TECHNICAL REPORT

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Software and systems engineering — Lifecycle profiles for very small entities (VSEs) —

Part 5-1-4: Software engineering: Management and engineering guidelines: Generic profile group: Advanced 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).

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 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 WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

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 website.

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 world-wide, 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 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 of standards and technical reports can be applied at any phase of system or software development within a life cycle. This series of standards and technical reports 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 guidelines	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 29110-1 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 guidelines.

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 (a profile group may contain a single profile or multiple profiles). A profile is specified in terms of requirements imported from appropriate base standards.

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

This document provides management and engineering guidelines for the software engineering Advanced profile of the Generic profile group. These guidelines describe the processes targeted at VSEs that want to sustain and grow as an independent competitive software development business.

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 guidelines, management and engineering guidelines are available from ISO as freely available Technical Reports (TR). The Framework document, profile specifications and certification schemes are published as International Standards (IS).

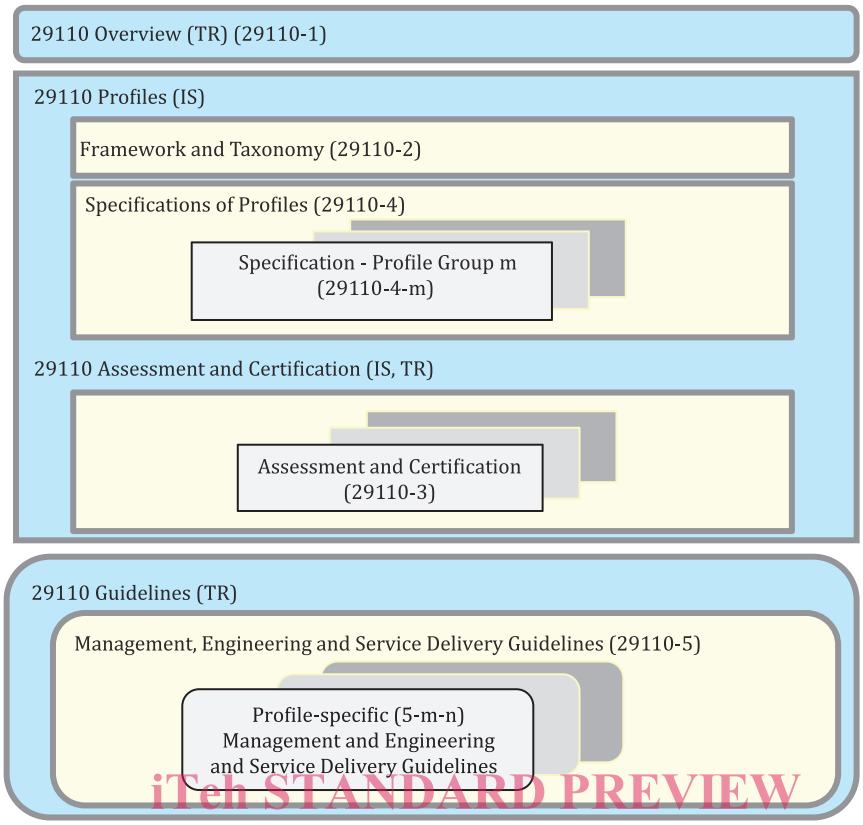

Figure 1 — ISO/IEC 29110 series

Software and systems engineering — Lifecycle profiles for very small entities (VSEs) —

Part 5-1-4:
Software engineering: Management and engineering guidelines: Generic profile group: Advanced profile

1 Scope

This document is applicable to Very Small Entities (VSEs). VSEs are enterprises, organisations, departments or projects having up to 25 people. The life cycle processes described in the set of International Standards (IS) and Technical Reports (TR) are not intended to preclude or discourage their use by organisations bigger than VSEs.

The Advanced profile is the fourth profile of a four-profile software engineering roadmap (i.e. Entry, Basic, Intermediate and Advanced). This document describes processes targeted at VSEs that want to sustain and grow as an independent competitive software development business.

ISO/IEC 29110-4-1 identifies the requirements applicable to the tasks and work products described in this document.

These guidelines apply to VSEs that develop non-critical software.

