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Information Technology - Software Engineering - Evaluation of software products
Part 2: Planning and Management

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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 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 JTC1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard equerries approval by at least 75% of the national bodies casting a vote.

International Standards ISO/IEC 14598-2 was prepared by Joint Technical Committee ISO/IEC JTC1, **Information Technology**.

ISO/IEC 14598 consists of the following parts under the general title **Information Engineering Evaluation of software products:**

Part 1: General Overview

Part 2: Planning and management

Part 3: Evaluation for development

Part 4: Evaluation for acquisition

Part 5: Third party evaluation

Part 6: Evaluation modules

Annex A of this part of ISO/IEC 14598 is normative

Introduction

The purpose of this document is to provide a guide for developing a plan for managing software product evaluation. It provides a description and the content of a Measurements Plan for software product evaluation. The guide is written for supporting the management and conduct of such evaluation and it is applicable to all personnel involved in software evaluation.

The Measurement Plan defines the activities associated with software product evaluation, and can be used as a stand alone standard or in conjunction with the following three standards: -

. Evaluation for development - ISO/IEC 14598-3
. Evaluation for acquisition - ISO/IEC 14598-4
. Third party evaluation - ISO/IEC 14598-5

This document also forms part of a number of other project standards such as Quality Plan Standards, Requirement and Design Specification Standards. This document should also be read in conjunction with other guides or standards such as:-

. Quality Requirements and Testing - ISO/IEC 12119
. General Guide - ISO/IEC 14598-1
. Quality Systems - ISO 9001
. Guidelines to the application of ISO 9001 - ISO 9000-3
. Guidelines to Quality Plans - ISO 9004-5
. Configuration Management - ISO 9004-7
. Software quality characteristics and metrics ISO/IEC 9126-1

The purpose of a product evaluation is to address the defined business objectives and to enable these objectives to be quantified and monitored during the product life cycle.

In short, the measurements plan should describe how quantitative management is to be carried out during software product evaluation.

The measurements plan will address among other things the critical success factors, dependencies, responsibilities, appropriateness of supporting tools, techniques and analytical methods. The plan also addresses how historical data information may be used in the planning and evaluation process.

Through its contents, references are made to the use of software quality management, statistical and other supporting techniques, methods and tools.

The guide is the first important step in the process of using effective quantitative management in software evaluation.

Information Technology - Software Engineering - Software product evaluation -
Part 2: Planning and management

1. Scope

1.1 Purpose and applicability

This part of ISO/IEC 14598 provides a guide to people involved in managing a quantitative software product or project evaluation within an existing quality management system. It provides a guide for the definition and the use of a Measurements Plan (see Annex A), which is prepared prior to the evaluation, and also used throughout the evaluation.

The measurement Plan document structure and its content are consistent with and complements the Quality Plan document defined in ISO 9000-3 and ISO 9004-5.

This part of ISO/IEC 14598 makes references to the importance and relevance of defined, documented and implemented quality management system (ref. ISO 9001 and ISO 9000-3), which include all necessary details about organization requirements, management responsibilities, auditing, the use of tools, methods, and standards such as configuration management (ref. ISO 9004-7). However it is outside the scope of this document to provide details about subjects which are already covered by various other ISO standards and guides.

2. Normative references

ISO/IEC 9126: 1991, Information Technology - Software product evaluation - Quality characteristics and guidelines for their use.

ISO 9001: 1994, Quality systems - Specification for design/development, production, installation and servicing.

ISO 9000-3: 1991, Quality management and quality assurance standards - Guidelines for the application of ISO 9001 to the development, supply and maintenance of software.

ISO 9004, Quality management and quality system elements,
Part 5: Guidelines to quality plans
Part 7: Configuration management

ISO 8402: 1994, Quality - Vocabulary

ISO/IEC 14598, Software product evaluation (parts 1, 3, 4, 5, 6)

3. Definitions

For the purposes of this part of ISO/IEC 14598, the definitions given in ISO 8402 and ISO/IEC 14598-1 apply

4. Managing software evaluation

The following topics should be considered prior to software evaluation: -

4.1 Organizational needs

It is essential that all evaluation activities are well supported within the organization. This includes well defined management structure, responsibilities, policies, procedures and standards.

