TECHNICAL REPORT

ISO/IEC TR 29110-1

Second edition
2016-06-15

Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) —

Part 1: Overview

Ingénierie des systèmes et du logiciel — Profils de cycle de vie pour très petits organismes (TPO) —

Partie 1: Aperçu général

Reference number
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Contents

Page

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

This second edition cancels and replaces the first edition (ISO/IEC 29110-1:2011), which has been technically revised.

ISO/IEC 29110 has the following parts under the general title *Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs)*:

— *Part 1: Overview* [Technical Report]

— *Part 2-1: Framework and taxonomy*

— *Part 2-2: Guide for the development of domain-specific profiles* [Technical Report]

— *Part 3-1: Assessment guide* [Technical Report]

— *Part 3-3: Certification requirements for process capability*

— *Part 3-4: Autonomy-based improvement method* [Technical Report]

— *Part 4-1: Profile specifications: Generic profile group*

— *Part 5-1-1: Management and engineering guide: Generic profile group: Entry profile* [Technical Report]

— *Part 5-1-2: Management and engineering guide: Generic profile groiup: Basic profile* [Technical Report]

— *Part 5-2-1: Organisational management guidelines* [Technical Report]

— *Part 5-6-1: Systems engineering — Management and engineering guide: Generic profile group: Entry profile* [Technical Report]

— *Part 5-6-2: Systems engineering — Management and engineering guide: Generic profile group: Basic profile* [Technical Report]

The following parts are under preparation:

— *Part 3-2: Conformity audit guide*

— *Part 4-3: Service delivery profile group specification*

— *Part 5-3: Service delivery — Guide* [Technical Report]

— *Part 5-1-3: Software engineering — Management and engineering guide: Generic profile group — Intermediate profile* [Technical Report]

Introduction

Very Small Entities (VSEs) around the world are creating valuable products and services. For the purpose of ISO/IEC 29110, a Very Small Entity (VSE) is an enterprise, an organization, a department or a project having up to 25 people. Since many VSEs develop and/or maintain system and software components used in systems, either as independent products or incorporated in larger systems, a recognition of VSEs as suppliers of high-quality products is required.

According to the Organization for Economic Co-operation and Development (OECD) SME and Entrepreneurship Outlook report (2005), "Small and Medium Enterprises (SMEs) constitute the dominant form of business organization in all countries worldwide, accounting for over 95 % and up to 99 % of the business population depending on country". The challenge facing governments and economies is to provide a business environment that supports the competitiveness of this large heterogeneous business population and that promotes a vibrant entrepreneurial culture.

From studies and surveys conducted, it is clear that the majority of International Standards do not address the needs of VSEs. Implementation of and conformance with these standards is difficult, if not impossible. Consequently, VSEs have no, or very limited, ways to be recognized as entities that produce quality systems/system elements including software in their domain. Therefore, VSEs are excluded from some economic activities.

It has been found that VSEs find it difficult to relate International Standards to their business needs and to justify the effort required to apply standards to their business practices. Most VSEs can neither afford the resources, in terms of number of employees, expertise, budget and time, nor do they see a net benefit in establishing over-complex systems or software life cycle processes. To address some of these difficulties, a set of guides has been developed based on a set of VSE characteristics. The guides are based on subsets of appropriate standards processes, activities, tasks, and outcomes, referred to as Profiles. The purpose of a profile is to define a subset of International Standards relevant to the VSEs' context; for example, processes, activities, tasks, and outcomes of ISO/IEC/IEEE 12207 for software; processes, activities, tasks, and outcomes of ISO/IEC/IEEE 15288 for systems; and information products (documentation) of ISO/IEC/IEEE 15289 for software and systems.

VSEs can achieve recognition through implementing a profile and by being audited against ISO/IEC 29110 specifications.

The ISO/IEC 29110 series of International Standards and Technical Reports can be applied at any phase of system or software development within a life cycle. This series of International Standards and Technical Rerports is intended to be used by VSEs that do not have experience or expertise in adapting/tailoring ISO/IEC/IEEE 12207 or ISO/IEC/IEEE 15288 standards to the needs of a specific project. VSEs that have expertise in adapting/tailoring ISO/IEC/IEEE 12207 or ISO/IEC/IEEE 15288 are encouraged to use those standards instead of ISO/IEC 29110.

ISO/IEC 29110 is intended to be used with any lifecycle such as waterfall, iterative, incremental, evolutionary or agile. Systems, in the context of ISO/IEC 29110, are typically composed of hardware and software components.

The ISO/IEC 29110 series, targeted by audience, has been developed to improve system or software and/or service quality and process performance. See Table 1.

Table 1 — ISO/IEC 29110 target audience

ISO/IEC 29110	Title	Target audience
ISO/IEC 29110-1	Overview	VSEs and their customers, assessors, standards producers, tool vendors and methodology vendors.
ISO/IEC 29110-2	Framework for profile preparation	Profile producers, tool vendors and methodology vendors. Not intended for VSEs.
ISO/IEC 29110-3	Certification and assessment guidance	VSEs and their customers, assessors, accreditation bodies.
ISO/IEC 29110-4	Profile specifications	VSEs, customers, standards producers, tool vendors and methodology vendors.
ISO/IEC 29110-5	Management, engineering and service delivery guides	VSEs and their customers.
ISO/IEC 29110-6	Management and engineering guides not tied to a specific profile	VSEs and their customers.

