Linux Standard Base Core Specification 4.1

Linux Standard Base Core Specification 4.1
ISO/IEC 23360 Part 1:2010(E)
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Foreword

This is version 4.1 of the Linux Standard Base Core Specification. This specification is one of a series of volumes under the collective title *Linux Standard Base*:

- Core
- C++
- Desktop
- Languages
- Printing

Note that the Core, C++ and Desktop volumes consist of a generic volume augmented by an architecture-specific volume.

Status of this Document

This is a released specification. Other documents may supersede or augment this specification. A list of current Linux Standard Base (LSB) specifications is available at http://refspecs.linuxfoundation.org (http://refspecs.linuxfoundation.org/).

If you wish to make comments regarding this document in a manner that is tracked by the LSB project, please submit them using our public bug database at http://bugs.linuxbase.org. Please enter your feedback, carefully indicating the title of the section for which you are submitting feedback, and the volume and version of the specification where you found the problem, quoting the incorrect text if appropriate. If you are suggesting a new feature, please indicate what the problem you are trying to solve is. That is more important than the solution, in fact.

If you do not have or wish to create a bug database account then you can also e-mail feedback to <`lsb-discuss@lists.linuxfoundation.org`> (subscribe (http://lists.linux-foundation.org/mailman/listinfo/lsb-discuss), archives (http://lists.linux-foundation.org/pipermail/lsb-discuss/)), and arrangements will be made to transpose the comments to our public bug database.

Introduction

The LSB defines a binary interface for application programs that are compiled and packaged for LSB-conforming implementations on many different hardware architectures. A binary specification must include information specific to the computer processor architecture for which it is intended. To avoid the complexity of conditional descriptions, the specification has instead been divided into generic parts which are augmented by one of several architecture-specific parts, depending on the target processor architecture; the generic part will indicate when reference must be made to the architecture part, and vice versa.

This document should be used in conjunction with the documents it references. This document enumerates the system components it includes, but descriptions of those components may be included entirely or partly in this document, partly in other documents, or entirely in other reference documents. For example, the section that describes system service routines includes a list of the system routines supported in this interface, formal declarations of the data structures they use that are visible to applications, and a pointer to the underlying referenced specification for information about the syntax and semantics of each call. Only those routines not described in standards referenced by this document, or extensions to those standards, are described in the detail. Information referenced in this way is as much a part of this document as is the information explicitly included here.

The specification carries a version number of either the form $x.y$ or $x.y.z$. This version number carries the following meaning:

1. The first number (x) is the major version number. Versions sharing the same major version number shall be compatible in a backwards direction; that is, a newer version shall be compatible with an older version. Any deletion of a library results in a new major version number. Interfaces marked as deprecated may be removed from the specification at a major version change.

2. The second number (y) is the minor version number. Libraries and individual interfaces may be added, but not removed. Interfaces may be marked as deprecated at a minor version change. Other minor changes may be permitted at the discretion of the LSB workgroup.

3. The third number (z), if present, is the editorial level. Only editorial changes should be included in such versions.

Since this specification is a descriptive Application Binary Interface, and not a source level API specification, it is not possible to make a guarantee of 100% backward compatibility between major releases. However, it is the intent that those parts of the binary interface that are visible in the source level API will remain backward compatible from version to version, except where a feature marked as "Deprecated" in one release may be removed from a future release. Implementors are strongly encouraged to make use of symbol versioning to permit simultaneous support of applications conforming to different releases of this specification.

LSB is a trademark of the Linux Foundation. Developers of applications or implementations interested in using the trademark should see the Linux Foundation Certification Policy for details.

I Introductory Elements

1 Scope

1.1 General

The Linux Standard Base (LSB) defines a system interface for compiled applications and a minimal environment for support of installation scripts. Its purpose is to enable a uniform industry standard environment for high-volume applications conforming to the LSB.

These specifications are composed of two basic parts: A common specification ("LSB-generic" or "generic LSB"), ISO/IEC 23360 Part 1, describing those parts of the interface that remain constant across all implementations of the LSB, and an architecture-specific part ("LSB-arch") describing the parts of the interface that vary by processor architecture. Together, the LSB-generic and the relevant architecture-specific part of ISO/IEC 23360 for a single hardware architecture provide a complete interface specification for compiled application programs on systems that share a common hardware architecture.

ISO/IEC 23360 Part 1, the LSB-generic document, should be used in conjunction with an architecture-specific part. Whenever a section of the LSB-generic specification is supplemented by architecture-specific information, the LSB-generic document includes a reference to the architecture part. Architecture-specific parts of ISO/IEC 23360 may also contain additional information that is not referenced in the LSB-generic document.

The LSB contains both a set of Application Program Interfaces (APIs) and Application Binary Interfaces (ABIs). APIs may appear in the source code of portable applications, while the compiled binary of that application may use the larger set of ABIs. A conforming implementation provides all of the ABIs listed here. The compilation system may replace (e.g. by macro definition) certain APIs with calls to one or more of the underlying binary interfaces, and may insert calls to binary interfaces as needed.

The LSB is primarily a binary interface definition. Not all of the source level APIs available to applications may be contained in this specification.

1.2 Module Specific Scope

This is the Core module of the Linux Standard Base (LSB), ISO/IEC 23360 Part 1. This module provides the fundamental system interfaces, libraries, and runtime environment upon which all conforming applications and libraries depend.

Interfaces described in this part of ISO/IEC 23360 are mandatory except where explicitly listed otherwise. Core interfaces may be supplemented by other modules; all modules are built upon the core.

2 References

2.1 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

> **Note:** Where copies of a document are available on the World Wide Web, a Uniform Resource Locator (URL) is given for informative purposes only. This may point to a more recent copy of the referenced specification, or may be out of date. Reference copies of specifications at the revision level indicated may be found at the Linux Foundation's Reference Specifications (http://refspecs.freestandards.org) site.

Table 2-1 Normative References

Name	Title	URL
Filesystem Hierarchy Standard	Filesystem Hierarchy Standard (FHS) 2.3	http://www.pathname.com/fhs/
ISO C (1999)	ISO/IEC 9899: 1999, Programming Languages --C	
Itanium™ C++ ABI	Itanium™ C++ ABI (Revision 1.86)	http://refspecs.linuxfoundation.org/cxxabi-1.86.html
Large File Support	Large File Support	http://www.UNIX-systems.org/version2/whatsnew/lfs20mar.html
POSIX 1003.1-2001 (ISO/IEC 9945-2003)	ISO/IEC 9945-1:2003 Information technology -- Portable Operating System Interface (POSIX) -- Part 1: Base Definitions ISO/IEC 9945-2:2003 Information technology -- Portable Operating System Interface (POSIX) -- Part 2: System Interfaces ISO/IEC 9945-3:2003 Information technology -- Portable Operating System Interface (POSIX) -- Part 3: Shell and Utilities ISO/IEC 9945-4:2003 Information technology	http://www.unix.org/version3/

Name	Title	URL
	-- Portable Operating System Interface (POSIX) -- Part 4: Rationale Including Technical Cor. 1: 2004	
POSIX 1003.1-2008 (ISO/IEC 9945-2009)	Portable Operating System Interface (POSIX®) 2008 Edition / The Open Group Technical Standard Base Specifications, Issue 7	http://www.unix.org/version4/
SUSv2	CAE Specification, January 1997, System Interfaces and Headers (XSH),Issue 5 (ISBN: 1-85912-181-0, C606)	http://www.opengroup.org/publications/catalog/un.htm
SVID Issue 3	American Telephone and Telegraph Company, System V Interface Definition, Issue 3; Morristown, NJ, UNIX Press, 1989. (ISBN 0201566524)	
SVID Issue 4	System V Interface Definition, Fourth Edition	http://refspecs.linuxfoundation.org/svid4/
System V ABI	System V Application Binary Interface, Edition 4.1	http://www.sco.com/developers/devspecs/gabi41.pdf
System V ABI Update	System V Application Binary Interface - DRAFT - 17 December 2003	http://www.sco.com/developers/gabi/2003-12-17/contents.html
X/Open Curses	CAE Specification, May 1996, X/Open Curses, Issue 4, Version 2 (ISBN: 1-85912-171-3, C610), plus Corrigendum U018	http://www.opengroup.org/publications/catalog/un.htm

2.2 Informative References/Bibliography

In addition, the specifications listed below provide essential background information to implementors of this specification. These references are included for information only.

