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Information technology — Process assessment — Application of ISO/IEC/IEEE 12207 processes to the ISO/IEC 33020 process capability measurement scale

Technologies de l'information — Évaluation du processus — Application des processus ISO/IEC/IEEE 12207 à l'échelle de la mesure de la capacité de procesus de l'ISO/IEC 33020

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Foreword

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This document was prepared by Technical Committee ISO/IEC JTC1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

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.

Introduction

This document provides a specification for mapping the ISO/IEC/IEEE 12207 life cycle processes to the ISO/IEC 33020 process attributes with the intent of demonstrating support for the levels 1 to 3 of the ISO/IEC 33020 process capability measurement framework.

This document is primarily addressed to developers of process assessment models for the process quality characteristic of process capability. It is also addressed to the lead assessor and other stakeholders, such as the sponsor of the assessment, who need to be assured that the requirements of the ISO/IEC 33020 process measurement framework have been met.

Within this document:

— Clause 4 provides a summary description of the relationship between the ISO/IEC 33020 process attribute outcomes and the ISO/IEC/IEEE 12207 life cycle processes.

— Annex A extends the summary mapping in Clause 4 by providing details of the relationship between the process attribute outcomes and the life cycle process outcomes. Links to the information items listed in Annex C are identified. These details are provided for validating by inspection the relationships between the process attribute outcomes of ISO/IEC 33020 and the ISO/IEC/IEEE 12207 life cycle process outcomes.

— Annex B focuses on the relationships between the generic practices associated with ISO/IEC 33020 and the task descriptions of ISO/IEC/IEEE 12207. These model elements are linked via the information item characteristics listed in Annex C.

— Annex C provides a listing of the applicable information items and their characteristics.

— Annex D provides an overview of the key concerns arising from the application of ISO/IEC/IEEE 24774 when attempting to demonstrate objective relationships between process model elements.

Information technology — Process assessment — Application of ISO/IEC/IEEE 12207 processes to the ISO/IEC 33020 process capability measurement scale

1 Scope

This document provides a specification for associating the life cycle processes of ISO/IEC/IEEE 12207 with the process attribute outcomes of ISO/IEC 33020 with the intent of demonstrating support for levels 1 to 3 of the process capability measurement scale defined in ISO/IEC 33020.

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 33001, *Information technology — Process assessment — Concepts and terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 33001 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/

4 Content of the process capability measurement framework

4.1 General

In ISO/IEC 33020:2019, Clause 5, the relationship between process attributes and process capability levels is described.

Process capability is defined in ISO/IEC 33020:2019, Clause 5 on a six-point ordinal scale that enables process capability to be assessed from the bottom of the scale, 'incomplete', through to the top end of the scale, 'innovating'. The scale represents increasing capability of an implemented process, from failing to achieve the process purpose through to continually improving and able to respond to process change.

The relationship between the process capability levels and the process attributes is shown in Table 1. In addition, a summary view is presented of the relationship of the process attributes to the life cycle processes associated with ISO/IEC/IEEE 12207.

Two processes from ISO/IEC/IEEE 12207 do not appear in the list in Table 1, namely, the acquisition and decision management processes. These outcomes of these processes do not have any discernible relationships to the process attribute outcomes of ISO/IEC 33020.

Certain ISO/IEC/IEEE 12207 processes have been partitioned into sub processes, namely life cycle model management, infrastructure management, human resource management, knowledge management, quality management, measurement and quality assurance. This action has been taken to address outcomes in the basic processes that deal with firstly, establishment concerns, and secondly, performance (or operational)

concerns. The 'establishment' outcomes of these sub processes are mapped to ISO/IEC 33020:2019 PA 3.1 concerns. The 'performance' concerns of the sub processes are mapped to either PA 3.2 or PA 3.3, as appropriate.

As an example, with reference to ISO/IEC/IEEE 12207:2017, 6.2.1, life cycle model management, the basic and sub process outcomes are presented in Table 1.