If a new profile is needed, ISO/IEC 29110-4 and ISO/IEC/TR 29110-5 can be developed with minimal impact to existing documents.

ISO/IEC 29110-2-1 introduces the concepts for systems and software engineering profiles for VSEs. It establishes the logic behind the definition and application of profiles. For standardized profiles, it specifies the elements common to all profiles (structure, requirements, conformance, and assessment). For domain-specific profiles (profiles that are not standardized and developed outside of the ISO process), it provides general guidance adapted from the definition of standardized profiles.

ISO/IEC 29110-3 defines certification schemes, assessment guidelines and compliance requirements for process capability assessment, conformity assessments, and self-assessments for process improvements. ISO/IEC 29110-3 also contains information that can be useful to developers of certification and assessment methods and developers of certification and assessment tools. ISO/IEC 29110-3 is addressed to people who have direct involvement with the assessment process, e.g. the auditor, certification and accreditation bodies and the sponsor of the audit, who need guidance on ensuring that the requirements for performing an audit have been met.

ISO/IEC 29110-4-m provides the specification for all profiles in one profile group that are based on subsets of appropriate standards elements.

ISO/IEC/TR 29110-5-m-n provides management, engineering and service delivery guides for the profiles in a profile group.

The future ISO/IEC/TR 29110-6-x provides management and engineering guides not tied to a specific profile.

This part of ISO/IEC 29110 defines the terms common to the ISO/IEC 29110 series. It introduces processes, lifecycle and standardization concepts, the taxonomy (catalogue) of ISO/IEC 29110 profiles and the ISO/IEC 29110 series. It also introduces the characteristics and needs of a VSE and clarifies the rationale for specific profiles, documents, standards and guides.

Figure 1 describes the ISO/IEC 29110 International Standards (IS) and Technical Reports (TR) and positions the parts within the framework of reference. Overview, assessment guide, management and engineering guide are available from ISO as freely available Technical Reports (TR). The Framework document, profile specifications and certification schemes are published as International Standards (IS).

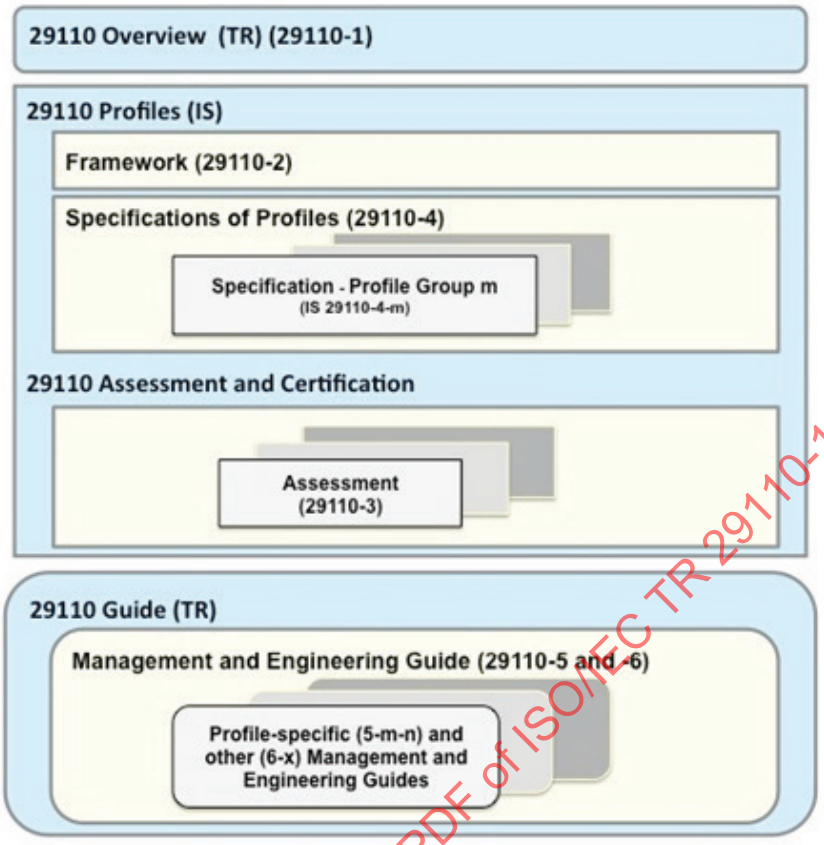

Figure 1 — ISO/IEC 29110 series

Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) —

Part 1: Overview

1 Scope

1.1 Fields of application

This part of ISO/IEC 29110 introduces the major concepts required to understand and use the ISO/IEC 29110 series. It introduces the characteristics and requirements of a VSE and clarifies the rationale for VSE-specific profiles, documents, standards and guides.

This part of ISO/IEC 29110 also introduces process, lifecycle, standardization concepts and defines the organizational terms common to the VSE Profile Set of Documents.

This part of ISO/IEC 29110 is applicable to a VSE. A VSE is an entity (enterprise, organization, department or project) having up to 25 people. The lifecycle processes described in the ISO/IEC 29110 series, Standardized Profiles and Technical Reports are not intended to preclude nor discourage their use by an entity that is larger than a VSE.

