
**Information technology — Process
assessment — Process assessment
model for software testing**

*Technologies de l'information — Évaluation du procédé — Modèle
d'évaluation du procédé pour l'essai de logiciel*

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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 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](#)

The committee responsible for this document is ISO/IEC JTC 1, *Information technology, SC 7, Software and systems engineering*.

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Introduction

The ISO/IEC 330xx set of standards covering the domain of process assessment are based on a view of assessment that establishes architecture of the following three components:

- process models that define processes, the entities that are the subject of assessment;
- measurement frameworks that provide scales for evaluating specified attributes;
- a specification of the process to be followed in conducting assessments.

This International Standard provides an example of a process assessment model for software testing for use in performing a conformant assessment in accordance with the requirements of ISO/IEC 33002.

An integral part of conducting an assessment is to use a process assessment model (PAM) related to a process reference model (PRM) and conformant with the requirements defined in ISO/IEC 33004.

A process reference model cannot be used alone as the basis for conducting a consistent and reliable assessment of process capability since the level of detail is not sufficient. Therefore,

- the description of the process purpose and process outcome(s) provided by the process reference model needs to be supported with a comprehensive set of indicators of process performance, and
- the capability levels and process attributes defined in ISO/IEC 33020 and its associated rating scale need to be supported with a set of indicators of process capability.

Used in this way and in conjunction with a documented process, consistent and repeatable ratings of process capability is possible. (standards.iteh.ai)

This International Standard, a process assessment model for software testing, contains a set of indicators to be considered when interpreting the intent of the process reference model. These indicators may also be used when implementing a process improvement program or to help evaluate and select an assessment model, methodology, and/or tools.

The process reference model defined in ISO/IEC/IEEE 29119-2 has been used as the basis for the ISO/IEC 33063 exemplar process assessment model for software testing.

The following are provided within this International Standard:

- [Clause 4](#) provides a detailed description of the structure and key components of the process assessment model, which introduces the following two dimensions: a) process dimension; b) capability dimension. Assessment indicators are also introduced in this Clause;
- [Clause 5](#) addresses the process dimension. It uses process definitions from ISO/IEC/IEEE 29119-2 to identify a process reference model. The processes of the process reference model are described in the process assessment model in terms of purpose and outcomes. The process assessment model expands the process reference model process definitions by including a set of process performance indicators called base practices for each process. The process assessment model also defines a second set of indicators of process performance by associating work products with each process;
- [Clause 6](#) addresses the capability dimension. It duplicates the definitions of the capability levels and process attributes from ISO/IEC 33020 and expands each of the attributes through the inclusion of a set of generic practices. These generic practices belong to a set of indicators of process;
- [Annex A](#) provides a statement of conformance of the process assessment model for software testing to the requirements defined in ISO/IEC 33004;
- [Annex B](#) provides a guideline on how the planning and scoping of an assessment is done with this process assessment model for software testing;

NOTE As the processes described in this model are generic when practically applied to an assessment, they have to be applied to the different test phases or test levels or test types encountered in the project which is to be assessed. The multiple applications of the processes have to be documented in the assessment scope. It also provides guideline on the use of additional processes from other process assessment models.

- [Annex C](#) provides selected characteristics for typical work products to assist the assessor in evaluating the capability level of processes;
- [Annex D](#) introduces additional process areas for the process assessment model;
- [Annex E](#) provides the additional process reference model processes which will be used by the PAM in [Annex D](#);
- Bibliography contains a list of informative references.

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Information technology — Process assessment — Process assessment model for software testing

1 Scope

This International Standard

- defines a process assessment model that meets the requirements of ISO/IEC 33004 and that supports the performance of an assessment of process capability using the process measurement framework defined in ISO/IEC 33020. The process assessment model provides indicators for guidance on the interpretation of the process purposes and outcomes as defined in ISO/IEC/IEEE 29119-2 and the process attributes as defined in ISO/IEC 33020, and
- provides guidance, by example, on the definition, selection, and use of assessment indicators.

