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

Part 7-1: Space software engineering guidelines

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

Partie 7-1: Lignes directrices relatives à l'ingénierie logicielle spatiale

Reference number
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Foreword

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

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

A list of all parts in the ISO/IEC 29110 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

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Introduction

0.1 Introduction to the ISO/IEC 29110 series

Very small entities (VSEs) around the world are creating valuable products and services. For the purpose of the ISO/IEC 29110 series, a 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 software components used in those systems, either as independent products or incorporated in the larger systems. Due to this a recognition of VSEs as suppliers of high-quality products is required.

According to the Organisation for Economic Co-operation and Development (OECD) SME and Entrepreneurship Outlook report (2019) “Small and medium-sized enterprises (SMEs) and entrepreneurship are essential drivers of economic and social well-being. Representing 99 % of all businesses, generating about 60 % of employment and totalling between 50 % and 60 % of value added in the OECD area. Almost one person out of three is employed in a micro firm with less than 10 employees”. 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 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 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.

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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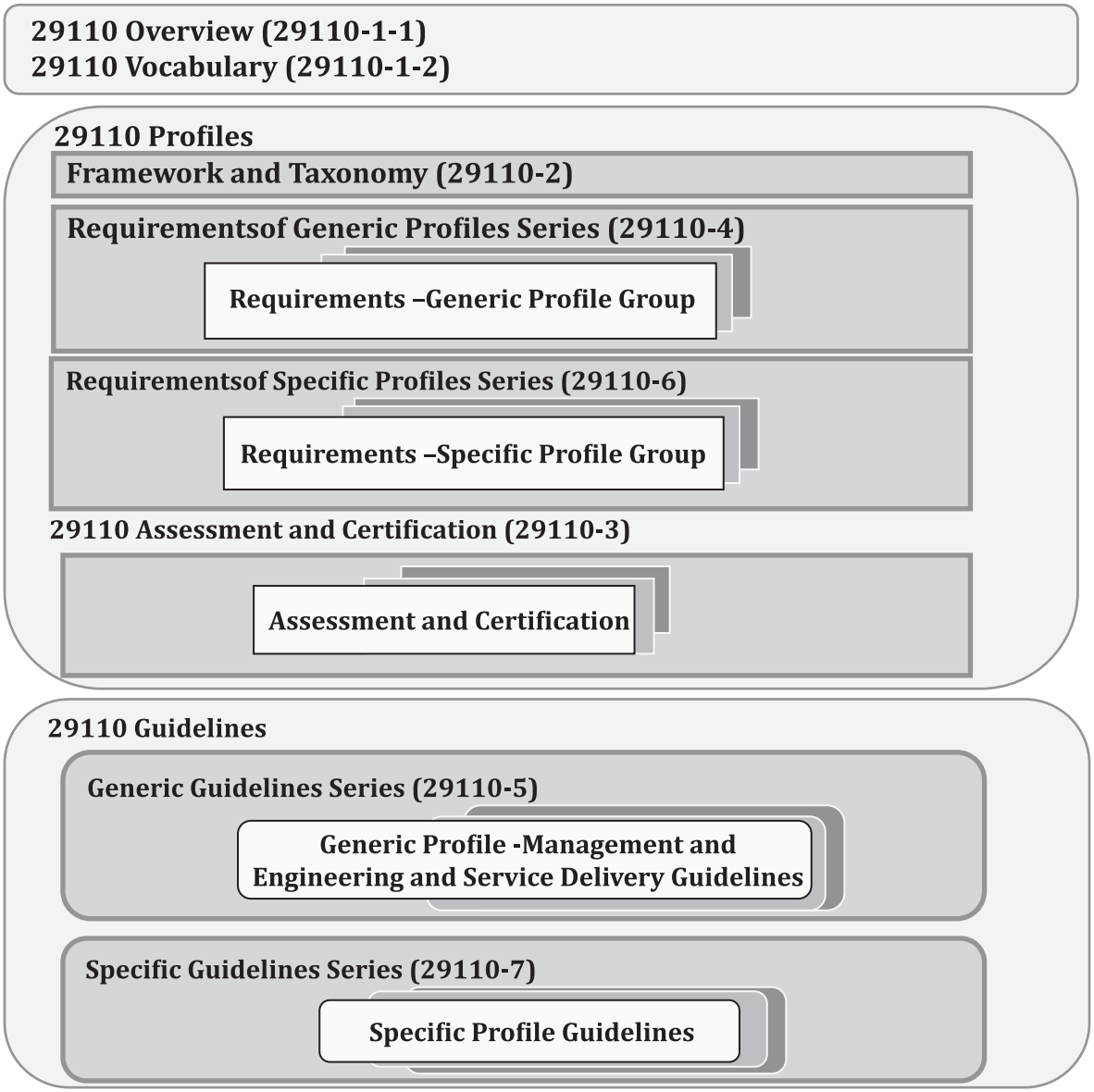


Figure 1 — ISO/IEC 29110 series

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.

