

MAKING SENSE OF ISO 15504 (AND SPICE)

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ABSTRACT

ISO 15504 was initiated in 1993 as the SPICE (Software Process Improvement and Capability determination) Project, then formally moved into ISO/IEC as JTC1/SC7's Working Group 10. The first draft appeared around June of 1995 and the second, around October of 1996. Several ballot and comment periods followed and ISO 15504 was issued as a Technical Report (TR) in 1998. Immediately thereafter, work was begun to plan the implementation of changes deemed needed to move the TR to full International Standard (IS) status. This work continues today and, during this time, activities under the name "SPICE" have continued as well such as a series of trials, which have used various versions of ISO 15504, including the TR. Though SPICE activities are not under ISO/IEC auspices, many of the people involved in the ISO 15504 standards effort are also associated with SPICE activities.

This paper describes the work which has been going on to move ISO 15504 from a TR to full IS status including reducing the document set from 9 to 5 documents and removing the Process Dimension from the standard in favor of Process Reference Models. In doing so, the paper covers:

- What is ISO 15504?
- ISO 15504 structure
 - Document set
 - Capability Dimension

- Models (and model structure)
- Assessment, assessor, and sponsor requirements

Since ISO 15504 is still being developed and the target completion of the parts spans 2003-2004, the presentation will attempt to provide the most up to date information with regard to the provisions of the standard as well as the schedule for its completion.

What is ISO 15504 and where did it come from?

ISO 15504 is an emerging International Standard (IS) for Process Assessment that was initiated in 1993 as the SPICE (Software Process Improvement and Capability dEtermination) Project. Early drafts attempted comprehensive coverage of requirements and guidance on all aspects of software process assessment. Material for the early drafts came from many sources such as existing international standards and assessment models/methods already in use. The result was a document set with hundreds of pages of material. Ultimately, the work was moved under ISO/IEC as JTC1/SC7's Working Group 10 and identified as ISO/IEC 15504. After several more years of work, the document set (9 Parts) was released as a Technical Report (TR) in 1998, covering assessment process/capability requirements, requirements for conducting an assessment, requirements for producing a profile of assessment results, guidance on use of assessment results for process improvement and for capability determination, and an exemplar assessment model. (The original documents also emphasized use of automated tools given the data collection effort expected for many large assessments, even offering up possible "requirements" for such tools. However, this has been dropped, though the usefulness of automated assessment tools is still understood.)

The initial goal was to create a world standard that could be used to "link [assessment] results to improvement actions and measure improvement through profile comparison." Thus, though many assessment models and methods could be used, results would be reported in a compatible way, facilitating comparisons across organizations for benchmarking both process improvement and capability determination efforts. The standard was intended to permit comparisons between assessments and allow for "verifiable self-assessment." ISO 15504 was also to provide a "flexible framework for building (various) assessment methodologies with tailoring that allows for industry specific variants (including addition of practices and/or processes)." The latter is significant since the standard has evolved to being a general process assessment standard, dropping "software" from its name, as it progresses to full IS status. Hence, ISO 15504 can be applied to any processes, though this was done specifically to allow application to both systems and software processes.

Today, a SPICE community still exists including many of the people involved in the ISO 15504 work. Among their activities has been a series of trials using various drafts of ISO 15504 to see how well the standard would work in practice, feeding data from the trials back to the standards development effort. Other SPICE activities have been conferences/seminars to promote knowledge of ISO 15504 throughout the world. Some in the SPICE community are also involved in commercial enterprises related to training people in "the SPICE model" and developing a "certification scheme for SPICE assessors" (initially based on the TR version of ISO 15504). This is done independently

of the standards development since ISO does not conduct standards trials or endorse/oversee any registration/certification schemes.

What Does ISO 15504 Consist of?

At this point in the progression of the document set from a 9-part TR to an IS, the material has been greatly reduced, once again, resulting in 5 parts. Perhaps the most significant change from the TR has been the removal of the “Process Dimension,” i.e., the identification of specific candidate processes (with associated Purpose and Outcome statement) that could be selected in an assessment. Instead, ISO 15504 now refers to “Process Reference Models” (PRMs) and “Process Assessment Models” (PAMs). PRMs are external sources of process specification such as ISO 12207. PAMs are specific sets of processes selected from such PRMs for a particular assessment or a generic set used regularly by particular assessment methods, e.g., the processes identified in the SEI’s CMMI. Another recent change in ISO 15504 has been the wording of the attributes of the Process Dimension to address consistency with ISO 9001:2000.