Table 2-2 Other References

Name	Title	URL
DWARF Debugging Information Format, Revision 2.0.0	DWARF Debugging Information Format, Revision 2.0.0 (July 27, 1993)	http://refspecs.linux-foundation.org/dwarf/dwarf-2.0.0.pdf
DWARF Debugging Information Format, Revision 3.0.0 (Draft)	DWARF Debugging Information Format, Revision 3.0.0 (Draft)	http://refspecs.linux-foundation.org/dwarf
IEC 60559/IEEE 754 Floating Point	IEC 60559:1989 Binary floating-point arithmetic for microprocessor systems	http://www.ieee.org/
ISO/IEC TR14652	ISO/IEC Technical Report 14652:2002 Specification method for cultural conventions	
ITU-T V.42	International Telecommunication Union Recommendation V.42 (2002): Error-correcting procedures for DCEs using asynchronous-to-synchronous conversionITUV	http://www.itu.int/rec/recommendation.asp?type=folders&lang=e&parent=T-REC-V.42
Li18nux Globalization Specification	LI18NUX 2000 Globalization Specification, Version 1.0 with Amendment 4	http://www.openi18n.org/docs/html/LI18NUX-2000-amd4.htm
Linux Allocated Device Registry	LINUX ALLOCATED DEVICES	http://www.lanana.org/docs/device-list/devices.txt
Mozilla's NSS SSL Reference	Mozilla's NSS SSL Reference	http://www.mozilla.org/projects/security/pki/nss/ref/ssl/
NSPR Reference	Mozilla's NSPR Reference	http://refspecs.linuxfoundation.org/NSPR_API_Reference/NSPR_API.html
PAM	Open Software Foundation, Request For Comments: 86.0 , October 1995, V. Samar & R.Schemers (SunSoft)	http://www.opengroup.org/tech/rfc/mirror-rfc/rfc86.0.txt
RFC 1321: The MD5 Message-Digest	IETF RFC 1321: The MD5 Message-Digest	http://www.ietf.org/rfc/rfc1321.txt

Name	Title	URL
Algorithm	Algorithm	
RFC 1831/1832 RPC & XDR	IETF RFC 1831 & 1832	http://www.ietf.org/
RFC 1833: Binding Protocols for ONC RPC Version 2	IETF RFC 1833: Binding Protocols for ONC RPC Version 2	http://www.ietf.org/rfc/rfc1833.txt
RFC 1950: ZLIB Compressed Data Format Specication	IETF RFC 1950: ZLIB Compressed Data Format Specification	http://www.ietf.org/rfc/rfc1950.txt
RFC 1951: DEFLATE Compressed Data Format Specification	IETF RFC 1951: DEFLATE Compressed Data Format Specification version 1.3	http://www.ietf.org/rfc/rfc1951.txt
RFC 1952: GZIP File Format Specification	IETF RFC 1952: GZIP file format specification version 4.3	http://www.ietf.org/rfc/rfc1952.txt
RFC 2440: OpenPGP Message Format	IETF RFC 2440: OpenPGP Message Format	http://www.ietf.org/rfc/rfc2440.txt
RFC 2821:Simple Mail Transfer Protocol	IETF RFC 2821: Simple Mail Transfer Protocol	http://www.ietf.org/rfc/rfc2821.txt
RFC 2822:Internet Message Format	IETF RFC 2822: Internet Message Format	http://www.ietf.org/rfc/rfc2822.txt
RFC 791:Internet Protocol	IETF RFC 791: Internet Protocol Specification	http://www.ietf.org/rfc/rfc791.txt
RPM Package Format	RPM Package Format V3.0	http://www.rpm.org/max-rpm/s1-rpm-file-format-rpm-file-format.html
SUSv2 Commands and Utilities	The Single UNIX Specification(SUS) Version 2, Commands and Utilities (XCU), Issue 5 (ISBN: 1-85912-191-8, C604)	http://www.opengroup.org/publications/catalog/un.htm
zlib Manual	zlib 1.2 Manual	http://www.gzip.org/zlib/

3 Requirements

3.1 Relevant Libraries

The libraries listed in Table 3-1 shall be available on a Linux Standard Base system, with the specified runtime names. The libraries listed in Table 3-2 are architecture specific, but shall be available on all LSB conforming systems. This list may be supplemented or amended by the relevant architecture specific part of ISO/IEC 23360.

Table 3-1 Standard Library Names

Library	Runtime Name
libdl	libdl.so.2
libcrypt	libcrypt.so.1
libz	libz.so.1
libncurses	libncurses.so.5
libutil	libutil.so.1
libpthread	libpthread.so.0
librt	librt.so.1
libpam	libpam.so.0
libgcc_s	libgcc_s.so.1

Table 3-2 Standard Library Names defined in the Architecture Specific Parts of ISO/IEC 23360

Library	Runtime Name
libm	See archLSB
libc	See archLSB
proginterp	See archLSB

These libraries will be in an implementation-defined directory which the dynamic linker shall search by default.

3.2 LSB Implementation Conformance

A conforming implementation is necessarily architecture specific, and must provide the interfaces specified by both the generic LSB Core specification (ISO/IEC 23360 Part 1) and the relevant architecture specific part of ISO/IEC 23360.

> **Rationale:** An implementation must provide *at least* the interfaces specified in these specifications. It may also provide additional interfaces.

A conforming implementation shall satisfy the following requirements:

• A processor architecture represents a family of related processors which may not have identical feature sets. The architecture specific parts of ISO/IEC 23360 that supplement this specification for a given target processor

architecture describe a minimum acceptable processor. The implementation shall provide all features of this processor, whether in hardware or through emulation transparent to the application.

- The implementation shall be capable of executing compiled applications having the format and using the system interfaces described in this document.

- The implementation shall provide libraries containing the interfaces specified by this document, and shall provide a dynamic linking mechanism that allows these interfaces to be attached to applications at runtime. All the interfaces shall behave as specified in this document.

- The map of virtual memory provided by the implementation shall conform to the requirements of this document.

- The implementation's low-level behavior with respect to function call linkage, system traps, signals, and other such activities shall conform to the formats described in this document.

- The implementation shall provide all of the mandatory interfaces in their entirety.

- The implementation may provide one or more of the optional interfaces. Each optional interface that is provided shall be provided in its entirety. The product documentation shall state which optional interfaces are provided.

- The implementation shall provide all files and utilities specified as part of this document in the format defined here and in other referenced documents. All commands and utilities shall behave as required by this document. The implementation shall also provide all mandatory components of an application's runtime environment that are included or referenced in this document.

- The implementation, when provided with standard data formats and values at a named interface, shall provide the behavior defined for those values and data formats at that interface. However, a conforming implementation may consist of components which are separately packaged and/or sold. For example, a vendor of a conforming implementation might sell the hardware, operating system, and windowing system as separately packaged items.

- The implementation may provide additional interfaces with different names. It may also provide additional behavior corresponding to data values outside the standard ranges, for standard named interfaces.

3.3 LSB Application Conformance

A conforming application is necessarily architecture specific, and must conform to both the generic LSB Core specification (ISO/IEC 23360 Part 1)and the relevant architecture specific part of ISO/IEC 23360.

A conforming application shall satisfy the following requirements:

- Its executable files shall be either shell scripts or object files in the format defined for the Object File Format system interface.

- Its object files shall participate in dynamic linking as defined in the Program Loading and Linking System interface.

- It shall employ only the instructions, traps, and other low-level facilities defined in the Low-Level System interface as being for use by applications.

- If it requires any optional interface defined in this document in order to be installed or to execute successfully, the requirement for that optional interface shall be stated in the application's documentation.

- It shall not use any interface or data format that is not required to be provided by a conforming implementation, unless:

  - If such an interface or data format is supplied by another application through direct invocation of that application during execution, that application shall be in turn an LSB conforming application.

  - The use of that interface or data format, as well as its source, shall be identified in the documentation of the application.

- It shall not use any values for a named interface that are reserved for vendor extensions.

A strictly conforming application shall not require or use any interface, facility, or implementation-defined extension that is not defined in this document in order to be installed or to execute successfully.

4 Terms and Definitions

For the purposes of this document, the terms given in *ISO/IEC Directives, Part 2, Annex H* and the following apply.

archLSB

Some LSB specification documents have both a generic, architecture-neutral part and an architecture-specific part. The latter describes elements whose definitions may be unique to a particular processor architecture. The term archLSB may be used in the generic part to refer to the corresponding section of the architecture-specific part.

Binary Standard, ABI

The total set of interfaces that are available to be used in the compiled binary code of a conforming application, including the run-time details such as calling conventions, binary format, C++ name mangling, etc.

Implementation-defined

Describes a value or behavior that is not defined by this document but is selected by an implementor. The value or behavior may vary among implementations that conform to this document. An application should not rely on the existence of the value or behavior. An application that relies on such a value or behavior cannot be assured to be portable across conforming implementations. The implementor shall document such a value or behavior so that it can be used correctly by an application.

Shell Script

A file that is read by an interpreter (e.g., awk). The first line of the shell script includes a reference to its interpreter binary.

Source Standard, API

The total set of interfaces that are available to be used in the source code of a conforming application. Due to translations, the Binary Standard and the Source Standard may contain some different interfaces.

Undefined

Describes the nature of a value or behavior not defined by this document which results from use of an invalid program construct or invalid data input. The value or behavior may vary among implementations that conform to this document. An application should not rely on the existence or validity of the value or behavior. An application that relies on any particular value or behavior cannot be assured to be portable across conforming implementations.

Unspecified

Describes the nature of a value or behavior not specified by this document which results from use of a valid program construct or valid data input. The value or behavior may vary among implementations that conform to this document. An application should not rely on the existence or validity of the value or behavior. An application that relies on any particular value or behavior cannot be assured to be portable across conforming implementations.

In addition, for the portions of this specification which build on IEEE Std 1003.1-2001, the definitions given in *IEEE Std 1003.1-2001, Base Definitions, Chapter 3* apply.

5 Documentation Conventions

Throughout this document, the following typographic conventions are used:

`function()`

> the name of a function

command

> the name of a command or utility

`CONSTANT`

> a constant value

`parameter`

> a parameter

`variable`

> a variable

Throughout this specification, several tables of interfaces are presented. Each entry in these tables has the following format:

name

> the name of the interface

(symver)

> An optional symbol version identifier, if required.

[*`refno`*]

> A reference number indexing the table of referenced specifications that follows this table.

For example,

forkpty(GLIBC_2.0) [SUSv3]

refers to the interface named `forkpty()` with symbol version `GLIBC_2.0` that is defined in the `SUSv3` reference.

> **Note:** For symbols with versions which differ between architectures, the symbol versions are defined in the architecture specific parts of ISO/IEC 23360 only.

6 Relationship To ISO/IEC 9945 POSIX

This specification includes many interfaces described in POSIX 1003.1-2001 (ISO/IEC 9945-2003). Unless otherwise specified, such interfaces should behave exactly as described in that specification. Any conflict between the requirements described here and the POSIX 1003.1-2001 (ISO/IEC 9945-2003) standard is unintentional, except as explicitly noted otherwise.

