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Systems and software engineering — Life cycle profiles for very small entities (VSEs) —

Part 5-6-3: System engineering guidelines for the generic Intermediate profile

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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.

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).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

A list of all parts in the ISO 29110 series can be found on the ISO website.

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Introduction

0.1 Introduction to the ISO/IEC 29110 series

For the ISO/IEC 29110 series, a very small entity (VSE) is an enterprise, organization (e.g., government agency, non-profit organization), department or project having up to 25 people. Many VSEs develop and/or maintain systems and the software components used in those systems, either as independent products or incorporated into the larger system. Due to this a recognition of VSEs as suppliers of high-quality products is required.

Very small entities (VSEs) around the world are creating valuable products and services. According to the World Bank, small and medium-sized enterprises (SMEs) account for about 90 % of enterprises worldwide. According to the Organisation for Economic Co-operation and Development (OECD), SMEs represent 99 % of all businesses and generate about 60 % of employment. Almost one person out of three is employed in a micro firm with less than 10 employees. The European Union reports that micro firms, with fewer than 10 persons, account for 93.5 % of all enterprises and small firms, with 10 to 49 employees, account for 5.5 % of all enterprises. The challenge facing OECD governments 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 conformity 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 guidelines has been developed based on a set of VSE characteristics. The guidelines 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; and 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 can be applied at any phase of system or software development within a life cycle. The ISO/IEC 29110 series 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 the ISO/IEC 29110 series.

The ISO/IEC 29110 series is intended to be used with any life cycle such as waterfall, iterative, incremental, evolutionary or agile.

The life cycle processes described in the ISO/IEC 29110 series are not intended to preclude or discourage their use by organizations bigger than VSEs.

Systems, in the context of the ISO/IEC 29110 series, 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. Figure 1 describes the ISO/IEC 29110 series and positions the parts within the framework of reference.

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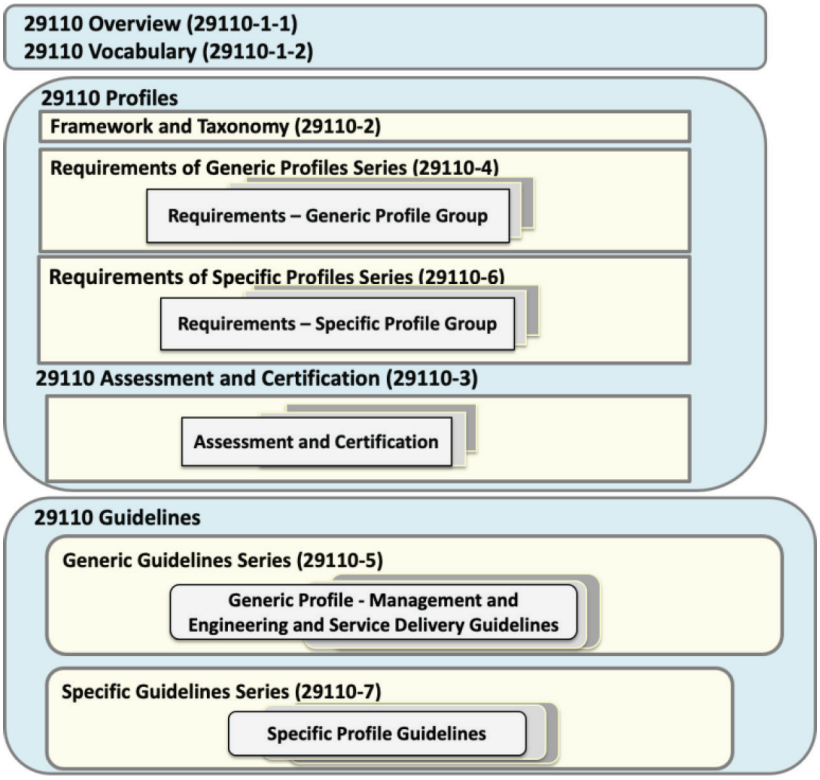


Figure 1 — ISO/IEC 29110 series

ISO/IEC 29110-1-1 introduces processes, life cycle and standardization concepts, the taxonomy (catalogue) of ISO/IEC 29110 profiles and the ISO/IEC 29110 series. ISO/IEC 29110-1-1 also introduces the characteristics and needs of a VSE, and clarifies the rationale for specific profiles, documents, standards and guidelines. ISO/IEC 29110-1-2 defines the terms common to the ISO/IEC 29110 series. ISO/IEC 29110-1-1 and ISO/IEC 29110-1-2 are targeted at VSEs and their customers, assessors, standards producers, tool vendors and methodology vendors.

