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Information technology — Process assessment —

Part 4: Guidance on use for process improvement and process capability determination

Technologies de l'information — Procédés d'évaluation —

Partie 4: Conseils sur l'utilisation pour l'amélioration de processus et la détermination de capacité de processus

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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.

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The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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.

ISO/IEC 15504-4 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and system engineering*.

This first edition cancels and replaces ISO/IEC TR 15504-7:1998 and ISO/IEC TR 15504-8:1998, which have been technically revised.

ISO/IEC 15504 consists of the following parts, under the general title *Information technology — Process assessment*:

— *Part 1: Concepts and vocabulary*

— *Part 2: Performing an assessment*

— *Part 3: Guidance on performing an assessment*

— *Part 4: Guidance on use for process improvement and process capability determination*

The following part is in preparation:

— *Part 5: An exemplar Process Assessment Model*

The complete series will replace ISO/IEC TR 15504-1 to ISO/IEC TR 15504-9.

Introduction

ISO/IEC 15504 provides a framework for process assessment and sets out the minimum requirements for performing an assessment in order to ensure consistency and repeatability of assessment ratings. Process assessment is applicable in the following circumstances:

— by or on behalf of an organization with the objective of understanding the state of its own processes for process improvement;

— by or on behalf of an organization with the objective of determining the capability of another organization's processes for a particular contract or class of contracts, or to determine the capability of its own processes for a particular requirement or class of requirements.

This informative part of ISO/IEC 15504 provides guidance on how to utilize a conformant process assessment within a process improvement programme or within either type of process capability determination.

ISO/IEC 15504-1 provides a general introduction to the concepts of process assessment and a glossary for assessment related terms.

ISO/IEC 15504-2 sets requirements for performing an assessment that ensure consistency and repeatability of the ratings. The requirements help to ensure that the assessment output is self-consistent and provides evidence to substantiate the ratings and to verify compliance with the requirements.

ISO/IEC 15504-3 provides guidance for interpreting the requirements for performing an assessment.

ISO/IEC 15504-5 contains an exemplar Process Assessment Model that is mapped to ISO/IEC 12207:1995/Amd.1:2002 as a Process Reference Model.

Information technology — Process assessment —

Part 4: Guidance on use for process improvement and process capability determination

1 Scope

This part of ISO/IEC 15504 provides guidance on how to utilize a conformant process assessment within a process improvement programme or a process capability determination. This part of ISO/IEC 15504 is for information only.

The guidance provided does not presume specific organizational structures, management philosophies, life cycle models or development methods, although some of the examples and tables within the text are based upon processes from ISO/IEC 12207.

In the case of process improvement, the concepts and principles are appropriate for the full range of different business goals, application domains and sizes of organization, so that all types of organizations may use them. In the case of process capability determination, this guidance is applicable within any customer–supplier relationship, and to any organization wishing to determine the process capability of its own processes.

2 Normative references

The following referenced documents are indispensable for the application 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 12207, *Information technology — Software life cycle processes*

ISO/IEC 15504-1, *Information technology — Process assessment — Part 1: Concepts and vocabulary*[1)]

ISO/IEC 15504-2, *Information technology — Process assessment — Part 2: Performing an assessment*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 15504-1 apply.

4 Introduction

4.1 Process improvement and process capability determination

Within ISO/IEC 15504, process assessment can be utilized:

— by or on behalf of an organization with the objective of understanding its own processes for *process improvement*;

1) To be published.

— by or on behalf of an organization with the objective of *determining the capability* of another organization's processes for a particular contract or class of contracts, or determining the capability of its own processes for a particular requirement or class of requirements.

Within a process improvement (PI) context, process assessment provides a means of characterizing an organizational unit in terms of the capability of selected processes. Analysis of the output of a conformant process assessment against an organizational unit's business goals identifies strengths, weaknesses and risks related to the processes. This, in turn, can help determine whether the processes are effective in achieving business goals, and provide the drivers for making improvements.

Process capability determination (PCD) is concerned with analysing the output of one or more conformant process assessments to identify the strengths, weaknesses and risks involved in undertaking a specific project using the selected processes within a given organizational unit. A process capability determination can provide a fundamental input to supplier selection, in which case it is often termed a 'supplier capability determination'.

