

# INTERNATIONAL STANDARD

# ISO/IEC 9945-2

**System Interfaces,  
IEEE Std 1003.1™, 2003 Edition  
The Open Group Technical Standard**  
Includes IEEE Std 1003.1™-2001 and IEEE Std 1003.1™-2001/Cor 1-2002

Third edition  
2003-08-15

---

---

## Information technology — Portable Operating System Interface (POSIX®) —

### Part 2: System Interfaces

*Technologies de l'information — Interface pour la portabilité des systèmes  
(POSIX®) —*

*Partie 2: Interfaces systèmes*



Reference number  
ISO/IEC 9945-2:2003(E)  
System Interfaces, IEEE Std 1003.1, 2003 Edition  
The Open Group Technical Standard, Issue 6

**ISO/IEC 9945-2:2003(E)**  
**System Interfaces, IEEE Std 1003.1, 2003 Edition**  
**The Open Group Technical Standard, Issue 6**

**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

Case postale 56 • CH-1211 Geneva 20

Tel. + 41 22 749 01 11

Fax + 41 22 749 09 47

E-mail [copyright@iso.org](mailto:copyright@iso.org)

ISO/IEC 9945-2:2003(E)

IEEE Std 1003.1™, 2003 Edition

The Open Group Technical Standard  
Base Specifications, Issue 6

Includes IEEE Std 1003.1™-2001 and IEEE Std 1003.1™-2001/Cor 1-2002

# Information Technology — Portable Operating System Interface (POSIX®)

## Part 2: System Interfaces

Sponsor

Portable Applications Standards Committee  
of the  
IEEE Computer Society

and

The Open Group



Adopted as an International Standard by the  
International Organization for Standardization  
and by the  
International Electrotechnical Commission



THE *Open* GROUP



This document is a preview generated by EVS

## International Standard ISO/IEC 9945-2:2003(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 part of ISO/IEC 9945 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 9945-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 22, *Programming languages, their environments and system software interfaces*.

This third edition of ISO/IEC 9945-2 is a minor revision and, together with ISO/IEC 9945-1, ISO/IEC 9945-3, and ISO/IEC 9945-4, cancels and replaces ISO/IEC 9945-1:2002 and ISO/IEC 9945-2:2002, ISO/IEC 9945-3:2002 and ISO/IEC 9945-4:2002.

ISO/IEC 9945 consists of the following parts, under the general title *Information technology — Portable Operating System Interface (POSIX<sup>®</sup>)*:

- *Part 1: Base Definitions*
- *Part 2: System Interfaces*
- *Part 3: Shell and Utilities*
- *Part 4: Rationale*



## Abstract

This standard is simultaneously ISO/IEC 9945:2003, IEEE Std 1003.1-2001, and forms the core of the Single UNIX Specification, Version 3.

The IEEE Std 1003.1, 2003 Edition includes IEEE Std 1003.1-2001/Cor 1-2002 incorporated into IEEE Std 1003.1-2001 (base document). The Corrigendum addresses problems discovered since the approval of IEEE Std 1003.1-2001. These changes are mainly due to resolving integration issues raised by the merger of the base documents that were incorporated into IEEE Std 1003.1-2001, which is the single common revision to IEEE Std 1003.1<sup>TM</sup>-1996, IEEE Std 1003.2<sup>TM</sup>-1992, ISO/IEC 9945-1:1996, ISO/IEC 9945-2:1993, and the Base Specifications of The Open Group Single UNIX<sup>®</sup> Specification, Version 2.

This standard defines a standard operating system interface and environment, including a command interpreter (or “shell”), and common utility programs to support applications portability at the source code level. This standard is intended to be used by both applications developers and system implementors and comprises four major components (each in an associated volume):

- General terms, concepts, and interfaces common to all volumes of this standard, including utility conventions and C-language header definitions, are included in the Base Definitions volume.
- Definitions for system service functions and subroutines, language-specific system services for the C programming language, function issues, including portability, error handling, and error recovery, are included in the System Interfaces volume.
- Definitions for a standard source code-level interface to command interpretation services (a “shell”) and common utility programs for application programs are included in the Shell and Utilities volume.
- Extended rationale that did not fit well into the rest of the document structure, which contains historical information concerning the contents of this standard and why features were included or discarded by the standard developers, is included in the Rationale (Informative) volume.

