Draft Standard for Information Technology— Portable Operating System Interface (POSIX®)

Prepared by the Austin Group

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Technical Standard

Rationale (Informative)

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Technical Standard

Rationale (Informative)

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Introduction

IEEE Std 1003.1-200x has been jointly developed by the IEEE and The Open Group. It is both an IEEE standard and an Open Group Technical Standard.

Background

The developers of IEEE Std 1003.1-200x 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, IEEE Std 1003.1-200x 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,[1] 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 IEEE Std 1003.1-200x 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 IEEE Std 1003.1-200x:

- 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. IEEE Std 1003.1-200x codifies the common, existing definition of the UNIX system.

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1. 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.

- Interface, Not Implementation

  IEEE Std 1003.1-200x 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.

- Source, Not Object, Portability

  IEEE Std 1003.1-200x 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. IEEE Std 1003.1-200x 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 IEEE Std 1003.1-200x, and functions usable only by the superuser have not been included. Still, an implementation of the standard interface may also implement features not in IEEE Std 1003.1-200x. IEEE Std 1003.1-200x 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 IEEE Std 1003.1-200x have been kept as minimal as possible. Additional capabilities have been added as optional extensions.

- Broadly Implementable

  The developers of IEEE Std 1003.1-200x 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 IEEE Std 1003.1-200x, but some results of it are mentioned in the Rationale (Informative) volume of IEEE Std 1003.1-200x.

- 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 interface standards, the 1992 common standards, the various Open Group (formerly X/Open) versions, 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 versions of the ISO C standard, and no longer supports ''Common Usage C'', there are a number of unavoidable changes. Applications portability is similarly affected.

IEEE Std 1003.1-200x 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 IEEE Std 1003.1-200x. These need to be used with careful management to be able to adapt to future IEEE Std 1003.1-200x extensions and/or port to implementations that provide these services in a different manner.

- Minimal Changes to Existing Application Code

  A goal of IEEE Std 1003.1-200x 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.

General

This Rationale (Informative) volume of IEEE Std 1003.1-200x is being published to assist in the process of review. It contains historical information concerning the contents of IEEE Std 1003.1-200x and why features were included or discarded by the standard developers. It also contains notes of interest to application programmers on recommended programming practices, emphasizing the consequences of some aspects of IEEE Std 1003.1-200x that may not be immediately apparent.

Development of IEEE Std 1003.1-200x

This portion of the Rationale (Informative) volume of IEEE Std 1003.1-200x outlines the organizations and documents involved in developing IEEE Std 1003.1-200x.

This revision was developed by a joint working group known as the Austin Common Standards Revision Group, or *Austin Group* for short. This joint technical working group was convened in late 1998 to consider the matter of a common revision of ISO/IEC 9945-1 (POSIX.1), ISO/IEC 9945-2 (POSIX.2), IEEE Std 1003.1, IEEE Std 1003.2, and appropriate parts of the Single UNIX Specification. The approach to specification development was to *write once, adopt everywhere*, with the deliverables being a single set of specifications that carry both the IEEE POSIX designation and The Open Group's Technical Standard designation, and, if adopted, an ISO/IEC designation.

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.

Organization of the Rationale

Within the Rationale (Informative) volume of IEEE Std 1003.1-200x, the following terms are used:

base standard
: The portions of IEEE Std 1003.1-200x that are not optional, equivalent to the definitions of *classic* POSIX.1 and POSIX.2.

XSI extension
: The portions of IEEE Std 1003.1-200x addressing the extension added for support of the Single UNIX Specification.

standard developers
: The individuals and companies in the development organizations responsible for IEEE Std 1003.1-200x: the IEEE P1003.1 working groups, The Open Group Base working group, advised by the hundreds of individual technical experts who balloted the draft standards within the Austin Group, and the member bodies and technical experts of ISO/IEC JTC 1/SC22/WG15.

The remainder of the Rationale (Informative) volume of IEEE Std 1003.1-200x is organized in parallel to the normative volumes of IEEE Std 1003.1-200x, with a separate part for each of the three normative volumes.

Organization of This Document

IEEE Std 1003.1-200x is organized into sections. Some of these, such as the Scope, are mandated by ISO/IEC, the IEEE, and other standards bodies. Due to the size of the overall document, IEEE Std 1003.1-200x has been divided logically into three normative volumes, for the convenience of the standards developers and others. The alphabetical ordering of the large sections including system interfaces and utilities was to make it easier for the documents to be used as reference documents.

The three volumes are as follows:

- Base Definitions

  This volume of IEEE Std 1003.1-200x is organized in chapters as follows:

— Introduction (including Scope and Normative References)

— Conformance

— Definitions

— General Concepts

— File Format Notation

— Character Set

— Locale

— Environment Variables

— Regular Expressions

— Directory Structure and Devices

— General Terminal Interface

— Utility Conventions

— Headers (organized alphabetically)

The presence of this volume of IEEE Std 1003.1-200x reduces duplication in the other volumes and ensures consistency of use of terminology. Where terminology and definitions common to both the System Interfaces volume of IEEE Std 1003.1-200x and Shell and Utilities volume of IEEE Std 1003.1-200x occurs, then additions have been made to this volume of IEEE Std 1003.1-200x.

- System Interfaces

This volume of IEEE Std 1003.1-200x is organized as follows:

— Introduction

— General Information

— System Interfaces (organized alphabetically)

- Shell and Utilities

This volume of IEEE Std 1003.1-200x is organized as follows:

— Introduction

— Shell Command Language

— Batch Environment Services

— Utilities (organized alphabetically)

Abbreviations

POSIX.0

Although this term is not used in the normative text of IEEE Std 1003.1-200x, it is used in the Rationale (Informative) volume of IEEE Std 1003.1-200x to refer to IEEE Std 1003.0-1995.

POSIX.1b

Although this term is not used in the normative text of IEEE Std 1003.1-200x, it is used in the Rationale (Informative) volume of IEEE Std 1003.1-200x to refer to the elements of the POSIX Realtime Extension amendment. (This was earlier referred to as POSIX.4 during the standard development process.)

POSIX.1c

Although this term is not used in the normative text of IEEE Std 1003.1-200x, it is used in the Rationale (Informative) volume of IEEE Std 1003.1-200x to refer to the POSIX Threads Extension amendment. (This was earlier referred to as POSIX.4a during the standard development process.)

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This document was prepared by the Austin Group, a joint working group of the IEEE, The Open Group, and ISO SC22 WG15.

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Part 7: Latin / Greek Alphabet
Part 8: Latin / Hebrew Alphabet
Part 9: Latin Alphabet No. 5
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