> **Note:** In addition to the differences noted inline in this specification, PDTR 24715 has extracted the differences between this specification and POSIX 1003.1-2001 (ISO/IEC 9945-2003) into a single place. It is the long term plan of the Linux Foundation to converge the LSB Core Specification with ISO/IEC 9945 POSIX.

The LSB Specification Authority is responsible for deciding the meaning of conformance to normative referenced standards in the LSB context. Problem Reports regarding underlying or referenced standards in any other context will be referred to the relevant maintenance body for that standard.

7 Relationship To Other Linux Foundation Specifications

The LSB is the base for several other specification projects under the umbrella of the Linux Foundation (LF). This specification is the foundation, and other specifications build on the interfaces defined here. However, beyond those specifications listed as Normative References, this specification has no dependencies on other LF projects.

II Executable And Linking Format (ELF)

8 Introduction

Executable and Linking Format (ELF) defines the object format for compiled applications. This specification supplements the information found in System V ABI Update and is intended to document additions made since the publication of that document.

9 Low Level System Information

9.1 Operating System Interface

LSB-conforming applications shall assume that stack, heap and other allocated memory regions will be non-executable. The application must take steps to make them executable if needed.

9.2 Machine Interface

9.2.1 Data Representation

LSB-conforming applications shall use the data representation as defined in the Arcitecture specific ELF documents.

9.2.1.1 Fundamental Types

In addition to the fundamental types specified in the relevant architecture specific part of ISO/IEC 23360, a 1 byte data type is defined here.

Table 9-1 Scalar Types

Type	C	C++	`sizeof`	Align-ment (bytes)	Architec-ture Rep-resenta-tion
Integral	_Bool	bool	1	1	byte

10 Object Format

10.1 Object Files

LSB-conforming implementations shall support the object file Executable and Linking Format (ELF), which is defined by the following documents:

• System V ABI

• System V ABI Update

• this specification

• the relevant architecture specific part of ISO/IEC 23360

Conforming implementations may also support other unspecified object file formats.

10.2 Sections

10.2.1 Introduction

As described in System V ABI, an ELF object file contains a number of *sections*.

10.2.2 Sections Types

The section header table is an array of `Elf32_Shdr` or `Elf64_Shdr` structures as described in System V ABI. The `sh_type` member shall be either a value from Table 10-1, drawn from the System V ABI, or one of the additional values specified in Table 10-2.

A section header's `sh_type` member specifies the sections's semantics.

10.2.2.1 ELF Section Types

The following section types are defined in the System V ABI and the System V ABI Update.

Table 10-1 ELF Section Types

Name	Value	Description
SHT_DYNAMIC	0x6	The section holds information for dynamic linking. Currently, an object file shall have only one dynamic section, but this restriction may be relaxed in the future. See `Dynamic Section' in Chapter 5 of System V ABI Update for details.
SHT_DYNSYM	0xb	This section holds a minimal set of symbols adequate for dynamic linking. See also SHT_SYMTAB. Currently, an object file

Name	Value	Description
		may have either a section of SHT_SYMTAB type or a section of SHT_DYNSYM type, but not both. This restriction may be relaxed in the future.
SHT_FINI_ARRAY	0xf	This section contains an array of pointers to termination functions, as described in `Initialization and Termination Functions' in Chapter 5 of System V ABI Update. Each pointer in the array is taken as a parameterless procedure with a void return.
SHT_HASH	0x5	The section holds a symbol hash table. Currently, an object file shall have only one hash table, but this restriction may be relaxed in the future. See `Hash Table' in Chapter 5 of System V ABI Update for details.
SHT_INIT_ARRAY	0xe	This section contains an array of pointers to initialization functions, as described in `Initialization and Termination Functions' in Chapter 5 of System V ABI Update. Each pointer in the array is taken as a parameterless procedure with a void return.
SHT_NOBITS	0x8	A section of this type occupies no space in the file but otherwise resembles SHT_PROGBITS. Although this section contains no bytes, the sh_offset member contains the conceptual file offset.
SHT_NOTE	0x7	The section holds in-

Name	Value	Description
		formation that marks the file in some way. See `Note Section' in Chapter 5 of System V ABI Update for details.
SHT_NULL	0x0	This value marks the section header as inactive; it does not have an associated section. Other members of the section header have undefined values.
SHT_PREINIT_ARRAY	0x10	This section contains an array of pointers to functions that are invoked before all other initialization functions, as described in `Initialization and Termination Functions' in Chapter 5 of System V ABI Update. Each pointer in the array is taken as a parameterless proceure with a void return.
SHT_PROGBITS	0x1	The section holds information defined by the program, whose format and meaning are determined solely by the program.
SHT_REL	0x9	The section holds relocation entries without explicit addends, such as type Elf32_Rel for the 32-bit class of object files or type Elf64_Rel for the 64-bit class of object files. An object file may have multiple relocation sections. See `Relocation' in Chapter 4 of System V ABI Update for details.
SHT_RELA	0x4	The section holds relocation entries with explicit addends, such as type Elf32_Rela for the 32-bit class of object files or type Elf64_Rela

Name	Value	Description
		for the 64-bit class of object files. An object file may have multiple relocation sections. See `Relocation' in Chapter 4 of System V ABI Update for details.
SHT_STRTAB	0x3	The section holds a string table. An object file may have multiple string table sections. See `String Table' in Chapter 4 of System V ABI Update for details.
SHT_SYMTAB	0x2	This section holds a symbol table. Currently, an object file may have either a section of SHT_SYMTAB type or a section of SHT_DYNSYM type, but not both. This restriction may be relaxed in the future. Typically, SHT_SYMTAB provides symbols for link editing, though it may also be used for dynamic linking. As a complete symbol table, it may contain many symbols unnecessary for dynamic linking.

10.2.2.2 Additional Section Types

The following additional section types are defined here.

Table 10-2 Additional Section Types

Name	Value	Description
SHT_GNU_verdef	0x6ffffffd	This section contains the symbol versions that are provided.
SHT_GNU_verneed	0x6ffffffe	This section contains the symbol versions that are required.
SHT_GNU_versym	0x6fffffff	This section contains the Symbol Version Table.

10.3 Special Sections

10.3.1 Special Sections

Various sections hold program and control information. Sections in the lists below are used by the system and have the indicated types and attributes.

10.3.1.1 ELF Special Sections

The following sections are defined in the System V ABI and the System V ABI Update.

Table 10-3 ELF Special Sections

Name	Type	Attributes
.bss	SHT_NOBITS	SHF_ALLOC+SHF_WRITE
.comment	SHT_PROGBITS	0
.data	SHT_PROGBITS	SHF_ALLOC+SHF_WRITE
.data1	SHT_PROGBITS	SHF_ALLOC+SHF_WRITE
.debug	SHT_PROGBITS	0
.dynamic	SHT_DYNAMIC	SHF_ALLOC+SHF_WRITE
.dynstr	SHT_STRTAB	SHF_ALLOC
.dynsym	SHT_DYNSYM	SHF_ALLOC
.fini	SHT_PROGBITS	SHF_ALLOC+SHF_EXECINSTR
.fini_array	SHT_FINI_ARRAY	SHF_ALLOC+SHF_WRITE
.hash	SHT_HASH	SHF_ALLOC
.init	SHT_PROGBITS	SHF_ALLOC+SHF_EXECINSTR
.init_array	SHT_INIT_ARRAY	SHF_ALLOC+SHF_WRITE
.interp	SHT_PROGBITS	SHF_ALLOC
.line	SHT_PROGBITS	0
.note	SHT_NOTE	0
.preinit_array	SHT_PREINIT_ARRAY	SHF_ALLOC+SHF_WRITE
.rodata	SHT_PROGBITS	SHF_ALLOC+SHF_MERGE+SHF_STRINGS
.rodata1	SHT_PROGBITS	SHF_ALLOC+SHF_ME

Name	Type	Attributes
		RGE+SHF_STRINGS
.shstrtab	SHT_STRTAB	0
.strtab	SHT_STRTAB	SHF_ALLOC
.symtab	SHT_SYMTAB	SHF_ALLOC
.tbss	SHT_NOBITS	SHF_ALLOC+SHF_WRITE+SHF_TLS
.tdata	SHT_PROGBITS	SHF_ALLOC+SHF_WRITE+SHF_TLS
.text	SHT_PROGBITS	SHF_ALLOC+SHF_EXECINSTR

.bss

> This section holds data that contributes to the program's memory image. The program may treat this data as uninitialized. However, the system shall initialize this data with zeroes when the program begins to run. The section occupies no file space, as indicated by the section type, SHT_NOBITS.

.comment

> This section holds version control information.

.data

> This section holds initialized data that contribute to the program's memory image.

.data1

> This section holds initialized data that contribute to the program's memory image.

.debug

> This section holds information for symbolic debugging. The contents are unspecified. All section names with the prefix .debug hold information for symbolic debugging. The contents of these sections are unspecified.

.dynamic

> This section holds dynamic linking information. The section's attributes will include the SHF_ALLOC bit. Whether the SHF_WRITE bit is set is processor specific. See Chapter 5 of System V ABI Update for more information.

.dynstr

> This section holds strings needed for dynamic linking, most commonly the strings that represent the names associated with symbol table entries. See Chapter 5 of System V ABI Update for more information.

.dynsym

> This section holds the dynamic linking symbol table, as described in `Symbol Table' of System V ABI Update.

.fini

> This section holds executable instructions that contribute to the process termination code. That is, when a program exits normally, the system arranges to execute the code in this section.

.fini_array

> This section holds an array of function pointers that contributes to a single termination array for the executable or shared object containing the section.

.hash

> This section holds a symbol hash table. See `Hash Table' in Chapter 5 of System V ABI Update for more information.