Table 1 — ISO/IEC/IEEE 12207:2017, 6.2.1, life cycle model management

Basic process outcomes	Sub process: Establish	Sub process: Perform
a) Organizational policies and procedures for the management and deployment of life cycle models and processes are established.	a) Organizational policies and procedures for the management and deployment of life cycle models and processes are established.	
b) Responsibility, accountability, and authority within life cycle policies, processes, models, and procedures are defined.	b) Responsibility, accountability, and authority within life cycle policies, processes, models, and procedures are defined.	
c) Life cycle models and processes for use by the organization are assessed.		c) Life cycle models and processes for use by the organization are assessed.
d) Prioritized process, model, and procedure improvements are implemented.		d) Prioritized process, model, and procedure improvements are implemented.

The list of ISO/IEC/IEEE 12207 processes that have been mapped as sub processes is presented in Table 2.

Table 2 — ISO/IEC/IEEE 12207 processes mapped as sub processes

Basic process reference in ISO/IEC/IEEE 12207:2017	Basic processes	Sub process reference in ISO/IEC/IEEE 12207:2017	Sub processes
6.2.1	Life cycle model management	6.2.1.1	Life cycle model management: Establish
		6.2.1.2	Life cycle model management: Assess and improve
6.2.2	Infrastructure management	6.2.2.1	Infrastructure management: Establish
		6.2.2.2	Infrastructure management: Maintain
6.2.4	Human resource management	6.2.4.1	Human resource management: Establish
		6.2.4.2	Human resource management: Perform
6.2.5	Quality management	6.2.5.1	Quality management: Establish
		6.2.5.2	Quality management: Perform
6.2.6	Knowledge management	6.2.6.1	Knowledge management: Establish
		6.2.6.2	Knowledge management: Share and manage
6.3.7	Measurement	6.3.7.1	Measurement: Establish
		6.3.7.2	Measurement: Perform
6.3.8	Quality assurance	6.3.8.1	Quality assurance: Establish
		6.3.8.2	Quality assurance: Perform

The summary relationship between the ISO/IEC/IEEE 12207 processes and the ISO/IEC 33020 process capability levels is presented in Table 3.

Table 3 — Relationship between the ISO/IEC 33020 process capability levels and process attributes, and the ISO/IEC/IEEE 12207 life cycle processes

Process Capability Level	ISO/IEC 33020:2019 process attribute outcomes	Reference in ISO/IEC/IEEE 12207:2017	ISO/IEC/IEEE 12207:2017 life cycle processes
1	5.2.3.2 PA 1.1 Process performance process attribute	6.4	The processes in this group are typically identified in the assessment scope. The processes ISO/IEC/IEEE 12207:2017, 6.4 are likely candidates.
2	5.2.4.2 PA 2.1 Performance management process attribute	6.3.1	Project planning
		6.3.2	Project assessment and control
		6.3.4	Risk management
2	5.2.4.3 PA 2.2 Documented information management process attribute	6.3.5	Configuration management
		6.3.6	Information management
3	5.2.5.2 PA 3.1 Process definition process attribute	6.2.1.1	Life cycle model management: Establish
		6.2.2.1	Infrastructure management: Establish
		6.2.4.1	Human resource management: Establish
		6.2.5.1	Quality management: Establish
		6.2.6.1	Knowledge management: Establish
		6.3.7.1	Measurement: Establish
		6.3.8.1	Quality assurance: Establish
3	5.2.5.3 PA 3.2 Process deployment process attribute	6.2.1.2	Life cycle model management: Assess and improve
		6.2.2.2	Infrastructure management: Maintain
		6.2.3	Portfolio management
		6.2.4.2	Human resource management: Perform
		6.2.6.2	Knowledge management: Share and manage
3	5.2.5.4 PA 3.3 Process assurance process attribute	6.2.5.2	Quality management: Perform
		6.3.7.2	Measurement: Perform
		6.3.8.2	Quality assurance: Perform

4.2 Relationships between model elements

The rationale for the selection of the ISO/IEC/IEEE 12207 life cycle processes and their associations with the ISO/IEC 33020 process attribute outcomes can be found in Annexes A and B.

Annex A elaborates the summary mapping in Clause 4 by providing extended details of the relationship between the ISO/IEC 33020 process attribute outcomes and the ISO/IEC/IEEE 12207 life cycle process outcomes. Links to the information items described in Annex C are provided in a summary format. The level of detail provides the basis for validation by inspecting the relationships between the ISO/IEC 33020 process attribute outcomes and the ISO/IEC/IEEE 12207 life cycle process outcomes.

