TECHNICAL REPORT

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

Part 3-1: Process assessment guidelines

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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.

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) or the IEC list of patent declarations received (see http://patents.iec.ch).

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

For an explanation of 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 www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO/IEC/TR 29110-3-1:2015), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Annex A has been reworked and split to distinguish measurement framework and exemplar process assessment model; exemplar process assessment model for system life cycle processes has been added;

— main concepts for VSE profiles, i.e. maturity levels and process capability levels, have been added;

— structure of the process assessment model has been reworked and mapped to VSE profiles and processes dimensions;

— process assessment indicators description has been reworked;

— software project management and software implementation process base practices indicators and work product characteristics have been aligned with the latest editions of ISO/IEC 29110-4-1, ISO/IEC/TR 29110-5-1-2 and ISO/IEC/TR 29110-5-2-1;

— software process performance indicators for organizational profile group have been added;

— software process capability levels and process attributes indicators (PA.1 to PA.4) have been added;

— rules to derive VSE profiles from process capability levels have been added;

— subclauses on conformity of the exemplar process assessment model have been added.

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

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.

Introduction

Very Small Entities (VSEs) around the world are creating valuable products and services. For the purpose of the ISO/IEC 29110 series, 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, 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 2019 report, ‘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’. 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 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; 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 standards and technical reports can be applied at any phase of system or software development within a life cycle. This 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 lifecycle 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. See Table 1.

Table 1 — ISO/IEC 29110 target audience

ISO/IEC 29110	Title	Target audience
ISO/IEC/TR 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/TR 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.
ISO/IEC/TR 29110-7	Specific profile guidelines	VSEs and their customers.

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

ISO/IEC/TR 29110-1 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.

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, 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.

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

ISO/IEC/TR 29110-7-x provides a guide for each profile in the specific profile group.

This document defines the process assessment guidelines needed to meet the purpose of defined VSE profiles. It is applicable to all VSE profiles and is compatible with ISO/IEC 33002.

Figure 1 describes the ISO/IEC 29110 series of 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 — The ISO/IEC 29110 series

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

Part 3-1: Process assessment guidelines

1 Scope

1.1 Fields of application

This document defines the process assessment guidelines needed to meet the purpose of defined VSE profiles. It is applicable to all VSE profiles and is compatible with ISO/IEC 33002.

The possible uses of this document are as follows.

a) Assessment to evaluate the process capabilities. Use when an organization wants an assessment of profile conformance (basic, etc.) of the implemented processes.

b) Supplier's capability assessment. Use when a customer asks for a third party to conduct an assessment in order to obtain a profile (basic, etc.) of the implemented process by the system or software development and maintenance supplier.

1.2 Target audience

The target audience of this document is primarily those who perform or have direct relationship with process assessments of VSEs. This document also contains information that can be useful to developers of assessment methods and assessment tools and those requiring additional guidance on the assessmet process.

This document is addressed to people who have a direct relation with the assessment process based on the VSE profiles (e.g. the assessors and the sponsor of the assessment) who need guidance on ensuring that the requirements for performing an assessment have been met.

It is intended that ISO/IEC/TR 29110-1 be read first when initially exploring VSE profile documents.

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/TR 29110-1, *Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) — Part 1: Overview*

3 Terms and definitions

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

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

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

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

NOTE In the ISO/IEC 29110 series, to minimize confusion about the term 'basic' that is used to mean different ideas, the term 'Basic' with a capital B is used to refer to the Basic profile while the term 'basic' is used to mean forming an essential foundation or starting point (e.g. basic types of work products).

3.1
process profile
set of process attribute ratings for an assessed process

Note 1 to entry: Within the ISO/IEC 29110 series, a profile is defined as "set of one or more base standards 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" (ISO/IEC/TR 10000-1).

Note 2 to entry: When used unqualified in this document, this is the applicable definition.

[SOURCE: ISO/IEC 33001:2015, 3.2.18, modified — Note 1 to entry and Note 2 to entry have been added.]