Using these guidelines, VSEs can obtain the following benefits:

— management and monitoring of more than one project in parallel with more than one work team;

— reuse of existing software components (e.g. code and document) in new projects;

— continuous measurement and evaluation of projects;

— continuous evaluation and improvement processes;

— continuous sustainability and growth; and

— support to customers in the disposal of software and installation of new software.

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

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.

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

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

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

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

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

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 12207:2017]

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/organisational sponsor.

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

3.4
basic profile
profile (3.12) targeted at VSEs developing a single application by a single work team

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

3.5
business objective
strategy designed by senior management to ensure an organization's continued existence and enhance its profitability, market share, and other factors influencing the organization's success

[SOURCE: ISO/IEC/IEEE 24765:2017]

3.6
conditional process
process that can be mandatory under some specified conditions, can be optional under other specified conditions, and can 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.

3.7
critical software
software having the potential for serious impact on the users or environment, due to factors including safety, performance, and security

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.

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 12207:2017]

3.9
entry profile
profile (3.12) targeted at start-up VSEs (i.e. VSEs who started their operation less than three years) and/or at VSEs working on small *project* (e.g. project size of less than six person-months)

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

3.10
generic profile group
profile (3.12) group applicable to VSEs (very small entities) that do not develop critical systems or critical software and have typical situational factors

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

3.11
intermediate profile
profile (3.12) targeted at VSEs involved in the development of more than one project in parallel with more than one work team

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

3.12
profile
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

[SOURCE: ISO/IEC/TR 10000-1:1998, modified — "International Standardized Profiles" or "ISPs" have been replaced by "standardized profiles"]

3.13
security and intellectual property scheme
established and operated management system in the entity to ensure the security and intellectual property of its information items

3.14
system-of-interest
system whose life cycle is under consideration

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

4 Conventions and abbreviated terms

4.1 Naming, diagramming and definition conventions

The following process structure description and notation are used to describe the processes:

Name — Process identifier, followed by its abbreviation in parentheses "()".

Purpose — General goals and results expected of the effective implementation of the process. The implementation of the process should provide tangible benefits to the stakeholders. The purpose is identified by the abbreviation of the process name.

Objectives — Specific goals to ensure the accomplishment of the process purpose. The objectives are identified by the abbreviation of the process name, followed by the letter 'O' and a consecutive number, for example RM.O1, PM.O2, etc. Each objective is followed by the square box which includes a list of the chosen processes for the Intermediate profile mainly from ISO/IEC/IEEE 12207 and its outcomes related to the objective. References to standards such as ISO/IEC/IEEE 15288, ISO/IEC/IEEE 12207 and ISO 9001 are informative and do not imply partial conformance to the standards.

Input Work products — Work products required to perform the process and its corresponding source, which can be another process or an external entity to the project, such as the Customer. Identified by the abbreviation of the process name and showed as two column table of work product names and sources.

Output Work products — Work products generated by the process and its corresponding destination, which can be another process or an external entity to the project, such as Customer or Organizational Management. Identified by the abbreviation of the process name and showed as two column table of work product names and destinations.

Internal Work products — Work products generated and consumed by the process itself. An internal Work product is not reviewed or approved by the Customer. Identified by the abbreviation of the process name and showed as one column table of the work product names.

All work products' names are printed in italics and initiate with capital letters. Some work products have one or more statuses attached to the work product name surrounded by square brackets "[ ]" and separated by a ",". The work product status may change during the process execution. See Clause 11 for the alphabetical list of the work products, its descriptions, possible statuses and the source of the work product. The source can be another process or an external entity to the project, such as the Customer.

Roles involved — Names and abbreviation of the functions to be performed by project team members. Several roles may be played by a single person and one role may be assumed by several persons. Roles are assigned to project participants based on the characteristics of the project. The role list is identified by the abbreviation of the process name and showed as two-column table. See Clause 10 for the alphabetical list of the roles, its abbreviations and required competencies description.

Diagram — Graphical representation of the processes. The large round-edged rectangles indicate process or activities and the smaller square-edged rectangles indicate the work products. The directional or bidirectional thick arrows indicate the major flow of information between processes or activities. The thin directional or bidirectional arrows indicate the input or output work products. The notation used in the diagrams does not imply the use of any specific process lifecycle.

Activity — A set of cohesive tasks. Task is a requirement, recommendation, or permissible action, intended to contribute to the achievement of one or more objectives of a process. A process activity is the first level of process workflow decomposition and the second one is a task. Activities are identified by process name abbreviation followed by consecutive number and the activity name.