Annex B focuses on the relationships between the ISO/IEC 33020 generic practices and the ISO/IEC/IEEE 12207 activity/task descriptions. These model elements are linked via the information item characteristics, as listed in Annex C.

Annex A
(informative)

Associations between the ISO/IEC 33020 process attribute outcomes, ISO/IEC/IEEE 12207 life cycle process outcomes and information items

A.1 General

This annex describes the relationships between the ISO/IEC 33020 process attribute outcomes and the ISO/IEC/IEEE 12207 life cycle process outcomes. The model outcomes are linked by applicable information item characteristics, as described in Annex D.

A.2 Associations between the ISO/IEC 33020 process attribute outcomes, ISO/IEC/IEEE 12207 life cycle processes and information items

Information item characteristics provide the link between the ISO/IEC 33020 process attribute outcomes and the ISO/IEC/IEEE 12207 life cycle process outcomes. Each linked information item in Table A.1 is indicated by its reference label and name, and the reference number of the characteristic.

Table A.1 provides the basis for a detailed validation by inspection of the associations between the ISO/IEC 33020 process attribute outcomes and ISO/IEC/IEEE 12207 life cycle process outcomes in accordance with ISO/IEC/IEEE 24774:2021, Annex B model mapping considerations.

Table A.1 — Associations between the ISO/IEC 33020 process attribute outcomes, ISO/IEC/IEEE 12207 life cycle process outcomes and information item characteristics

ISO/IEC 33020:2019 process attribute outcomes	Description	ISO/IEC/IEEE 12207:2017	Description	ISO/IEC/IEEE 12207:2017
5.2.3.2	**PA 1.1 Process performance process attribute** 1) the process achieves its defined process outcomes.	6.1.2	**Supply** 1) An acquirer for a product or service is identified.	03-23 Request for proposal (RFP) 3) 04-28 Supply strategy 3)
		6.1.2	**Supply** 2) A response to the acquirer's request is produced.	03-24 Response to RFP 2) 08-65 RFP acquisition requirements review record 2)
		6.1.2	**Supply** 3) An agreement is established between the acquirer and supplier.	01-2 Supply agreement 5), 6)
		6.1.2	**Supply** 4) A product or service is provided.	08-07 Agreement performance review record 6) 08-75 Supply Delivery Records (for system, software, product or service) 3)

Table A.1 *(continued)*

ISO/IEC 33020:2019 process attribute outcomes	Description	ISO/IEC/IEEE 12207:2017	Description	ISO/IEC/IEEE 12207:2017
		6.1.2	**Supply** 5) Supplier obligations defined in the agreement are satisfied.	08-52 Product acceptance record 8) 08-73 Supplier payment receipt record 2) 11-6 Request for Supply (e.g., Request for Proposal, Request for Tender) 1)
		6.1.2	**Supply** 6) Responsibility for the acquired product or service, as directed by the agreement, is transferred.	08-52 Product acceptance record 6)
		6.4.1	**Business or mission analysis** 1) The problem or opportunity space is defined.	03-08 Identify business opportunities 6) 04-02 Business strategy 3) 08-10 Business opportunities review record 3)
		6.4.1	**Business or mission analysis** 2) The solution space is characterized.	03-08 Identify business opportunities 7)
		6.4.1	**Business or mission analysis** 3) Preliminary operational concepts and other concepts in the life cycle stages are defined.	03-07 Business opportunity space 7)
		6.4.1	**Business or mission analysis** 4) Candidate alternative solution classes are identified and analysed.	03-07 Business opportunity space 8)
		6.4.1	**Business or mission analysis** 5) The preferred candidate alternative solution class(es) are selected.	08-09 Business opportunities evaluation record 6), 7)
		6.4.1	**Business or mission analysis** 6) Any enabling systems or services needed for business or mission analysis are available.	08-20 Enabling system records: Business or Mission Analysis. 1), 2)
		6.4.2	**Stakeholder needs and requirements definition** 1) Stakeholders of the system are identified.	02-2 Stakeholders 3) 04-29 System requirements definition strategy 3)
		6.4.2	**Stakeholder needs and requirements definition** 2) Required characteristics and context of use of capabilities and concepts in the life cycle stages, including operational concepts, are defined.	03-31 Stakeholder Needs 11) 03-32 System operational concept 7), 8)
		6.4.2	**Stakeholder needs and requirements definition** 3) Constraints on a system are identified.	12-11 System stakeholder requirements 13)
		6.4.2	**Stakeholder needs and requirements definition** 4) Stakeholder needs are defined.	03-31 Stakeholder Needs 12), 14)
		6.4.2	**Stakeholder needs and requirements definition** 5) Stakeholder needs are prioritized and transformed into clearly defined stakeholder requirements.	03-02 Analyse stakeholder requirements 8), 9), 11) 03-31 Stakeholder Needs 13)
		6.4.2	**Stakeholder needs and requirements definition** 6) Critical performance measures are defined.	12-11 System stakeholder requirements 14), 15)

