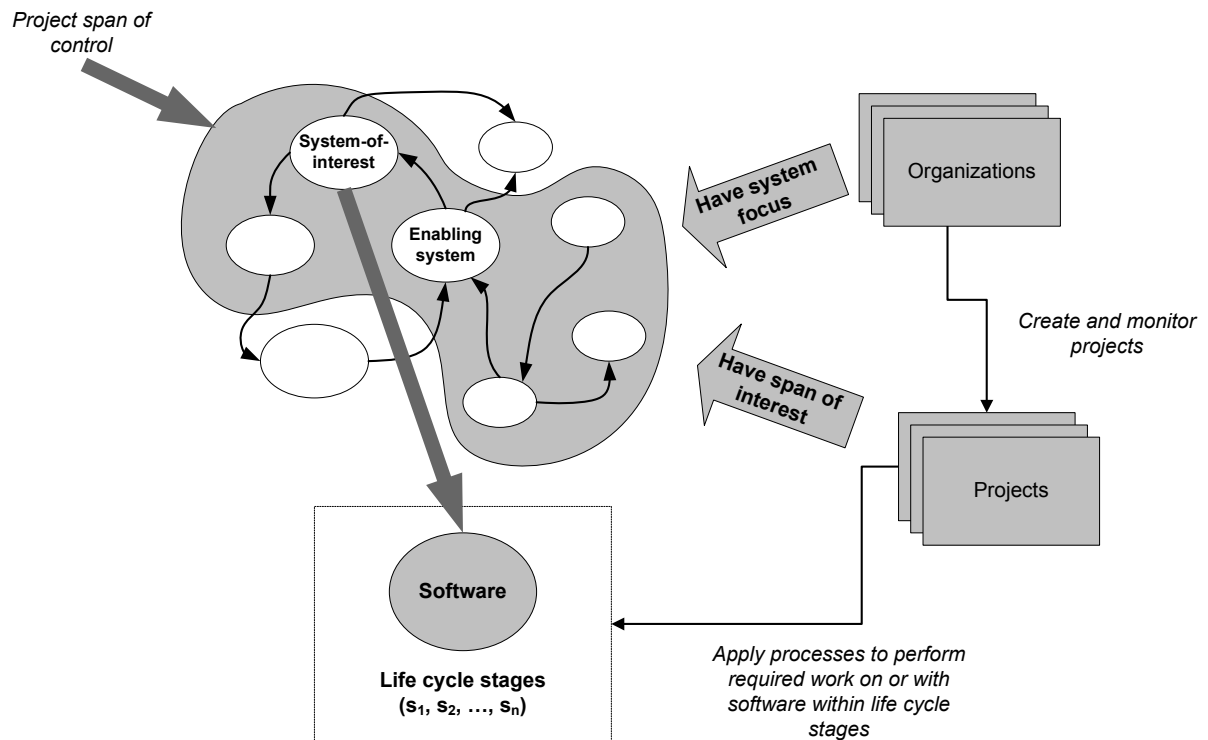


Figure 1 — Context of ISO/IEC 12207:2008
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A single project may involve multiple organizations working together as partners. Such a project should use ISO/IEC 12207:2008 to establish common terminology, as well as information flows and interfaces among the organizations to enhance communication.

When an organization applies ISO/IEC 12207:2008 to a particular software system, then that system becomes the system-of-interest. The system-of-interest has a life cycle that consists of multiple stages through which the system passes during its lifetime, denoted s_1, s_2, \dots, s_n .

EXAMPLE An example of typical stages is:

- s_1 : concept,
- s_2 : development,
- s_3 : operation, and
- s_4 : maintenance.

NOTE 1 Stages are described in clause 5.1.12 of ISO/IEC 12207:2008 and in clauses 3.2, 4 and 5 of ISO/IEC TR 24748-1.

A number of enabling systems are deployed throughout the software life cycle to provide the system-of-interest with support as needed. Each life cycle stage can require one or more enabling systems. Enabling systems that cooperate with the software during its operation and maintenance stages can be needed, as well. It is important to note that an enabling system has its own life cycle and that when ISO/IEC 12207:2008 (or ISO/IEC 15288:2008, if applicable) is applied to it, it then becomes a system-of-interest.

NOTE 2 The role and use of enabling systems are described in clause 4.6.3 of this Technical Report.

NOTE 3 For related material on enabling systems, see also clause 5.1.4 of ISO/IEC 15288:2008 and clause 3.1.5 of ISO/IEC TR 24748-1.