1.2 Target audience

This part of ISO/IEC 29110 is targeted both at the general audience wishing to understand the series of documents and, more specifically, at users of the ISO/IEC 29110 series. It should be read first when initially exploring VSE Profile documents. While there is no specific prerequisite to read this part of ISO/IEC 29110, it will be helpful to the user in understanding the other parts.

The lifecycle processes defined in the set of Standardized Profiles and Technical Reports can be used by a VSE when developing, acquiring and using, as well as when creating and supplying systems having hardware and software elements and software. They can be applied at any level in a systems development, software system's structure and at any stage in the lifecycle. They are not intended to preclude or discourage the use of additional processes that a VSE finds useful.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 29110-2-1, *Software engineering — Lifecycle profiles for Very Small Entities (VSEs) — Part 2-1: Framework and taxonomy*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 29110-2-1 and the following apply.

3.1
activity
set of cohesive *tasks* (3.69) of a *process* (3.36)

[SOURCE: ISO/IEC/IEEE 12207]

3.2
acquirer
stakeholder that acquires or procures a product or *service* (3.53) from a supplier

Note 1 to entry: Other terms commonly used for an acquirer are buyer, *customer* (3.22), owner, purchaser or internal/organizational sponsor.

[SOURCE: ISO/IEC/IEEE 12207]

3.3
advanced profile
profile (3.45) targeted at VSEs which want to sustain and grow as an independent competitive system and/or *software* (3.56) development business

3.4
agreement
mutual acknowledgement of terms and conditions under which a working relationship is conducted

EXAMPLE Contract, memorandum of agreement.

[SOURCE: ISO/IEC/IEEE 12207]

3.5
assessment indicator
sources of objective evidence used to support the *assessors*' (3.6) judgment in rating *process* (3.36) attributes

EXAMPLE *Work products* (3.77), practice, or *resource* (3.51).

[SOURCE: ISO/IEC 33001]

3.6
assessor
individual who participates in the rating of *process* (3.36) attributes

[SOURCE: ISO/IEC 33001]

3.7
audit
systematic, independent, documented *process* (3.36) for obtaining *records* (3.48), statements of fact or other relevant information and assessing them objectively, to determine the extent to which specified requirements are fulfilled

Note 1 to entry: While "audit" applies to management systems, "assessment" applies to *conformity assessment* (3.20) bodies, as well as more generally.

[SOURCE: ISO/IEC 17000]

3.8
auditee
organization (3.34) being audited

[SOURCE: ISO 19011:2011, 3.7]

3.9
auditor
person who conducts an *audit* (3.7)

[SOURCE: ISO 19011:2011, 3.8]

3.10
audit team
one or more *auditors* (3.9) conducting an *audit* (3.7), supported if needed by technical experts

Note 1 to entry: One auditor of the audit team is appointed as the audit team leader.

Note 2 to entry: The audit team may include auditors-in-training.

[SOURCE: ISO 19011:2011, 3.9, modified]

3.11
autonomy-based improvement
self-motivated and self-determined professional *process improvement* (3.41) with an understanding of the work (process) objectives, latest technology, and outcomes from product use

3.12
baseline
formally approved version of a configuration item, regardless of media, formally designated and fixed at a specific time during the configuration item's lifecycle

[SOURCE: ISO/IEC/IEEE 24765]

3.13
base standard
approved *International Standard* (3.30) or Telecommunication Standardization Sector of the International Telecommunications Union (ITU-T) Recommendation

[SOURCE: ISO/IEC/TR 10000-1]

3.14
basic profile
profile (3.45) targeted at VSEs developing a single application by a single work team

3.15
certification
third-party attestation related to products, *processes* (3.36), *systems* (3.62) or persons

Note 1 to entry: Certification of a management system is sometimes also called registration.

Note 2 to entry: Certification is applicable to all objects of *conformity assessment* (3.20), except for conformity assessment bodies themselves, to which accreditation is applicable.

[SOURCE: ISO/IEC 17000]

3.16
certification body
third-party *conformity assessment* (3.20) body operating *certification schemes* (3.17)

[SOURCE: ISO/IEC 17065]

3.17
certification scheme
certification system related to specified products, to which the same specified requirements, specific rules and procedures apply

Note 1 to entry: For definition of "certification system", refer to ISO/IEC 17000:2004, 2.7.

Note 2 to entry: The criteria for the rules, procedures and management for implementing product, *process* (3.36) and *service* (3.53).

[SOURCE: ISO/IEC 17065, modified]

3.18
certification scheme owner
person or *organization* (3.34) that is responsible for developing and maintaining a specific *certification scheme* (3.17)

Note 1 to entry: The certification scheme owner can be the *certification body* (3.16) itself, a governmental authority, trade association, group of certification bodies or other.

[SOURCE: ISO/IEC 17065]

3.19
client
<for certification> *organization* (3.34) that is responsible to a *certification body* (3.16) for ensuring *certification* (3.15) requirements, including product requirements, are fulfilled

[SOURCE: ISO/IEC 17065]

3.20
conformity assessment
demonstration that specified requirements relating to a product, *process* (3.36), *system* (3.62), person or body are fulfilled

[SOURCE: ISO/IEC 17000]

3.21
critical system
system (3.62) having the potential for serious impact on the *users* (3.72) or environment, due to factors including safety, performance, and security

3.22
customer
person or *organization* (3.34) that could or does receive a product or a *service* (3.53) that is intended for or required by this person or organization

EXAMPLE Consumer, client, end-user, retailer, receiver or product or service from an internal *process* (3.36), beneficiary and purchaser.