For a well managed organization most of these requirements are defined, documented, implemented and verified through its quality system, such as ISO 9001, which is implemented by using the respective ISO 9000-3 guide.

Such quality system implementation covers management responsibilities, quality policies defect reporting, use of testing standards, new product introduction or development procedures, configuration management, etc., all the requirements which are normally associated with software product evaluation.

4.2 Project Management needs

Managing software product evaluation is a responsible and skillful task. The evaluation should be carried out as any other software development project. It should be driven by business objectives and by clearly defined and documented user requirements.

The evaluation is required to be managed by a competent project manager, it requires approved budget, suitable human and machine resources, supporting tools/standards/procedures and clearly defined, documented and agreed plans. These plans should specify how the stated objectives will be achieved, and also how this will be quantified and measured, and how these measurements are intended to be used in support of the evaluation process.

4.3 Planning needs - Measurements Plan

In order to carry out software product evaluation successfully, the quality objectives and the identified quality characteristics needed to be quantified, measured and rated to meet a defined level of acceptance. The purpose of a measurements plan is to define all these requirements. The measurements plan should specify how quantitative management is to be carried out during software product evaluation.

NOTE 1
Clause 5 offers guidance for the development and use of a standard form of measurements plan, the outline of which is given in Annex A.

5. Guide for developing and using the Measurements Plan

5.1 General considerations

The Measurements Plan should be developed at the start of a project or evaluation. It should be used and maintained during the life cycle. The analyzed results of the derived measurements should be continuously used for the benefit of the project and product, as well as the benefit of the developer and buyer organizations.

The content of the plan should cover measures applicable to the characteristics of the software product.

The plan should be documented like any other project document, should be brought under formal configuration control. Its content should be accepted and complied with by all project personnel, which may including those suppliers and buyers personnel contributing to the project.

Like any other planning document it should be available for reference purposes to the organization and to all personnel contributing to the project.

The aim of the plan is to assist the project manager to define and monitor quantitative quality objectives. It should also assist all project staff to identify their own quality objectives and to monitor their progress continuously against those objectives.

Implementation of the plan should be the responsibility of the project (or line) manager and its usefulness should be acknowledged and supported by all project personnel as well as by the management external to the project or evaluation process.

Management - project and line - should understand the benefits of using measures and should fully support the agreed metrics related tasks.

Implementation of these tasks may involves additional effort, tool support and training. All these factors should be discussed, agreed and documented in the plan.

Evaluations and projects included in the plan should have stated objectives, which in turn convert to corresponding quality characteristics. The author of a Measurements Plan should ensure that the plan supports the project to meet its stated objectives. These objectives should be prioritized at the outset, so that future trade-off decisions can be made in a structured and defined manner.

The objectives stated in the plan should not only reflect in the corresponding product quality characteristics, but also in the choice of process quality criteria, the adopted standards, methods, staff skills, tool support and project management.

NOTE 2
Taking for example a safety critical application; the corresponding standards, methods, tools, staff skill, and management procedures, are expected to reflect the safety critical needs of the project. This means that standards and methods need to be applied rigorously, testers need to have proven test harnesses and staff need to be trained in the use of formal methods.

Additional information which should be in the plan are the respective quality objectives; which may be product, process or even size related. These objectives may be verified during the project development life cycle (e.g. an intermediate evaluation may capture the number of errors found in a design specification) or after product delivery (e.g. the number of errors reported by users).

NOTE 3
The evaluation may also be internal to the product (e.g. counting the number of program branch points) or external (e.g. error counting). It may also include the evaluation and the rating of software suppliers.

The measurements plan should also clearly define the tasks and assign corresponding responsibilities (e.g. such as who is responsible for data collection, analysis and feedback to the project staff and to the management). All requirements derived from clause 5 should be planned in advance and documented in the plan.

