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

Prepared by the Austin Group

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Technical Standard

System Interfaces, Issue 6

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Preface

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.

IEEE Std 1003.1-200x

IEEE Std 1003.1-200x 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)

This Volume

The System Interfaces volume of IEEE Std 1003.1-200x describes the interfaces offered to application programs by POSIX-conformant systems. Readers are expected to be experienced C language programmers, and to be familiar with the Base Definitions volume of IEEE Std 1003.1-200x.

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

- Chapter 1 explains the status of this volume of IEEE Std 1003.1-200x and its relationship to other formal standards.
- Chapter 2 contains important concepts, terms, and caveats relating to the rest of this volume of IEEE Std 1003.1-200x.
- Chapter 3 defines the functional interfaces to the POSIX-conformant system.

Comprehensive references are available in the index.

Typographical Conventions

The following typographical conventions are used throughout IEEE Std 1003.1-200x.

The typographical conventions listed here are for ease of reading only. Editorial inconsistencies in the use of typography are unintentional and have no normative meaning in IEEE Std 1003.1-200x.

Reference	Example	Notes
C-Language Data Structure	**aiocb**	
C-Language Data Structure Member	*aio_lio_opcode*	
C-Language Data Type	**long**	
C-Language Function	*system*( )	
C-Language Function Family	*exec*	
C-Language Function Argument	*arg1*	
C-Language External Variable	*errno*	
C-Language Header	**<sys/stat.h>**	
C-Language Keyword	**#define**	
C-Language Macro with Argument	*assert*( )	
C-Language Macro with No Argument	INET_ADDRSTRLEN	
Commands within a Utility	**a**, **c**	
Conversion Specification, Specifier / Modifier Character	%A, g, E	1
Environment Variable	*PATH*	
Error Number	[EINTR]	
Example Output	**Hello, World**	
Filename	**/tmp**	
Literal Character	'c'	2
Literal String	"abcde"	2
Optional Items in Utility Syntax	**[ ]**	
Parameter	<*directory pathname*>	
Special Character	<newline>	3

Reference	Example	Notes
Symbolic Limit, Configuration Value	{LINE_MAX}	4
Symbolic Constant	_POSIX_VDISABLE	
Syntax	`#include <sys/stat.h>`	
User Input and Example Code	`echo Hello, World`	5
Utility Name	*awk*	
Utility Operand	*file_name*	
Utility Option	**−c**	
Utility Option with Option-Argument	**−w** *width*	

Notes:

1. Conversion specifications, specifier characters, and modifier characters are used primarily in date-related functions and utilities and the *fprintf* and *fscanf* formatting functions.
2. Unless otherwise noted, the quotes shall not be used as input or output. When used in a list item, the quotes are omitted.
3. The style selected for some of the special characters, such as <newline>, matches the form of the input given to the *localedef* utility. Generally, the characters selected for this special treatment are those that are not visually distinct, such as the control characters <tab> or <newline>.
4. Names surrounded by braces represent symbolic limits or configuration values which may be declared in appropriate headers by means of the C **#define** construct.
5. Brackets shown in this font, `"[ ]"`, are part of the syntax and do *not* indicate optional items. In syntax the `' | '` symbol is used to separate alternatives, and ellipses (`". . ."`) are used to show that additional arguments are optional.

Shading is used to identify extensions and options; see Section 1.8.1 (on page 453).

Footnotes and notes within the body of the normative text are for information only (informative).

Informative sections (such as Rationale, Change History, Application Usage, and so on) are denoted by continuous shading bars in the margins.

Ranges of values are indicated with parentheses or brackets as follows:

— (*a*,*b*) means the range of all values from *a* to *b*, including neither *a* nor *b*.

— [*a*,*b*] means the range of all values from *a* to *b*, including *a* and *b*.

— [*a*,*b*) means the range of all values from *a* to *b*, including *a*, but not *b*.

— (*a*,*b*] means the range of all values from *a* to *b*, including *b*, but not *a*.

Notes:

1. Symbolic limits are used in this volume of IEEE Std 1003.1-200x instead of fixed values for portability. The values of most of these constants are defined in the Base Definitions volume of IEEE Std 1003.1-200x, **<limits.h>** or **<unistd.h>**.
2. The values of errors are defined in the Base Definitions volume of IEEE Std 1003.1-200x, **<errno.h>**.

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Part 7: Latin / Greek Alphabet
Part 8: Latin / Hebrew Alphabet
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- System Interface Definitions (XBD), Issue 4, Version 2 (ISBN: 1-85912-036-9, C434)
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- System Interface Definitions (XBD), Issue 5 (ISBN: 1-85912-186-1, C605)
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