3.2
process quality
ability of a process to satisfy stated and implied stakeholder needs when used in a specified context

[SOURCE: ISO/IEC 33001:2015, 3.4.8]

3.3
process quality level
representation of the achieved level of a *process quality* (3.2) characteristic derived from the process attribute ratings for an assessed process

[SOURCE: ISO/IEC 33001:2015, 3.4.10, modified — "point on a scale of achievement" has been replaced with "representation of the achieved level".]

3.4
target process profile
process profile (3.1) specifying which process attributes are required and the rating necessary for each process attribute for a required process

[SOURCE: ISO/IEC 33001:2015, 3.2.20]

4 Abbreviated terms

BP base practice

OM organizational management

PA process attributes

PAM process assessment model

PMP process management process

PPM project portfolio management

PRM process reference model

RM resource management

VSE Very Small Entity

5 Process assessment framework

These guidelines apply to VSE process assessments. The assessment, as defined in this document, has two purposes:

— To evaluate the process capability based on a two-dimensional assessment model containing a process dimension and the process quality dimension. The process dimension refers to the processes defined in each VSE profile which are provided by an external process reference model (PRM). The process quality dimension consists of a Process measurement framework comprising process quality levels, their associated process attributes, and the rating scale.

— To evaluate whether an organization fulfils the targeted VSE profile based on the evaluated capabilities for the processes.

For an official recognition, the conformity assessments should be carried out following a process assessment process satisfying the requirements of ISO/IEC 33002 and described in Clause 6. For self-assessments emphasizing identification of process improvements, other approaches can be applied (additional information can be found in other parts of ISO/IEC 29110 specifically dedicated to self-assessment).

According to ISO/IEC 33001, a process assessment is "a disciplined evaluation of an organizational unit's processes against a process assessment model (PAM)". In this context, the process assessment model consists of a subset of process purposes and outcomes of a process reference model, and the process attributes, quality levels and rating scale that are defined in the correspondent process assessment model. A process reference model is, for instance, ISO/IEC/IEEE 12207 and the applicable subset is defined in a Specification of a VSE profile, for instance, ISO/IEC 29110-4-1. The applied process assessment model, always conformant to ISO/IEC 33002, has as its result represented as a set of process attribute ratings, i.e. a process profile. Figure 2 illustrates the relevant documents and data for a process applicable to VSE process assessment.

ISO/IEC 33002 sets out the minimum requirements for performing a process assessment that ensure consistency and repeatability of the ratings. The requirements help to ensure that the process assessment output is self-consistent and provides evidence to substantiate the ratings and to verify conformance with the requirements.

Self-assessments are typically performed to identify process improvement opportunities or to check current status of the organization's performance. Self-assessments in VSEs are outside the scope of this document.