A process assessment model comprises a set of indicators of process performance and process capability. The indicators are used as a basis for collecting the objective evidence that enables an assessor to assign ratings, following the requirements of ISO/IEC 33002. The set of indicators included in this International Standard is not intended to be an all-inclusive set nor is it intended to be applicable in its entirety. Subsets that are appropriate to the context and scope of the assessment should be selected.

The process assessment model in this International Standard is directed at assessment sponsors and competent assessors who wish to select a model and associated documented process method for assessment (for either capability determination or process improvement).

Any process assessment model for software testing meeting the requirements defined in ISO/IEC 33004 concerning models for process assessment may be used for assessment. Different models and methods might be needed to address differing business and testing needs. This assessment model is provided as an exemplar of a model meeting all the requirements expressed in ISO/IEC 33004.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC/IEEE 29119-1, *Software and systems engineering — Software testing — Part 1: Concepts and definitions*

ISO/IEC/IEEE 29119-2, *Software and systems engineering — Software testing — Part 2: Test processes*

ISO/IEC 33001, *Information technology — Process assessment — Concepts and terminology*

ISO/IEC 33004, *Information technology — Process assessment — Requirements for process reference, process assessment and maturity models*

ISO/IEC 33020, *Information technology — Process assessment — Process measurement framework for assessment of process capability*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 33001, ISO/IEC/IEEE 29119-1, and ISO/IEC/IEEE 29119-2 apply.

4 Overview of the process assessment model

4.1 General

ISO/IEC 33063 provides an exemplar Process assessment model (PAM) for software testing that includes examples of assessment indicators.

The process reference model (PRM) defined in ISO/IEC/IEEE 29119-2, together with the process attributes defined in ISO/IEC 33020, establish the process assessment model used as a common basis for performing assessments of software testing process capability, allowing for the reporting of results using a common rating scale.

The process assessment model is a two-dimensional model of process capability. In one dimension, the process dimension, the processes are defined and classified into process categories. In the other dimension, the capability dimension, a set of process attributes grouped into capability levels is defined. The process attributes provide the measurable characteristics of process capability.

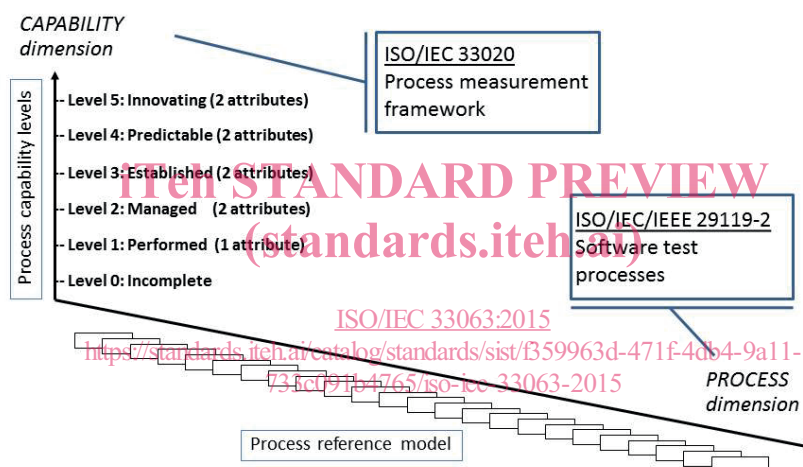


Figure 1 — Relationship between the process assessment model and its inputs

Figure 1 shows the relationship between the general structure of the process assessment model, ISO/IEC 33020 and ISO/IEC/IEEE 29119-2.

The process reference model and the capability dimension defined in ISO/IEC 33020 cannot be used alone as the basis for conducting reliable and consistent assessments of process capability since the level of detail provided is not sufficient. The descriptions of the process purpose and outcomes in the process reference model, and the process attribute definitions in ISO/IEC 33020, need to be supported with a comprehensive set of indicators of process performance and process capability that are used for assessment performance.

The exemplar process assessment model for software testing defined in ISO/IEC 33063 is conformant with the ISO/IEC 33004 requirements for a process assessment model, and can be used as the basis for conducting an assessment of software testing process capability.

4.2 Structure of the process assessment model

4.2.1 Overview

This clause describes the detailed structure of the process assessment model and its key components.