The following areas are outside the scope of this standard:

- Graphics interfaces
- Database management system interfaces
- Record I/O considerations
- Object or binary code portability
- System configuration and resource availability

This standard describes the external characteristics and facilities that are of importance to applications developers, rather than the internal construction techniques employed to achieve these capabilities. Special emphasis is placed on those functions and facilities that are needed in a wide variety of commercial applications.

## Keywords

application program interface (API), argument, asynchronous, basic regular expression (BRE), batch job, batch system, built-in utility, byte, child, command language interpreter, CPU, extended regular expression (ERE), FIFO, file access control mechanism, input/output (I/O), job control, network, portable operating system interface (POSIX<sup>®</sup>), parent, shell, stream, string, synchronous, system, thread, X/Open System Interface (XSI)

Copyright © 2001-2003 by the Institute of Electrical and Electronics Engineers, Inc. and The Open Group. All rights reserved. This printing is by the International Organization for Standardization with special permission of the Institute of Electrical and Electronics Engineers, Inc. and The Open Group. Published in Switzerland.

System Interfaces, Issue 6

Published 31 March 2003 by the Institute of Electrical and Electronics Engineers, Inc.  
3 Park Avenue, New York, NY 10016-5997, U.S.A.  
ISBN: 0-7381-3436-8 PDF 0-7381-3564-X/SS95078 CD-ROM 0-7381-3563-1/SE95078  
Printed in the United States of America by the IEEE.

Published 31 March 2003 by The Open Group  
Apex Plaza, Forbury Road, Reading, Berkshire RG1 1AX, U.K.  
Document Number: C032  
ISBN: 1-931624-24-0  
Printed in the U.K. by The Open Group.

All rights reserved. No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without prior written permission from both the IEEE and The Open Group.

Portions of this standard are derived with permission from copyrighted material owned by Hewlett-Packard Company, International Business Machines Corporation, Novell Inc., The Open Software Foundation, and Sun Microsystems, Inc.

#### **Permissions**

Authorization to photocopy portions of this standard for internal or personal use is granted provided that the appropriate fee is paid to the Copyright Clearance Center or the equivalent body outside of the U.S. Permission to make multiple copies for educational purposes in the U.S. requires agreement and a license fee to be paid to the Copyright Clearance Center.

Beyond these provisions, permission to reproduce all or any part of this standard must be with the consent of both copyright holders and may be subject to a license fee. Both copyright holders will need to be satisfied that the other has granted permission. Requests to the copyright holders should be sent by email to [austin-group-permissions@opengroup.org](mailto:austin-group-permissions@opengroup.org).

#### **Feedback**

This standard has been prepared by the Austin Group. Feedback relating to the material contained in this standard may be submitted using the Austin Group web site at <http://www.opengroup.org/austin/defectform.html>.

## IEEE

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 the 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.

Comments for revision of IEEE Standards are welcome from any interested party, regardless of membership affiliation with the IEEE.<sup>1</sup> 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, P.O. Box 1331, Piscataway, NJ 08855-1331, U.S.A.

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.

A patent holder has filed a statement of assurance that it will grant licenses under these rights without compensation or under reasonable rates and non-discriminatory, reasonable terms and conditions to all applicants desiring to obtain such licenses. The IEEE makes no representation as to the reasonableness of rates and/or terms and conditions of the license agreements offered by patent holders. Further information may be obtained from the IEEE Standards Department.

Authorization to photocopy portions of any individual standard for internal or personal use is granted in the U.S. by the Institute of Electrical and Electronics Engineers, Inc., provided that the appropriate fee is paid to the Copyright Clearance Center.<sup>2</sup> Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center. To arrange for payment of the licensing fee, please contact:

Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923, U.S.A.; tel: +1 978 750 8400

Amendments, corrigenda, and interpretations for this standard, or information about the IEEE standards development process, may be found at <http://standards.ieee.org>.

Full catalog and ordering information on all IEEE publications is available from the IEEE Online Catalog & Store at <http://shop.ieee.org/store>.

1. For this standard, please send comments via the Austin Group as requested on page iii.

2. Please refer to the special provisions for this standard on page iii concerning permissions from both copyright holders and arrangements to cover photocopying and reproduction across the world, as well as by commercial organizations wishing to license the material for use in product documentation.

## The Open Group

The Open Group, a vendor and technology-neutral consortium, is committed to delivering greater business efficiency by bringing together buyers and suppliers of information technology to lower the time, cost, and risks associated with integrating new technology across the enterprise.