ISO/IEC 12207:2008 is applicable at any level of the structure associated with a software system. As the software is decomposed recursively into its elements, the processes of ISO/IEC 12207:2008 may be used for each element in the software structure. Each system element has a life cycle of its own and its own set of enabling systems.

NOTE 4 For related material on system structure, see clause 5.1.3 of ISO/IEC 15288:2008 and clause 3.1.4 of ISO/IEC TR 24748-1.

NOTE 5 A view from a project hierarchy perspective is given in clause 4.6.4 of this Technical Report.

In order to perform needed operations and transformations upon software systems during their life cycles, the organization creates and monitors projects. Projects have defined scope, resources (including time) and focus. The scope can involve managing all of the stages of the life cycle, a subset of the stages, one or more defined processes or one or more process activities. The time scale can be of varying duration, for example one hour or tens of years. The focus of the project is related to the software and its elements in some form of system structure or stage partitioning.

NOTE 6 Related project concepts are described in clause 4.6 of this Technical Report.

NOTE 7 System life cycle concepts are described in clause 3.2 of ISO/IEC TR 24748-1.

Organizations focus on software that is created in projects within the organization or in conjunction with other organizations. Projects have a span of interest that includes the software and its related enabling systems. Some enabling systems are under direct control of the project. The software and those enabling systems make up the project span of control.

NOTE 8 The span of interest is described in clause 4.6.3 of this Technical Report.

The work performed in projects is on or with the software within one or more life cycle stages. The scope of ISO/IEC 12207:2008 includes the definition of an appropriate life cycle for software, the selection of processes to be applied throughout the life cycle and the application of these processes to fulfil agreements and achieve customer satisfaction.

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ISO/IEC 12207:2008 can be applied to all types of software product-focused or service-focused systems and system elements consisting of software.

The use of ISO/IEC 12207:2008 may be adapted to accommodate the varying project requirements in treating software life cycles.

NOTE 9 This may be performed by adapting the life cycle as described in clauses 6 and 7 of ISO/IEC TR 24748-1 and tailoring described in Annex A of ISO/IEC 12207:2008.

3.4 Comparison to previous versions of ISO/IEC 12207

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 standalone 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.

ISO/IEC 12207:2008 integrates ISO/IEC 12207:1995 with its two Amendments and provides better process definition to support consistency and improved usability.

NOTE 1 Clause 9.1 of ISO/IEC TR 24748-1 gives extensive detailed comparison between the versions of ISO/IEC 12207, as well as comparisons between ISO/IEC 15288:2008 and ISO/IEC 12207:2008.

NOTE 2 Figure 18 in ISO/IEC TR 24748-1 shows the process structure changes of the 2008 update.

NOTE 3 Figure 20 in ISO/IEC TR 24748-1 provides information regarding the source of the provisions in the aligned process clause set of ISO/IEC 12207:2008.

NOTE 4 Figure 21 in ISO/IEC TR 24748-1 provides a mapping between ISO/IEC 12207:1995 and ISO/IEC 12207:2008 process clause sets.

NOTE 5 Figure 22 in ISO/IEC TR 24748-1 gives the inverse mapping between ISO/IEC 12207:2008 and ISO/IEC 12207:1995.

4 Application Concepts

4.1 Overview

This Technical Report provides guidelines for life cycle management in the field of software systems. This clause highlights and explains essential concepts on which this Technical Report is based, and introduces key concepts useful in reading and applying ISO/IEC 12207:2008.

NOTE ISO/IEC TR 24748-1 provides more information on concepts related to life cycle management in general.

4.2 Software concepts

4.2.1 System and software concepts

The application of ISO/IEC 12207:2008 presupposes an understanding of system concepts. A system is a combination of interacting elements organized to achieve one or more stated purposes. For the purposes of this Technical Report, systems are considered man-made and utilized to provide services in defined environments for the benefit of users and other stakeholders. These systems may be configured with one or more of the following: hardware, software, services, humans, processes (e.g. review process), procedures (e.g. operator instructions), facilities and naturally occurring entities (e.g. water, organisms, minerals). A system may be considered as a product or as the services it provides. A system element is a member of a set of elements that constitutes a system. A system element is a discrete part of a system that can be implemented to fulfil specified requirements.

NOTE 1 System concepts are introduced in ISO/IEC 15288:2008, clause 5.1. Additional discussion, such as systems and system structure, is provided in ISO/IEC TR 24748-1, clause 3.1.

