FINAL DRAFT
International Standard

ISO/IEC/IEEE FDIS 30982

Software engineering — Standard for measures of the software aspects of dependability

ISO/IEC JTC **1**/SC **7**

Secretariat: **BIS**

Voting begins on:
2026-06-01

Voting terminates on:
2026-10-19

This document has not been edited by the ISO Central Secretariat.

FAST TRACK PROCEDURE

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

Reference number
ISO/IEC/IEEE FDIS 30982:2026(en)

© IEEE 2026



COPYRIGHT PROTECTED DOCUMENT

© IEEE 2026

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from IEEE at the address below.

Institute of Electrical and Electronics Engineers, Inc
3 Park Avenue, New York
NY 10016-5997, USA

Email: stds.ipr@ieee.org
Website: www.ieee.org

Published in Switzerland

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.

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.

IEEE Standards documents are developed within IEEE Societies and subcommittees of IEEE Standards Association (IEEE SA) Board of Governors. IEEE develops its standards through an accredited consensus development process, which brings together volunteers representing varied viewpoints and interests to achieve the final product. IEEE standards are documents developed by volunteers with scientific, academic, and industry-based expertise in technical working groups. Volunteers are not necessarily members of IEEE or IEEE SA and participate without compensation from IEEE. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

ISO and IEC draw attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO and IEC take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO and IEC had received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents and https://patents.iec.ch. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

ISO/IEC/IEEE 30982 was prepared by the LAN/MAN of the IEEE Computer Society (as IEEE Std 982™-2024) and drafted in accordance with its editorial rules. It was adopted, under the “fast-track procedure” defined in the Partner Standards Development Organization cooperation agreement between ISO and IEEE, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

© IEEE 2024 – All rights reserved

IEEE Std 982™-2024
(Revision of IEEE Std 982-2005)

IEEE Standard for Measures of the Software Aspects of Dependability

Developed by the

Software & Systems Engineering Standards Committee
of the
IEEE Computer Society

Approved 26 September 2024

IEEE SA Standards Board

Abstract: Definitions, sample requirements, equations, and guidance for data collection and analysis necessary to make consistent and actionable measurements of a software system's reliability, availability, supportability, and recoverability are provided in this document. The dependability of software systems is collectively defined by these characteristics.

Keywords: availability, dependability, IEEE 982™, measurement, recoverability, reliability, supportability

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

Copyright © 2024 by The Institute of Electrical and Electronics Engineers, Inc.
All rights reserved. Published 1 November 2024. 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.

PDF: ISBN 979-8-8557-1326-8 STD27387
Print: ISBN 979-8-8557-1327-5 STDPD27387

IEEE prohibits discrimination, harassment, and bullying.
For more information, visit https://www.ieee.org/about/corporate/governance/p9-26.html.
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.

Copyright © 2024 IEEE. All rights reserved.

Important Notices and Disclaimers Concerning IEEE Standards Documents

IEEE Standards documents are made available for use subject to important notices and legal disclaimers. These notices and disclaimers, or a reference to this page (https://standards.ieee.org/ipr/disclaimers.html), appear in all IEEE standards and may be found under the heading "Important Notices and Disclaimers Concerning IEEE Standards Documents."

Notice and Disclaimer of Liability Concerning the Use of IEEE Standards Documents

IEEE Standards documents are developed within IEEE Societies and subcommittees of IEEE Standards Association (IEEE SA) Board of Governors. IEEE develops its standards through an accredited consensus development process, which brings together volunteers representing varied viewpoints and interests to achieve the final product. IEEE standards are documents developed by volunteers with scientific, academic, and industry-based expertise in technical working groups. Volunteers involved in technical working groups are not necessarily members of IEEE or IEEE SA and participate without compensation from IEEE. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

IEEE makes no warranties or representations concerning its standards, and expressly disclaims all warranties, express or implied, concerning all standards, including but not limited to the warranties of merchantability, fitness for a particular purpose and non-infringement IEEE Standards documents do not guarantee safety, security, health, or environmental protection, or compliance with law, or guarantee against interference with or from other devices or networks. In addition, IEEE does not warrant or represent that the use of the material contained in its standards is free from patent infringement. IEEE Standards documents are supplied "AS IS" and "WITH ALL FAULTS."