The Open Group's mission is to offer all organizations concerned with open information infrastructures a forum to share knowledge, integrate open initiatives, and certify approved products and processes in a manner in which they continue to trust our impartiality.

In the global eCommerce world of today, no single economic entity can achieve independence while still ensuring interoperability. The assurance that products will interoperate with each other across differing systems and platforms is essential to the success of eCommerce and business workflow. The Open Group, with its proven testing and certification program, is the international guarantor of interoperability in the new century.

The Open Group provides opportunities to exchange information and shape the future of IT. The Open Group's members include some of the largest and most influential organizations in the world. The flexible structure of The Open Groups membership allows for almost any organization, no matter what their size, to join and have a voice in shaping the future of the IT world.

More information is available on The Open Group web site at <http://www.opengroup.org>.

The Open Group has over 15 years' experience in developing and operating certification programs and has extensive experience developing and facilitating industry adoption of test suites used to validate conformance to an open standard or specification. The Open Group portfolio of test suites includes the *Westwood* family of tests for this standard and the associated certification program for Version 3 of the Single UNIX Specification, as well tests for CDE, CORBA, Motif, Linux, LDAP, POSIX.1, POSIX.2, POSIX Realtime, Sockets, UNIX, XPG4, XNFS, XTI, and X11. The Open Group test tools are essential for proper development and maintenance of standards-based products, ensuring conformance of products to industry-standard APIs, applications portability, and interoperability. In-depth testing identifies defects at the earliest possible point in the development cycle, saving costs in development and quality assurance.

More information is available at <http://www.opengroup.org/testing>.

The Open Group publishes a wide range of technical documentation, the main part of which is focused on development of Technical and Product Standards and Guides, but which also includes white papers, technical studies, branding and testing documentation, and business titles. Full details and a catalog are available at <http://www.opengroup.org/pubs>.

As with all *live* documents, Technical Standards and Specifications require revision to align with new developments and associated international standards. To distinguish between revised specifications which are fully backwards compatible and those which are not:

- A new *Version* indicates there is no change to the definitive information contained in the previous publication of that title, but additions/extensions are included. As such, it *replaces* the previous publication.
- A new *Issue* indicates there is substantive change to the definitive information contained in the previous publication of that title, and there may also be additions/extensions. As such, both previous and new documents are maintained as current publications.

Readers should note that Corrigenda may apply to any publication. Corrigenda information is published at <http://www.opengroup.org/corrigenda>.

Full catalog and ordering information on all Open Group publications is available at <http://www.opengroup.org/pubs>.



# Contents

<b>Chapter 1</b>	<b>Introduction.....</b>	<b>1</b>
1.1	Scope.....	1
1.2	Conformance .....	1
1.3	Normative References .....	1
1.4	Change History .....	1
1.5	Terminology .....	1
1.6	Definitions .....	3
1.7	Relationship to Other Formal Standards .....	3
1.8	Portability .....	3
1.8.1	Codes .....	3
1.9	Format of Entries.....	11
<b>Chapter 2</b>	<b>General Information .....</b>	<b>13</b>
2.1	Use and Implementation of Functions .....	13
2.2	The Compilation Environment .....	13
2.2.1	POSIX.1 Symbols .....	13
2.2.1.1	The <code>_POSIX_C_SOURCE</code> Feature Test Macro .....	14
2.2.1.2	The <code>_XOPEN_SOURCE</code> Feature Test Macro.....	14
2.2.2	The Name Space.....	14
2.3	Error Numbers .....	21
2.3.1	Additional Error Numbers.....	28
2.4	Signal Concepts.....	28
2.4.1	Signal Generation and Delivery.....	28
2.4.2	Realtime Signal Generation and Delivery .....	29
2.4.3	Signal Actions .....	30
2.4.4	Signal Effects on Other Functions .....	34
2.5	Standard I/O Streams.....	34
2.5.1	Interaction of File Descriptors and Standard I/O Streams.....	35
2.5.2	Stream Orientation and Encoding Rules .....	36
2.6	STREAMS .....	38
2.6.1	Accessing STREAMS.....	39
2.7	XSI Interprocess Communication .....	39
2.7.1	IPC General Description.....	40
2.8	Realtime .....	41
2.8.1	Realtime Signals.....	41
2.8.2	Asynchronous I/O .....	41
2.8.3	Memory Management .....	43
2.8.3.1	Memory Locking.....	43
2.8.3.2	Memory Mapped Files.....	43
2.8.3.3	Memory Protection.....	43
2.8.3.4	Typed Memory Objects .....	44
2.8.4	Process Scheduling .....	44