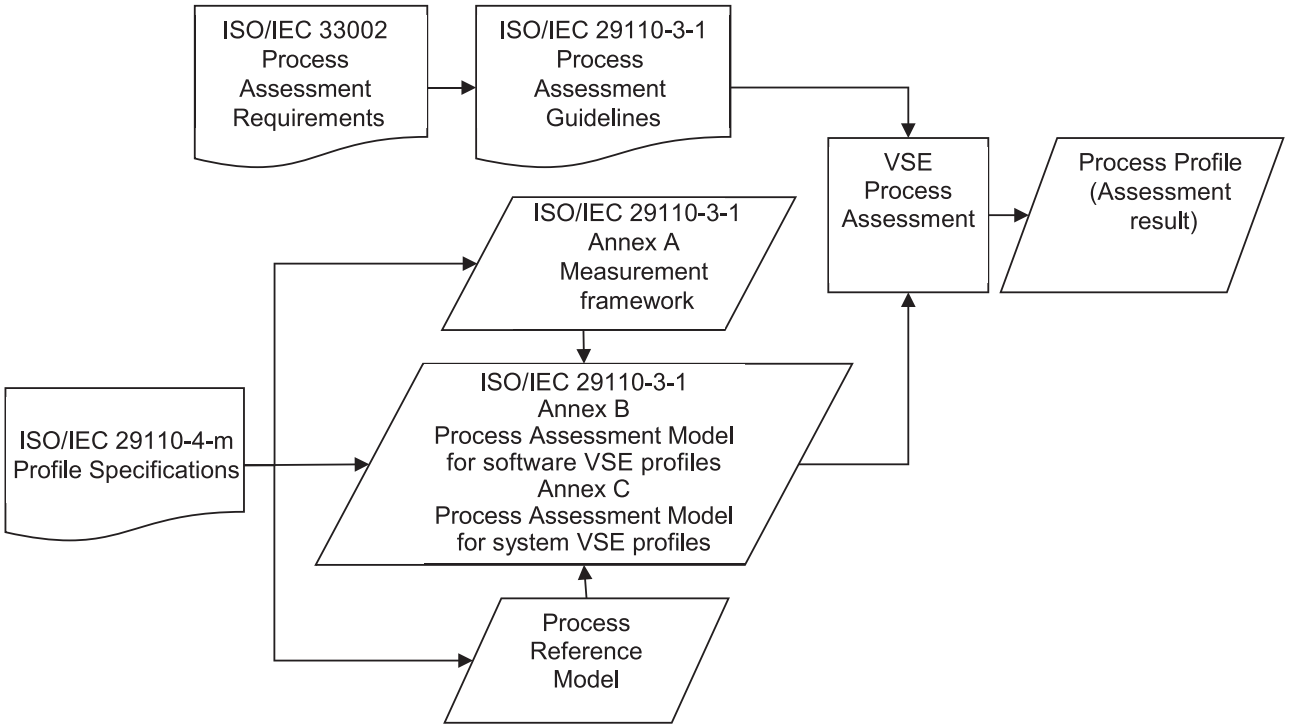

Figure 2 — Elements of VSE process assessment

6 VSE process assessment

6.1 Performing an assessment

6.1.1 General

In performing a process assessment based on the ISO/IEC 29110 series, the requirements expressed in ISO/IEC 33002 are intended to be satisfied in full. This clause provides additional guidance related specifically to the process assessment in VSEs.

A process assessment is conducted according to a documented process that is capable of meeting the process assessment purpose. The key elements of a documented assessment process are closely tied to the requirements for performing an assessment, defined in ISO/IEC 33002. The documented assessment process is the set of instructions for conducting the process assessment. A documented assessment process addresses the following aspects of the conduct of a process assessment:

— incorporate as a minimum, the tasks defined in ISO/IEC 33002;

— identify the classes of process assessment for which the documented assessment process can be applied and the nature and extent of tailoring associated with each class addressed by the documented process;

— define the criteria for ensuring coverage for both the defined organizational scope and the defined process scope for the assessment, in terms of the strategy for collecting and analysing data;

— identify or define the approach to be taken in performing the generation of process attribute ratings, including (where applicable) the aggregation of observations and/or characterisations across the elements of the assessment.

6.1.2 Assessment inputs

Process assessment inputs as specified in ISO/IEC 33002:2015, 4.4 are to be defined. In conducting process assessments of VSEs based on ISO/IEC 29110-4-1, the following issues are expected.

— The process scope of the process assessment [ISO/IEC 33002:2015, 4.4 (d) (1, 2)] should be determined by the target VSE profile specified for the process assessment.

— The organizational scope of the process assessment [ISO/IEC 33002:2015, 4.4 (d) (3)] should typically be the entire VSE; however, where the VSE deploys a small number of clearly distinct projects or functions, the scope can be limited to a single project or function.

— In defining the process assessment context [ISO/IEC 33002:2015, 4.4 (d) (4)], the process assessment plan should take into account the VSE business and engineering context and be affordable for a VSE.

— In defining the process assessment constraints [ISO/IEC 33002:2015, 4.4 (g)], the specific nature of the VSE should be explored to establish constraints on availability of resources or data that might affect the reliability of the process assessment.

6.1.3 Roles and responsibilities

Typically, the process assessment team for VSE process assessment process consists of at least one lead assessor or a lead assessor with other assessors. The assessors should be familiar with the VSE characteristics.

6.1.4 The assessment process

The activities to be performed will be determined by the chosen documented assessment process tailored as necessary. The documented process for the process assessment of a VSE should address all of the required activities defined in ISO/IEC 33002:2015, 4.2.