Activity Description — Each activity description is identified by the activity name and the list of related objectives surrounded by parentheses "()". For example, PM.1 Project Planning (PM.01, PM.05, PM.06, PM.07) means that the activity PM.1 Project Planning contributes to the achievement of the listed objectives: PM.01, PM.05, PM.06 and PM.07. The activity description begins with the task summary and is followed by the task descriptions table. The task description does not impose any technique or method to perform it. The selection of the techniques or methods is left to the VSE or project team.

Tasks description table contain four columns corresponding to:

— Role — the abbreviation of roles involved in the task execution;

— Task — description of the task to be performed. Each task is identified by activity ID and consecutive number, for example PM.01.01, PM.01.02, and so on;

— Input Work products — work products needed to execute the task; and

— Output Work products — work products created or modified by the execution of the task.

Incorporation to *Organisational Repository* — List of work products to be saved in *Organizational Repository*.

NOTE Tables used in process description are for presentation purpose only.

4.2 Notation used to document new processes, additions and modifications to the Intermediate profile processes

The Advanced profile is the fourth profile of a four-profile software engineering roadmap (i.e. Entry, Basic, Intermediate and Advanced). The Advanced profile has been designed to build upon the processes of the Intermediate profile such that, when moving from the Intermediate profile to the Advanced profile, a VSE should add to its existing Intermediate profile processes the new processes (e.g. objectives, activities, tasks, roles and work products) described in this document.

Since, in the Advanced profile, there are additions and modifications to the Intermediate profile processes, this document has been written such that it will be easy for a VSE to identify these additions and modifications. The processes of the Intermediate profile have been complemented with additional objectives, tasks and work products in a context where a VSE is conducting more than one project in parallel with more than one work team. The following notation is used to highlight the addition/deletion/modification to the Intermediate profile:

— added text

  — is underlined;

  — except for the processes of the Intermediate profile;

— deleted/modified text is ~~struck out~~ as follows: ~~the text is struck out~~.

The Advanced profile has one new process that is not in the Intermediate profile: Software Transition and Disposal process (STD).

The purpose of the Software Transition and Disposal process is to move the software in an orderly, planned manner into the operational status such that the system is functional and operable in the operational environment of the Customer and to end the existence of a system element or system for a specified intended use, appropriately handle replaced or retired elements, and to properly attend to identify critical disposal needs (e.g. per an agreement, per organisational policy, or for environmental, safety, security aspects).

The STD process is a conditional process. It is executed if a VSE is required, in the Agreement (e.g. Statement of Work), to install and/or dispose a software at the customer operational environment. If this is the case, this process is included in the scope of an audit or an assessment.

To facilitate the identification of additional abbreviations, roles and work products of the STD process of the Advanced profile, these items are underlined. To facilitate reading, the STD process has not been underlined.

The Advanced profile terminology has been aligned to the ISO/IEC/IEEE 12207 and ISO/IEC/IEEE 15289. The following terms of old standards have been replaced with the new terms:

— “Agreement” and “Contract” have been replaced with “Agreement”; and

— Work products are identified with a unique code WP.XX where XX is a sequential number in Clause 12. These codes have not been used in the descriptions of activities and tasks in order to facilitate readability.

4.3 Abbreviated terms

The following abbreviations are used in this document:

AM Acquisition Management

BM Business Management

BSM Business Manager

OLR Organisational Lesson Learned Record

OR Organisational Repository

PJM Project Manager

PLR Project Lesson Learned Record

PO Purchase Order

RFP Request for Proposal

RR Resource Request

SOW Statement of Work

SUP Supplier

STD Software Transition and Disposal

VSE Very Small Entity

5 Overview

The Advanced Profile Management and Engineering Guidelines apply to a Very Small Entity (VSE) (enterprise, organization, department or project having up to 25 people) which is familiar with or has implemented ISO/IEC TR 29110-5-1-3 for their software development projects.

These guidelines provide Business Management, Project Management, Software Implementation, Acquisition Management and Software Transition and Disposal processes which integrate practices mainly based on the selection of ISO/IEC/IEEE 12207 and ISO/IEC/IEEE 15289 standards elements. Annex A provides information about Deployment Packages that facilitate the implementation of these processes.