4.2 PI and PCD sponsors and teams

Process improvement programmes and process capability determinations will usually be required and resourced by a *sponsor* – as described in ISO/IEC 15504-1. The sponsor has the authority to ensure that the programme is carried out effectively, and takes ownership of the results. The sponsor may have one or more staff working within a team – a PI Team or PCD Team – whose task is to plan and implement the actions required to achieve the objectives identified by the sponsor.

Sponsorship may be implemented in a variety of ways, according to the culture of the organization. In non-hierarchical or higher maturity organizations for example, both sponsorship and project management of process improvement activities may be delegated to working level, although authorities, roles and responsibilities should always be clearly defined.

4.3 Process, guidance and method

In order to achieve improvements to selected processes, PI Sponsors should deploy a PI *process* as outlined in 4.4. In order to determine the capability of selected processes, PCD Teams should deploy a PCD process, as outlined in 4.5. This part of ISO/IEC 15504 provides *guidance* on how to deploy such processes. In either case, organizations should deploy a suitably capable process, and either acquire or develop a suitable *method* — setting out appropriate roles, techniques and specific activities — with which to implement the process. Such a method should:

— take account of the guidance contained within this part of ISO/IEC 15504;

— include or reference an assessment process which satisfies the requirements set out within ISO/IEC 15504-2 and accords with the guidance set out in ISO/IEC 15504-3.

4.4 Process improvement – purpose and outcomes

The purpose of process improvement is to continually improve the organization's effectiveness and efficiency through the processes used and maintained aligned with the business need.

As a result of successful implementation of process improvement:

— commitment is established to provide resources to sustain improvement actions;

— issues arising from the organization's internal/external environment are identified as improvement opportunities and justified as reasons for change;

— analysis of the current status of the existing process is performed, focusing on those processes from which improvement stimuli arise;

— improvement goals are identified and prioritized, and consequent changes to the process are defined and implemented;

— the effects of process implementation are monitored and confirmed against the defined improvement goals;

— knowledge gained from the improvements is communicated within the organization; and

— the improvements made are evaluated and consideration given for using solutions elsewhere within the organization.

[ISO/IEC 12207:1995/Amd.2[2)], F.3.3.3]

NOTE 1 Information sources providing input for change may include: process assessment results, audits, customer's satisfaction reports, organizational effectiveness / efficiency, cost of quality.

NOTE 2 The current status of processes may be determined by process assessment.

4.5 Process capability determination — purpose and outcomes

The purpose of *process capability determination* is to identify the strengths, weaknesses and process-related risks associated with selected processes with respect to a particular specified requirement.

As a result of successful implementation of *process capability determination*:

— a target capability appropriate to the particular specified requirement is identified;

— reviews of the organization's processes are carried out to determine their suitability for the particular specified requirement in the light of process assessment results;

— strengths and weaknesses within the assessed processes are identified;

— any gaps between target and assessed capabilities are analysed;

— overall process-related risk is determined.

NOTE 1 The *selected processes* are chosen by the PCD Team as described in 7.2.2.

NOTE 2 The *specified requirement* may involve deploying an organization's processes for a new or an existing task, a contract or an internal undertaking, a product or a service, or any other business requirement.

NOTE 3 Reviews of the *organization's standard processes* are generally carried out following a process assessment of the organization's implemented processes, as described in ISO/IEC 15504-3.

NOTE 4 Process capability determination does not address all aspects of risk, which may include strategic, organizational, financial, personnel and many other factors. The output from a process capability determination feeds into an organization's risk management process, but only with respect to *process-related risk* – as outlined in 5.5.

4.6 Process assessment output

The output of a conformant process assessment includes a set of process profiles, which express the process attribute ratings assigned for each process selected from the specified Process Reference Model(s) – as described in ISO/IEC 15504-2.

An example set of process profiles, with ISO/IEC 12207 as the Process Reference Model, might be presented as illustrated in Figure 1. The processes (F.1.3.1, etc.) are from ISO/IEC 12207, while the process attributes (PA 1.1, etc.) and ratings (Fully achieved, etc.) are defined in ISO/IEC 15504-2.

2) To be published.