Use of an IEEE standard is wholly voluntary. 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.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity, nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document should rely upon their own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

IN NO EVENT SHALL IEEE BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO: THE NEED TO PROCURE SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE PUBLICATION, USE OF, OR RELIANCE UPON ANY STANDARD, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE AND REGARDLESS OF WHETHER SUCH DAMAGE WAS FORESEEABLE.

Copyright © 2024 IEEE. All rights reserved.

Translations

The IEEE consensus balloting process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English language version published by IEEE is the approved IEEE standard.

Use by artificial intelligence systems

In no event shall material in any IEEE Standards documents be used for the purpose of creating, training, enhancing, developing, maintaining, or contributing to any artificial intelligence systems without the express, written consent of IEEE SA in advance. "Artificial intelligence" refers to any software, application, or other system that uses artificial intelligence, machine learning, or similar technologies, to analyze, train, process, or generate content. Requests for consent can be submitted using the Contact Us form.

Official statements

A statement, written or oral, that is not processed in accordance with the IEEE SA Standards Board Operations Manual is not, and shall not be considered or inferred to be, the official position of IEEE or any of its committees and shall not be considered to be, or be relied upon as, a formal position of IEEE or IEEE SA. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that the presenter's views should be considered the personal views of that individual rather than the formal position of IEEE, IEEE SA, the Standards Committee, or the Working Group. Statements made by volunteers may not represent the formal position of their employer(s) or affiliation(s). News releases about IEEE standards issued by entities other than IEEE SA should be considered the view of the entity issuing the release rather than the formal position of IEEE or IEEE SA.

Comments on standards

Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE or IEEE SA. However, **IEEE does not provide interpretations, consulting information, or advice pertaining to IEEE Standards documents**.

Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important that any responses to comments and questions also receive the concurrence of a balance of interests. For this reason, IEEE and the members of its Societies and subcommittees of the IEEE SA Board of Governors are not able to provide an instant response to comments or questions, except in those cases where the matter has previously been addressed. For the same reason, IEEE does not respond to interpretation requests. Any person who would like to participate in evaluating comments or revisions to an IEEE standard is welcome to join the relevant IEEE SA working group. You can indicate interest in a working group using the Interests tab in the Manage Profile and Interests area of the IEEE SA myProject system.[1] An IEEE Account is needed to access the application.

Comments on standards should be submitted using the Contact Us form.[2]

Laws and regulations

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document does not constitute compliance to any applicable regulatory

[1]Available at: https://development.standards.ieee.org/myproject-web/public/view.html#landing.
[2]Available at: https://standards.ieee.org/about/contact/.

Copyright © 2024 IEEE. All rights reserved.

requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Data privacy

Users of IEEE Standards documents should evaluate the standards for considerations of data privacy and data ownership in the context of assessing and using the standards in compliance with applicable laws and regulations.

Copyrights

IEEE draft and approved standards are copyrighted by IEEE under US and international copyright laws. They are made available by IEEE and are adopted for a wide variety of both public and private uses. These include both use by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making these documents available for use and adoption by public authorities and private users, neither IEEE nor its licensors waive any rights in copyright to the documents.

Photocopies

Subject to payment of the appropriate licensing fees, IEEE will grant users a limited, non-exclusive license to photocopy portions of any individual standard for company or organizational internal use or individual, non-commercial use only. To arrange for payment of licensing fees, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400; https://www.copyright.com/. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Updating of IEEE Standards documents

Users of IEEE Standards documents should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect.

