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

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Technical Standard

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

- Rationale (Informative)

This Volume

The Base Definitions volume of IEEE Std 1003.1-200x provides common definitions for IEEE Std 1003.1-200x, therefore readers should be familiar with it before using the other volumes.

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

- Chapter 1 is an introduction.
- Chapter 2 defines the conformance requirements for IEEE Std 1003.1-200x.
- Chapter 3 defines general terms used in IEEE Std 1003.1-200x.
- Chapter 4 describes general concepts used in IEEE Std 1003.1-200x.
- Chapter 5 describes the notation used to specify file input and output formats in this volume of IEEE Std 1003.1-200x and the Shell and Utilities volume of IEEE Std 1003.1-200x.
- Chapter 6 describes the portable character set and the process of character set definition.
- Chapter 7 describes the syntax for defining internationalization locales as well as the POSIX locale provided on all systems.
- Chapter 8 describes the use of environment variables for internationalization and other purposes.
- Chapter 9 describes the syntax of pattern matching using regular expressions employed by many utilities and matched by the *regcomp*( ) and *regexec*( ) functions.
- Chapter 10 describes files and devices found on all systems.
- Chapter 11 describes the asynchronous terminal interface for many of the functions in the System Interfaces volume of IEEE Std 1003.1-200x and the *stty* utility in the Shell and Utilities volume of IEEE Std 1003.1-200x.
- Chapter 12 describes the policies for command line argument construction and parsing.
- Chapter 13 defines the contents of headers which declare constants, macros, and data structures that are needed by programs using the services provided by the System Interfaces volume of IEEE Std 1003.1-200x.

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 C-Language Data Structure Member	**aiocb** *aio_lio_opcode*	

Reference	Example	Notes
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
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 1.5.1 (on page 6).

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*.

Note: A symbolic limit beginning with POSIX is treated differently, depending on context. In a C-language header, the symbol POSIX*string* (where *string* may contain underscores) is represented by the C identifier _POSIX*string*, with a leading underscore required to prevent ISO C standard name space pollution. However, in other contexts, such as languages other than C, the leading underscore is not used because this requirement does not exist.

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Part 7: Latin / Greek Alphabet
Part 8: Latin / Hebrew Alphabet
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Issue 4, Version 2

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