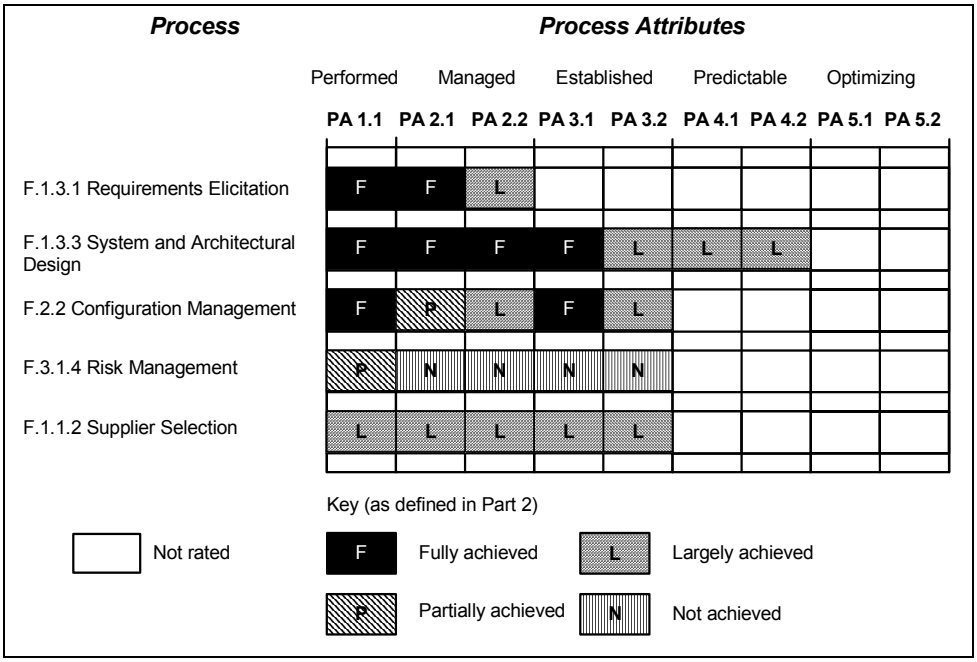

Figure 1 — Example assessment output set of process profiles

The guidance contained in this part of ISO/IEC 15504 is intended to apply to the output from a conformant process assessment.

5 Utilizing process assessment

5.1 General

This clause provides guidance upon issues common to both process improvement and process capability determination.

5.2 Selecting Process Reference Model(s)

Both process improvement and process capability determination require that the sponsor select a suitable Process Reference Model or Models.

A Process Reference Model describes a set of processes in terms of purpose and outcomes as defined in ISO/IEC 15504-2. A Process Reference Model is generally a recognized domain standard. ISO/IEC 12207, Annex F, and ISO/IEC 15288:2002 are Process Reference Models within the domains of software engineering and systems engineering, respectively.

The sponsor should determine which Process Reference Model(s) will best suit the specified requirement (for PCD) or business goals (for PI), following the guidance in ISO/IEC 15504-3 on the selection of suitable Process Reference Models.

Where improvements are planned for processes that do not align with any recognized domain standard, appropriate process models can still be defined and used, but this could not then be considered to be based upon a conformant process assessment.

5.3 Setting target capability

The sponsor should determine which processes from the chosen Process Reference Model(s) are most important to meeting the specified requirement (for PCD) or business goals (for PI).

The sponsor should then specify, for each selected process, a target process profile showing which process attributes are required, and – for each process attribute – what rating is judged necessary. Only process

attribute ratings of Fully achieved or Largely achieved should be set; Not required should be noted for any process attributes deemed not necessary. Partially achieved should not be set since this would indicate that some aspects of achievement would be unpredictable – as defined in ISO/IEC 15504-2.

The set of target process profiles expresses the *target capability* which the sponsor judges to be adequate, subject to an acceptable process risk, for meeting the specified requirement (for PCD) or business goals (for PI).