Every IEEE standard is subjected to review at least every 10 years. When a document is more than 10 years old and has not undergone a revision process, 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 order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit IEEE Xplore or contact IEEE.[3] For more information about the IEEE SA or IEEE's standards development process, visit the IEEE SA Website.

Errata

Errata, if any, for all IEEE standards can be accessed on the IEEE SA Website.[4] Search for standard number and year of approval to access the web page of the published standard. Errata links are located under the Additional Resources Details section. Errata are also available in IEEE Xplore. Users are encouraged to periodically check for errata.

[3]Available at: https://ieeexplore.ieee.org/browse/standards/collection/ieee.
[4]Available at: https://standards.ieee.org/standard/index.html.

Copyright © 2024 IEEE. All rights reserved.

Patents

IEEE standards are developed in compliance with the IEEE SA Patent Policy.[5]

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 by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE SA Website at https://standards.ieee.org/about/sasb/patcom/patents.html. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses.

Essential Patent Claims may exist for which a Letter of Assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

IMPORTANT NOTICE

Technologies, application of technologies, and recommended procedures in various industries evolve over time. The IEEE standards development process allows participants to review developments in industries, technologies, and practices, and to determine what, if any, updates should be made to the IEEE standard. During this evolution, the technologies and recommendations in IEEE standards may be implemented in ways not foreseen during the standard's development. IEEE standards development activities consider research and information presented to the standards development group in developing any safety recommendations. Other information about safety practices, changes in technology or technology implementation, or impact by peripheral systems also may be pertinent to safety considerations during implementation of the standard. Implementers and users of IEEE Standards documents are responsible for determining and complying with all appropriate safety, security, environmental, health, data privacy, and interference protection practices and all applicable laws and regulations.

[5]Available at: https://standards.ieee.org/about/sasb/patcom/materials.html.

Copyright © 2024 IEEE. All rights reserved.

Participants

At the time this draft standard was completed, the Standard for Measures of Software Aspects of Dependability Working Group had the following membership:

Robert Binder, *Chair*

Pieter Botman
Lynn Robert Carter
Sigrid Eldh
Michael Grottke
Louis Gullo
Jon Hagar
Pratap Lakshman
Phillip Laplante
Ann Marie Neufelder
Joanna Olszewska
Annette Reilly
Rob Schaaf

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

Boon Chong Ang
Butch Anton
Robert Binder
Juris Borzovs
Pieter Botman
Lawrence Catchpole
Zhiman Chen
Diego Chiozzi
Scott Crawford
Ronald Dean
Kurniawan Diharja
David Fuschi
Emanuel Grant
Louis Gullo
Jon Hagar
Sheri Harshberger
Werner Hoelzl
Ronald Jarrett
Piotr Karocki
Madhav Krishna
Xiao Liang
Murray Little
Johnny Marques
Roberto Moreno
Rajesh Murthy
Andrew Nack
Joanna Olszewska
Thomas Owens
Howard Penrose
Rajaraman
Ramachandran
R. K. Rannow
Annette Reilly
Robert Schaaf
Jhony Sembiring
Thomas Starai
Walter Struppler
John Vergis
Oren Yuen
Janusz Zalewski

When the IEEE SA Standards Board approved this standard on 26 September 2024, it had the following membership:

David J. Law, *Chair*
Jon Walter Rosdahl, *Vice Chair*
Gary Hoffman, *Past Chair*
Alpesh Shah, *Secretary*

Sara R. Biyabani
Ted Burse
Stephen Dukes
Doug Edwards
J. Travis Griffith
Guido R. Hiertz
Ronald W Hotchkiss
Hao Hu
Yousef Kimiagar
Joseph L. Koepfinger*
Howard Li
Xiaohui Liu
John Haiying Lu
Kevin W. Lu
Hiroshi Mano
Paul Nikolich
Robby Robson
Lei Wang
F. Keith Waters
Sha Wei
Philip B. Winston
Don Wright

*Member Emeritus

Copyright © 2024 IEEE. All rights reserved.