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

[SOURCE: ISO 9000]

3.23
deployment package
set of artefacts developed to facilitate the implementation of a set of practices, of the selected framework, in a *very small entity* (3.75)

3.24
disposed system
system (3.62) that has been transformed (i.e. state change) by applying the disposal process

Note 1 to entry: A systems approach considers the total system and the total *lifecycle* (3.32) of the system. This includes all aspects of the system and the system throughout its life until the day users dispose of the system and the external enterprises complete the handling of the disposed system products.

[SOURCE: ISO/IEC/IEEE 15288]

3.25
entity
registered *organization* (3.34), group within a registered organization, or a *project* (3.47) within an organization

3.26
entry profile
profile (3.45) targeted at start-up VSEs (i.e. VSEs who started their operation less than three years) and/or at VSEs working on small *project* (3.47) (e.g. project size of less than six person-months)

3.27
generic profile group
profile group (3.46) applicable to VSEs (very small entities) that do not develop *critical systems* (3.21) or *software* (3.56) products and have typical situational factors

3.28
guide
document published by ISO or IEC giving rules, orientation, advice or recommendations relating to international standardization

3.29
intermediate profile
profile (3.45) targeted at VSEs involved in the development of more than one *project* (3.47) in parallel with more than one work team

3.30
international standard
standard (3.59) that is adopted by an international standardizing/standards organization and made available to the public

3.31
lead assessor
assessor (3.6) who has demonstrated the competencies to conduct an assessment and to monitor and verify the conformance of a *process assessment* (3.37)

[SOURCE: ISO 33001]

3.32
lifecycle
evolution of a *system* (3.62), product, *service* (3.53), *project* (3.47) or other human-made *entity* (3.25), from conception through retirement

[SOURCE: ISO/IEC/IEEE 15288]

3.33
operator
individual or *organization* (3.34) that performs the operations of a *system* (3.62)

Note 1 to entry: The role of operator and the role of *user* (3.72) can be vested, simultaneously or sequentially, in the same individual or organization.

Note 2 to entry: An individual operator combined with knowledge, skills and procedures can be considered as an element of the system.

Note 3 to entry: An operator may perform operations on a system that is operated, or of a system that is operated, depending on whether or not operating instructions are placed within the system boundary.

[SOURCE: ISO/IEC/IEEE 12207]

3.34
organization
person or a group of people that has its own functions responsibilities, authorities and relationships to achieve its objectives

[SOURCE: ISO 9000]

3.35
organizational management profile
profile (3.45) targeted at VSEs to provide them with additional organizational management guidance

3.36
process
set of interrelated or interacting activities that use inputs to deliver an intended result

[SOURCE: ISO 9000]

3.37
process assessment
disciplined evaluation of an organizational unit's processes against a *process assessment model* (3.38)

[SOURCE: ISO/IEC 33001]

3.38
process assessment model
model suitable for the purpose of assessing a specified process quality characteristic, based on one or more *process reference models* (3.44)

[SOURCE: ISO/IEC 33001]

3.39
process capability
characterization of the ability of a process to meet current or projected business goals

[SOURCE: ISO/IEC 33020]

3.40
process capability level
characterization of a process on an ordinal measurement scale of *process capability* (3.39)

[SOURCE: ISO/IEC 33000]

3.41
process improvement
actions taken to improve the quality of the organization's processes aligned with the business needs

[SOURCE: ISO/IEC 33001]

3.42
process outcome
observable result of the successful achievement of the process purpose

[SOURCE: ISO/IEC/IEEE 12207]

3.43
process profile
set of process attribute ratings for an assessed process

[SOURCE: ISO/IEC 33001]

3.44
process reference model
model comprising definitions of processes in a *lifecycle* (3.32) described in terms of process purpose and outcomes, together with an architecture describing the relationships between the processes

[SOURCE: ISO/IEC 33001]

3.45
profile
set of one or more *base standards* (3.13) and/or profiles, and where applicable, the identification of chosen classes, conforming subsets, option and parameters of those base standard, or standardized profiles necessary to accomplish a particular function

[SOURCE: ISO/IEC/TR 10000-1]

3.46
profile group
collection of *profiles* (3.45) which are related either by composition of processes [e.g. *activities* (3.1) and *tasks* (3.69)], or by capability level, or both

3.47
project
endeavour with defined start and finish dates undertaken to create a product or *service* (3.53) in accordance with specified *resources* (3.51) and requirements

Note 1 to entry: A project is sometimes viewed as a unique process comprising coordinated and controlled activities and composed of activities from the Technical Management processes and Technical processes defined in this part of ISO/IEC 29110.

[SOURCE: ISO/IEC/IEEE 12207]

3.48
record
set of related data items treated as a unit

[SOURCE: ISO/IEC/IEEE 15289]

3.49
report
information item that describe the results of activities such as investigations, observations, assessments, or tests

[SOURCE: ISO/IEC/IEEE 15289]

3.50
repository
1. collection of all system elements or *software* (3.56) related artefacts belonging to a system. 2. The location/format in which such a collection is stored

[SOURCE: ISO/IEC/IEEE 24765]

3.51
resource
asset that is utilized or consumed during the execution of a process

Note 1 to entry: Includes diverse entities such as funding, personnel, facilities, capital equipment, tools, and utilities such as power, water, fuel and communication infrastructures.