Table A.1 *(continued)*

ISO/IEC 33020:2019 process attribute outcomes	Description	ISO/IEC/IEEE 12207:2017	Description	ISO/IEC/IEEE 12207:2017
		6.4.2	**Stakeholder needs and requirements definition** 7) Stakeholder agreement that their needs and expectations are reflected adequately in the requirements is achieved.	03-02 Analyse stakeholder requirements 10) 08-44 Manage stakeholder requirements 3)
		6.4.2	**Stakeholder needs and requirements definition** 8) Any enabling systems or services needed for stakeholder needs and requirements are available.	08-27 Enabling system records: Stakeholder needs and requirements 1), 2)
		6.4.3	**System/software requirements definition** 1) The system or element description, including interfaces, functions and boundaries, for a system solution is defined.	03-34 System requirements definition 5), 6) 12-10 System requirements 16)
		6.4.3	**System/software requirements definition** 2) System/software requirements (functional, performance, process, non-functional, and interface) and design constraints are defined.	12-10 System requirements 18), 19), 20)
		6.4.3	**System/software requirements definition** 3) Critical performance measures are defined.	12-10 System requirements 17)
		6.4.3	**System/software requirements definition** 4) The system/software requirements are analysed.	03-33 System requirements analysis 11), 12), 13), 14)
		6.4.3	**System/software requirements definition** 5) Any enabling systems or services needed for system/software requirements definition are available.	08-29 Enabling system records: System/software requirements 1), 2)
		6.4.3	**System/software requirements definition** 6) Traceability of system/software requirements to stakeholder requirements is developed.	08-45 Manage system requirements 3)
		6.4.4	**Architecture definition** 1) Identified stakeholder concerns are addressed by the architecture.	03-03 Architecture definition 10), 11), 12), 13)
		6.4.4	**Architecture definition** 2) Architecture viewpoints are developed.	03-05 Architecture viewpoints 7), 8), 9), 10)
		6.4.4	**Architecture definition** 3) Context, boundaries, and external interfaces of the system are defined.	03-06 Architecture views 11)
		6.4.4	**Architecture definition** 4) Architecture views and models of the system are developed.	03-06 Architecture views 12), 13), 14), 15), 16)
		6.4.4	**Architecture definition** 5) Concepts, properties, characteristics, behaviours, functions, or constraints that are significant to architecture decisions of the system are allocated to architectural entities.	08-66 Requirements allocation 9), 12), 13)
		6.4.4	**Architecture definition** 6) System elements and their interfaces are identified.	08-66 Requirements allocation 10)