Introduction

This introduction is not part of IEEE Std 982-2024, IEEE Standard for Measures of the Software Aspects of Dependability.

Reliance on software in all manner of critical systems has increased tremendously since the previous version of this standard was issued, as have concerns regarding growing cyber threats. The expanding dialog on software dependability and the increasing body of work in software assurance call for a broader perspective and a revision of this standard to ensure its continuing relevance. Therefore, the revised standard updates and augments the set of measurable attributes of the software aspects of dependability while acknowledging the significance of prior work, preserving its rigor, and retaining essential measures and concepts.

This standard provides equations and definitions to characterize in-service dependability along with guidance to develop these measurements. It presents a unified framework for measurement of quality characteristics evidenced by system behavior, including functionality, performance, safety, and security; and by the time consumed by certain kinds of support actions. The intended audience for this standard is primarily software and systems engineers; persons operating or supporting software systems; sponsors, managers, and users of software systems; researchers and other parties interested in software systems.

Dependability measurements, produced at any life cycle stage, can be used for many purposes: evaluation of operational effectiveness, evidence for key performance indicators, service level management, service monetization, system health monitoring, troubleshooting, identification of product gaps and opportunities, failure identification and mitigation, dependability prediction, allocating resources for support, and regulatory compliance.

Although this standard focuses on in-service measurement, its definitions can also be applied during development. Such pre-release measurements are essential to guide system engineering, manage development activities, improve development processes, predict operational dependability, and assess post-release risks.

As part of a quality management system, development and operational dependability measurements can be used to manage risks and as an input for preventative and correction actions for process improvement.

This standard supersedes and completely replaces inactive standard IEEE Std 982.1™-2005, IEEE Standard Dictionary of Measures of the Software Aspects of Dependability, which replaced IEEE Std 982.1™:1988, IEEE Standard Dictionary of Measures to Produce Reliable Software.

Copyright © 2024 IEEE. All rights reserved.

Contents

1. Overview 10
1.1 Scope 10
1.2 Purpose 10
1.3 Applicability 10
1.4 Word usage 12

2. Normative references 13

3. Definitions, acronyms, and abbreviations 13
3.1 Definitions 13
3.2 Acronyms and abbreviations 19

4. Dependability measurement model 21
4.1 Dependability is a composite quality characteristic 21
4.2 System of interest (SOI) 21
4.3 Content and role of dependability requirements 22
4.4 Dependability requirements 24
4.5 In-service reference model (ISRM) 26
4.6 Timing 31
4.7 Abstract data model 35

5. Dependability measures 36
5.1 Reliability 36
5.2 Availability 48
5.3 Supportability 60
5.4 Recoverability 62

Annex A (informative) Bibliography 67

Copyright © 2024 IEEE. All rights reserved.

IEEE Standard for Measures of the Software Aspects of Dependability

1. Overview

1.1 Scope

This standard identifies, classifies, and defines measures of the software aspects of in-service dependability. As such, it provides a framework for stakeholders to understand the software aspects of dependability and to make dependability measurements throughout the system life cycle.

It provides definitions, requirements, and guidance for the data collection and analysis necessary to make consistent and actionable measurements of a software system’s reliability, availability, supportability, and recoverability.

This standard is applicable to any software system or service. It is particularly useful for critical systems where the reliability of their safety, security, functionality, performance, and utilization, as well as recoverability, supportability, and availability are foremost. Examples of critical systems include those supplying communications infrastructure, first responder services, energy production and distribution, real time financial transactions, medical devices, health care administrative services, defense capabilities, personal and mass transportation, environmental monitoring, and water and waste management.

1.2 Purpose

The purpose of this standard is to establish guidance for measuring the software aspects of dependability as applicable to a system's operational context. It is intended for in-service measurement. It may be used during requirements, architecture, and design development; software construction and integration; and verification and validation of the software products of these activities. The overall objective is to enable stakeholders to measure dependability in software intensive systems throughout software operations and maintenance.