NOTE 2 ISO/IEC TR 24748-2 provides more information on concepts related to system life cycle management.

Software is the subsystems or elements of a system consisting of computer programs, related procedures, associated documentation, and data pertaining to the operation of the subsystem or element.

System concepts are directly applicable to software. The underlying philosophy of ISO/IEC 12207:2008 is that aspects such as software implementation and maintenance should be conducted in a manner that exhibits engineering discipline. Following this approach allows the establishment of a framework that has clear linkages to the systems engineering environment, i.e. one that includes software, hardware, people and business practices.

Characteristic properties at a system's boundary arise from the interactions between subordinate systems. Whatever the boundaries chosen to define the software system, the concepts and models in this Technical Report are generic and permit a practitioner to correlate or adapt individual instances of life cycles to its software concepts and principles.

NOTE 3 The relationship between systems and software is introduced in ISO/IEC 12207:2008, clause 5.1.2.

Figure 2 illustrates a system as a specific combination of hardware, computers, software, people, and facilities. In the parent system, processes such as business processes exist. Software serves by providing for the execution of certain functions of these processes in computers. The software could be resident in a computer, embedded in a piece of firmware, or integral to a hardware item. In any case, the acquisition, supply, implementation, operation, or maintenance of the software needs to be in coordination and harmony with those of the parent system.

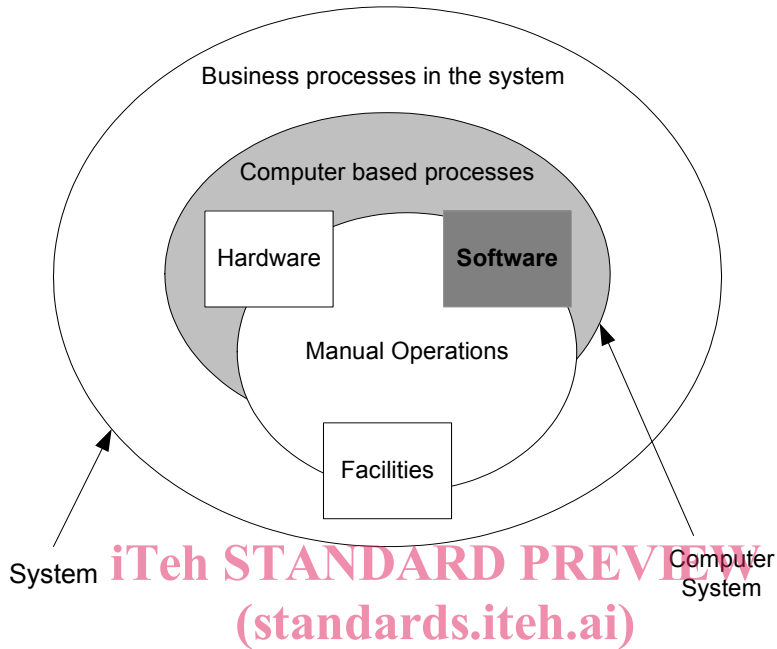


Figure 2 — Software in the system

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Within an organization, there may be a number of computer systems supporting the business processes, as shown in Figure 3.