Figure 1 shows the parts of the standard as it is being progressed to full IS status as well as identifying what each part, in general, covers.

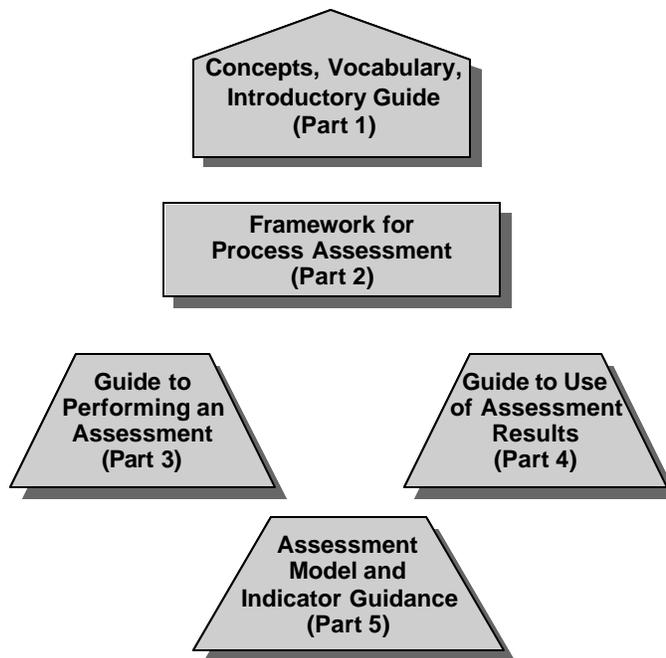


Figure 1—ISO 15504 Document Set

Part 1 provides general concepts and vocabulary used within the rest of the document set. Parts 3, 4 and 5 contain material that is “informative,” i.e., intended as guidance when performing an assessment and using assessment results. In particular, Part 5, referred to by some as “the SPICE model,” is an example that could be taken and used in performing an assessment. It has been greatly reduced from what exists in the TR such that it now contains only a few processes as examples of how an assessment

model might be defined. Part 2 contains the “normative” material considered to be “requirements” of the standard, i.e., what must be done in conducting an assessment for the assessment to be considered to conform to the standard.

The main sections of Part 2 define:

- minimum activities that a documented assessment process would need to contain to conform to the standard -- planning, data collection, data validation, process attribute rating, and reporting;
- roles and responsibilities of the key participants in an assessment -- the assessment sponsor, competent assessor, and (other) assessors (where the “competent assessor” could be understood to be what other assessment approaches call a “lead” assessor or auditor);
- assessment input -- purpose, scope, constraints, the identity of the Process Assessment (PAM) (and Process Reference (PRM)) Models used, the identity of all assessors, criteria for judging the competence of the “competent assessor,” and the identify of assessees and support staff related to the assessment;
- assessment output and how it is recorded, including the “set of process profiles resulting from the assessment (i.e., one profile for each process assessed)”;
- the measurement framework which includes the Capability Dimension and Rating Scale;
- PAMs and PRMs and the requirements placed upon them; and,
- mechanisms to verify conformity with the standard’s requirements.

The framework and models will be discussed in more detail below. Some brief comments will also be made about assessment, assessor, and sponsor requirements.

Capability Dimension & Attributes

ISO 15504 is based on a “continuous” model. That is, each process involved in an assessment can be individually assessed through an entire range (dimension) of capability. The range of capability is defined by 6 levels:

- Level 0 - Incomplete (At this level, there are no attributes since it represents lack of achievement of purpose through defined outcomes.)
- Level 1 – Performed (At this level, there is one Attribute, Process Performance (PA 1.1), addressing meeting the purpose of the process through defined outcomes.)
- Level 2 – Managed (At this level, there are two Attributes, Performance

Management (PA 2.1) & Work Product Management (PA 2.2), addressing effective managing of the performance of the process as well as of the work products (inputs and outputs) associated with the process.)