This document, is intended to be used by VSEs to establish processes to implement any development approach or methodology including, e.g. agile, evolutionary, incremental, test driven development, etc. based on a VSE or project needs.

Using these guidelines, VSEs can obtain the following benefits:

— management and monitoring of more than one project in parallel with more than one work team;

— reuse of existing software components (e.g. code and document) in new projects;

— continuous measurement and evaluation of projects;

— continuous evaluation and improvement processes;

— continuous sustainability and growth; and

— support to customers in the disposal of software and installation of new software.

To use these guidelines, a VSE should fulfil the following entrance conditions.

— VSEs that are familiar with or have implemented ISO/IEC TR 29110–5-1-3; Generic profile group: Intermediate profile for their software development projects.

The purpose of the Business Management (BM) process is to define business objectives, identify opportunities, evaluate all in-place *Agreements* or requests from customers for fit with organisational objectives and resources, obtain and provide the VSE with the necessary resources to perform all projects, monitor and evaluate all projects, conduct lesson learned to improve the VSE and protect its intellectual property and the security of its assets and information items.

The purpose of the Project Management (PM) process is to establish and carry out in a systematic way the *Tasks* of the software implementation process, which allows complying with the project's *Objectives* in the expected quality, time and costs.

The purpose of the Software Implementation (SI) process is the systematic performance of the analysis, design, construction, integration and tests activities for new or modified software work products according to the specified requirements.

The purpose of the Acquisition Management (AM) process is to obtain a product or service required by the VSE. The execution of the AM process is required if a product/service needs to be obtained from a supplier by the VSE (i.e. a conditional process).

The purpose of the Software Transition and Disposal (STD) process is to move the software in an orderly, planned manner into the operational status such that the system is functional and operable in the operational environment of the Customer and to end the existence of a system element or system for a specified intended use, appropriately handle replaced or retired elements, and to properly attend to identify critical disposal needs (e.g. per an agreement, per organisational policy, or for environmental, safety, and security aspects).

The processes are interrelated (see Figure 2). The arrows connecting the AM process, the STD process to the other processes are dashed to indicate that these 2 processes are conditional processes.

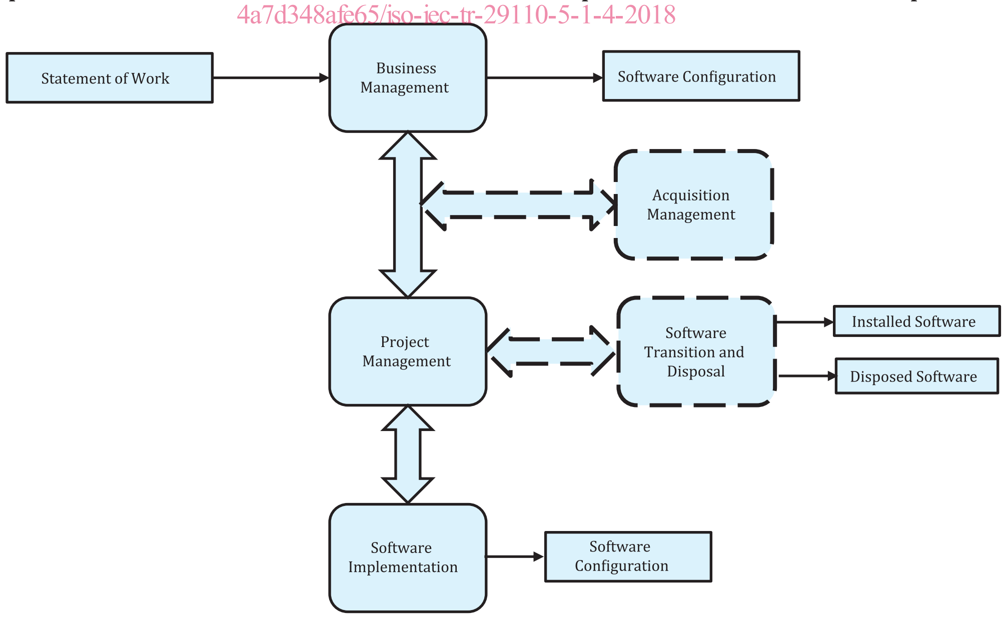

Figure 2 — Advanced profile processes