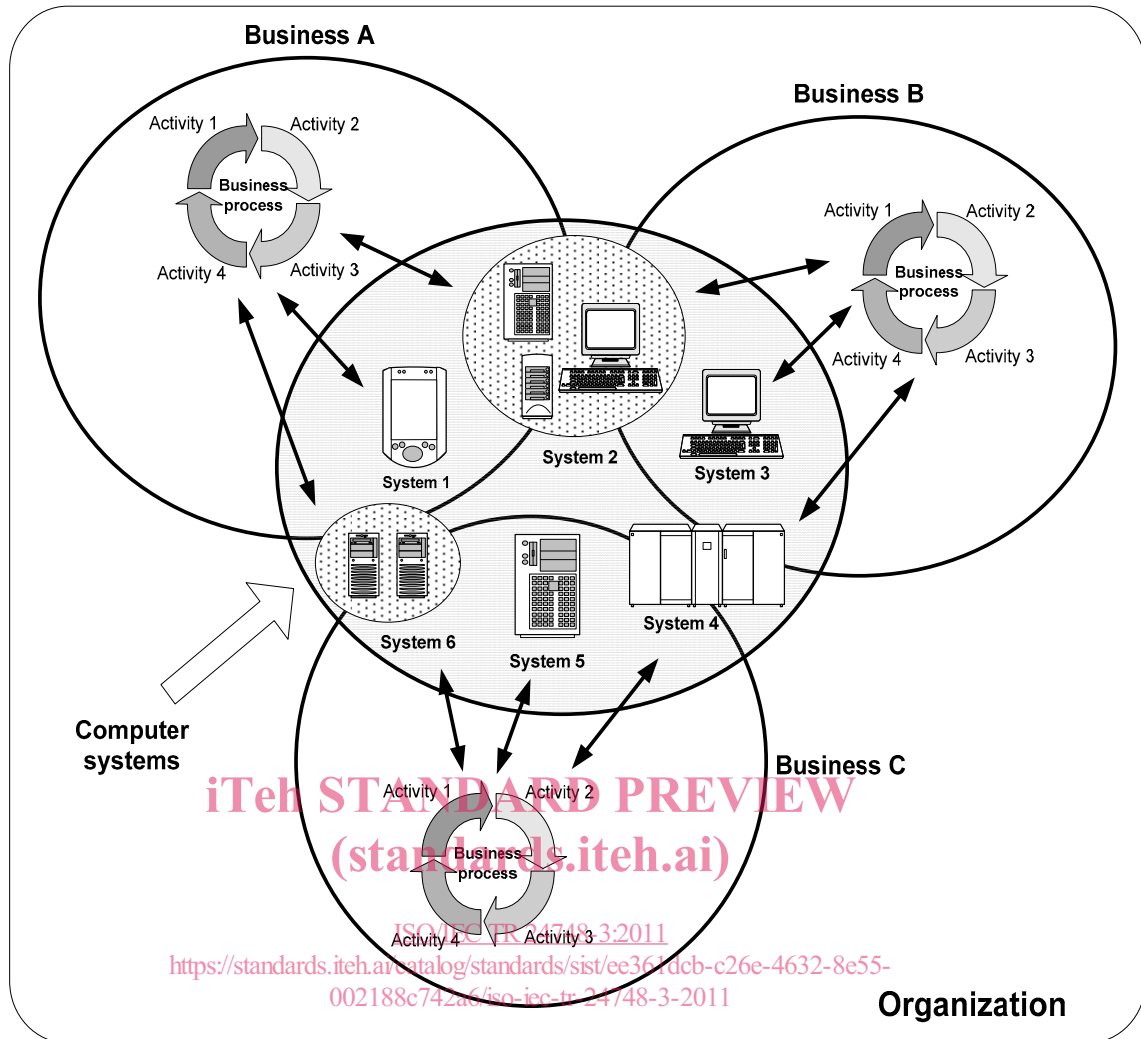


Figure 3 — Computer systems in an organization

4.3 Life cycle concepts

Application of ISO/IEC 12207:2008 presupposes an understanding of life cycle concepts.

NOTE Life cycle concepts are introduced in ISO/IEC 15288:2008, clause 5.2. Additional discussion is in ISO/IEC TR 24748-1 clause 3.2.

4.4 Process concepts

4.4.1 General

4.4.1.1 Introduction

The application of ISO/IEC 12207:2008 presupposes an understanding of process concepts.

NOTE 1 Process concepts are introduced in ISO/IEC 15288:2008, clause 5.3. Additional discussion is in ISO/IEC TR 24748-1, clause 3.3.

The focus of ISO/IEC 12207:2008 is on the processes that are applied within a life cycle. The processes can be used by organizations (for example functional organizations and projects) that play the role of acquirer, supplier (for example main contractor, subcontractor, or service provider) or management to fulfil

responsibilities pertaining to the software system. Additionally, the processes in ISO/IEC 12207:2008 can be used as a reference model for process assessments under ISO/IEC 15504, *Information technology — Process assessment*.

A process is an integrated set of activities that transform inputs (for example a set of data such as requirements) into desired outputs (for example a set of data describing a desired solution). An activity is a set of cohesive tasks. A task is a requirement, recommendation, or permissible action, intended to contribute to the achievement of one or more outcomes of a process.

A task is expressed in the form of a requirement, self-declaration, recommendation, or permissible action. For this purpose, Note 3 of Clause 2.3 in ISO/IEC 15288:2008 carefully employs certain auxiliary verbs to differentiate between the forms of tasks:

- “Shall” is used to express a requirement of the International Standard;
- “Should” to express a recommendation;
- “May” to indicate permission.