- Level 3 – Established (At this level, there are two Attributes, Process Definition (PA 3.1) & Process Deployment (PA 3.2), addressing effective definition and documentation of the process and effective dissemination and understanding of the process within the organization.)
- Level 4 – Predictable (At this level, there are two Attributes, Process Measurement (PA 4.1) & Process Control (PA 4.2), addressing effective measures & metrics -- product and process -- and quantitative process management.)
- Level 5 – Optimizing (At this level, there are two Attributes, Process Innovation (PA 5.1) & Process Optimization (PA 5.2), addressing process change and the effective impact of change.)

For those familiar with the staged model version of the SEI's CMMI (or the SEI's Software CMM (v. 1.1) which is a staged model), Levels 2-5 can be viewed, at a high-level, as very similar in intent. Level 1 allows distinguishing between an organization that fails to meet process purposes/goals (Level 0) and one that achieves them, though, perhaps not in a repeatable, well-managed or defined manner.

Each attribute must be rated on a scale from Not achieved through Fully achieved as follows:

- Not (little or no evidence of the attribute in the process)
- Partially (some evidence of the attribute in the process, though some aspects may be unpredictable)
- Largely (significant evidence of the attribute in the process, though some variation may exist)
- Fully (the attribute is completely and consistently found in the process with no significant weakness in process performance detected)

Using such a scale, the difference between Partially and Largely is significant since, to achieve a given level, all attributes at that level must be Fully or Largely achieved (with all attributes at lower levels Fully achieved). One goal of the scale was to avoid an "average" rating, either disguising the need for or creating an arbitrary need for improvement.

Assessment Profile

Having looked at each process in the scope of the assessment and determined the rating for each attribute for each process, the results are then expected to be reported out as a "profile." While the profile could take many forms, it must clearly identify the rating given for each attribute for each process. Figure 2 shows one form of displaying profile data in a graphical manner. The vertical axis identifies the attributes

(and would be the same for any assessment) while the horizontal axis identifies the processes assessed (and would vary based on the processes chosen). The patterns used to build the vertical bars show the rating given each attribute for the process represented by the vertical bar.