Table 1 — Example target capability

Selected process from Process Reference Model	Process attributes	Required process attribute rating
F.1.3.1 Requirements elicitation	PA 1.1 PA 2.1, PA 2.2	Fully achieved Largely achieved
F.1.3.3 System and Architectural Design	PA 1.1, PA 2.1, PA 2.2, PA 3.1, PA 3.2 PA 4.1, PA 4.2	Fully achieved Largely achieved
F.2.2 Configuration management	PA 1.1, PA 2.1, PA 2.2 PA 3.1, PA 3.2	Fully achieved Largely achieved
F.3.1.4 Risk Management	PA 1.1, PA 2.1, PA 2.2, PA 3.1, PA 3.2	Fully achieved
F.1.1.2 Supplier Selection	PA 1.1, PA 2.1 PA 2.2 PA 3.1, PA 3.2	Fully achieved Not required Largely achieved

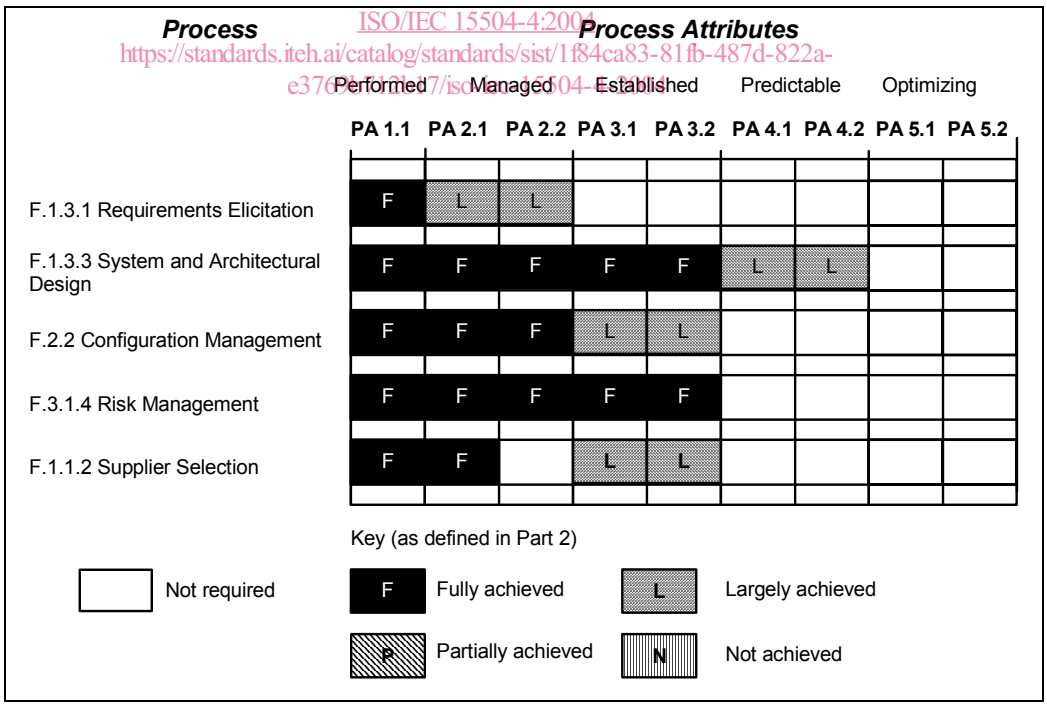

Figure 2 — Example target capability presented as a set of target process profiles

Table 1 and Figure 2 illustrate an example target capability. The processes shown (F.1.3.1, etc.) are from ISO/IEC 12207, while the process attributes (PA 1.1, etc.) and ratings (Fully achieved, etc.) are defined in ISO/IEC 15504-2. Figure 2 illustrates a target capability where required ratings have been specified for individual process attributes.

Target capability can also be expressed by specifying a required capability level rating for each selected process, using the required process attribute ratings shown in ISO/IEC 15504-2, Table 1. This approach is also illustrated in Figure 2, where the required process attribute ratings for F.1.3.1 Requirements Elicitation correspond to level 2, the required ratings for F.2.2 Configuration Management correspond to level 3, and the required ratings for F.1.3.3 System and Architectural Design correspond to level 4.

A defined PI method should include a means of deriving a target capability from analysis of the organization's business goals. A defined PCD method should include a means of setting target capability from analysis of the specified requirement.

One simple approach to establishing target capability – based on ISO/IEC 12207 as the Process Reference Model – is set out in Table 2.