Note 2 to entry: Resources include those that are reusable, renewable or consumable.

[SOURCE: ISO/IEC/IEEE 12207]

3.52
review
process or meeting during which a *work product* (3.77), or set of work products, is presented to project personnel, managers, *users* (3.72), *customers* (3.22), or other interested parties for comment or approval

[SOURCE: ISO/IEC/IEEE 24765]

3.53
service
performance of activities, work, or duties

Note 1 to entry: A service is self contained, coherent, discrete, and can be composed of other services.

Note 2 to entry: A service is generally an intangible product.

[SOURCE: ISO/IEC/IEEE 15288]

3.54
service delivery profile
profile targeted at VSEs that need to perform and manage service delivery processes, either for *systems* (3.62) or *software* (3.56) products that they have developed or that were developed by others

3.55
small and medium enterprise
SME
enterprise which employ fewer than 250 persons

[SOURCE: OECD 2005, modified]

3.56
software
computer programs, procedures, and possibly associated documentation and data pertaining to the operation of a computer system

[SOURCE: IEEE 828]

3.57
software component
general term used to refer to a software system or an element, such as module, unit, data, or document

[SOURCE: IEEE 1061]

3.58
software engineering
application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of *software* (3.56); that is, the application of engineering to software

[SOURCE: ISO/IEC/IEEE 12207]

3.59
standard
document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context

Note 1 to entry: Standards should be based on the consolidated results of science, technology and experience, and aimed at the promotion of optimum community benefits.

3.60
standardized profile
internationally agreed-to, harmonized *standard* (3.59) which describes one or more *profiles* (3.45)

[SOURCE: ISO/IEC/TR 10000-1]

3.61
surveillance
systematic iteration of *conformity assessment* (3.20) activities as a basis for maintaining the validity of the statement of conformity

[SOURCE: ISO/IEC 17000]

3.62
system
combination of interacting elements organized to achieve one or more stated purposes

Note 1 to entry: A system is sometimes considered as a product or as the services it provides.

Note 2 to entry: In practice, the interpretation of its meaning is frequently clarified by the use of an associative noun, e.g. aircraft system or database management system. Alternatively, the word "system" is substituted simply by a context dependent synonym, e.g. aircraft or database, though this potentially obscures a system principles perspective.

Note 3 to entry: A system can include the associated equipment, facilities, material, software, firmware, technical documentation, services and personnel required for operations and support to the degree necessary for use in its intended environment, e.g. enabling system, system-of-interest, system of systems.

[SOURCE: ISO/IEC/IEEE 15288]

3.63
systems engineering
interdisciplinary approach governing the total technical and managerial effort required to transform a set of *customer* (3.22) needs, expectations, and constraints into a solution and to support that solution throughout its life

[SOURCE: ISO/IEC/IEEE 15288]

3.64
systems engineering management plan
SEMP
top level technical planning document for a *project* (3.47), which addresses technical management processes established by three principal sources [the project's contract or *agreement* (3.4), applicable organizational processes, and the *systems engineering* (3.63) project team], as necessary to successfully accomplish the systems engineering-related *tasks* (3.69) of the project

[SOURCE: ISO/IEC 24748-4]

3.65
statement of work
SOW
means to describe and specify the *tasks* (3.69) to be performed under the contract

[SOURCE: ISO/IEC/IEEE 12207]

3.66
system structure
decomposition of a system of interest into a set of interacting systems and system elements

Note 1 to entry: The system structure is described in a System Breakdown Structure (SBS).

[SOURCE: ISO/IEC/IEEE 15288:2008]

3.67
taxonomy
classification scheme for referencing *profiles* (3.45) or sets of profiles unambiguously

[SOURCE: ISO/IEC/TR 10000-1]

3.68
technical report
document published by ISO or IEC containing collected data of a different kind from that normally published as an *International Standard* (3.30) or Technical Specification

Note 1 to entry: Such data may include, for example, data obtained from a survey carried out among the national bodies, data on work in other international organizations or data on the "state of the art" in relation to *standards* (3.59) of national bodies on a particular subject.

3.69
task
requirement, recommendation, or permissible action, intended to contribute to the achievement of one or more outcomes of a process

[SOURCE: ISO/IEC/IEEE 12207]

3.70
trade-off
decision-making actions that select from various requirements and alternative solutions on the basis of net benefit to the stakeholders

[SOURCE: ISO/IEC/IEEE 12207]

3.71
traceability
describes association among two or more logical entities, such as requirements, system elements, *verifications* (3.74), or *tasks* (3.69)

EXAMPLE Software features and test cases are typically traced to software requirements.

[SOURCE: ISO/IEC/IEEE 12207]

3.72
user
individual or group that interacts with a *system* (3.62) or benefits from a system during its utilization

Note 1 to entry: The role of user and the role of *operator* (3.33) are sometimes vested, simultaneously or sequentially, in the same individual or *organization* (3.34).

[SOURCE: ISO/IEC 25010]

3.73
validation
confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled

Note 1 to entry: A *system* (3.62) is able to accomplish its intended use, goals and objectives (i.e. meet stakeholder requirements) in the intended operational environment. The right system was built.

