INTERNATIONAL STANDARD

ISO/IEC 14764

IEEE Std 14764-2006

Second edition
2006-09-01

Software Engineering — Software Life Cycle Processes — Maintenance

Ingénierie du logiciel — Processus du cycle de vie du logiciel — Maintenance

Reference number
ISO/IEC 14764:2006(E)
IEEE
Std 14764-2006

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ISO/IEC 14764:2006(E)
IEEE Std 14764-2006

(Revision of IEEE Std 1219-1988)

Secretariat: Standards Council of Canada
Date 2005-06-29

Standard for Software Engineering — Software Life Cycle Processes — Maintenance

Norme pour ingénierie du logiciel — Processus de cycle de vie du logiciel — Maintenance

Sponsor
Software & Systems Engineering Standards Committee
of the
IEEE Computer Society

Approved 30 March 2006
IEEE SA Standards Board

Abstract: The process for managing and executing software maintenance activities is described.

Keywords: life cycle, maintenance, software, software maintenance

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Published 19 May 2006. Printed in the United States of America.

Print: ISBN 0-7381-4960-8 SH95534
PDF: ISBN 0-7381-4961-6 SS95534

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The first edition of ISO/IEC 14764 was prepared by ISO/IEC JTC 1/SC 7. The current edition is the result of merging the original edition with IEEE Std 1219-1998. ISO/IEC JTC 1/SC 7 and the IEEE Computer Society cooperated in this project to merge the two standards. This second edition cancels and replaces the first edition (1999).

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IEEE Introduction

This introduction is not part of ISO/IEC/IEEE 14764:2005(E), Standard for Software Engineering—Software Life Cycle Processes—Maintenance.

This International Standard provides guidance on the Software Maintenance Process. Software Maintenance is a primary process in the life cycle of a software product, as described in ISO/IEC 12207, "Information technology – Software life cycle processes." The Maintenance Process contains the activities and tasks of the maintainer. This International Standard is part of the ISO/IEC 12207 family of documents. In this International Standard, ISO/IEC 12207 refers to ISO/IEC 12207:1995 as amended in 2002 and 2004. The only mandatory clauses in this International Standard come from ISO/IEC 12207. The mandatory clauses contain shalls and each shall from ISO/IEC 12207 that is duplicated in this International Standard is boxed. The related ISO/IEC 12207 clause number is listed after the boxed ISO/IEC 12207 shalls. This International Standard is the result of the harmonization of ISO/IEC 14764 and IEEE Std 1219-1998.[1]

Because maintenance consumes a major share of a software life cycle financial resources, it should be an important project consideration.

During operation of the software, problems may be detected that were not detected during validation and acceptance. Therefore, a maintenance effort is needed to cope with these problems. This maintenance effort also covers software improvements needed to meet new or modified user requirements. Software maintenance is commonly needed when upgrading system components, such as operating systems and databases, as well as when modifications are made to external software and systems interfaces. Software maintenance may be a significant portion of life cycle costs.

Software maintainers use a number of specific tools, methods, and techniques. This International Standard does not specify how to implement or perform the activities and tasks in the Software Maintenance Process since these are dependent upon the formal agreement and organizational requirements. Maintenance is required on all types of software, whatever the technology, technique or tool used to create it.

Clause 1 provides the scope of this International Standard. Clause 2 provides conformance information. Clause 3 provides normative references. Clause 4 provides terms and definitions. Clause 5 provides the application of this International Standard. Clause 6 provides the details of the Maintenance Process. Clause 7 provides execution considerations for the Maintenance Process. Clause 8 provides the software maintenance strategy. Annex A provides a cross reference between clauses in this International Standard and ISO/IEC 12207. Annex B provides a list of abbreviations used in this International Standard. Annex C provides a bibliography.

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[1] IEEE publications are available from the Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, Piscataway, NJ 08854, USA (http://standards.ieee.org/).

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At the time this standard was completed, the Software Maintenance Working Group had the following membership:

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Standard for Software Engineering — Software Life Cycle Processes — Maintenance

1 Overview

This International Standard describes in greater detail management of the Maintenance Process described in ISO/IEC 12207, including Amendments. This International Standard also establishes definitions for the various types of maintenance. This International Standard provides guidance that applies to planning, execution and control, review and evaluation, and closure of the Maintenance Process. The scope of this International Standard includes maintenance for multiple software products with the same maintenance resources. “Maintenance” in this International Standard means software maintenance unless otherwise stated.

1.1 Scope

This standard describes an iterative process for managing and executing software maintenance activities. Use of this standard is not restricted by size, complexity, criticality, or application of the software product. This standard uses a process model to discuss and depict each phase of software maintenance. The criteria established apply to both the planning of maintenance for software while under development, as well as the planning and execution of software maintenance activities for existing software products. Ideally, maintenance planning should begin during the stage of planning for software development.

This International Standard provides the framework within which generic and specific software maintenance plans may be executed, evaluated, and tailored to the maintenance scope and magnitude of given software products.