1.3 Applicability

This standard is intended for use in any domain of software application, whether user-facing or embedded, including personal convenience, real-time control, medical devices, high-volume transaction processing, high-performance numerical computing, data communications, industrial control, or artificial intelligence, to name a few. It is intended for use with any kind of computer hardware, runtime stack (operating system), or programming language; or in any computing infrastructure including personal computers, smartphones, on-board embedded devices, industrial controllers, edge devices, network operations centers, or data centers.

Copyright © 2024 IEEE. All rights reserved.

As a catalog of measures, this standard:

- Defines variables and equations to quantitatively characterize the software aspects of dependability: reliability, availability, supportability, and recoverability.
- Presents the in-service reference model (ISRM), a framework for uniform identification of system behaviors and support actions to be measured.
- Presents the reliability class model to support consistent and extensible differential analysis of the effects of anomalies and failures on the reliability of safety, security, functionality, performance, and utilization.
- Defines downtime subsets for certain types of activity (slices), providing insight into factors contributing to availability and supportability.
- Calls for explicit and bounded dependability requirements as a prerequisite for measurement and therefore provides normative criteria and guidance for their development and use.

It does not address other pre-release development practices including 1) software reliability prediction, 2) software engineering techniques for improving dependability, or 3) software maintenance.

IEEE Std 1633™-2016, Recommended Practice on Software Reliability [B15] provides a thorough resource for topics 1 and 2.[6] ISO/IEC/IEEE Std 14764:2022, Software engineering—Software life cycle processes—Maintenance [B21] likewise addresses topic 3.

Although this standard calls for well-formed and complete expressions of capability and dependability requirements, it does not address how to set specific levels of reliability, availability, supportability, or recoverability for any system or class of systems. It does not address how to develop software artifacts that achieve acceptable levels of functionality, performance, utilization, fault-tolerance, security, or safety.

This standard contains notional examples of requirement statements for reliability, availability, supportability, and recoverability. These are informative and not requirements of this standard.

Certain software engineering and operational processes, practices, and artifacts tend to result in higher dependability; their absence tends to result in lower dependability (Bourque and Fairley [B3]). Although general principles of software engineering for dependability are well-established, specific practices evolve and become irrelevant, often rapidly. This standard therefore focuses on defining useful measures of in-service dependability, regardless of the developmental and operational practices applied to a system of interest (SOI).

NOTE—IEEE 1012™-2016 [B13] provides guidance for requirements-based verification and validation of software/hardware systems.[7]

Often, identical copies of a software system are installed on numerous host computers. A population of deployed instances often has substantial variation in versions, configuration, operating conditions, and usage patterns. This variation typically has material effects on the dependability of any given instance. When this standard was revised, no generally accepted and validated techniques or models for measuring dependability of a software population were published and proven in practice. Therefore, this standard's dependability measurements are limited to a single instance of a system in a particular context; it does not address obtaining or characterizing population dependability measurements.

[6]The numbers in brackets correspond to those of the bibliography in Annex A.
[7]Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

Copyright © 2024 IEEE. All rights reserved.

Consistent and accurate measurements of in-service dependability and other quality attributes are essential for effective corrective and preventative actions (CAPA) in all software life cycle stages. Software product and process improvement through CAPA is a well-established and well-documented best practice. This standard therefore does not address CAPA.

NOTE—ISO/IEC/IEEE 90003:2018 [B18] provides comprehensive guidance for establishing a quality management system for software products and identifying software-related CAPAs.

This standard does not attempt to provide a mathematically formal and complete model for a measurement system, its abstract functions, or its binding to any data management system. It does not identify techniques to obtain logs or records of events from any specific software SOI or runtime environment.

To characterize dependability, this standard is focused on the classification and quantitative characterization (analysis) of certain operational activities and system behaviors from an external observer's perspective. Except to the extent necessary to make these measurements, it does not address other engineering or operational topics that may affect or depend on the nature or degree of these behaviors. It does not address characterizations of source-code, software architecture, or development practices, as they do not produce in-service behavioral data. Although some implementation measurements have been shown to be useful leading indicators of in-service dependability, many application-specific factors can confound these predictions (Hall, Beecham, Bowes, Gray, and Counsell [B9]).