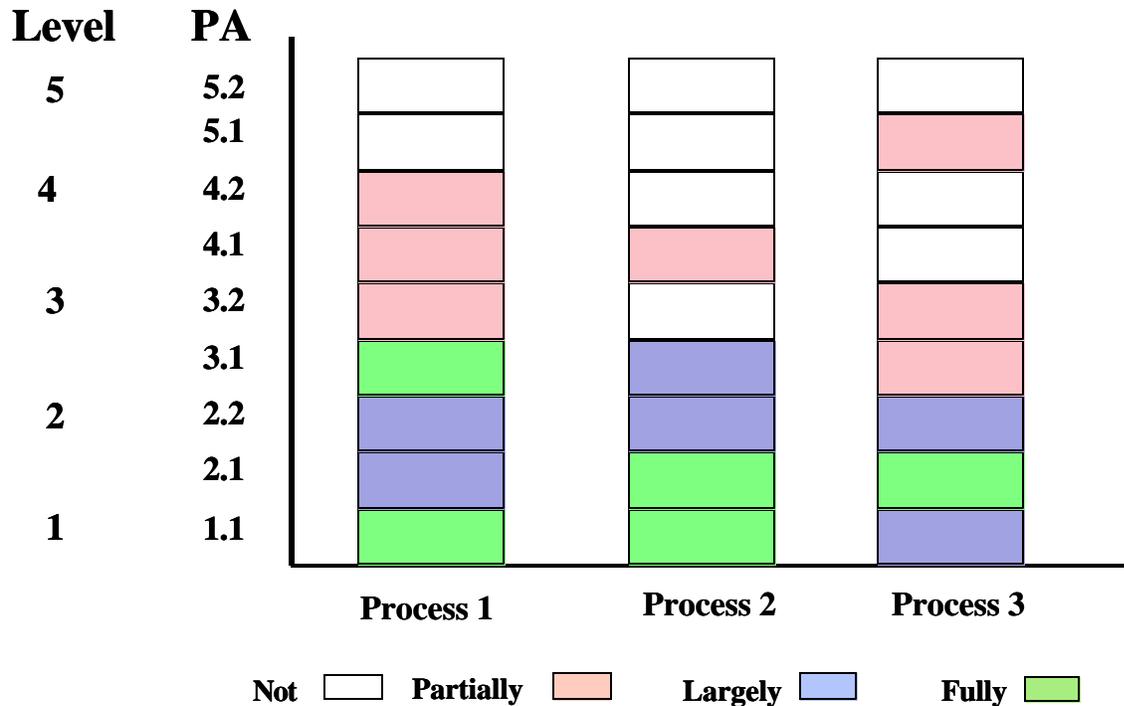


Figure 2 – Sample Assessment Profile

Interpreting this, we could say that Process 3 is at Level 1 since it Largely achieves PA 1.1 (Process Performance) and that Processes 2 and 3 are at Level 2 because PA 1.1 is Fully and PAs 2.1 & 2.2 are Fully or Largely achieved for both processes. It also seems that all processes were assessed for all attributes since there are ratings for all Attributes at all Levels. It is not necessary to do this as long as no Levels or Attributes are skipped, i.e., one could not skip an Attribute in any Level and assess Attributes at a higher Level.

Competent Assessor Requirements

The competent assessor, in general, sees to it that the assessment is conducted in accordance with the requirements of ISO 15504. This includes making sure that other assessors involved in the assessment are knowledgeable and have the skills needed to participate. The competent assessor then provides overall guidance to the assessment team and moderates team judgments/ratings to ensure consistent interpretation.

The competence of the competent assessor is judged according to their knowledge of the software process, their skill in the principle technologies of ISO 15504, and personal attributes contributing to effective performance. All of these can be gained through education, training and experience and can be demonstrated through actual

examination as well as validation of the education, training and experience. Part of the experience expected is, of course, prior participation in other ISO 15504 assessments, i.e., as a member of assessment teams.

Assessment Sponsor Requirements

The assessment sponsor bears considerable responsibility in that they define the purpose of the assessment and must verify the qualifications of the competent assessor and ensure that the PRM and PAM meet ISO 15504 requirements. Because of this, assessment sponsors will likely be very willing to see independent means of verifying competence and model acceptability, i.e., recognized training and certification programs and internationally accepted models which, without extensive effort on the sponsor's part, would be considered acceptable by others concerned that the assessments meet requirements.

Models and Their Requirements

As noted early in this paper, the Process Dimension that exists in the TR version of ISO 15504 has been replaced with the concept of the Process Reference and Process Assessment Models (PRMs and PAMs). Part 5 of ISO 15504 exists as a PAM, using the amended version of ISO 12207 as its PRM.

A PRM defines processes in terms of a purpose statement and one or more outcomes expected when the process is performed. The outcomes described should be "necessary and sufficient to achieve the purpose of the process." And, perhaps most importantly (and most controversially for some) the process descriptions may not contain or imply "any aspects of the measurement framework...beyond level 1." That is, only the Process Performance Attribute can be expected in PRM descriptions.

A PAM, then, is based on the descriptions of processes selected from a PRM and addresses how Attributes are to be rated for each process. A PAM will contain "indicators used by the assessment team to determine if Attributes are met." Indicators can include various process and product artifacts and records to show that a process has been performed, managed, established, measured, and/or optimized. A PAM must also explain how it turns the assessment data into a set of Attribute Ratings using the indicators and then into Process Profiles, using clear, unambiguous rules.

Conclusion

Considerable effort has been expended on ISO 15504 over the past decade involving hundreds of people from dozens of countries around the world. Many of the early goals of the work are now left up to individuals and organizations outside the standards work because they involve the specifics of model definition and development of assessment tools and support technologies. What remains has attempted to allow as broad a scope of processes as possible to be assessed using ISO 15504's Capability Dimension and Rating Scale and to provide the requirements for turning the results of many different assessment approaches into a common profile of process capability.

At this point in time, it appears the various parts of ISO 15504 will achieve IS status during 2003-2004. Parts 1 and 2 will likely be first among the documents since they contain the important overview, vocabulary, and normative material. Parts 3 and 4 will likely come next, containing informative guidance on conducting assessments and using assessment results. Part 5 will likely be the last since it has just begun its move into the formal balloting stream.