.init

> This section holds executable instructions that contribute to the process initialization code. When a program starts to run, the system arranges to execute the code in this section before calling the main program entry point (called main for C programs).

.init_array

> This section holds an array of function pointers that contributes to a single initialization array for the executable or shared object containing the section.

.interp

> This section holds the path name of a program interpreter. If the file has a loadable segment that includes relocation, the sections' attributes will include the SHF_ALLOC bit; otherwise, that bit will be off. See Chapter 5 of System V ABI Update for more information.

.line

> This section holds line number information for symbolic debugging, which describes the correspondence between the source program and the machine code. The contents are unspecified.

.note

> This section holds information in the format that `Note Section' in Chapter 5 of System V ABI Update describes.

.preinit_array

> This section holds an array of function pointers that contributes to a single pre-initialization array for the executable or shared object containing the section.

.rodata

> This section holds read-only data that typically contribute to a non-writable segment in the process image. See `Program Header' in Chapter 5 of System V ABI Update for more information.

.rodata1

> This section holds read-only data that typically contribute to a non-writable segment in the process image. See `Program Header' in Chapter 5 of System V ABI Update for more information.

.shstrtab

> This section holds section names.

.strtab

> This section holds strings, most commonly the strings that represent the names associated with symbol table entries. If the file has a loadable segment that includes the symbol string table, the section's attributes will include the SHF_ALLOC bit; otherwise, that bit will be off.

.symtab

> This section holds a symbol table, as `Symbol Table' in Chapter 4 of System V ABI Update describes. If the file has a loadable segment that includes the symbol table, the section's attributes will include the SHF_ALLOC bit; otherwise, that bit will be off.

.tbss

> This section holds uninitialized thread-local data that contribute to the program's memory image. By definition, the system initializes the data with zeros when the data is instantiated for each new execution flow. The section occupies no file space, as indicated by the section type, SHT_NOBITS. Implementations need not support thread-local storage.

.tdata

> This section holds initialized thread-local data that contributes to the program's memory image. A copy of its contents is instantiated by the system for each new execution flow. Implementations need not support thread-local storage.

.text

> This section holds the `text', or executable instructions, of a program.

10.3.1.2 Additional Special Sections

Object files in an LSB conforming application may also contain one or more of the additional special sections described below.

Table 10-4 Additional Special Sections

Name	Type	Attributes
.ctors	SHT_PROGBITS	SHF_ALLOC+SHF_WRITE
.data.rel.ro	SHT_PROGBITS	SHF_ALLOC+SHF_WRITE
.dtors	SHT_PROGBITS	SHF_ALLOC+SHF_WRITE
.eh_frame	SHT_PROGBITS	SHF_ALLOC

Name	Type	Attributes
.eh_frame_hdr	SHT_PROGBITS	SHF_ALLOC
.gcc_except_table	SHT_PROGBITS	SHF_ALLOC
.gnu.version	SHT_GNU_versym	SHF_ALLOC
.gnu.version_d	SHT_GNU_verdef	SHF_ALLOC
.gnu.version_r	SHT_GNU_verneed	SHF_ALLOC
.got.plt	SHT_PROGBITS	SHF_ALLOC+SHF_WRITE
.jcr	SHT_PROGBITS	SHF_ALLOC+SHF_WRITE
.note.ABI-tag	SHT_NOTE	SHF_ALLOC
.stab	SHT_PROGBITS	0
.stabstr	SHT_STRTAB	0

.ctors

> This section contains a list of global constructor function pointers.

.data.rel.ro

> This section holds initialized data that contribute to the program's memory image. This section may be made read-only after relocations have been applied.

.dtors

> This section contains a list of global destructor function pointers.

.eh_frame

> This section contains information necessary for frame unwinding during exception handling. See Section 10.6.1.

.eh_frame_hdr

> This section contains a pointer to the .eh_frame section which is accessible to the runtime support code of a C++ application. This section may also contain a binary search table which may be used by the runtime support code to more efficiently access records in the .eh_frame section. See Section 10.6.2.

.gcc_except_table

> This section holds Language Specific Data.

.gnu.version

> This section contains the Symbol Version Table. See Section 10.7.2.

.gnu.version_d

> This section contains the Version Definitions. See Section 10.7.3.

.gnu.version_r

   This section contains the Version Requirements. See Section 10.7.4.

.got.plt

   This section holds the read-only portion of the GLobal Offset Table. This section may be made read-only after relocations have been applied.

.jcr

   This section contains information necessary for registering compiled Java classes. The contents are compiler-specific and used by compiler initialization functions.

.note.ABI-tag

   Specify ABI details. See Section 10.8.

.stab

   This section contains debugging information. The contents are not specified as part of the LSB.

.stabstr

   This section contains strings associated with the debugging infomation contained in the .stab section.

10.4 Symbol Mapping

10.4.1 Introduction

Symbols in a source program are translated by the compilation system into symbols that exist in the object file.

10.4.1.1 C Language

External C symbols shall be unchanged in an object file's symbol table.

10.5 DWARF Extensions

The LSB does not specify debugging information, however, some additional sections contain information which is encoded using the the encoding as specified by DWARF Debugging Information Format, Revision 2.0.0 with extensions defined here.

> **Note:** The extensions specified here also exist in DWARF Debugging Information Format, Revision 3.0.0 (Draft). It is expected that future versions of the LSB will reference the final version of that document, and that the definitions here will be taken from that document instead of being specified here.

10.5.1 DWARF Exception Header Encoding

The DWARF Exception Header Encoding is used to describe the type of data used in the `.eh_frame` and `.eh_frame_hdr` section. The upper 4 bits indicate how the value is to be applied. The lower 4 bits indicate the format of the data.

Table 10-5 DWARF Exception Header value format

Name	Value	Meaning

Name	Value	Meaning
DW_EH_PE_absptr	0x00	The Value is a literal pointer whose size is determined by the architecture.
DW_EH_PE_uleb128	0x01	Unsigned value is encoded using the Little Endian Base 128 (LEB128) as defined by DWARF Debugging Information Format, Revision 2.0.0.
DW_EH_PE_udata2	0x02	A 2 bytes unsigned value.
DW_EH_PE_udata4	0x03	A 4 bytes unsigned value.
DW_EH_PE_udata8	0x04	An 8 bytes unsigned value.
DW_EH_PE_sleb128	0x09	Signed value is encoded using the Little Endian Base 128 (LEB128) as defined by DWARF Debugging Information Format, Revision 2.0.0.
DW_EH_PE_sdata2	0x0A	A 2 bytes signed value.
DW_EH_PE_sdata4	0x0B	A 4 bytes signed value.
DW_EH_PE_sdata8	0x0C	An 8 bytes signed value.

Table 10-6 DWARF Exception Header application

Name	Value	Meaning
DW_EH_PE_pcrel	0x10	Value is relative to the current program counter.
DW_EH_PE_textrel	0x20	Value is relative to the beginning of the .text section.
DW_EH_PE_datarel	0x30	Value is relative to the beginning of the .got or .eh_frame_hdr section.
DW_EH_PE_funcrel	0x40	Value is relative to the beginning of the function.
DW_EH_PE_aligned	0x50	Value is aligned to an address unit sized

Name	Value	Meaning
		boundary.

One special encoding, 0xff (DW_EH_PE_omit), shall be used to indicate that no value ispresent.

10.5.2 DWARF CFI Extensions

In addition to the Call Frame Instructions defined in section 6.4.2 of DWARF Debugging Information Format, Revision 2.0.0, the following additional Call Frame Instructions may also be used.

Table 10-7 Additional DWARF Call Frame Instructions

Name	Value	Meaning
DW_CFA_expression	0x10	The DW_CFA_expression instruction takes two operands: an unsigned LEB128 value representing a register number, and a DW_FORM_block value representing a DWARF expression. The required action is to establish the DWARF expression as the means by which the address in which the given register contents are found may be computed. The value of the CFA is pushed on the DWARF evaluation stack prior to execution of the DWARF expression. The DW_OP_call2, DW_OP_call4, DW_OP_call_ref and DW_OP_push_object_address DWARF operators (see Section 2.4.1 of DWARF Debugging Information Format, Revision 2.0.0) cannot be used in such a DWARF expression.
DW_CFA_offset_extended_sf	0x11	The DW_CFA_offset_extended_sf instruction takes two operands: an unsigned LEB128 value

Name	Value	Meaning
		representing a register number and a signed LEB128 factored offset. This instruction is identical to DW_CFA_offset_extended except that the second operand is signed.
DW_CFA_def_cfa_sf	0x12	The DW_CFA_def_cfa_sf instruction takes two operands: an unsigned LEB128 value representing a register number and a signed LEB128 factored offset. This instruction is identical to DW_CFA_def_cfa except that the second operand is signed and factored.
DW_CFA_def_cfa_offset_sf	0x13	The DW_CFA_def_cfa_offset_sf instruction takes a signed LEB128 operand representing a factored offset. This instruction is identical to DW_CFA_def_cfa_offset except that the operand is signed and factored.
DW_CFA_GNU_args_size	0x2e	The DW_CFA_GNU_args_size instruction takes an unsigned LEB128 operand representing an argument size. This instruction specifies the total of the size of the arguments which have been pushed onto the stack.
DW_CFA_GNU_negative_offset_extended	0x2f	The DW_CFA_def_cfa_sf instruction takes two operands: an unsigned LEB128 value

Name	Value	Meaning
		representing a register number and an unsigned LEB128 which represents the magnitude of the offset. This instruction is identical to DW_CFA_offset_exten ded_sf except that the operand is subtracted to produce the offset. This instructions is obsoleted by DW_CFA_offset_exten ded_sf.

10.6 Exception Frames

When using languages that support exceptions, such as C++, additional information must be provided to the runtime environment that describes the call frames that must be unwound during the processing of an exception. This information is contained in the special sections `.eh_frame` and `.eh_framehdr`.