5.2 Measurement planning process

The measurements planning process should include the definition of the product and process quality evaluation requirements.

The product quality requirements definition include the following steps:-

a) Define the quality requirements
If specific quality requirements have not been defined, then the requirements should be extracted from the implied needs.

b) Prioritize the quality requirements
The above requirements should be prioritized and related to the quality characteristics and subcharacteristics listed in ISO/IEC 9126.

c) Define the attributes to be measured in terms of external and internal characteristics
Definition of suitable indicators and metrics.

d) Establish the evaluation target
Meaningful and quantifiable evaluation targets should be established, in particular from the viewpoint of the user.

e) Define acceptable rating levels.
The definition of the acceptable rating levels should also be stated.

The process quality requirements definition include the following steps:-

a) Establish the evaluation process
The evaluation activities which make up the evaluation process should be defined. These should be integrated into the overall management process and should be supported by current technology (tools, methods and standards)

b) Define the measurement process schedules and precision levels
The process and corresponding schedules should be established for defining what and when measurements should be captured and to what level of accuracy.

c) Define the responsibilities for all tasks
All responsibilities and interfaces should be defined so that activities can be allocated to individuals, and the progress monitored.

d) Define requirements for tools and analysis methods
The requirements should be agreed and documented. This may include the use of supporting tools, definition of techniques and methods covering the data analysis approach.

e) Define the reporting and feedback
The reporting frequency, responsibility and its format should be agreed and documented. The reporting process should be made part of the normal management process, so as to ensure that relevant actions such as rework will follow as the consequence of the feedback provided by the report.

NOTE 4
To facilitate the preparation of a Measurement Plan, the following guidance summarizes the common requirements of the standard Measurements Plan given in Annex A.

5.3 Detailed considerations

The following list of items should be considered while preparing a Measurements Plan:-

a) Direct and indirect measures and the model in which these will fit (e.g. quality characteristics, sub-characteristics, clarification of the data elements of the metrics used for measurements).

b) Sources of data (e.g. design inspection results, code testing)

c) Tool support (e.g. collection, data base, analysis, report generator)

d) Validation method (e.g. follow up interview, reviews)

e) Intended use of data (e.g. cost or reliability tracking)

f) Data presentation and reporting (e.g. histogram, pie chart)

g) Cost benefit tracking for the measurements program

h) Identification of all tasks and relevant responsibilities

i) Users of the reported results (e.g. programmers, managers)

j) Method of data collection (e.g. form based, automatic retrieval)

k) Data repository (e.g. data base, file cabinet)

l) Data collection forms, schedules and analysis

m) Relations between system and software components, requirement specification and design, reliability and performance

n) Relations between organizations (e.g. developers and quality organization; suppliers and buyers)

o) Goals of the measurements program (e.g. to reduce the number of errors by a factor of ten compared with current error status)

p) The interpretation of the results

q) Training required to implement or use the measures

Other considerations should include the following:

1) Possible reuse of existing metrics data

2) Possible development of new standardized data sets, assessment methods and rating rationale. When embarking on this task, the following steps should be considered:

- Feasibility of developing new measures
- Priority setting
- Clarification of metrics (e.g. direct and indirect measures)
- Testing the validity of the new metrics

3) Method of use of the analyzed results
It is important that the results are fed back to the people who will need metrics data for their job. All metrics activities (e.g. data collection, analysis, reporting) should be an integral part of the evaluation and management process

4) Development of a measurements program checklist in order to verify progress, usefulness and accuracy. Some example questions are listed below:

- Are the indicators and measures used in accordance with the defined method?
- Are the metrics correct, accurate and usable for the intended purposes?
- Are the rating levels meaningful or too low or high?
- Are the supporting tools adequate?
- Are the measurement activities on target?

All measurements activities should be fully supported by the main business requirements and all people should have high confidence in using the collected and analyzed results for improvement purposes.