2.8.5	Clocks and Timers .....	48
2.9	Threads.....	50
2.9.1	Thread-Safety.....	50
2.9.2	Thread IDs.....	51
2.9.3	Thread Mutexes.....	51
2.9.4	Thread Scheduling.....	52
2.9.5	Thread Cancellation .....	54
2.9.5.1	Cancelability States .....	54
2.9.5.2	Cancellation Points.....	55
2.9.5.3	Thread Cancellation Cleanup Handlers .....	57
2.9.5.4	Async-Cancel Safety.....	57
2.9.6	Thread Read-Write Locks.....	58
2.9.7	Thread Interactions with Regular File Operations .....	58
2.10	Sockets.....	58
2.10.1	Address Families.....	58
2.10.2	Addressing.....	59
2.10.3	Protocols .....	59
2.10.4	Routing.....	59
2.10.5	Interfaces.....	59
2.10.6	Socket Types.....	59
2.10.7	Socket I/O Mode.....	60
2.10.8	Socket Owner.....	60
2.10.9	Socket Queue Limits .....	60
2.10.10	Pending Error.....	60
2.10.11	Socket Receive Queue.....	61
2.10.12	Socket Out-of-Band Data State .....	61
2.10.13	Connection Indication Queue .....	62
2.10.14	Signals .....	62
2.10.15	Asynchronous Errors .....	62
2.10.16	Use of Options.....	63
2.10.17	Use of Sockets for Local UNIX Connections.....	66
2.10.17.1	Headers .....	66
2.10.18	Use of Sockets over Internet Protocols.....	66
2.10.19	Use of Sockets over Internet Protocols Based on IPv4.....	67
2.10.19.1	Headers .....	67
2.10.20	Use of Sockets over Internet Protocols Based on IPv6.....	67
2.10.20.1	Addressing .....	67
2.10.20.2	Compatibility with IPv4 .....	68
2.10.20.3	Interface Identification.....	68
2.10.20.4	Options.....	69
2.10.20.5	Headers .....	70
2.11	Tracing.....	70
2.11.1	Tracing Data Definitions.....	71
2.11.1.1	Structures.....	71
2.11.1.2	Trace Stream Attributes.....	75
2.11.2	Trace Event Type Definitions .....	76
2.11.2.1	System Trace Event Type Definitions.....	76
2.11.2.2	User Trace Event Type Definitions.....	79

This document is a preview generated by EVSS

2.11.3	Trace Functions.....	79
2.12	Data Types.....	80
<b>Chapter 3</b>	<b>System Interfaces .....</b>	<b>83</b>
	<b>Index.....</b>	<b>1669</b>

**List of Tables**

2-1	Value of Level for Socket Options.....	63
2-2	Socket-Level Options.....	64
2-3	Trace Option: System Trace Events.....	77
2-4	Trace and Trace Event Filter Options: System Trace Events.....	78
2-5	Trace and Trace Log Options: System Trace Events.....	78
2-6	Trace, Trace Log, and Trace Event Filter Options: System Trace Events .....	79
2-7	Trace Option: User Trace Event .....	79

This document is a preview generated by EVS

This document is a preview generated by EVS

# Foreword

## Structure of the Standard

This standard was originally developed by the Austin Group, a joint working group of members of the IEEE, members of The Open Group, and members of ISO/IEC Joint Technical Committee 1, as one of the four volumes of IEEE Std 1003.1-2001. The standard was approved by ISO and IEC and published in four parts, correlating to the original volumes.

A mapping of the parts to the volumes is shown below:

ISO/IEC 9945 Part	IEEE Std 1003.1 Volume	Description
9945-1	Base Definitions	Includes general terms, concepts, and interfaces common to all parts of ISO/IEC 9945, including utility conventions and C-language header definitions.
9945-2	System Interfaces	Includes definitions for system service functions and subroutines, language-specific system services for the C programming language, function issues, including portability, error handling, and error recovery.
9945-3	Shell and Utilities	Includes definitions for a standard source code-level interface to command interpretation services (a “shell”) and common utility programs for application programs.
9945-4	Rationale	Includes extended rationale that did not fit well into the rest of the document structure, containing historical information concerning the contents of ISO/IEC 9945 and why features were included or discarded by the standard developers.