Specific concerns of relevance to process assessment of VSEs include the following.

a) Plan the assessment

Typically, the schedule for process assessment of a VSE will need to take account of the availability of key resources. The level of resources required for the process assessment should be determined according to the resources available to the VSE.

b) Collect the data

The strategy for data collection should take account of the nature of the work performed within the VSE and of the nature of the items of objective evidence that will typically be available. Often, process assessments in VSEs rely heavily on testimony from performers of the processes; however, to the best extent possible, the assessors should endeavour to obtain other supporting objective evidence drawn from the VSE work products.

c) Validate the data

The key issue in data validation in process assessment of a VSE is ensuring that the data collected is representative of the normal operations of the enterprise.

d) Derive results

In conducting process attribute rating, the assessors should focus on the extent to which the evidence obtained addresses the processes and process attributes being rated. The requirement for traceability between the rating and the evidence employed [ISO/IEC 33002:2015, 4.2.1 e) 1)] is relevant here.

e) Report the assessment

The assessors should ensure that the report to the sponsor of the process assessment covers the full scope of the VSE profile employed in the process assessment.

6.2 Use of the assessment results

The process assessment results can be used to:

a) evaluate the process quality levels of an organization;

b) determine the improvement opportunities, in order to enhance the organization's ability to meet its business goals by improving efficiency and quality of its products and services. The findings can be used as a base to perform the improvement plan;

c) benchmark the process quality levels with other organizations in the market;

d) select a supplier based on the supplier's quality level assessment.

6.3 Achievement of a VSE profile

This subclause provides guidance on how to determine whether an organization fulfils a VSE profile. The determination is based on the evaluated quality levels for the processes within each VSE profile. ISO/IEC 29110-4-1 defines the conformance requirements.

The requirements for the VSE profiles are defined in ISO/IEC 29110-4-1. The corresponding quality levels to be evaluated for each VSE profile can be derived from the respective parts of ISO/IEC 29110-4-1. At minimum, all mandatory elements of the VSE profile, as defined in ISO/IEC 29110-4-1, are the ones to be considered in the process assessment.

For example, the achievement of the software Basic profile, implies that the assessed processes achieve quality level one as defined in Annex A. This means that the implemented process achieves its process purpose and its defined outcomes. For example, for the Generic Basic profile for software, the applicable process purposes are documented in ISO/IEC 29110-4-1 (process reference model for the Basic profile):

— Project management process;

— Software implementation process.

NOTE Process reference models are now to be contained in ISO/IEC 29110-4-1.

The related outcomes of the process reference model are documented in Annex A (supported by ISO/IEC/TR 29110-5–1–2 under the process-specific objectives). A detailed mapping of the VSE profile process elements to ISO/IEC/IEEE 15288, ISO/IEC/IEEE 12207, and other base standards are provided in ISO/IEC 29110-4-1.

6.4 Application of process assessment models

Use of ISO/IEC 33004 compliant process assessment model (PAM) ensures that the process assessment results are comparable, reliable, and repeatable. The assessor should confirm that the applied PAM is suitable for assessing the process capability in the context of VSEs.

The applied PAM should have a set of indicators that address the process purpose and outcomes, and demonstrate the achievement of the required capability level.

ISO/IEC 29110-4-1 Specifications for VSE profiles document a detailed mapping of process elements between ISO/IEC 29110-5-m-n and the process reference model in of ISO/IEC 29110-4-1, respectively.

A VSE-specific PAM can be derived by selecting those process assessment indicators relevant to the corresponding process outcomes defined in ISO/IEC 29110-4-1.

Two examplars of PAMs are provided in Annex B and Annex C, respectively.

Annex A presents two main process assessment aspects for the assessment of VSE software related processes: a) the measuremment framework, and b) the principles of VSE maturity model (i.e. VSE profiles achievement rules).

Annex B presents the software process assessment model for the assessment of the processes of Software development VSEs, as defined in ISO/IEC 29110-4-1 and ISO/IEC 29110-5-2-1 (Basic profile processes for software and the organizational profile processes respectively). It also details the VSE maturity model specific for the software development VSEs.

Annex C presents the same two process assessment aspects as in Annex B but for the assessment of VSE system related processes

Each main aspect above is accompanied by their compliancy verification section towards their applicable requirements defined in ISO/IEC 330xx standards, respectively within each annex.