Within a life cycle stage, processes are performed as required to achieve stated objectives. The progression of a system through its life is the result of actions managed and performed by people in one or more organizations using the processes selected for a life cycle stage.

NOTE 2 Process concepts are introduced in ISO/IEC 15288:2008, clause 5.3, ISO/IEC 12207:2008, clauses 5.1.9 and 5.1.10, and ISO/IEC TR 24748-1, clause 3.3.

NOTE 3 Criteria for processes are discussed in ISO/IEC 12207:2008, clause 5.1.8, and the decomposition of processes is discussed in clause 5.1.11. ISO/IEC 15288:2008 does not contain corresponding material.

NOTE 4 ISO/IEC TR 24774, *Systems and software engineering — Life cycle management — Guidelines for process definition*, provides guidelines for the description of processes.

Figure 4 illustrates example inputs and outputs of a process for engineering a system. The inputs can be either converted to desired outputs or can enable or control the conversion. Each set of these process inputs and outputs needs to be defined and managed.

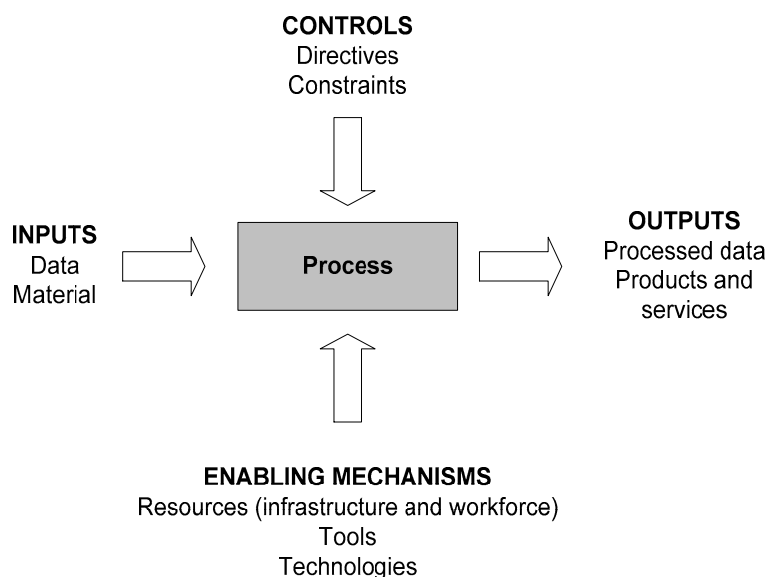


Figure 4 — Example process inputs and outputs

4.4.1.2 Inputs

Inputs can come from outside an organization or project, or from other processes that precede or accompany the process being examined. Examples of inputs to a process include:

- a) Information, such as requirements, interface or architecture definitions.
- b) Data, such as measurements and test reports.
- c) Material that either ends up in the output or is consumed in producing the output.
- d) Services that are part of a chain of services, such as setting up a computer prior to, or coincident with establishing an account.

4.4.1.3 Outputs

Outputs can go to other processes or back to the same process (recursive processing) inside the organization, project (or both), or they can go outside the project or organization, or both. Examples of outputs parallels the examples given for inputs in 4.4.1.1. However, the outputs are often (but not necessarily) transformed in some way by the process being examined.

4.4.1.4 Controls

Processes can be controlled by organizational or organization management directives and constraints and by governmental regulations and laws. Examples of such controls on a process include:

- a) The project agreement. (standards.iteh.ai)
- b) The interfaces with processes used on other systems for which the project is responsible (see clause 4.6.2 of this Technical Report). <https://standards.iteh.ai/catalog/standards/sist/ee361dcb-c26e-4632-8e55-1021e8-742a6f00-iso-tr-24748-3-2011>
- c) The applicable system life cycle stage or stages.
- d) Internal standard practices of the organization, or the part of the organization that has project responsibility.

4.4.1.5 Enabling Mechanisms

Each process can have a set of process enabling mechanisms such as listed below.

- a) The workforce that performs the tasks related to the process.
- b) Other resources required by the process such as facilities, equipment and funds.
- c) Tools (for example software and hardware, automated, manual) required for performing the process activities.
- d) Technologies required by persons performing the activities including methods, procedures and techniques.

4.4.2 Process principles

4.4.2.1 Introduction

ISO/IEC 12207:2008 establishes a top-level architecture of the life cycle of software from conception through retirement. The architecture is constructed with a set of processes and interrelationships among these processes. The processes are based on two primary principles: