

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

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

This document is a preview generated by EVS

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

This document is a preview generated by EVS

This ISO/IEEE document is an International Standard and is copyright-protected by ISO and the IEEE. Except as permitted under the applicable laws of the user's country, neither this ISO/IEEE standard nor any extract from it may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, photocopying, recording or otherwise, without prior written permission being secured. Requests for permission to reproduce should be addressed to either ISO or the IEEE at the addresses below.

ISO Copyright Office
Case postale 56 · CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Institute of Electrical and Electronics Engineers
Standards Association
Manager, Standards
Intellectual Property
445 Hoes Lane
Piscataway, NJ 08854
E-mail: stds.ipr@ieee.org
Web: www.ieee.org

Copyright © 2006 ISO/IEEE. All rights reserved.
Published 19 May 2006. Printed in the United States of America.
IEEE is a registered trademark in the U.S. Patent & Trademark Office, owned by the Institute of Electrical and Electronics Engineers, Incorporated.

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

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. The IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and serve without compensation. While the IEEE administers the process and establishes rules to promote fairness in the consensus development process, the IEEE does not independently evaluate, test, or verify the accuracy of any of the information contained in its standards.

Use of an IEEE Standard is wholly voluntary. The IEEE disclaims liability for any personal injury, property or other damage, of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance upon this, or any other IEEE Standard document.

The IEEE does not warrant or represent the accuracy or content of the material contained herein, and expressly disclaims any express or implied warranty, including any implied warranty of merchantability or fitness for a specific purpose, or that the use of the material contained herein is free from patent infringement. IEEE Standards documents are supplied "AS IS."

The existence of an IEEE Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE Standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard. Every IEEE Standard is subjected to review at least every five years for revision or reaffirmation. When a document is more than five years old and has not been reaffirmed, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE Standard.

In publishing and making this document available, the IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity. Nor is the IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing this, and any other IEEE Standards document, should rely upon the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

Interpretations: Occasionally questions may arise regarding the meaning of portions of standards as they relate to specific applications. When the need for interpretations is brought to the attention of IEEE, the Institute will initiate action to prepare appropriate responses. Since IEEE Standards represent a consensus of concerned interests, it is important to ensure that any interpretation has also received the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to interpretation requests except in those cases where the matter has previously received formal consideration. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position, explanation, or interpretation of the IEEE.

Comments for revision of IEEE Standards are welcome from any interested party, regardless of membership affiliation with IEEE. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Comments on standards and requests for interpretations should be addressed to:

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854
USA

NOTE—Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken with respect to the existence or validity of any patent rights in connection therewith. The IEEE shall not be responsible for identifying patents for which a license may be required by an IEEE standard or for conducting inquiries into the legal validity or scope of those patents that are brought to its attention.

Authorization to photocopy portions of any individual standard for internal or personal use is granted by the Institute of Electrical and Electronics Engineers, Inc., provided that the appropriate fee is paid to Copyright Clearance Center. To arrange for payment of licensing fee, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

International Standard ISO/IEC 14764:2006(E)

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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/IEEE 14764 was prepared by Joint Technical Committee ISO/IEC JTC 1, Subcommittee SC 7, (Software and Systems Engineering).

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).



International Organization for Standardization/International Electrotechnical Commission
Case postale 56 • CH-1211 Genève 20 • Switzerland

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.

Notice to users

Errata

Errata, if any, for this and all other standards can be accessed at the following URL: <http://standards.ieee.org/reading/ieee/updates/errata/index.html>. Users are encouraged to check this URL for errata periodically.

Interpretations

Current interpretations can be accessed at the following URL: <http://standards.ieee.org/reading/ieee/interp/index.html>.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken with respect to the existence or validity of any patent rights in connection therewith. The IEEE shall not be responsible for identifying patents or patent applications for which a license may be required to implement an IEEE standard or for conducting inquiries into the legal validity or scope of those patents that are brought to its attention.

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/>).