ISO/IEC 29110-2 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, conformity, 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 29110-2 is targeted at profile producers, tool vendors and methodology vendors.

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 29110-3 is targeted at VSEs and their customers, assessors, accreditation bodies.

ISO/IEC 29110-4 provides the specifications for all generic profiles of the generic profile group that are based on subsets of appropriate standards elements. ISO/IEC 29110-4 is targeted at VSEs, customers, standards producers, tool vendors and methodology vendors.

ISO/IEC 29110-5 provides a management, engineering and service delivery guidelines for profiles of the Generic profile group. ISO/IEC 29110-5 is targeted at VSEs and their customers.

ISO/IEC 29110-6 provides the specifications for specific profiles that are based on subsets of appropriate standards elements. ISO/IEC 29110-6 is targeted at VSEs, customers, standards producers, tool vendors and methodology vendors.

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ISO/IEC 29110-7 provides a guideline for each profile of the specific profile group. ISO/IEC 29110-7 is targeted at VSEs and their customers.

If a new profile is needed, ISO/IEC 29110-4 or ISO/IEC 29110-6 and or ISO/IEC 29110-7, ISO/IEC 29110-5 can be developed with minimal impact to existing documents.

Conformity requirements for implementations of this document can be found in ISO/IEC 29110-4-1.

0.2 Introduction to this document

This document is the third software profile of a four-profile systems engineering roadmap (i.e. Entry, Basic, Intermediate and Advanced).

The guidelines of the Intermediate profile describe the processes targeted at VSEs involved in the development of more than one project in parallel with more than one work team

The outcomes and tasks are guidance, not requirements, and not to be interpreted as requirements for purposes of process assessment.

This document applies for the development of non-safety critical systems.

Using this part of ISO/IEC 29110, a VSE can obtain benefits in the following aspects:

— An agreed set of project requirements (technical part of contract) and expected work products are agreed by the acquirer.

— A disciplined management process, that provides project visibility and corrective actions of project problems and deviations, is performed.

— A systematic system definition and realisation process, that satisfies acquirer needs and helps ensure quality work products, is followed.

Using this document, a VSE can obtain benefits in the following aspects:

— An in-place technical management process maintains and improves the business relationship across different projects. Technical management is making sure that the human resources, infrastructure and supportive equipment (H/W and S/W) are available, known and functional for more than one project at a time. The business management process helps ensure that each project satisfies acquirer needs and provides quality work products.

— A set of project needs (acquirer's needs) and a set of technical requirements (technical part of the agreement ~~contract~~) and expected work products as are agreed with the acquirer.

— A disciplined project management process, to plan and execute more than one project at a time and that provides project visibility and control; coupled with corrective actions of project problems and deviations, is performed;

— A disciplined system engineering management process that defines systematic system definition and realisation processes, which satisfies Acquirer needs and helps ensure quality work products, is followed.

To use this document the VSE needs to fulfil the following entry conditions:

— project needs and expectations are documented;

— feasibility of the project was performed before its start;

— project team, including project manager and system engineer, is assigned and trained; and

— goods, services and infrastructure to start the project are available.

In the context of systems engineering, that is the system definition and realisation process, the group that is part of the VSE responsible for developing software elements that are part of the system, should use the management and engineering guidelines of the software engineering Intermediate profile (ISO/IEC 29110-5-1-3).

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To use this document, a VSE should be familiar with or have implemented ISO/IEC 29110-5-6-3, the systems engineering Intermediate profile, for their system development projects.

In this document, Annex A provides a mapping between the outcomes of the processes of this document and the ISO/IEC/IEEE 15288 and, Annex B describes the systems engineering deployment packages to facilitate the implementation of the Intermediate profile by VSEs.

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Systems and software engineering — Life cycle profiles for very small entities (VSEs) —

Part 5-6-3: System engineering guidelines for the generic Intermediate profile

1 Scope

1.1 Fields of application

The lifecycle processes described in the ISO/IEC 29110 series are not intended to preclude or discourage their use by organisations bigger than VSEs.

ISO/IEC 29110–4-6 identifies the requirements applicable to the tasks and work products described in this document.

This document has been developed for using the management and engineering guide from the systems engineering Basic profile. Elements were added or modified (e.g. process, task, work product, role) to support VSEs involved in the development of more than one project in parallel with more than one work team.

This guide is oriented towards the management of more than one project in parallel with more than one work team.

This document applies for the development of non-critical systems.