This process assessment model expands upon the process reference model by adding the definition and use of assessment indicators. Assessment indicators comprise of indicators of process performance and process capability. These are defined to support the assessor's judgment of the performance and capability of an implemented process.

[Clause 5](#), together with its associated [Annex C](#), describes the components of the process dimension. [Clause 6](#) describes the components of the capability dimension while [Annex A](#) provides a demonstration of conformity that meets the requirements of ISO/IEC 33004.

ISO/IEC 33004 requires that processes included in a process reference model satisfy the following criterion:

"The fundamental elements of a process reference model are the set of descriptions of the processes within the scope of the model. These process descriptions shall meet the following requirements:

- a) *a process shall be described in terms of its purpose and outcomes;*
- b) *the set of process outcomes shall be necessary and sufficient to achieve the purpose of the process;*
- c) *process descriptions shall not contain or imply aspects of the process quality characteristic beyond the basic level of any relevant process measurement framework conformant with ISO/IEC 33003."*

As processes are directly derived and applied from ISO/IEC/IEEE 29119-2, these requirements are satisfied.

The process assessment model includes process groups defined in ISO/IEC/IEEE 29119-2 which are:

- the organizational test Process;
- the test management processes;
- the dynamic test processes;

The static test process group is added in an informative [Annex D](#) expanding the current process reference model since they are the processes to be assessed when considering industry practice.

4.2.2 Processes

[Figure 2](#) lists the processes from ISO/IEC/IEEE 29119-2 that are included in the process dimension of the process assessment model for software testing.

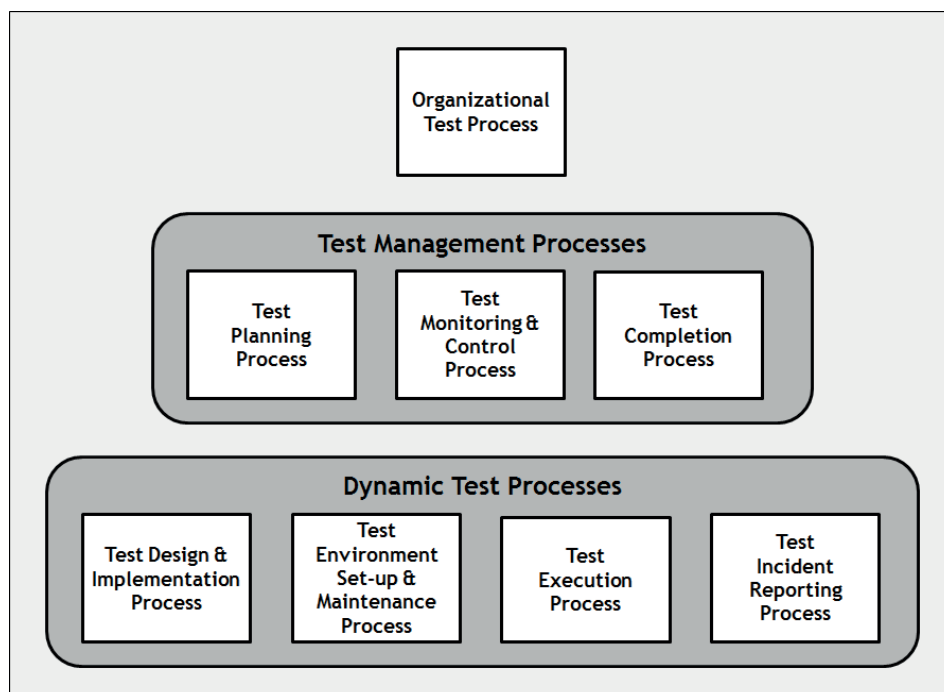


Figure 2 — Process groups and processes of PRM, ISO/IEC/IEEE 29119-2

Test processes in this process assessment model are classified into organizational test (OT) process group, test management (TM) process group and dynamic test (DT) process group, exactly following the structure given in the process reference model.

The **organizational test** process group includes a single process performed for the creation and maintenance of organizational test specifications such as organizational test policies, organizational test strategies, and other organization-wide specifications.

This group includes the process listed in [Table 1](#).