Note 2 to entry: In a *lifecycle* (3.32) context, validation involves the set of activities for gaining confidence that a system is able to accomplish its intended use, goals and objectives in an environment like the operational environment.

[SOURCE: ISO 9000, modified — Note 1 to entry and Note 2 to entry have been added]

3.74
verification
confirmation, through the provision of objective evidence, that specified requirements have been fulfilled.

Note 1 to entry: Verification is a set of activities that compares a *system* (3.62) or system element against the required characteristics. This includes, but is not limited to, specified requirements, design, descriptions, and the system itself. The system was built right.

[SOURCE: ISO 9000:2015, modified — Note 1 to entry has been added]

3.75
very small entity
enterprise, an *organization* (3.34), a department or a *project* (3.47) having up to 25 people

3.76
work breakdown structure
WBS
deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables; it organizes and defines the total scope of the *project* (3.47)

[SOURCE: ISO/IEC/IEEE 24765]

3.77
work product
artefact associated with the execution of a process

[SOURCE: ISO/IEC 33000]

4 Symbols and abbreviated terms

4.1 Naming, diagramming and definition conventions

There are no specific conventions applicable to this part of ISO/IEC 29110.

4.2 Abbreviated terms

COTS	Commercial-off-the-shelf software
DP	Deployment Package
PG	Profile Group
SE	Systems Engineering
SOW	Statement of Work
SW	Software Engineering
VSE	Very Small Entity
WBS	Work Breakdown Structure

5 VSE characteristics and VSE potential benefits

5.1 General

A VSE is considered to be an entity that engages in systems or software engineering activities at any point, including development, integration, or maintenance. Annex A provides more basic information.

5.2 VSE characteristics

VSEs are subject to a number of characteristics, needs and desirable competencies that affect the contents, the nature and the extent of their activities. The Profiles address a subset of VSEs which are described through the following characteristics, needs, and desirable competencies, classified in four categories: Finance and Resources, Customer Interface, Internal Business Processes, and Learning and Growth.

In some cases, a VSE is expected to perform limited missions in the entire systems and/or software development lifecycle under the directions of either another organization or consortium fulfilling contract or agreement requirements. These missions may be a part of the systems development and/or software implementation project according to the statement of work. The VSE is chosen by its own competencies or by a bid for the project. Amplification of these characteristics is provided in ISO/IEC 29110-4-m.

5.3 VSE potential benefits

From the VSE perspective, some benefits considered for using the ISO/IEC 29110 include good internal system development processes, software management processes, greater customer confidence and satisfaction, greater systems and/or software product quality, increased sponsorship for process improvement and decreased development risk. These benefits might also help with increased competitiveness and market share.

NOTE According to recommendation of the European Commission (2003/361/EC), this size of enterprise is called small enterprise (<50 persons) or microenterprise (<10 persons).

6 Lifecycle process concepts

6.1 General

This Clause provides lifecycle process concepts that are considered in the ISO/IEC 29110 series and are supportive of the potential coordinated use of ISO/IEC/IEEE 12207, ISO/IEC/IEEE 15288, and ISO/IEC/IEEE 15289. It will assist users in their management of information items as products of the system or software lifecycle.

6.2 Systems concepts

The systems approach to solving a problem, analyse and observe the system as a whole and identify the interrelationships among the parts that compose it and also with the system environment (e.g. enabling systems). It also considers the entire lifecycle of the system and the different possible applications of the system. Systems can be immersed in different environments and multiple relationships will emerge. Every project has a context in which the system is embedded.

Thus, a system is not only composed of software and hardware, but is always part of a larger operation, often involving people and other systems. The designer must clearly understand these relationships before defining a solution. Following this approach, when deploying the requirements in smaller modules, it will help ensure effective integration of the parts.

6.3 Lifecycle models and stages

This subclause, using text from ISO/IEC/IEEE 12207 and ISO/IEC/IEEE 15288, helps to establish a common framework for lifecycle processes and in planning, producing, and evaluating the results of the lifecycle processes. The texts below are quoted as follows: paragraph number, text and identification of the document from which the text is extracted.

5.4.3 Software lifecycle models and stages

A common set of stages for a software system is concept exploration, development, sustainment, and retirement, with transitions between stages for the system as a whole and for its elements.

Often, the development stage is subdivided more finely and in different ways. One often-cited set of software development stages are elicitation, requirements, design, construction, and testing — the "waterfall" model. If the stages are considered as sequential, then each stage is required to produce correct results before proceeding to the next stage. In practice, this is extremely difficult to achieve unless the requirements are known very well and the cost estimates are very good. In performing a waterfall, one risks performing extensive rework that does not properly fall within any of the planned stages, hence probably does not fall within any budget.

NOTE 1 Winston Royce, commonly recognized as an early analyst of lifecycle process models, described the need for rework stages rather than the waterfall (a term that he did not use). Unfortunately, the rework stages were dropped from the "waterfall" model as it was popularly understood.

To deal with the issues of incompletely known requirements and inaccurate estimates, a number of other models have been proposed: incremental, spiral, iterative, and evolutionary, including agile. These models involve repeated performance of the lifecycle processes and stages during the lifecycle, e.g. for different increments of the software product, for more precise handling of exceptions to common functions, or for requirements that were not fully defined at the outset. These models can be applied across stages, such as development and utilization or deployment. For example, software elements can be developed incrementally and then held for block operational release at a convenient time in the organization's business cycle.