Most extant definitions of software system trustworthiness include some or all of the dependability measurements defined in this standard (Newman [B30]). They also call for evidence to support claims that a system is sufficiently unlikely to behave in an anomalous, insecure, or harmful manner, and that its future behavior is likely to be consistent with socio-technical norms. These claims may be supported by evidence or analysis of any phenomena deemed relevant (Cho, Chan, and Adali [B3]). The observational measurements of this standard can provide some of this evidence, but do not address the broad scope of artifacts and activities or the subjective characterizations necessary to judge system trustworthiness.

1.4 Word usage

The word *shall* indicates mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (*shall* equals *is required to*).[8,9]

The word *should* indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required (*should* equals *is recommended that*).

The word *may* is used to indicate a course of action permissible within the limits of the standard (*may* equals *is permitted to*).

The word *can* is used for statements of possibility and capability, whether material, physical, or causal (*can* equals *is able to*).

[8]The use of the word *must* is deprecated and cannot be used when stating mandatory requirements; *must* is used only to describe unavoidable situations.
[9]The use of *will* is deprecated and cannot be used when stating mandatory requirements; *will* is only used in statements of fact.

Copyright © 2024 IEEE. All rights reserved.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ISO/IEC/IEEE 15939, Systems and software engineering—Measurement process.[10,11,12,13]

ISO/IEC/IEEE 24765, Systems and software engineering—Vocabulary.

3. Definitions, acronyms, and abbreviations

3.1 Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.[14] Definitions for other system and software engineering terms can be found in ISO/IEC/IEEE 24765, available at <www.computer.org/sevocab>.[15]

abnormal termination: Uncommanded cessation of software execution, typically resulting in a terminal failure. *Syn:* abend, blue screen, crash, dump, panic.

absolute time: A tick in a generally agreed chronological frame of reference. *Contrast:* **relative time**, **natural unit**.

EXAMPLE—a calendar date and time of day in a given reference time zone, such as Coordinated Universal Time (UTC).

abstract behavior: A description, model, or other general characterization of similar behaviors.

NOTE—There are many representations that express abstract behavior, for example, use cases, protocol message types, sequence diagram messages, and interface control documents.

adaptive support: Modification of an in-service SOI performed after installation to keep it usable in a changed or changing runtime environment. (Adapted from IESO/IEC/IEEE 14764:2022 [B21])

additive support: Modification of an in-service system performed after installation to add functionality or features to a system instance. (Adapted from IESO/IEC/IEEE 14764:2022 [B21])

NOTE—In contrast to perfective support, additive support results in new functions or features.

anomaly: A judgment that a system's behavior or artifact deviates from expectations based on 1) the system's high-level goals for outcomes, similar requirements, development or operational documentation, 2) applicable standards, regulations, or laws, or 3) an observer's perceptions or experiences.

NOTE—An anomaly can result in a revealed requirement.

[10]ISO publications are available from the International Organization for Standardization (https://www.iso.org/) and the American National Standards Institute (https://www.ansi.org/).
[11]IEC publications are available from the International Electrotechnical Commission (https://www.iec.ch) and the American National Standards Institute (https://www.ansi.org/).
[12]IEEE standards and products are trademarks owned by The Institute of Electrical and Electronics Engineers, Incorporated.
[13]IEEE publications are available from The Institute of Electrical and Electronics Engineers (https://standards.ieee.org/).
[14]*IEEE Standards Dictionary Online* is available at: http://dictionary.ieee.org. An IEEE Account is required for access to the dictionary, and one can be created at no charge on the dictionary sign-in page.
[15]Information on references can be found in Clause 2.

Copyright © 2024 IEEE. All rights reserved.