This International Standard provides the framework, precise terminology, and processes to allow the consistent application of technology (tools, techniques, and methods) to software maintenance.

This International Standard provides guidance for the maintenance of software. The basis for the Maintenance Process and its activities comes from the definitions of ISO/IEC 12207. It defines the activities and tasks of software maintenance, and provides maintenance planning requirements. It does not address the operation of software and the operational functions, e.g., backup, recovery, system administration, which are normally performed by those who operate the software.

This International Standard is written primarily for maintainers of software and additionally for those responsible for development and quality assurance. It may also be used by acquirers and users of systems containing software who may provide inputs to the maintenance plan.

1.2 Purpose

This International Standard provides guidance on the management of (or how to perform) the Maintenance Process. It identifies how the Maintenance Process can be invoked during acquisition and operation. This lnternational Standard also emphasizes the following in the Maintenance Process: the maintainability of software products; the need for maintenance service models; and the need for a maintenance strategy and plan.

1.3 Field of application

This International Standard is intended to provide guidance for the planning for and maintenance of software products or services, whether performed internally or externally to an organization. It is not intended to apply to the operation of the software.

This International Standard is intended to provide guidance for two-party situations and may be equally applied where the two parties are from the same organization. This International Standard is intended to also be used by a single party as self-imposed tasks (ISO/IEC 12207).

This International Standard is not intended for software products that are "throw-away" or a "short-term" solution.

It is intended for self-imposition by developers of off-the-shelf software products to maintain such products. It is not intended for software products customized by users and products maintained as end-user applications. Maintenance is applied to computer programs, code, data, and documentation. It is intended to apply to software products created during the development of the software product. This may include such things as the test software, test databases, the Software Test Environment (STE), or the Software Engineering Environment (SEE).

This International Standard is intended for use in all maintenance efforts, regardless of the life cycle model (e.g., incremental, waterfall, evolutionary). This International Standard is not restricted by size, complexity, criticality, or application of the software product. This International Standard is intended to guide the use of results from the Maintenance Process as input to the next development in order to improve the maintainability of the software product.

1.4 Limitations

This International Standard describes the framework of the Software Maintenance Process but does not specify the details of how to implement or perform the activities and tasks included in the process.

In this International Standard, there are a number of lists. None of these is presumed to be exhaustive. They are intended as examples.

1.5 Conformance

This International Standard provides guidance for the execution of the Maintenance Process of ISO/IEC 12207. The guidance in this standard is completely consistent with ISO/IEC 12207. Conformance cannot be claimed to this standard but can be claimed to the ISO/IEC 12207 Maintenance Process and related tailoring.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC/IEEE 14764. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC/IEEE 14764 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 9126-1:2001, *Software engineering -- Product quality -- Part 1: Quality model.*[2]

ISO/IEC 12207:1995, *Information technology -- Software life cycle processes.*

ISO/IEC 12207: Amd 1:2002, *Information technology -- Software life cycle processes (AMENDMENT 1).*

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[2] ISO/IEC publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembé, CH-1211, Genève 20, Switzerland/Suisse (http://www.iso.ch/). ISO/IEC publications are also available in the United States from Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112, USA (http://global.ihs.com/). Electronic copies are available in the United States from the American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, USA (http://www.ansi.org/).

ISO/IEC 12207: Amd 2:2004, *Information technology -- Software life cycle processes (AMENDMENT 2).*

ISO/IEC 15939:2002, *Software engineering – Software measurement process.*

3 Definitions and terms

For the purpose of this standard, the following definitions apply. The Authoritative Dictionary of IEEE Standards Terms, Seventh Edition, and the the terms and definitions given in ISO/IEC 12207 should be referenced for terms not defined in this clause.

3.1 adaptive maintenance

the modification of a software product, performed after delivery, to keep a software product usable in a changed or changing environment

NOTE—Adaptive maintenance provides enhancements necessary to accommodate changes in the environment in which a software product must operate. These changes are those that must be made to keep pace with the changing environment. For example, the operating system might be upgraded and some changes may be made to accommodate the new operating system.[3]

3.2 corrective maintenance

the reactive modification of a software product performed after delivery to correct discovered problems

NOTE—The modification repairs the software product to satisfy requirements.

3.3 emergency maintenance

an unscheduled modification performed to temporarily keep a system operational pending corrective maintenance

NOTE—Emergency maintenance is a part of corrective maintenance

3.4 maintainability

the capability of the software product to be modified. Modifications may include corrections, improvements or adaptation of the software to changes in environment, and in requirements and functional specifications [ISO/IEC 9126-1][4]

3.5 maintenance enhancement

a modification to an existing software product to satisfy a new requirement

NOTE—There are two types of software enhancements, adaptive and perfective. A maintenance enhancement is not a software correction.

3.6 Modification Request (MR)

a generic term used to identify proposed modifications to a software product that is being maintained

NOTE—The MR may later be classified as a correction or enhancement and identified as corrective, preventive, adaptive, or perfective maintenance. MRs are also referred to as change requests. See Figure 1.

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[3] Notes in text, tables, and figures are given for information only, and do not contain requirements needed to implement the standard.