Table 1 — Organizational test process group

Process Identification	Process name	Source
OT.1	Organizational test process	ISO/IEC/IEEE 29119-2

The **test management** process group consists of processes that cover the management of testing. The processes contain practices that may be used by anyone who manages the whole test project or a particular test phase, test level or test type within the project.

This group includes the processes listed in [Table 2](#).

Table 2 — Test management process group

Process Identification	Process name	Source
TM.1	Test planning process	ISO/IEC/IEEE 29119-2
TM.2	Test monitoring and control process	ISO/IEC/IEEE 29119-2
TM.3	Test completion process	ISO/IEC/IEEE 29119-2

The **dynamic test** process group consists of processes that prepare and maintain the test environment; design, implement and execute the tests and/or report the incidents resulting from the test execution.

The **dynamic test** process group includes the processes listed in [Table 3](#).

Table 3 — Dynamic test process group

Process Identification	Process name	Source
DT.1	Test design & implementation process	ISO/IEC/IEEE 29119-2
DT.2	Test environment set-up & maintenance process	ISO/IEC/IEEE 29119-2
DT.3	Test execution process	ISO/IEC/IEEE 29119-2
DT.4	Test incident reporting process	ISO/IEC/IEEE 29119-2

The **static test** process group consists of processes with related activities that review software and related work products and perform static analysis, which are not in the processes from ISO/IEC/IEEE 29119-2. The static test process group is defined and described in an informative [Annex D](#).

The **static test** process group includes the processes listed in [Table 4](#).

Table 4 — Dynamic test process group

Process Identification	Process name	Source
STAT.1	Software review process	ISO/IEC 12207
STAT.2	Static analysis process	ISO/IEC CD1 29119-2:2011

As illustrated in [B.2](#), the processes within the test management process group and dynamic test process group are generic. Within the context of an assessment they have to be applied to the whole project, different test phases, test levels or test types depending on the characteristics of the project to be assessed.

For example, processes within the test management process can be applied to the management of projects (e.g. master test level), of test levels such as unit testing or acceptance testing, or of types of testing such as security testing and performance testing. The processes within the dynamic test process group can e.g. be applied to integration testing or performance testing, security testing or other test phases/test levels/test types.

NOTE Application of the test management processes and dynamic test processes is unique for each situation with distinct characteristics, hence [B.2](#) is normative.

For practical purposes, in an informative [Annex D](#) and [E](#), three additional processes for organizational test and test management process group, and one additional process group are added. The additional processes such as *skill development process (OT.2)*, *problem resolution management process (TM.4)*, *measurement process (TM.5)*, and *software review process (STAT.1)* are from the ISO/IEC 12207 PRM, while the *static analysis process (STAT.2)* is defined based on the previous version of the PRM. Those additional processes in [Annex D](#) and [E](#) are selectively included for the practical assessment of software test processes reflecting the industry practice.

The guideline on the use of additional processes from other process assessment models is depicted in [B.3](#).

4.2.3 Process dimension

For the process dimension, all the processes in [Figure 2](#) are included within the process dimension of the process assessment model. The processes are classified into process Groups. There are four process groups: organizational test process, test management processes, dynamic test processes, and static test processes ([Annex D](#)). Each process in the process assessment model is described in terms of a purpose statement. These statements contain the unique functional objectives of the process when performed in a particular environment. A list of specific outcomes is associated with each of the process purpose statements, as a list of expected positive results of the process performance.

Satisfying the purpose statement of a process represents the first step in building a level 1 process capability where the expected outcomes are observable. The process groups and their associated processes are described in [Clause 5](#).

4.2.4 Capability dimension

For the capability dimension, the process capability levels and process attributes are identical to those defined in ISO/IEC 33020.

Evolving process capability is expressed in the Test Process assessment model in terms of process attributes grouped into capability levels. Process attributes are features of a process that can be evaluated on a scale of achievement thereby providing a measure of the capability of the process. Attributes are applicable to all processes. Each process attribute describes a facet of the overall capability of managing and improving the effectiveness of a process in achieving its purpose and contributing to the business goals of the organization.