The "incremental development" model includes initial planning, initial requirements analysis, initial architectural definition, and initial validation, but allocates design, implementation, verification (and sometimes delivery) activities to a series of stages, each of which provides a portion of the intended functionality. The approach provides for some flexibility to respond to inaccurate cost or schedule estimates by moving functionality to later increments.

The "spiral" variation on incremental developmental proposes ordering the development of functionality based on risk, with the riskiest problems considered in the early increments. This provides some protection against cost surprises occurring late in the development cycle.

The "iterative development" model performs initial planning and then consists of a cyclic process of prototyping, testing, analyzing and refining the requirements and the solution. "Iterative" models repeatedly perform the lifecycle processes to deliver prioritized system functions sooner, with refined or more complex elements of the system coming in later iterations

The "evolutionary model" is intended to deal with incomplete knowledge of requirements. It provides for initial planning and initial architecture definition, but allocates requirements analysis, design, construction, verification, validation and delivery to a series of stages. Delivered capabilities that do not meet user needs can be reworked in subsequent stages of the evolution.

Agile" methods actually use a variety of models. What the methods have in common is an emphasis on collaboration in the rapid production of working software and in managing the changes as the requirements evolve. Annex H provides information on the application of this standard in an agile context. "

NOTE 2 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 3 ISO/IEC/TR 24748-1, ISO/IEC/TR 24748-2, and ISO/IEC/TR 24748-3 provide additional detail regarding lifecycle models and stages. The models described in this Clause apply not only to software systems but also to other systems as described in ISO/IEC/IEEE 15288.

[ISO/IEC/IEEE 12207]

5.4.1 System lifecycle model

Every system has a lifecycle. A lifecycle can be described using an abstract functional model that represents the conceptualization of a need for the system, its realization, utilization, evolution and disposal.

A system progresses through its lifecycle as the result of actions, performed and managed by people in organizations, using processes for execution of these actions. The detail in the lifecycle model is expressed in terms of these processes, their outcomes, relationships and sequence. This International Standard does not prescribe any particular lifecycle model. Instead, it defines a set of processes, termed lifecycle processes that can be used in the definition of the system's lifecycle. Also, this International Standard does not prescribe any particular sequence of processes within the lifecycle model. The sequence of the processes is determined by project objectives and by selection of the system lifecycle model.

5.4.2 System lifecycle stages

Lifecycles vary according to the nature, purpose, use and prevailing circumstances of the system. Each stage has a distinct purpose and contribution to the whole lifecycle and is considered when planning and executing the system lifecycle.

The stages represent the major lifecycle periods associated with a system and they relate to the state of the system description or the system itself. The stages describe the major progress and achievement milestones of the system through its lifecycle. They give rise to the primary decision gates of the lifecycle. These decision gates are used by organizations to understand and manage the inherent uncertainties and risks associated with costs, schedule and functionality when creating or utilizing a system. The stages thus provide organizations with a framework within which organization management has high-level visibility and control of project and technical processes.

Per ISO/IEC/TR 24748-1 (IEEE STD 24748-1-2011), the typical system lifecycle stages include concept, development, production, utilization, support, and retirement.

Organizations employ stages differently to satisfy contrasting business and risk mitigation strategies. Using stages concurrently and in different orders can lead to lifecycle forms with distinctly different characteristics.

Further elaboration of these concepts can be found in the ISO/IEC/IEEE/TR 24748 guides, on the application of lifecycle management.

[ISO/IEC/IEEE 15288]

6.4 Lifecycle product types

This subclause helps to clarify that information items are essential to preserving what transpired when using system and/or software lifecycle processes and be identified as deliverable documents. Information items allow project participants to have a common understanding of what is planned and how work is performed. The result of a process can be documented or may imply the need for a document (or information item) and often do not specify the contents.

The use of generic types simplifies the application of consistent structure, content, and formats for similar information items (records and documents), to support usability. Successive parts of the ISO/IEC 29110 series define the lifecycle data of ISO/IEC/IEEE 12207 and ISO/IEC/IEEE 15288 by relating tasks and activities to generic information item types. Some example Lifecycle product types are shown in Table 2.

Table 2 — Example lifecycle product types

Type	Purpose	Sample of recommended output information types
Record	Characterize the data an organizational entity retains.	Configuration record Problem record
Description	Represent a planned or actual function, design, or item	High-level software design description
Plan	Define when, how, and by whom specific activities are to be performed.	Project management plan
Procedure	Define in detail when and how to perform certain activities or tasks, including tools needed.	Problem resolution procedure
Report	Describe the results of activities such as investigations, assessments, and tests.	Problem report Validation report
Request	Record information needed to solicit a response.	Change request
Specification	Specify a required function, performance or process (such as, requirements specification, standard, policy).	Software requirements specification
NOTE Adapted from ISO/IEC/IEEE 15289.		

7 Process improvement and assessment concepts

7.1 Process improvement concepts

The process improvement concept is to encourage VSE's project teams to implement systematic approaches which allow for the repetition and realism in estimating and implementing a project.

Process improvement concepts characterize all actions undertaken to improve an organization's processes to both increase their efficiency and meet the organization's business goals. Some process improvement activities are addressed in the ISO/IEC 33000 series and ISO/IEC 29110-3.