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 29110-2 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, conformance, 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, for example, the auditor, certification and

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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 provides the specifications for all generic profiles of the generic profile group that are based on subsets of appropriate standards elements.

ISO/IEC 29110-5 provides a management, engineering and service delivery guidelines for profiles of the generic profile group.

ISO/IEC 29110-6 provides the specifications for specific profiles that are based on subsets of appropriate standards elements.

ISO/IEC 29110-7 provides a guideline for each profile of the specific profile group.

0.2 Introduction to this document

Industry and large organisations recognize the value of VSEs, i.e. enterprises, organisations (e.g. government agency, non-profit organisation), projects or departments with up to 25 people, in contributing with emerging new technology that bigger organisations cannot use them as easily nor incorporate them in their solutions as fast.

But often these VSEs are not ready to comply with the stringent requirements for space projects. The purpose of this document is to ultimately achieve the process capacity to participate in the development of critical software in the space domain. But not all software in the space domain can be addressed. For example, for software embedded in products that can be fatal to human life, additional safeguards will be required.

VSE in space domain can demonstrate the quality in their processes in a stepwise approach to eventually participate in space projects in a faster and feasible way.

The mainstream of space projects so far has been large rockets and artificial satellites developed by government agencies and large organizations. Inevitably, the development process applied in space projects was rigorous and extensive. In recent years, these traditional space development trends have changed. Development of small artificial satellites and system development, in which multiple small artificial satellites called “satellite constellation” are linked and collaborate, is being actively considered by small companies from around the world.

Many start-ups have entered the development of these small space systems and are enlivening the industry. In short, many VSEs are entering the space industry. However, in many cases, these VSEs are not ready to comply with the development requirements of space projects. These challenges involve discipline and more rigorous processes than for non-critical systems. Although the processes involved in software engineering are extremely important in the space sector, there are not many space-related standards focused on VSE.

In many cases, VSEs refer to space agency standards and implement processes that are not appropriate for their scale and risk.

VSEs in the space domain, i.e. space-VSEs, can demonstrate the quality of software processes expected by the space domain in the risk-based approach to participate in space projects.

This document provides management and engineering guidelines for the specific space profiles.

This document presents an Intermediate space profile (Clause 6) and an Advanced space profile (Clause 7). To use this document, it is presupposed that the VSE has already implemented the software Basic profile guidelines (i.e. ISO/IEC 29110-5-1-2). The correspondence between the four-stage roadmap of the generic profile guidelines and the space profile guidelines is shown in Table 1.

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Table 1 — Correspondence between ISO/IEC 29110 guidelines

ISO/IEC 29110-5-1		ISO/IEC 29110-7-1
VSE generic profiles guidelines	Title of profile	Title of profile
ISO/IEC 29110-5-1-1	Entry profile	Not applicable
ISO/IEC 29110-5-1-2	Basic profile	Basic profile
ISO/IEC 29110-5-1-3	Intermediate profile	Intermediate space profile
ISO/IEC 29110-5-1-4	Advanced profile	Advanced space profile

The processes in this document are contained in Clauses 6, 7, 8 and 9. It is recognised that specific projects or organizations may not need to use all the processes provided by this document. Therefore, implementation of this document typically involves selecting a set of processes suitable to the organization or project and will so be reflected in the project plan of each project.

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

Basic profile:

— the Basic profile is the starting point for space-VSE. This profile is identical to that in ISO/IEC 29110-5-1-2; it is not included in this document;

— refer to ISO/IEC 29110-5-1-2 for the benefits of the Basic profile.

Intermediate space profile:

— an agreed set of project requirements and expected work products is delivered to the customers;

— a disciplined management process that provides project visibility and corrective actions of project problems and deviations is performed;

— managing and controlling project work products;

— ensuring that project problems are identified and resolved;

— ensuring that work products and processes are aligned with the project discipline.

Advanced space profile:

— ensuring that safety and/or dependability concepts and related requirements are obtained;

— a safety and dependability related process that achieve safety and dependability requirements of product is performed;

— strengthening non-testing verification activities.

The users of this document select the processes to be deployed and map them onto the specific project life cycle model. The parties are also responsible for selecting and applying the software development methods and for performing the activities and tasks suitable for the software project.

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

Part 7-1:
Space software engineering guidelines

1 Scope

This document provides guidelines for the implementation of the specific space profiles for VSEs through a set of development processes.

This document is applicable to small suppliers, developers, managers and quality assurance managers of software products in the space domain.

The document can also be applied by a single party through a self-imposed set of processes.

This document does not prescribe a specific system or software life cycle model, development methodology, model or technique.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

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

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

3.1
Advanced profile
profile (3.12) targeted at VSEs which want to sustain and grow as an independent competitive system and/or *software* (3.19) development business

[SOURCE: ISO/IEC 29110-2-1:2015, 4.3]

3.2
Advanced space profile
profile (3.12) that provides safety and *dependability* (3.8) related processes to achieve safety-related requirements of *software* (3.19)

3.3
agreement
mutual acknowledgement of terms and conditions under which a working relationship is conducted

EXAMPLE Contract, memorandum of agreement.

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.5]

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