A capability level is a set of process attribute(s) that work together to provide a major enhancement in the ability to carry out a process. The levels constitute a rational way of progressing through improvement of the capability of any process and are defined in ISO/IEC 33020.

There are six capability levels which includes nine process attributes.

Level 0: Incomplete process

The process is not implemented, or fails to achieve the process purpose.

At this level, there is little or no evidence of any systematic achievement of the process purpose.

Level 1: Performed process

The implemented process achieves its process purpose.

Level 2: Managed process

The previously described Performed process is implemented in a managed fashion (planned, monitored and adjusted) and its work products are appropriately established, controlled and maintained.

Level 3: Established process

The previously described Managed process is implemented using a defined process that is capable of achieving the process outcomes.

Level 4: Predictable process

The previously described Established process now operates within defined limits to achieve the process outcomes. Quantitative management needs are identified, measurement data are collected and analysed to identify causes of variation.

Level 5: Innovating process

The previously described Predictable process is continually improved to respond to organizational change.

Within the process assessment model, the measure of capability is based upon the nine process attributes (PA) defined in ISO/IEC 33020. Process attributes are used to determine whether a process has reached a given capability. Each attribute measures a particular aspect of the process capability.

At each level there is no ordering between the process attributes; each attribute addresses a specific aspect of the capability level. The list of process attributes is shown in [Table 5](#).

Table 5 — Capability levels and process attributes

Process attribute ID	Capability levels and process attributes
	Level 0: Incomplete process
	Level 1: Performed process
PA 1.1	Process performance
	Level 2: Managed process
PA 2.1	Performance management
PA 2.2	Work product management
	Level 3: Established process
PA 3.1	Process definition
PA 3.2	Process deployment
	Level 4: Predictable process
PA 4.1	Quantitative analysis
PA 4.2	Quantitative control
	Level 5: Innovating process
PA 5.1	Process innovation
PA 5.2	Process Innovation implementation

The process attributes are evaluated on a four point ordinal scale of achievement, as defined in ISO/IEC 33020. They provide insight into the specific aspects of process capability required to support process improvement and capability determination.

4.3 Assessment indicators

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4.3.1 Overview

The process assessment model is based on the principle that the capability of a process can be assessed by demonstrating the achievement of process attributes on the basis of evidences related to assessment indicators.

There are two types of assessment indicators: process capability indicators, which apply to capability levels 1 to 5 and process performance indicators, which apply exclusively to capability level 1. These indicators are defined in 4.3.2.

The process attributes in the capability dimension have a set of process capability indicators that provide an indication of the extent of achievement of the attribute in the instantiated process. These indicators concern significant activities, resources or results associated with the achievement of the attribute purpose by a process.

The process capability indicators are:

- Generic practice (GP);
- Generic resource (GR);
- Generic work product (GWP).

As additional indicators for supporting the assessment of a process at Level 1, each process in the process dimension has a set of process performance indicators which is used to measure the degree of achievement of the process performance attribute for the process assessed.

The process performance indicators are:

- Base practice (BP);
- Work product (WP).

The performance of base practices (BPs) provides an indication of the extent of achievement of the process purpose and process outcomes. Work products (WPs) are either used or produced (or both), when performing the process.

The process performance and process capability indicators defined in the process assessment model represent types of objective evidence that may be found in an instantiation of a process and therefore could be used to judge achievement of capability.

Figure 3 shows how the assessment indicators are related to process performance and process capability.