Table A.1 *(continued)*

ISO/IEC 33020:2019 process attribute outcomes	Description	ISO/IEC/IEEE 12207:2017	Description	ISO/IEC/IEEE 12207:2017
		6.4.4	**Architecture definition** 7) Architecture candidates are assessed.	08-08 Architecture assessment result 8), 9), 10)
		6.4.4	**Architecture definition** 8) An architectural basis for processes throughout the life cycle is achieved.	08-08 Architecture assessment result 11)
		6.4.4	**Architecture definition** 9) Alignment of the architecture with requirements and design characteristics is achieved.	08-41 Manage architecture 8), 9), 10), 11), 12) 08-66 Requirements allocation 11)
		6.4.4	**Architecture definition** 10) Any enabling systems or services needed for architecture definition are available.	08-19 Enabling system records: Architecture definition 1), 2)
		6.4.5	**Design definition** 1) Design characteristics of each system element are defined.	03-28 Software system design definition 5), 6) 03-29 Software system element design 12) 03-30 Software system element evaluation 9)
		6.4.5	**Design definition** 3) Design enablers necessary for design definition are selected or defined.	03-29 Software system element design 13)
		6.4.5	**Design definition** 4) Interfaces between system elements composing the system are defined or refined.	03-29 Software system element design 15)
		6.4.5	**Design definition** 5) Design alternatives for system elements are assessed.	03-29 Software system element design 14) 03-30 Software system element evaluation 10), 11), 12)
		6.4.5	**Design definition** 6) Design artifacts are developed.	03-29 Software system element design 16) 08-43 Manage software system element design 6)
		6.4.5	**Design definition** 7) Any enabling systems or services needed for design definition are available.	08-21 Enabling system records: Design definition 1), 2)
		6.4.5	**Design definition** 8) Traceability of the design characteristics to the architectural entities of the system architecture is established.	08-43 Manage software system element design 7)
		6.4.6	**System analysis** 1) System analyses needed are identified.	04-30 Systems analysis strategy 9), 10), 11), 12), 13)
		6.4.6	**System analysis** 2) System analysis assumptions and results are validated.	08-48 Perform systems analysis 8), 9), 10)
		6.4.6	**System analysis** 3) System analysis results are provided for decisions.	08-48 Perform systems analysis 11), 12)
		6.4.6	**System analysis** 4) Any enabling systems or services needed for system analysis are available.	08-28 Enabling system records: System analysis 1), 2)

Table A.1 *(continued)*

ISO/IEC 33020:2019 process attribute outcomes	Description	ISO/IEC/IEEE 12207:2017	Description	ISO/IEC/IEEE 12207:2017
		6.4.7	**Implementation** 1) Implementation constraints that influence the requirements, architecture, or design are identified.	04-07 Implementation Plan 6), 7)
		6.4.7	**Implementation** 2) A system element is realized.	07-8 Software element 9), 10), 11) 08-69 Software code & test evaluation record 5), 6)
		6.4.7	**Implementation** 3) A system element is packaged or stored.	08-42 Manage software elements 5), 6)
		6.4.7	**Implementation** 4) Any enabling systems or services needed for implementation are available.	08-23 Enabling system records: Implementation 1), 2)
		6.4.8	**Integration** 1) Integration constraints that influence system requirements, architecture, or design, including interfaces, are identified.	04-26 Software integration plan 11), 13)
		6.4.8	**Integration** 2) Approach and checkpoints for the correct operation of the assembled interfaces and system functions are defined.	04-26 Software integration plan 12)
		6.4.8	**Integration** 3) Any enabling systems or services needed for integration are available.	08-24 Enabling system records: Integration 1), 2)
		6.4.8	**Integration** 4) A system composed of implemented system elements is integrated.	07-6 Integrated system 9), 10)
		6.4.8	**Integration** 7) Integration results and anomalies are identified.	08-71 Software integration test results 3)
		6.4.9	**Verification** 1) Constraints of verification that influence the requirements, architecture, or design are identified.	04-32 Verification strategy 14), 15), 16), 17) 06-3 Verification Procedures 5)
		6.4.9	**Verification** 2) Any enabling systems or services needed for verification are available.	08-32 Enabling system records: Verification 1), 2)
		6.4.9	**Verification** 6) Verification results and anomalies are identified.	08-93 Verification problems and non-conformances 6), 7)
		6.4.10	**Transition** 1) Transition constraints that influence system/software requirements, architecture, or design are identified.	04-27 Software release plan 12), 13), 14), 15), 16)
		6.4.10	**Transition** 2) Any enabling systems or services needed for transition are available.	08-30 Enabling system records: Transition 1), 2)
		6.4.10	**Transition** 3) The site is prepared.	08-76 System/ software installation record 17), 18)
		6.4.10	**Transition** 4) The system, as installed in its operational location, is capable of delivering its specified functions.	08-76 System/ software installation record 19)
		6.4.10	**Transition** 5) Operators, users and other stakeholders necessary to the system utilization and support are trained.	08-76 System/ software installation record 20)