Participants

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

Paul Croll, Chair
Thomas Pigoski, Editor
James W. Moore, Liaison to ISO/IEC JTC 1/SC 7

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

Edward Bartlett	Christof Ebert	Carol Long	Mike Smith
Bakul Banerjee	John Fendrich	James Moore	Mitchell Smith
Juris Borzovs	Gregg Giesler	Jeremy Moore	Luca Spotorno
Curtis Browne	John Garth Glynn	Richard Moore	Thomas Starai
Bruce Bullock	Lewis Gray	Rajesh Moorkath	Richard Thayer
Joseph Butchko	Michael Grimley	Gerald Radack	Scott Valcourt
Keith Chow	Victoria Hanley	Annette Reilly	John Walz
Antonio M. Cicu	John Horch	Garry Roedler	Oren Yuen
Todd Cooper	Peeya Iwagoshi	Terence Rout	Janusz Zalewski
Paul Croll	William Junk	James Ruggieri	Li Zhang
Geoffrey Darnton	Joerg Kampmann	James Sanders	Geraldine Zimmerman
Guru Dutt Dhingra	Piotr Karocki	Robert J. Schaaf	
Einar Dragstedt	Ron Kenett	David Schultz	
Clint Early	J. Dennis Lawrence	Carl Singer	

When the IEEE-SA Standards Board approved this standard on 30 March 2006, it had the following membership:

Steve M. Mills, Chair
Richard H. Hulett, Vice Chair
Don Wright, Past Chair
Judith Gorman, Secretary

Mark D. Bowman
Dennis B. Brophy
Joseph Bruder
Richard Cox
Bob Davis
Julian Forster*
Joanna N. Guenin
Mark S. Halpin
Raymond Hapeman

William B. Hopf
Lowell G. Johnson
Herman Koch
Joseph L. Koepfinger*
David J. Law
Daleep C. Mohla
Paul Nikolich
T. W. Olsen
Glenn Parsons

Ronald C. Petersen
Gary S. Robinson
Frank Stone
Malcolm V. Thaden
Richard L. Townsend
Joe D. Watson
Howard L. Wolfman

*Member Emeritus

Also included are the following non-voting IEEE-SA Standards Board liaisons:

Satish K. Aggarwal, *NRC Representative*
Richard DeBlasio, *DOE Representative*
Alan H. Cookson, *NIST Representative*

Mike Fisher
IEEE Standards Project Editor

CONTENTS

1	Overview	1
1.1	Scope	1
1.2	Purpose	1
1.3	Field of application	1
1.4	Limitations	2
1.5	Conformance	2
2	Normative references	2
3	Definitions and terms	3
4	Application of this International Standard	4
4.1	Maintenance Process	4
4.2	Organization of this International Standard	5
5	Maintenance Processes	5
5.1	Process Implementation	6
5.1.1	Inputs	6
5.1.2	Tasks	7
5.1.3	Controls	8
5.1.4	Support	8
5.1.5	Outputs	8
5.2	Problem and Modification Analysis	9
5.2.1	Inputs	9
5.2.2	Tasks	9
5.2.3	Controls	12
5.2.4	Support	12
5.2.5	Outputs	12
5.3	Modification Implementation	13
5.3.1	Inputs	13
5.3.2	Tasks	13
5.3.3	Controls	14
5.3.4	Support	14
5.3.5	Outputs	15
5.4	Maintenance Review/Acceptance	15
5.4.1	Inputs	15
5.4.2	Tasks	15
5.4.3	Controls	16
5.4.4	Support	16
5.4.5	Outputs	17
5.5	Migration	17
5.5.1	Inputs	17
5.5.2	Tasks	17
5.5.3	Controls	20
5.5.4	Support	20
5.5.5	Outputs	21
5.6	Software retirement	21
5.6.1	Inputs	21
5.6.2	Tasks	22
5.6.3	Controls	24
5.6.4	Support	24
5.6.5	Outputs	24
6	Execution considerations	24
6.1	Introduction	24
6.2	Types of maintenance	25
6.3	Arrangements for maintenance	25

6.4	Tools for maintenance	26
6.5	Software maintenance measurement	27
6.6	Documentation of process	27
6.7	Early involvement in development	27
6.8	Maintainability	28
6.8.1	Maintainability and the development process	28
6.8.2	Maintainability and specific activities in the development process	29
6.9	Software transition	30
6.10	Documentation	31
7	Software maintenance strategy	31
7.1	Introduction	31
7.2	The maintenance concept	32
7.2.1	Scope	32
7.2.2	Defining the process	32
7.2.3	Designation of who will provide maintenance	32
7.2.4	Estimate of maintenance costs	33
7.3	Maintenance planning	33
7.3.1	Introduction	33
7.3.2	The maintenance plan	33
7.3.3	Maintenance plan topics	34
7.4	Resource analysis	37
7.4.1	Personnel resources	38
7.4.2	Environment resources	38
7.4.3	Financial resources	38
Annex A (informative)	Cross-reference between ISO/IEC/IEEE 14764 and ISO/IEC 12207 and ISO/IEC 12207 Amd 1	39
Annex B (informative)	Abbreviations	42
Annex C (informative)	Bibliography	43

This document is a preview generated by EVS

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 International 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)*.

² ISO/IEC publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembe, 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 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.

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.