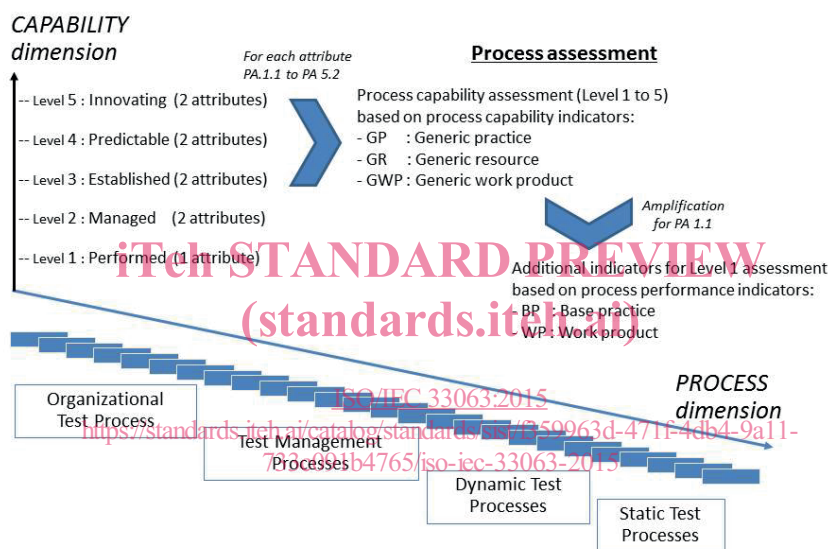


Figure 3 — Assessment indicators

4.3.2 Process capability indicators

The three types of process capability indicators related to levels 1 to 5 are identified in Figure 4. They are intended to be applicable to all processes.

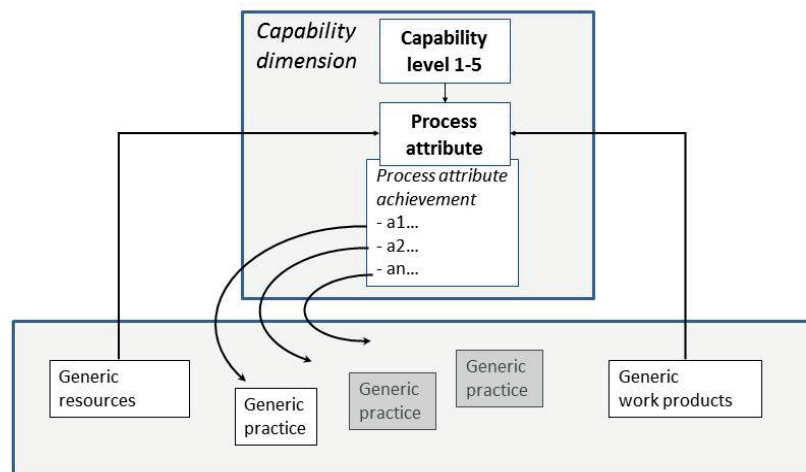


Figure 4 — Process capability indicators

All the process capability indicators relate to the process attributes defined in the capability dimension of the process assessment model. They represent the type of evidence that would support judgments of the extent to which the attributes are achieved. Evidence of their effective performance or existence supports the judgment of the degree of achievement of the attribute. The generic practices are the principal indicators of process capability.

The **generic practice (GP)** indicators are activities of a generic type and provide guidance on the implementation of the attribute's characteristics. They support the achievement of the process attribute and many of them concern management practices, i.e. practices that are established to support the process performance as it is characterized at level 1.

During the evaluation of process capability, the primary focus is on the performance of the generic practices. In general, performance of all generic practices is expected for full achievement of the process attribute.

The **generic resource (GR)** indicators are associated resources that may be used when performing the process in order to achieve the attribute. These resources may include human resources, tools, methods and infrastructure. The availability of a resource indicates the potential to fulfill the purpose of a specific attribute.

NOTE The assessor should interpret the generic resources according to the process assessed; e.g. for PA 2.1 resources (with identified objectives, responsibilities and authorities), an assessor would look for roles (with identified objectives, responsibilities and authorities) in test management and dynamic test processes, but for organizational processes would look for governance structures (e.g. mandated committees, positions) with identified objectives, responsibilities and authorities.

The **generic work product (GWP)** indicators are sets of characteristics that would be expected to be evident in work products of generic types as a result of achievement of an attribute. The generic work products form the basis for the classification of the work products defined as process performance indicators; they represent basic types of work products that may be inputs to or outputs from all types of process.

These three types of indicators help to establish objective evidence of the extent of achievement of the specified process attribute.

Due to the fact that Level 1 capability of a process is only characterized by the measure of the extent to which the process purpose is achieved, the process performance attribute (PA.1.1) has a single generic practice indicator (GP.1.1.1). In order to support the assessment of PA.1.1 and to amplify the process