Table 2 — Setting target capability

Step	Action	Rationale
Step 1 – Select an initial set of processes	Select the Primary Lifecycle Processes, excluding any processes not relevant to the specified requirement	The Primary Lifecycle Processes within the ISO/IEC 12207 Process Reference Model contribute most directly to the delivery of products and services
Step 2 – Set default required process attribute ratings for the initial set of processes	Set all process attribute ratings for capability levels 1, 2 and 3 to *Fully achieved*	This approach ensures that selected processes are fully performed; that practices are in place to avoid missed deadlines, budget overspend and product quality problems; and that processes are deployed following proven best practice, thus providing confidence that future performance will be consistent with past accomplishments
Step 3 – Review and adjust the required process attribute ratings for each initial process	Add attribute ratings for level 4 or level 5; or remove attribute ratings for level 3	Adding level 4 and level 5 process attributes for some processes may sometimes be justified to reduce process–related risks, as illustrated in Figure 2 where the target process profile for F.1.3.3 System and Architectural Design includes process attributes from capability level 4 Sometimes, deleting process attributes from level 3 may be justified, as illustrated in Figure 2, where the target process profile for F.1.3.1 Requirements Elicitation includes process attribute from capability levels 1 and 2 only
Step 4 – Add further processes, plus required process attribute ratings for each	Add supporting Lifecycle Processes and Organizational Lifecycle Processes	The supporting Lifecycle Processes and Organizational Lifecycle Processes are critical to establishing high levels of process capability within an organization Many process attributes are related to Supporting Lifecycle Processes and Organizational Lifecycle Processes For example, if the *Performance Management* attribute (PA 2.1) has been included for a Primary Lifecycle Process, then the *Project Management* process should also be included The target capability for Supporting Lifecycle Processes and Organizational Lifecycle Processes is driven by the extent to which they support process attributes applying to the initial set of selected processes Other Supporting Lifecycle Processes and Organizational Lifecycle Processes should also be included in the target capability statement where they are relevant to the specified requirement (for PCD) or business goals (for PI)

Note that the target capability may need to address organizational capability, rather than a product or service. The requirement may, for example, be to establish a strong configuration management process as an end in itself, and the selected process set would then include this single process.

5.4 Defining the assessment input

The sponsor should generate the input for a process assessment – as specified in ISO/IEC 15504-2 – according to the guidance set out in ISO/IEC 15504-3 and the additional guidance set out below.

At a minimum, the assessment input shall specify:

a) the identity of the sponsor of the assessment and the sponsor's relationship to the organizational unit being assessed,

[ISO/IEC 15504-2, 4.4.2]

The identity of the assessment sponsor will be either the PCD Sponsor or the PI Sponsor.

e) the assessment constraints considering, at minimum:

...

4) the quantity and type of objective evidence to be examined in the assessment,

5) the ownership of the assessment outputs and any restrictions on their use,

[ISO/IEC 15504-2, 4.4.2]

The quantity and type of objective evidence needed to support each process attribute rating will depend upon the assessment purpose and scope.

— For an initial process improvement programme, a sponsor or method may for example require that every process attribute rating be supported by a minimum of two verbal assertions collected at distinct data collection sessions – but with possibly no documentary evidence required.

— For a supplier capability evaluation, a sponsor or method may for example require that every process attribute rating be supported by a minimum of three verbal assertions collected at different data collection sessions plus at least one piece of documentary evidence. The sponsor or method may also specify that if a document has been formally requested by a competent assessor but the organizational unit has stated that it cannot be produced, then this assertion may be counted in lieu of the documentary evidence required.

The ownership of the assessment outputs and any restrictions on their use, plus any controls on information resulting from a confidentiality agreement, must be defined within the assessment input, reflecting any confidentiality agreements in place that affect the overall process improvement programme or process capability determination.

5.5 Evaluating process-related risk

5.5.1 Inferring process-related risk from assessment output

The quality of a product or service is greatly influenced by the processes deployed to provide it. Process capability is measured via the process attributes described in ISO/IEC 15504-2. Process-related risk arises from inappropriate process management, i.e. not deploying appropriate processes, or from deploying them in a way which does not achieve required process attribute ratings.

The output of a conformant process assessment includes a set of process profiles as described in 4.6 and illustrated in Figure 1. Required process attributes can be represented as a set of target process profiles, as described in 5.3 and illustrated in Figure 2.

Both target and assessed process profiles can be presented within a single diagram, as illustrated in Figure 3. Again, the processes shown (F.1.3.1, etc.) are from ISO/IEC 12207, while the process attributes (PA 1.1, etc.) and ratings (Fully achieved, etc.) are defined in ISO/IEC 15504-2.