> **Note:** The format of the `.eh_frame` section is similar in format and purpose to the `.debug_frame` section which is specified in DWARF Debugging Information Format, Revision 3.0.0 (Draft). Readers are advised that there are some subtle difference, and care should be taken when comparing the two sections.

10.6.1 The `.eh_frame` section

The `.eh_frame` section shall contain 1 or more Call Frame Information (CFI) records. The number of records present shall be determined by size of the section as contained in the section header. Each CFI record contains a Common Information Entry (CIE) record followed by 1 or more Frame Description Entry (FDE) records. Both CIEs and FDEs shall be aligned to an addressing unit sized boundary.

Table 10-8 Call Frame Information Format

Common Information Entry Record
Frame Description Entry Record(s)

10.6.1.1 The Common Information Entry Format

Table 10-9 Common Information Entry Format

Length	Required
Extended Length	Optional
CIE ID	Required
Version	Required
Augmentation String	Required

Code Alignment Factor	Required
Data Alignment Factor	Required
Return Address Register	Required
Augmentation Data Length	Optional
Augmentation Data	Optional
Initial Instructions	Required
Padding	

Length

A 4 byte unsigned value indicating the length in bytes of the CIE structure, not including the `Length` field itself. If `Length` contains the value 0xffffffff, then the length is contained in the `Extended Length` field. If `Length` contains the value 0, then this CIE shall be considered a terminator and processing shall end.

Extended Length

A 8 byte unsigned value indicating the length in bytes of the CIE structure, not including the `Length` and `Extended Length` fields.

CIE ID

A 4 byte unsigned value that is used to distinguish CIE records from FDE records. This value shall always be 0, which indicates this record is a CIE.

Version

A 1 byte value that identifies the version number of the frame information structure. This value shall be 1.

Augmentation String

This value is a NUL terminated string that identifies the augmentation to the CIE or to the FDEs associated with this CIE. A zero length string indicates that no augmentation data is present. The augmentation string is case sensitive and shall be interpreted as described below.

Code Alignment Factor

An unsigned LEB128 encoded value that is factored out of all advance location instructions that are associated with this CIE or its FDEs. This value shall be multiplied by the delta argument of an adavance location instruction to obtain the new location value.

Data Alignment Factor

A signed LEB128 encoded value that is factored out of all offset instructions that are associated with this CIE or its FDEs. This value shall be multiplied by the register offset argument of an offset instruction to obtain the new offset value.

Augmentation Length

An unsigned LEB128 encoded value indicating the length in bytes of the Augmentation Data. This field is only present if the Augmentation String contains the character 'z'.

Augmentation Data

A block of data whose contents are defined by the contents of the Augmentation String as described below. This field is only present if the Augmentation String contains the character 'z'. The size of this data is given by the Augentation Length.

Initial Instructions

Initial set of Call Frame Instructions. The number of instructions is determined by the remaining space in the CIE record.

Padding

Extra bytes to align the CIE structure to an addressing unit size boundary.

10.6.1.1.1 Augmentation String Format

The Agumentation String indicates the presence of some optional fields, and how those fields should be intepreted. This string is case sensitive. Each character in the augmentation string in the CIE can be interpreted as below:

'z'

A 'z' may be present as the first character of the string. If present, the Augmentation Data field shall be present. The contents of the Augmentation Data shall be intepreted according to other characters in the Augmentation String.

'L'

A 'L' may be present at any position after the first character of the string. This character may only be present if 'z' is the first character of the string. If present, it indicates the presence of one argument in the Augmentation Data of the CIE, and a corresponding argument in the Augmentation Data of the FDE. The argument in the Augmentation Data of the CIE is 1-byte and represents the pointer encoding used for the argument in the Augmentation Data of the FDE, which is the address of a language-specific data area (LSDA). The size of the LSDA pointer is specified by the pointer encoding used.

'P'

A 'P' may be present at any position after the first character of the string. This character may only be present if 'z' is the first character of the string. If present, it indicates the presence of two arguments in the Augmentation Data of the CIE. The first argument is 1-byte and represents the pointer encoding used for the second argument, which is the address of a *personality routine* handler. The personality routine is used to handle language and vendor-specific tasks. The system unwind library interface accesses the language-specific exception handling semantics via the pointer to the personality routine. The personality routine does not have an ABI-specific name. The size of the personality routine pointer is specified by the pointer encoding used.

'R'

A 'R' may be present at any position after the first character of the string. This character may only be present if 'z' is the first character of the string. If present, The Augmentation Data shall include a 1 byte argument that represents the pointer encoding for the address pointers used in the FDE.

10.6.1.2 The Frame Description Entry Format

Table 10-10 Frame Description Entry Format

Length	Required
Extended Length	Optional
CIE Pointer	Required
PC Begin	Required
PC Range	Required
Augmentation Data Length	Optional
Augmentation Data	Optional
Call Frame Instructions	Required
Padding	

Length

A 4 byte unsigned value indicating the length in bytes of the CIE structure, not including the *Length* field itself. If *Length* contains the value 0xffffffff, then the length is contained the *Extended Length* field. If *Length* contains the value 0, then this CIE shall be considered a terminator and processing shall end.

Extended Length

A 8 byte unsigned value indicating the length in bytes of the CIE structure, not including the *Length* field itself.

CIE Pointer

A 4 byte unsigned value that when subtracted from the offset of the the CIE Pointer in the current FDE yields the offset of the start of the associated CIE. This value shall never be 0.

PC Begin

An encoded value that indicates the address of the initial location associated with this FDE. The encoding format is specified in the Augmentation Data.

PC Range

An absolute value that indicates the number of bytes of instructions associated with this FDE.

Augmentation Length

An unsigned LEB128 encoded value indicating the length in bytes of the Augmentation Data. This field is only present if the Augmentation String in the associated CIE contains the character 'z'.

Augmentation Data

A block of data whose contents are defined by the contents of the Augmentation String in the associated CIE as described above. This field is only present if the Augmentation String in the associated CIE contains the character 'z'. The size of this data is given by the Augentation Length.

```
Call Frame Instructions
```

A set of Call Frame Instructions.

```
Padding
```

Extra bytes to align the FDE structure to an addressing unit size boundary.

10.6.2 The `.eh_frame_hdr` section

The `.eh_frame_hdr` section contains additional information about the `.eh_frame` section. A pointer to the start of the `.eh_frame` data, and optionally, a binary search table of pointers to the `.eh_frame` records are found in this section.

Data in this section is encoded according to Section 10.5.1.

Table 10-11 `.eh_frame_hdr` Section Format

Encoding	Field
unsigned byte	version
unsigned byte	eh_frame_ptr_enc
unsigned byte	fde_count_enc
unsigned byte	table_enc
encoded	eh_frame_ptr
encoded	fde_count
	binary search table

version

Version of the `.eh_frame_hdr` format. This value shall be 1.

eh_frame_ptr_enc

The encoding format of the eh_frame_ptr field.

fde_count_enc

The encoding format of the fde_count field. A value of DW_EH_PE_omit indicates the binary search table is not present.

table_enc

The encoding format of the entries in the binary search table. A value of DW_EH_PE_omit indicates the binary search table is not present.

eh_frame_ptr

The encoded value of the pointer to the start of the `.eh_frame` section.

fde_count

The encoded value of the count of entries in the binary search table.

binary search table

A binary search table containing fde_count entries. Each entry of the table consist of two encoded values, the initial location, and the address. The entries are sorted in an increasing order by the initial location value.

10.7 Symbol Versioning

10.7.1 Introduction

This chapter describes the Symbol Versioning mechanism. All ELF objects may provide or depend on versioned symbols. Symbol Versioning is implemented by 3 section types: SHT_GNU_versym, SHT_GNU_verdef, and SHT_GNU_verneed.

The prefix Elfxx in the following descriptions and code fragments stands for either "Elf32" or "Elf64", depending on the architecture.

Versions are described by strings. The structures that are used for symbol versions also contain a member that holds the ELF hashing values of the strings. This allows for more efficient processing.

10.7.2 Symbol Version Table

The special section .gnu.version which has a section type of SHT_GNU_versym shall contain the Symbol Version Table. This section shall have the same number of entries as the Dynamic Symbol Table in the .dynsym section.

The .gnu.version section shall contain an array of elements of type Elfxx_Half. Each entry specifies the version defined for or required by the corresponding symbol in the Dynamic Symbol Table.

The values in the Symbol Version Table are specific to the object in which they are located. These values are identifiers that are provided by the the *vna_other* member of the Elfxx_Vernaux structure or the *vd_ndx* member of the Elfxx_Verdef structure.

The values 0 and 1 are reserved.

0

> The symbol is local, not available outside the object.

1

> The symbol is defined in this object and is globally available.

All other values are used to identify version strings located in one of the other Symbol Version sections. The value itself is not the version associated with the symbol. The string identified by the value defines the version of the symbol.

10.7.3 Version Definitions

The special section .gnu.version_d which has a section type of SHT_GNU_verdef shall contain symbol version definitions. The number of entries in this section shall be contained in the DT_VERDEFNUM entry of the Dynamic Section .dynamic. The sh_link member of the section header (see figure 4-8 in the System V ABI) shall point to the section that contains the strings referenced by this section.