Ideally, process improvement is driven by business goals such as increasing quality, productivity, customer satisfaction or increasing market share. Several approaches start with organizational goals identification, followed by identification of potential problems preventing the realization of these business goals. From this diagnosis, corrections are identified and implemented.

It could be easy for a VSE to over commit to a specific customer project based on their limited resources. Periodic assessments and communication (internal and external) of the project progress will help ensure customer satisfaction.

7.2 Capability assessment concepts

Capability assessment concept refers to the determination of the extent to which the organization's processes contribute to the achievement of its business goals and to help the organization focus on the need for process improvement. For example, the assessment can either beformal or informal, use an outside evaluator or an internal evaluator, use a standard checklist or personnel interviews, etc.

7.3 Conformity assessment

The conformity assessment parts describes the process conformance assessment requirements needed to get recognition of the implementation of defined VSE Profiles. The targeted audience is primarily those who perform process certifications for VSEs and who have a direct relation with the certification process based on the VSE Profiles.

Certification is carried out by certification bodies that operate certification schemas. There are ISO/IEC standards and guides that provide guidance and set the rules for conformity assessments, certification bodies, and certification schemas.

In order to increase confidence in certification, it can be useful to consider accreditation of certification bodies.

8 Standardization concepts

8.1 General

Recognizing the limitations of VSEs resources, the need for minimum processes and practices are supported in the scope of the ISO/IEC 29110 series. This will allow the VSE to be flexible and achieve its organizational goals without compromising systems and software engineering processes.

NOTE Rationale for defining each profile is described in ISO/IEC 29110-2-1.

8.2 Standard

Systems and software engineering standards are focusing on both processes and products aspects. They contain formal requirements developed and used to prescribe consistent approaches to develop systems and software engineering standards have the following objectives:

— to provide a common framework and vocabulary for project practitioners;

— to provide a framework for two party agreements;

— to improve and evaluate competence;

— to facilitate process or product evaluation.

Standards contain normative and, in some cases, informative parts. The normative part of standards is used as requirements for conformance evaluation. The informative part of standards contains information that either complements or facilitates the understanding of or the use of the normative part.

The need for process improvement should be a business issue for VSEs (e.g. for-profit organizations and for non for-profit organizations), motivated by efficiency and effectiveness. In large organizations, large quantities of data are tracked in sophisticated ways, including application of Lean and six sigma tools. In VSEs, process improvement can be handled, more informally.

8.3 Guides

Guides provide practical information to facilitate the implementation and assessment of the defined profiles. In accordance with ISO/IEC JTC 1, guides are published as Technical Reports.

8.4 Profile

A profile is a set of one or more base standards and/or standardized profiles and, where applicable, the identification of chosen classes, conforming subsets, options and parameters of those base standards, or standardized profiles necessary to accomplish a particular function.

8.5 Profile group

A profile group (PG) is a collection of profiles which are related either by composition of processes (i.e. activities, tasks, etc.). Amplification of these characteristics is provided in ISO/IEC 29110-2-1.

8.6 Generic profile group

The generic profile group is applicable to VSEs that do not develop critical systems or software products. The generic profile group does not imply any specific application domain. Amplification of these characteristics is provided in ISO/IEC 29110-2-1.

This Profile Group is a collection of four profiles (Entry, Basic, Intermediate, and Advanced) providing a progressive approach to satisfying a vast majority of VSEs. VSEs targeted by the Entry Profile are VSEs working on small projects (e.g. project size of less than six person-months) and for start-up VSEs. The Basic Profile describes a single application by a single project team of a VSE. The Intermediate Profile is targeted at VSEs involved in the development of more than one project in parallel with more than one work team. The Advanced Profile is targeted to VSEs which want to sustain and grow as an independent competitive system and/or software development business.

8.7 Use of profiles

Profiles are designed to be used by a VSE to implement specific functionality through the use of Guides published as Technical Reports. At a minimum, each Profile of the ISO/IEC 29110 is to be linked to an Assessment Guide and one or more Implementation Guides (e.g. management and engineering guides).

Additional materials, such as a deployment package, a set of artefacts developed to facilitate the implementation of a set of practices of the selected framework, are available to further facilitate the implementation of Profiles by a VSE.

References to standardized profiles can simplify deployment and assessment of capabilities, processes, and services.

8.8 Conformance to profiles

Conformance to profiles may be complete when all the required elements of the profile are satisfied or partially satisfied when a selected subset is completed.

Unless otherwise noted in the standardized profile conformance clause, conformance to the profile implies conformance to the base standards.

For methodology-related products and tools, conformance means that the proposed method or tools implements the required elements of the profile.

For the implementation of the required elements within a VSE, conformance means that all the mandatory requirements of the profile are met by the implementation. This can be evaluated through an assessment process.

These concepts provide the context and standardization details for the format and content of the product, as required to support the principles and classification schema selected for them. Conformance to a VSE profile should be evaluated through an assessment defined in the Assessment Guide referenced by the VSE profile.

By conforming to International Standards, the VSE shows that their produced documents and work products are produced and supported consistent with defined process outcomes or activities.

9 Taxonomy of VSE profiles

9.1 General

The profile identifier should not to be confused with the part number in the ISO/IEC 29110 series, which use the profile identifier as a suffix to the part number for part 4-m and 5-m-n.