All four parts comprise the entire standard, and are intended to be used together to accommodate significant internal referencing among them. POSIX-conforming systems are required to support all four parts.

# Introduction

**Note:** This introduction is not part of IEEE Std 1003.1-2001, Standard for Information Technology — Portable Operating System Interface (POSIX).

This standard has been jointly developed by the IEEE and The Open Group. It is simultaneously an IEEE Standard, an ISO/IEC Standard, and an Open Group Technical Standard.

## The Austin Group

This standard was developed, and is maintained, by a joint working group of members of the IEEE Portable Applications Standards Committee, members of The Open Group, and members of ISO/IEC Joint Technical Committee 1. This joint working group is known as the Austin Group.<sup>3</sup> The Austin Group arose out of discussions amongst the parties which started in early 1998, leading to an initial meeting and formation of the group in September 1998. The purpose of the Austin Group has been to revise, combine, and update the following standards: ISO/IEC 9945-1, ISO/IEC 9945-2, IEEE Std 1003.1, IEEE Std 1003.2, and the Base Specifications of The Open Group Single UNIX Specification.

After two initial meetings, an agreement was signed in July 1999 between The Open Group and the Institute of Electrical and Electronics Engineers (IEEE), Inc., to formalize the project with the first draft of the revised specifications being made available at the same time. Under this agreement, The Open Group and IEEE agreed to share joint copyright of the resulting work. The Open Group has provided the chair and secretariat for the Austin Group.

The base document for the revision was The Open Group's Base volumes of its Single UNIX Specification, Version 2. These were selected since they were a superset of the existing POSIX.1 and POSIX.2 specifications and had some organizational aspects that would benefit the audience for the new revision.

The approach to specification development has been one of "write once, adopt everywhere", with the deliverables being a set of specifications that carry the IEEE POSIX designation, The Open Group's Technical Standard designation, and an ISO/IEC designation. This set of specifications forms the core of the Single UNIX Specification, Version 3.

This unique development has combined both the industry-led efforts and the formal standardization activities into a single initiative, and included a wide spectrum of participants. The Austin Group continues as the maintenance body for this document.

Anyone wishing to participate in the Austin Group should contact the chair with their request. There are no fees for participation or membership. You may participate as an observer or as a contributor. You do not have to attend face-to-face meetings to participate; electronic participation is most welcome. For more information on the Austin Group and how to participate, see <http://www.opengroup.org/austin>.

---

3. The Austin Group is named after the location of the inaugural meeting held at the IBM facility in Austin, Texas in September 1998.

### Background

The developers of this standard represent a cross section of hardware manufacturers, vendors of operating systems and other software development tools, software designers, consultants, academics, authors, applications programmers, and others.

Conceptually, this standard describes a set of fundamental services needed for the efficient construction of application programs. Access to these services has been provided by defining an interface, using the C programming language, a command interpreter, and common utility programs that establish standard semantics and syntax. Since this interface enables application writers to write portable applications—it was developed with that goal in mind—it has been designated POSIX,<sup>4</sup> an acronym for Portable Operating System Interface.

Although originated to refer to the original IEEE Std 1003.1-1988, the name POSIX more correctly refers to a family of related standards: IEEE Std 1003.*n* and the parts of ISO/IEC 9945. In earlier editions of the IEEE standard, the term POSIX was used as a synonym for IEEE Std 1003.1-1988. A preferred term, POSIX.1, emerged. This maintained the advantages of readability of the symbol ‘POSIX’ without being ambiguous with the POSIX family of standards.

### Audience

The intended audience for this standard is all persons concerned with an industry-wide standard operating system based on the UNIX system. This includes at least four groups of people:

1. Persons buying hardware and software systems
2. Persons managing companies that are deciding on future corporate computing directions
3. Persons implementing operating systems, and especially
4. Persons developing applications where portability is an objective

### Purpose

Several principles guided the development of this standard:

- Application-Oriented

The basic goal was to promote portability of application programs across UNIX system environments by developing a clear, consistent, and unambiguous standard for the interface specification of a portable operating system based on the UNIX system documentation. This standard codifies the common, existing definition of the UNIX system.