Annex A (normative)

A.1 Measurements Plan content

A Measurements Plan shall include the following chapters:

A.1.1 Chapter 1 Introduction

The following should be described:-

- the purpose of the plan
- the audience of the plan
- the intended use of the plan

A.1.2 Chapter 2 Project objectives

This chapter should provide a clear statement about the major objective(s) of the application. This may be stated in terms of business needs, however, they should be usable for the purpose of setting quality objectives and respective criteria, (e.g. safety critical systems to be used for automated landing of aircraft application and these requirements are specifically stated).

A.1.3 Chapter 3 Applicable quality characteristics

This chapter should provide statements of the quality characteristics (see (SO 9126) which support the objectives prescribed in A.1.23.

The stated quality objectives may be both product and process oriented, (e.g. reliability, correctness and maintainability as product quality characteristics and all testers have proven test harnesses, and were trained in the use of test tools as process quality targets).

A.1.4 Chapter 4 List of priorities

This chapter should prioritize the above characteristics and should provide a supporting rationale for these priorities.

NOTE 6
Again priorities may cover process requirements, (e.g. from the point of view of the business, training of staff may be deemed a higher priority than the introduction of a new method or tool).

A.1.5 Chapter 5 Quality objectives

This chapter should provide quantifiable quality objectives which are measurable at interim or final phases of project development, (e.g. number of errors per lines of code during final testing or number of faults per total entry which is under the control of the latest version of the configuration management system). It may state the maximum down-time of an installed product or system.

A.1.6 Chapter 6 Schedules

This chapter should provide a clear plan of objectives with milestones and stated deliverables.

A.1.7 Chapter 7 Definition of responsibilities

This chapter should define all envisaged responsibilities associated with the implementation of the Measurements Plan. This includes all data collection, analysis tasks, implementation of other supporting requirements, reporting, follow up and similar requirements.

A.1.8 Chapter 8 Measurement categories

This chapter should define the various measurements which are planned to be carried out. If process measurements are taken these should be categorized and carried out as follows:-

a) Product quality measurements

Include measurements such as performance, reliability and portability. State at what stage of the development these measurements are to be carried out, how often they are repeated, what techniques or tools are used to aid data capture and analysis and what actions are envisaged if there are divergencies from the stated objectives.

These measurements may be final or intermediate and they may be obtained directly or through the use of sub-characteristics.

b) Process quality measurements

Describe how process measurements are to be carried out. Include the monitoring of the effectiveness of standards, tools usage, project management, etc.

These measurements may also be carried out at various phases of the project life cycle.

Define and document how process related corrective actions are to be carried out if corrective action is deemed necessary.

A.1.9 Chapter 9 Using and analyzing data

This chapter should define how data is to be analyzed, what, if any, statistical methods are to be employed and what presentation techniques are to be used.

It should make references to previously stated responsibilities, supporting tools and forms. It should also state how the information is envisaged to be integrated into the progress tracking process or into the product acceptance process.

A.1.10 Chapter 10 Reporting

This chapter should define whether the analyzed results are to be reported within or outside the project or product evaluation and should also define how to resolve all outstanding items.

A.1.11 Chapter 11 Other requirements

This chapter (or a number of chapters) may be used to include requirements not covered previously. (e.g. it may include the following information):

a) Techniques and methods employed

Provide a full description (or provide reference to other material) of the techniques and methods used, (e.g. method for sizing; development maturity assessment; inspection method for error finding; defect removal model for predicting error rates).

The section or the referred material should be clear and complete for the purpose of understanding and use by all nominated personnel.

b) Supporting tools

Describe or provide reference (as in item a) above), but covering the tool support requirements. This may include guides for the use of databases, spreadsheets and statistical packages.

c) Relevant standards and guides

Refer to applicable standards, supporting guides and describe their use and benefits (e.g. ISO/IEC 9126; ISO/IEC 9001; ISO/IEC 9000-3).

d) Suppliers' evaluation

Include evaluation and measurements procedures for the effective quantitative assessment of the software product suppliers.

This may cover the number of released copies, current error status, surveys about post installation support performance, statistics about past and current users satisfaction, management performance and financial stability. Other suppliers related parameters, relevant to the application, may be incorporated in the suppliers evaluation plan.