[4] Information on references can be found in Clause 2.

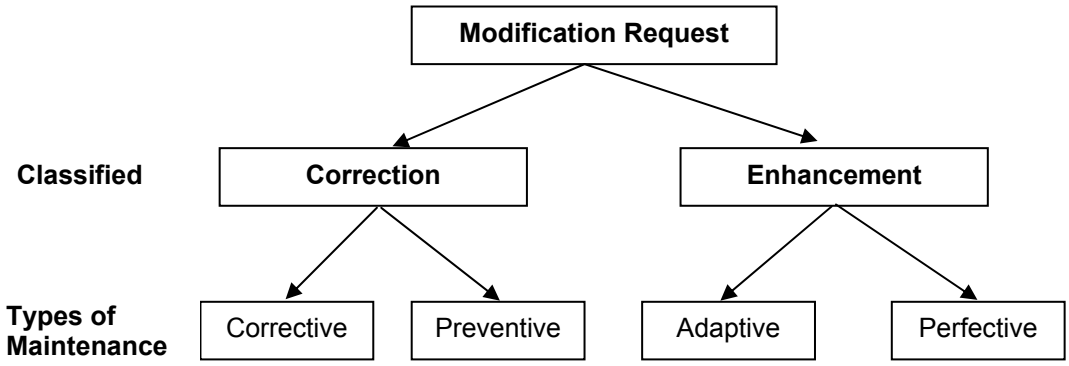

Figure 1 — Modification Request

3.7 perfective maintenance

the modification of a software product after delivery to detect and correct latent faults in the software product before they are manifested as failures

NOTE—Perfective maintenance provides enhancements for users, improvement of program documentation, and recoding to improve software performance, maintainability, or other software attributes.

3.8 preventive maintenance

the modification of a software product after delivery to detect and correct latent faults in the software product before they become operational faults

3.9 Problem Report (PR)

a term used to identify and describe problems detected in a software product

NOTE—PRs are either submitted directly to denote faults or established after impact analysis is performed on Modification Requests and faults are found.

3.10 software maintenance

the totality of activities required to provide cost-effective support to a software system. Activities are performed during the pre-delivery stage as well as the post-delivery stage

NOTE—Pre-delivery activities include planning for post-delivery operations, supportability, and logistics determination. Post-delivery activities include software modification, training, and operating a help desk.

3.11 software transition

a controlled and coordinated sequence of actions wherein software development passes from the organization performing initial software development to the organization performing software maintenance

4 Application of this International Standard

This clause presents the Maintenance Process that is required to maintain software products.

4.1 Maintenance Process

Maintenance is one of the five primary life cycle processes that may be performed during the life cycle of software (ISO/IEC 12207). The Acquisition and Supply primary life cycle processes of ISO/IEC 12207 may initiate the Process Implementation activity of the Maintenance primary life cycle process through an agreement or contract. The Operation primary life cycle process of

ISO/IEC 12207 may initiate the Maintenance life cycle process through submission of a Modification Request or Problem Report. The Maintenance life cycle process invokes the Development primary life cycle process of ISO/IEC 12207. The supporting processes of Documentation, Configuration Management, Quality Assurance, Verification, Validation, Joint Review, Audit, and Problem Resolution of ISO/IEC 12207 are used by the Maintenance life cycle process.

4.2 Organization of this International Standard

The clauses that follow are presented in the order that Maintainers should address them.

Clause 6 provides the details of the Maintenance Process including tasks and task-steps needed to implement the Maintenance Process. Clause 7 provides execution considerations, and issues to be considered when planning for maintenance. Clause 8 provides comprehensive planning information.

5 Maintenance Processes

This clause defines the activities and tasks for the primary life cycle process of software maintenance.

The Maintenance Process contains the activities and tasks necessary to modify an existing software product while preserving its integrity. These activities and tasks are the responsibility of the maintainer. This International Standard provides task-steps which are examples of what to perform in order to implement the maintenance activities and tasks. The maintainer should ensure that the Maintenance Process exists and is functional prior to development of any software product. The Maintenance Process should be activated when a requirement exists to maintain a software product.

As soon as the process is activated, Maintenance Plans and Procedures should be developed and resources should be allocated specifically for maintenance. After the software product is delivered, the maintainers should modify the code and associated documentation in response to a modification request or problem report. The overall objective of software maintenance is to modify the existing product while preserving its integrity. This process supports the software product from its inception through migration to new environments, to its retirement. The process ends when the software product is finally retired.

The activities which comprise the Maintenance Process are:

a) Process Implementation.

b) Problem and Modification Analysis.

c) Modification Implementation.

d) Maintenance Review/Acceptance.

e) Migration.

f) Retirement.

Inputs are transformed or consumed by the maintenance activities to produce outputs. Controls provide guidance to ensure that the maintenance activity produces correct outputs. Outputs are the data or objects produced by the maintenance activity. Support identifies supporting life cycle processes of ISO/IEC 12207 used by the maintenance activities.

Figure 2 provides an overview of the Maintenance Process.