- Interface, Not Implementation

This standard defines an interface, not an implementation. No distinction is made between library functions and system calls; both are referred to as functions. No details of the implementation of any function are given (although historical practice is sometimes indicated in the RATIONALE section). Symbolic names are given for constants (such as signals and error numbers) rather than numbers.

---

4. The name POSIX was suggested by Richard Stallman. It is expected to be pronounced *pahz-icks*, as in *positive*, not *poh-six*, or other variations. The pronunciation has been published in an attempt to promulgate a standardized way of referring to a standard operating system interface.

- Source, Not Object, Portability

This standard has been written so that a program written and translated for execution on one conforming implementation may also be translated for execution on another conforming implementation. This standard does not guarantee that executable (object or binary) code will execute under a different conforming implementation than that for which it was translated, even if the underlying hardware is identical.

- The C Language

The system interfaces and header definitions are written in terms of the standard C language as specified in the ISO C standard.

- No Superuser, No System Administration

There was no intention to specify all aspects of an operating system. System administration facilities and functions are excluded from this standard, and functions usable only by the superuser have not been included. Still, an implementation of the standard interface may also implement features not in this standard. This standard is also not concerned with hardware constraints or system maintenance.

- Minimal Interface, Minimally Defined

In keeping with the historical design principles of the UNIX system, the mandatory core facilities of this standard have been kept as minimal as possible. Additional capabilities have been added as optional extensions.

- Broadly Implementable

The developers of this standard endeavored to make all specified functions implementable across a wide range of existing and potential systems, including:

1. All of the current major systems that are ultimately derived from the original UNIX system code (Version 7 or later)
2. Compatible systems that are not derived from the original UNIX system code
3. Emulations hosted on entirely different operating systems
4. Networked systems
5. Distributed systems
6. Systems running on a broad range of hardware

No direct references to this goal appear in this standard, but some results of it are mentioned in the Rationale (Informative) volume.

- Minimal Changes to Historical Implementations

When the original version of IEEE Std 1003.1 was published, there were no known historical implementations that did not have to change. However, there was a broad consensus on a set of functions, types, definitions, and concepts that formed an interface that was common to most historical implementations.

The adoption of the 1988 and 1990 IEEE system interface standards, the 1992 IEEE shell and utilities standard, the various Open Group (formerly X/Open) specifications, and the subsequent revisions and addenda to all of them have consolidated this consensus, and this revision reflects the significantly increased level of consensus arrived at since the original versions. The earlier standards and their modifications specified a number of areas where consensus had not been reached before, and these are now reflected in this revision. The authors of the original versions tried, as much as possible, to follow the principles below



when creating new specifications:

1. By standardizing an interface like one in an historical implementation; for example, directories
2. By specifying an interface that is readily implementable in terms of, and backwards-compatible with, historical implementations, such as the extended *tar* format defined in the *pax* utility
3. By specifying an interface that, when added to an historical implementation, will not conflict with it; for example, the *sigaction()* function

This revision tries to minimize the number of changes required to implementations which conform to the earlier versions of the approved standards to bring them into conformance with the current standard. Specifically, the scope of this work excluded doing any “new” work, but rather collecting into a single document what had been spread across a number of documents, and presenting it in what had been proven in practice to be a more effective way. Some changes to prior conforming implementations were unavoidable, primarily as a consequence of resolving conflicts found in prior revisions, or which became apparent when bringing the various pieces together.

However, since it references the 1999 version of the ISO C standard, and no longer supports “Common Usage C”, there are a number of unavoidable changes. Applications portability is similarly affected.

This standard is specifically not a codification of a particular vendor’s product.

It should be noted that implementations will have different kinds of extensions. Some will reflect “historical usage” and will be preserved for execution of pre-existing applications. These functions should be considered “obsolescent” and the standard functions used for new applications. Some extensions will represent functions beyond the scope of this standard. These need to be used with careful management to be able to adapt to future extensions of this standard and/or port to implementations that provide these services in a different manner.

- Minimal Changes to Existing Application Code

A goal of this standard was to minimize additional work for the developers of applications. However, because every known historical implementation will have to change at least slightly to conform, some applications will have to change.

### This Standard

This standard defines the Portable Operating System Interface (POSIX) requirements and consists of the following volumes:

- Base Definitions
- Shell and Utilities
- System Interfaces (this volume)
- Rationale (Informative)