The section shall contain an array of Elfxx_Verdef structures, as described in Figure 10-1, optionally followed by an array of Elfxx_Verdaux structures, as defined in Figure 10-2.

```
typedef struct {
        Elfxx_Half      vd_version;
        Elfxx_Half      vd_flags;
        Elfxx_Half      vd_ndx;
        Elfxx_Half      vd_cnt;
        Elfxx_Word      vd_hash;
```

```
        Elfxx_Word      vd_aux;
        Elfxx_Word      vd_next;
} Elfxx_Verdef;
```

Figure 10-1 Version Definition Entries

vd_version

> Version revision. This field shall be set to 1.

vd_flags

> Version information flag bitmask.

vd_ndx

> Version index numeric value referencing the SHT_GNU_versym section.

vd_cnt

> Number of associated verdaux array entries.

vd_hash

> Version name hash value (ELF hash function).

vd_aux

> Offset in bytes to a corresponding entry in an array of Elfxx_Verdaux structures as defined in Figure 10-2

vd_next

> Offset to the next verdef entry, in bytes.

```
typedef struct {
        Elfxx_Word      vda_name;
        Elfxx_Word      vda_next;
} Elfxx_Verdaux;
```

Figure 10-2 Version Definition Auxiliary Entries

vda_name

> Offset to the version or dependency name string in the section header, in bytes.

vda_next

> Offset to the next verdaux entry, in bytes.

10.7.4 Version Requirements

The special section .gnu.version_r which has a section type of SHT_GNU_verneed shall contain required symbol version definitions. The number of entries in this section shall be contained in the DT_VERNEEDNUM entry of the Dynamic Section .dynamic. The *sh_link* member of the section header (see figure 4-8 in System V ABI) shall point to the section that contains the strings referenced by this section.

The section shall contain an array of Elfxx_Verneed structures, as described in Figure 10-3, optionally followed by an array of Elfxx_Vernaux structures, as defined in Figure 10-4.

```
typedef struct {
        Elfxx_Half      vn_version;
        Elfxx_Half      vn_cnt;
```

```
        Elfxx_Word      vn_file;
        Elfxx_Word      vn_aux;
        Elfxx_Word      vn_next;
} Elfxx_Verneed;
```

Figure 10-3 Version Needed Entries

vn_version

> Version of structure. This value is currently set to 1, and will be reset if the versioning implementation is incompatibly altered.

vn_cnt

> Number of associated verneed array entries.

vn_file

> Offset to the file name string in the section header, in bytes.

vn_aux

> Offset to a corresponding entry in the vernaux array, in bytes.

vn_next

> Offset to the next verneed entry, in bytes.

```
typedef struct {
        Elfxx_Word      vna_hash;
        Elfxx_Half      vna_flags;
        Elfxx_Half      vna_other;
        Elfxx_Word      vna_name;
        Elfxx_Word      vna_next;
} Elfxx_Vernaux;
```

Figure 10-4 Version Needed Auxiliary Entries

vna_hash

> Dependency name hash value (ELF hash function).

vna_flags

> Dependency information flag bitmask.

vna_other

> Object file version identifier used in the .gnu.version symbol version array. Bit number 15 controls whether or not the object is hidden; if this bit is set, the object cannot be used and the static linker will ignore the symbol's presence in the object.

vna_name

> Offset to the dependency name string in the section header, in bytes.

vna_next

> Offset to the next vernaux entry, in bytes.

10.7.5 Startup Sequence

When loading a sharable object the system shall analyze version definition data from the loaded object to assure that it meets the version requirements of the calling object. This step is referred to as definition testing. The dynamic loader

shall retrieve the entries in the caller's `Elfxx_Verneed` array and attempt to find matching definition information in the loaded `Elfxx_Verdef` table.

Each object and dependency shall be tested in turn. If a symbol definition is missing and the `vna_flags` bit for `VER_FLG_WEAK` is not set, the loader shall return an error and exit. If the `vna_flags` bit for `VER_FLG_WEAK` is set in the `Elfxx_Vernaux` entry, and the loader shall issue a warning and continue operation.

When the versions referenced by undefined symbols in the loaded object are found, version availability is certified. The test completes without error and the object shall be made available.

10.7.6 Symbol Resolution

When symbol versioning is used in an object, relocations extend definition testing beyond the simple match of symbol name strings: the version of the reference shall also equal the name of the definition.

The same index that is used in the symbol table can be referenced in the `SHT_GNU_versym` section, and the value of this index is then used to acquire name data. The corresponding requirement string is retrieved from the `Elfxx_Verneed` array, and likewise, the corresponding definition string from the `Elfxx_Verdef` table.

If the high order bit (bit number 15) of the version symbolis set, the object cannot be used and the static linker shall ignore the symbol's presence in the object.

When an object with a reference and an object with the definition are being linked, the following rules shall govern the result:

- The object with the reference and the object with the definitions both use versioning. All described matching is processed in this case. A fatal error shall be triggered when no matching definition can be found in the object whose name is the one referenced by the *vn_name* element in the `Elfxx_Verneed` entry.

- The object with the reference does not use versioning, while the object with the definitions does. In this instance, only the definitions with index numbers 1 and 2 will be used in the reference match, the same identified by the static linker as the base definition. In cases where the static linker was not used, such as in calls to `dlopen()`, a version that does not have the base definition index shall be acceptable if it is the only version for which the symbol is defined.

- The object with the reference uses versioning, but the object with the definitions specifies none. A matching symbol shall be accepted in this case. A fatal error shall be triggered if a corruption in the required symbols list obscures an outdated object file and causes a match on the object filename in the `Elfxx_Verneed` entry.

- Neither the object with the reference nor the object with the definitions use versioning. The behavior in this instance shall default to pre-existing symbol rules.

10.8 ABI note tag

Every executable shall contain a section named `.note.ABI-tag` of type `SHT_NOTE`. This section is structured as a note section as documented in the ELF spec. The section shall contain at least the following entry. The `name` field

(`namesz/name`) contains the string "`GNU`". The `type` field shall be 1. The `descsz` field shall be at least 16, and the first 16 bytes of the `desc` field shall be as follows.

The first 32-bit word of the `desc` field shall be 0 (this signifies a Linux executable). The second, third, and fourth 32-bit words of the `desc` field contain the earliest compatible kernel version. For example, if the 3 words are 2, 2, and 5, this signifies a 2.2.5 kernel.

11 Dynamic Linking

11.1 Program Loading and Dynamic Linking

LSB-conforming implementations shall support the object file information and system actions that create running programs as specified in the System V ABI and System V ABI Update and as further required by this specification and the relevant architecture specific part of ISO/IEC 23360.

Any shared object that is loaded shall contain sufficient DT_NEEDED records to satisfy the symbols on the shared library.

11.2 Program Header

In addition to the Segment Types defined in the System V ABI and System V ABI Update the following Segment Types shall also be supported.

Table 11-1 Linux Segment Types

Name	Value
PT_GNU_EH_FRAME	0x6474e550
PT_GNU_STACK	0x6474e551
PT_GNU_RELRO	0x6474e552

PT_GNU_EH_FRAME

The array element specifies the location and size of the exception handling information as defined by the .eh_frame_hdr section.

PT_GNU_STACK

The `p_flags` member specifies the permissions on the segment containing the stack and is used to indicate wether the stack should be executable. The absense of this header indicates that the stack will be executable.

PT_GNU_RELRO

the array element specifies the location and size of a segment which may be made read-only after relocations have been processed.

11.3 Dynamic Entries

11.3.1 Introduction

As described in System V ABI, if an object file participates in dynamic linking, its program header table shall have an element of type `PT_DYNAMIC`. This `segment' contains the `.dynamic` section. A special symbol, `_DYNAMIC`, labels the section, which contains an array of the following structures.

```
typedef struct {
        Elf32_Sword     d_tag;
        union {
                Elf32_Word      d_val;
                Elf32_Addr      d_ptr;
        } d_un;
} Elf32_Dyn;

extern Elf32_Dyn        _DYNAMIC[];
```

```
typedef struct {
        Elf64_Sxword    d_tag;
        union {
                Elf64_Xword     d_val;
                Elf64_Addr      d_ptr;
        } d_un;
} Elf64_Dyn;

extern Elf64_Dyn        _DYNAMIC[];
```

Figure 11-1 Dynamic Structure

For each object with this type, `d_tag` controls the interpretation of `d_un`.

11.3.2 Dynamic Entries

11.3.2.1 ELF Dynamic Entries

The following dynamic entries are defined in the System V ABI and System V ABI Update.

DT_BIND_NOW

> Process relocations of object

DT_DEBUG

> For debugging; unspecified

DT_FINI

> Address of termination function

DT_FINI_ARRAY

> The address of an array of pointers to termination functions.

DT_FINI_ARRAYSZ

> Size in bytes of DT_FINI_ARRAY

DT_FLAGS

> Flag values specific to the object being loaded

DT_HASH

> Address of symbol hash table

DT_HIPROC

> End of processor-specific

DT_INIT

> Address of init function

DT_INIT_ARRAY

> The address of an array of pointers to initialization functions.

DT_INIT_ARRAYSZ

> Size in bytes of DT_INIT_ARRAY

DT_JMPREL

 Address of PLT relocs

DT_LOPROC

 Start of processor-specific

DT_NEEDED

 Name of needed library

DT_NULL

 Marks end of dynamic section

DT_PLTREL

 Type of reloc in PLT

DT_PLTRELSZ

 Size in bytes of PLT relocs

DT_PREINIT_ARRAY

 Array with addresses of preinit functions

DT_PREINIT_ARRAYSZ

 Size in bytes of DT_PREINIT_ARRAY

DT_REL

 Address of Rel relocs

DT_RELA

 Address of Rela relocs

DT_RELAENT

 Size of one Rela reloc

DT_RELASZ

 Total size of Rela relocs

DT_RELENT

 Size of one Rel reloc

DT_RELSZ

 Total size of Rel relocs

DT_RPATH

 Library search path

DT_RUNPATH

 null-terminated library search path string

DT_SONAME

 Name of shared object

DT_STRSZ

   Size of string table

DT_STRTAB

   Address of string table

DT_SYMBOLIC

   Start symbol search here

DT_SYMENT

   Size of one symbol table entry

DT_SYMTAB

   Address of symbol table

DT_TEXTREL

   Reloc might modify .text

11.3.2.2 Additional Dynamic Entries

An LSB conforming object may also use the following additional Dynamic Entry types.