This document is also targeted to VSEs which are familiar with management and engineering guide of the systems engineering Basic profile (ISO/IEC 29110 5-6-2) for their system development projects and are involved in the development of more than one project in parallel with more than one work team.

This document is intended to be used with any processes, techniques and methods that enhance the VSE's stakeholder satisfaction and productivity.

Once the system, developed by a VSE, has been accepted by their customers, the VSE that wants to provide after delivery services can refer to ISO/IEC 29110-5-3.

2 Normative references

There is no normative reference in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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

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

NOTE Definitions for other system and software engineering terms can be found in ISO/IEC/IEEE 24765, available at www.computer.org/sevocab

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3.1
Advanced profile
profile targeted at VSEs which want to sustain and grow as a competitive system and/or software development organization

[SOURCE: ISO/IEC 29110-1-2:2024]

3.2
agreement
mutual acknowledgement of terms and conditions under which a working relationship is conducted

EXAMPLE Contract, memorandum of agreement.

[SOURCE: ISO/IEC/IEEE 15288:2023]

3.3
acquirer
stakeholder that acquires or procures a product or service from a supplier

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

[SOURCE: ISO/IEC/IEEE 15288:2023]

3.4
Basic profile
profile targeted at VSEs developing a single product by a single work team

[SOURCE: ISO/IEC 29110-1-2:2024]

3.5
critical system
System whose failure or malfunction can result in one (or more) of the following outcomes: death or serious injury to people, loss or severe damage to equipment or property, or environmental harm

[SOURCE: ISO/IEC 23643:2020, 3.15]

3.6
conditional process
process that may be mandatory under some specified conditions, may be optional under other specified conditions, and may be out of scope or not applicable under other specified conditions

Note 1 to entry: These are to be observed if the specified conditions apply.

[SOURCE: ISO/IEC 29110-1-2:2024]

3.7
disposed system
system 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 of the system. This includes all aspects of the system and the system throughout its life until the day users depose of the system and the external enterprises complete the handling of the disposed system products.

[SOURCE: ISO/IEC/IEEE 15288:2023, modified]

3.8
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

EXAMPLE A configuration management system used to control software elements during software development.

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Note 1 to entry: Each enabling system has a life cycle of its own. This document is applicable to each enabling system when, in its own right, it is treated as a system-of-interest.

[SOURCE: ISO/IEC/IEEE 15288:2023]

3.9
Entry profile
profile targeted at start-up VSEs (i.e. VSEs who started their operation fewer than three years ago) and/or at VSEs working on a single small project (e.g. project size of less than 6 person-months)

[SOURCE: ISO/IEC 29110-1-2:2024]

3.10
Intermediate profile
profile targeted at VSEs involved in the development of more than one project in parallel with more than one work team

[SOURCE: ISO/IEC 29110-1-2:2024]

3.11
operator
individual or organization that performs the operations of a system

Note 1 to entry: The role of operator and the role of user 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 15288:2023]

3.12
security and intellectual property scheme
established and operated management system in the entity to ensure the security and intellectual property of its information items

[SOURCE: ISO/IEC 29110-5-1-3-:2025]

3.13
systems engineering plan
SEMP
top level technical plan for managing the systems engineering effort which defines how the technical aspects of the project will be organized, structured, and conducted and how the systems engineering processes will be controlled to provide a product that satisfies stakeholder requirements

[SOURCE: ISO/IEC/IEEE 24748-4:2016, 4.14]

3.14
small and medium enterprise
SME
enterprises which employ less than 250 persons

[SOURCE: ISO/IEC 29110-1-2:2024]

3.15
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.

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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. Alternatively, the word "system" is substituted simply by a context-dependent synonym, e.g., aircraft, though this potentially obscures a system principles perspective.

Note 3 to entry: A complete system includes all of the associated equipment, facilities, material, computer programs, firmware, technical documentation, services and personnel required for operations and support to the degree necessary for self-sufficient use in its intended environment.

[SOURCE: ISO/IEC/IEEE 15288:2023]

3.16
system-of-interest
SOI
system whose life cycle is under consideration in the context of this document

[SOURCE: ISO/IEC/IEEE 15288:2023]

3.17
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 15288:2023]

3.18
user
individual or group that benefits from a system during its utilization

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

[SOURCE: ISO/IEC/IEEE 15288:2023]

3.19
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 15288:2023]

3.20
statement of work
SOW
document used by the acquirer that includes the needs and expectations, the scope, objectives and deliverables

[SOURCE: ISO/IEC 29110-1-2:2024]

3.21
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

Note 1 to entry: It organizes and defines the total scope of the project.

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.4603, definition 2, modified — Note 1 to entry has been added.]

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