DT_ADDRRNGHI

   Values from DT_ADDRRNGLO through DT_ADDRRNGHI are reserved for definition by an archLSB.

DT_ADDRRNGLO

   Values from DT_ADDRRNGLO through DT_ADDRRNGHI are reserved for definition by an archLSB.

DT_AUXILIARY

   Shared object to load before self

DT_FILTER

   Shared object to get values from

DT_HIOS

   Values from DT_LOOS through DT_HIOS are reserved for definition by specific operating systems.

DT_LOOS

   Values from DT_LOOS through DT_HIOS are reserved for definition by specific operating systems.

DT_NUM

   Number of dynamic entry tags defined (excepting reserved ranges).

DT_POSFLAG_1

   Flags for DT_* entries, effecting the following DT_* entry

DT_RELCOUNT

> All Elf32_Rel R_*_RELATIVE relocations have been placed into a single block and this entry specifies the number of entries in that block. This permits ld.so.1 to streamline the processing of RELATIVE relocations.

DT_SYMINENT

> Entry size of syminfo

DT_SYMINFO

> Address of the Syminfo table.

DT_SYMINSZ

> Size of syminfo table (in bytes)

DT_VALRNGHI

> Entries which fall between DT_VALRNGHI & DT_VALRNGLO use the Dyn.d_un.d_val field of the Elf*_Dyn structure.

DT_VALRNGLO

> Entries which fall between DT_VALRNGHI & DT_VALRNGLO use the Dyn.d_un.d_val field of the Elf*_Dyn structure.

DT_VERDEF

> Address of version definition table

DT_VERDEFNUM

> Number of version definitions

DT_VERNEED

> Address of table with needed versions

DT_VERNEEDNUM

> Number of needed versions

DT_VERSYM

> Address of the table provided by the .gnu.version section.

III Base Libraries

12 Base Libraries

12.1 Introduction

An LSB-conforming implementation shall support the following base libraries which provide interfaces for accessing the operating system, processor and other hardware in the system.

- libc

- libm

- libgcc_s

- libdl

- librt

- libcrypt

- libpam

There are three main parts to the definition of each of these libraries.

The "Interfaces" section defines the required library name and version, and the required public symbols (interfaces and global data), as well as symbol versions, if any.

The "Interface Definitions" section provides complete or partial definitions of certain interfaces where either this specification is the source specification, or where there are variations from the source specification. If an interface definition requires one or more header files, one of those headers shall include the function prototype for the interface.

For source definitions of interfaces which include a reference to a header file, the contents of such header files form a part of the specification. The "Data Definitions" section provides the binary-level details for the header files from the source specifications, such as values for macros and enumerated types, as well as structure layouts, sizes and padding, etc. These data definitions, although presented in the form of header files for convenience, should not be taken a representing complete header files, as they are a supplement to the source specifications. Application developers should follow the guidelines of the source specifications when determining which header files need to be included to completely resolve all references.

> **Note:** While the Data Definitions supplement the source specifications, this specification itself does not require conforming implementations to supply any header files.

12.2 Program Interpreter

The Program Interpreter is specified in the appropriate architecture specific part of ISO/IEC 23360.

12.3 Interfaces for libc

Table 12-1 defines the library name and shared object name for the libc library

Table 12-1 libc Definition

Library:	libc

SONAME:	See archLSB.

The behavior of the interfaces in this library is specified by the following specifications:

[LFS] Large File Support
[LSB] This Specification
[RPC & XDR] RFC 1831/1832 RPC & XDR
[SUSv2] SUSv2
[SUSv3] POSIX 1003.1-2001 (ISO/IEC 9945-2003)
[SUSv4] POSIX 1003.1-2008 (ISO/IEC 9945-2009)
[SVID.4] SVID Issue 4

12.3.1 RPC

12.3.1.1 Interfaces for RPC

An LSB conforming implementation shall provide the generic functions for RPC specified in Table 12-2, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-2 libc - RPC Function Interfaces

authnone_create [SVID.4]	callrpc [RPC & XDR]	clnt_create [SVID.4]	clnt_pcreateerror [SVID.4]
clnt_perrno [SVID.4]	clnt_perror [SVID.4]	clnt_spcreateerror [SVID.4]	clnt_sperrno [SVID.4]
clnt_sperror [SVID.4]	clntraw_create [RPC & XDR]	clnttcp_create [RPC & XDR]	clntudp_bufcreate [RPC & XDR]
clntudp_create [RPC & XDR]	key_decryptsession [SVID.4]	pmap_getport [LSB]	pmap_set [LSB]
pmap_unset [LSB]	svc_getreqset [SVID.4]	svc_register [LSB]	svc_run [LSB]
svc_sendreply [LSB]	svcerr_auth [SVID.4]	svcerr_decode [SVID.4]	svcerr_noproc [SVID.4]
svcerr_noprog [SVID.4]	svcerr_progvers [SVID.4]	svcerr_systemerr [SVID.4]	svcerr_weakauth [SVID.4]
svcfd_create [RPC & XDR]	svcraw_create [RPC & XDR]	svctcp_create [LSB]	svcudp_create [LSB]
xdr_accepted_reply [SVID.4]	xdr_array [SVID.4]	xdr_bool [SVID.4]	xdr_bytes [SVID.4]
xdr_callhdr [SVID.4]	xdr_callmsg [SVID.4]	xdr_char [SVID.4]	xdr_double [SVID.4]
xdr_enum [SVID.4]	xdr_float [SVID.4]	xdr_free [SVID.4]	xdr_int [SVID.4]
xdr_long [SVID.4]	xdr_opaque [SVID.4]	xdr_opaque_auth [SVID.4]	xdr_pointer [SVID.4]
xdr_reference [SVID.4]	xdr_rejected_reply [SVID.4]	xdr_replymsg [SVID.4]	xdr_short [SVID.4]

xdr_string [SVID.4]	xdr_u_char [SVID.4]	xdr_u_int [LSB]	xdr_u_long [SVID.4]
xdr_u_short [SVID.4]	xdr_union [SVID.4]	xdr_vector [SVID.4]	xdr_void [SVID.4]
xdr_wrapstring [SVID.4]	xdrmem_create [SVID.4]	xdrrec_create [SVID.4]	xdrrec_endofreco rd [RPC & XDR]
xdrrec_eof [SVID.4]	xdrrec_skiprecor d [RPC & XDR]	xdrstdio_create [LSB]	

An LSB conforming implementation shall provide the generic deprecated functions for RPC specified in Table 12-3, with the full mandatory functionality as described in the referenced underlying specification.

> **Note:** These interfaces are deprecated, and applications should avoid using them. These interfaces may be withdrawn in future releases of this specification.

Table 12-3 libc - RPC Deprecated Function Interfaces

key_decryptsessi on [SVID.4]			

12.3.2 Epoll

12.3.2.1 Interfaces for Epoll

An LSB conforming implementation shall provide the generic functions for Epoll specified in Table 12-4, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-4 libc - Epoll Function Interfaces

epoll_create(GLI BC_2.3.2) [LSB]	epoll_ctl(GLIBC_ 2.3.2) [LSB]	epoll_wait(GLIB C_2.3.2) [LSB]	

12.3.3 System Calls

12.3.3.1 Interfaces for System Calls

An LSB conforming implementation shall provide the generic functions for System Calls specified in Table 12-5, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-5 libc - System Calls Function Interfaces

__chk_fail(GLIB C_2.3.4) [LSB]	__fxstat [LSB]	__fxstatat(GLIBC _2.4) [LSB]	__getgroups_chk (GLIBC_2.4) [LSB]
__getpgid [LSB]	__lxstat [LSB]	__read_chk(GLIB C_2.4) [LSB]	__readlink_chk(GLIBC_2.4) [LSB]
__stack_chk_fail(GLIBC_2.4) [LSB]	__xmknod [LSB]	__xmknodat(GLI BC_2.4) [LSB]	__xstat [LSB]
access [SUSv3]	acct [LSB]	alarm [SUSv3]	backtrace [LSB]

backtrace_symbols [LSB]	backtrace_symbols_fd [LSB]	brk [SUSv2]	chdir [SUSv3]
chmod [SUSv3]	chown [SUSv3]	chroot [SUSv2]	clock [SUSv3]
close [SUSv3]	closedir [SUSv3]	creat [SUSv3]	dup [SUSv3]
dup2 [SUSv3]	execl [SUSv3]	execle [SUSv3]	execlp [SUSv3]
execv [SUSv3]	execve [SUSv3]	execvp [SUSv3]	exit [SUSv3]
faccessat(GLIBC_2.4) [SUSv4]	fchdir [SUSv3]	fchmod [SUSv3]	fchmodat(GLIBC_2.4) [SUSv4]
fchown [SUSv3]	fchownat(GLIBC_2.4) [SUSv4]	fcntl [LSB]	fdatasync [SUSv3]
fdopendir(GLIBC_2.4) [SUSv4]	fexecve [SUSv4]	flock [LSB]	fork [SUSv3]
fstatfs [LSB]	fstatvfs [SUSv3]	fsync [SUSv3]	ftime [SUSv3]
ftruncate [SUSv3]	getcontext [SUSv3]	getdtablesize [LSB]	getegid [SUSv3]
geteuid [SUSv3]	getgid [SUSv3]	getgroups [SUSv3]	getitimer [SUSv3]
getloadavg [LSB]	getpagesize [LSB]	getpgid [SUSv3]	getpgrp [SUSv3]
getpid [SUSv3]	getppid [SUSv3]	getpriority [SUSv3]	getrlimit [SUSv3]
getrusage [SUSv3]	getsid [SUSv3]	getuid [SUSv3]	getwd [SUSv3]
initgroups [LSB]	ioctl [LSB]	kill [LSB]	killpg [SUSv3]
lchown [SUSv3]	link [LSB]	linkat(GLIBC_2.4) [SUSv4]	lockf [SUSv3]
lseek [SUSv3]	mkdir [SUSv3]	mkdirat(GLIBC_2.4) [SUSv4]	mkfifo [SUSv3]
mkfifoat(GLIBC_2.4) [SUSv4]	mlock [SUSv3]	mlockall [SUSv3]	mmap [SUSv3]
mprotect [SUSv3]	mremap [LSB]	msync [SUSv3]	munlock [SUSv3]
munlockall [SUSv3]	munmap [SUSv3]	nanosleep [SUSv3]	nice [SUSv3]
open [SUSv3]	openat(GLIBC_2.4) [SUSv4]	opendir [SUSv3]	pathconf [SUSv3]
pause [SUSv3]	pipe [SUSv3]	poll [SUSv3]	pread [SUSv3]
pselect [SUSv3]	ptrace [LSB]	pwrite [SUSv3]	read [SUSv3]
readdir [SUSv3]	readdir_r [SUSv3]	readlink [SUSv3]	readlinkat(GLIBC_2.4) [SUSv4]

readv [SUSv3]	rename [SUSv3]	renameat(GLIBC_2.4) [SUSv4]	rmdir [SUSv3]
sbrk [SUSv2]	sched_get_priority_max [SUSv3]	sched_get_priority_min [SUSv3]	sched_getaffinity (GLIBC_2.3.4) [LSB]
sched_getparam [SUSv3]	sched_getscheduler [SUSv3]	sched_rr_get_interval [SUSv3]	sched_setaffinity (GLIBC_2.3.4) [LSB]
sched_setparam [SUSv3]	sched_setscheduler [LSB]	sched_yield [SUSv3]	select [SUSv3]
setcontext [SUSv3]	setegid [SUSv3]	seteuid [SUSv3]	setgid [SUSv3]
setitimer [SUSv3]	setpgid [SUSv3]	setpgrp [SUSv3]	setpriority [SUSv3]
setregid [SUSv3]	setreuid [SUSv3]	setrlimit [SUSv3]	setrlimit64 [LFS]
setsid [SUSv3]	setuid [SUSv3]	sleep [SUSv3]	statfs [LSB]
statvfs [SUSv3]	stime [LSB]	symlink [SUSv3]	symlinkat(GLIBC_2.4) [SUSv4]
sync [SUSv3]	sysconf [LSB]	sysinfo [LSB]	time [SUSv3]
times [SUSv3]	truncate [SUSv3]	ulimit [SUSv3]	umask [SUSv3]
uname [SUSv3]	unlink [LSB]	unlinkat(GLIBC_2.4) [SUSv4]	utime [SUSv3]
utimes [SUSv3]	vfork [SUSv3]	wait [SUSv3]	wait4 [LSB]
waitid [SUSv3]	waitpid [SUSv3]	write [SUSv3]	writev [SUSv3]

An LSB conforming implementation shall provide the generic deprecated functions for System Calls specified in Table 12-6, with the full mandatory functionality as described in the referenced underlying specification.

Note: These interfaces are deprecated, and applications should avoid using them. These interfaces may be withdrawn in future releases of this specification.

Table 12-6 libc - System Calls Deprecated Function Interfaces

fstatfs [LSB]	getdtablesize [LSB]	getpagesize [LSB]	getwd [SUSv3]
statfs [LSB]			

12.3.4 Standard I/O

12.3.4.1 Interfaces for Standard I/O

An LSB conforming implementation shall provide the generic functions for Standard I/O specified in Table 12-7, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-7 libc - Standard I/O Function Interfaces

_IO_feof [LSB]	_IO_getc [LSB]	_IO_putc [LSB]	_IO_puts [LSB]
__fgets_chk(GLIBC_2.4) [LSB]	__fgets_unlocked_chk(GLIBC_2.4) [LSB]	__fgetws_unlocked_chk(GLIBC_2.4) [LSB]	__fprintf_chk [LSB]
__printf_chk [LSB]	__snprintf_chk [LSB]	__sprintf_chk [LSB]	__vfprintf_chk [LSB]
__vprintf_chk [LSB]	__vsnprintf_chk [LSB]	__vsprintf_chk [LSB]	asprintf [LSB]
clearerr [SUSv3]	clearerr_unlocked [LSB]	ctermid [SUSv3]	dprintf [SUSv4]
fclose [SUSv3]	fdopen [SUSv3]	feof [SUSv3]	feof_unlocked [LSB]
ferror [SUSv3]	ferror_unlocked [LSB]	fflush [SUSv3]	fflush_unlocked [LSB]
fgetc [SUSv3]	fgetc_unlocked [LSB]	fgetpos [SUSv3]	fgets [SUSv3]
fgets_unlocked [LSB]	fgetwc_unlocked [LSB]	fgetws_unlocked [LSB]	fileno [SUSv3]
fileno_unlocked [LSB]	flockfile [SUSv3]	fopen [SUSv3]	fprintf [SUSv3]
fputc [SUSv3]	fputc_unlocked [LSB]	fputs [SUSv3]	fputs_unlocked [LSB]
fputwc_unlocked [LSB]	fputws_unlocked [LSB]	fread [SUSv3]	fread_unlocked [LSB]
freopen [SUSv3]	fscanf [LSB]	fseek [SUSv3]	fseeko [SUSv3]
fsetpos [SUSv3]	ftell [SUSv3]	ftello [SUSv3]	fwrite [SUSv3]
fwrite_unlocked [LSB]	getc [SUSv3]	getc_unlocked [SUSv3]	getchar [SUSv3]
getchar_unlocked [SUSv3]	getdelim [SUSv4]	getline [SUSv4]	getw [SUSv2]
getwc_unlocked [LSB]	getwchar_unlocked [LSB]	pclose [SUSv3]	popen [SUSv3]
printf [SUSv3]	putc [SUSv3]	putc_unlocked [SUSv3]	putchar [SUSv3]
putchar_unlocked [SUSv3]	puts [SUSv3]	putw [SUSv2]	putwc_unlocked [LSB]
putwchar_unlocked [LSB]	remove [SUSv3]	rewind [SUSv3]	rewinddir [SUSv3]
scanf [LSB]	seekdir [SUSv3]	setbuf [SUSv3]	setbuffer [LSB]
setvbuf [SUSv3]	snprintf [SUSv3]	sprintf [SUSv3]	sscanf [LSB]

telldir [SUSv3]	tempnam [SUSv3]	ungetc [SUSv3]	vasprintf [LSB]
vdprintf [LSB]	vfprintf [SUSv3]	vprintf [SUSv3]	vsnprintf [SUSv3]
vsprintf [SUSv3]			

An LSB conforming implementation shall provide the generic deprecated functions for Standard I/O specified in Table 12-8, with the full mandatory functionality as described in the referenced underlying specification.

> **Note:** These interfaces are deprecated, and applications should avoid using them. These interfaces may be withdrawn in future releases of this specification.

Table 12-8 libc - Standard I/O Deprecated Function Interfaces

tempnam [SUSv3]			

An LSB conforming implementation shall provide the generic data interfaces for Standard I/O specified in Table 12-9, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-9 libc - Standard I/O Data Interfaces

stderr [SUSv3]	stdin [SUSv3]	stdout [SUSv3]	

12.3.5 Signal Handling

12.3.5.1 Interfaces for Signal Handling

An LSB conforming implementation shall provide the generic functions for Signal Handling specified in Table 12-10, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-10 libc - Signal Handling Function Interfaces

__libc_current_sigrtmax [LSB]	__libc_current_sigrtmin [LSB]	__sigsetjmp [LSB]	__sysv_signal [LSB]
__xpg_sigpause [LSB]	bsd_signal [SUSv3]	psignal [LSB]	raise [SUSv3]
sigaction [SUSv3]	sigaddset [SUSv3]	sigaltstack [SUSv3]	sigandset [LSB]
sigdelset [SUSv3]	sigemptyset [SUSv3]	sigfillset [SUSv3]	sighold [SUSv3]
sigignore [SUSv3]	siginterrupt [SUSv3]	sigisemptyset [LSB]	sigismember [SUSv3]
siglongjmp [SUSv3]	signal [SUSv3]	sigorset [LSB]	sigpause [LSB]
sigpending [SUSv3]	sigprocmask [SUSv3]	sigqueue [SUSv3]	sigrelse [SUSv3]
sigreturn [LSB]	sigset [SUSv3]	sigsuspend	sigtimedwait

		[SUSv3]	[SUSv3]
sigwait [SUSv3]	sigwaitinfo [SUSv3]		

An LSB conforming implementation shall provide the generic deprecated functions for Signal Handling specified in Table 12-11, with the full mandatory functionality as described in the referenced underlying specification.

> **Note:** These interfaces are deprecated, and applications should avoid using them. These interfaces may be withdrawn in future releases of this specification.

Table 12-11 libc - Signal Handling Deprecated Function Interfaces

sigpause [LSB]			

An LSB conforming implementation shall provide the generic data interfaces for Signal Handling specified in Table 12-12, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-12 libc - Signal Handling Data Interfaces

_sys_siglist [LSB]			

12.3.6 Localization Functions

12.3.6.1 Interfaces for Localization Functions

An LSB conforming implementation shall provide the generic functions for Localization Functions specified in Table 12-13, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-13 libc - Localization Functions Function Interfaces

bind_textdomain_codeset [LSB]	bindtextdomain [LSB]	catclose [SUSv3]	catgets [SUSv3]
catopen [SUSv3]	dcgettext [LSB]	dcngettext [LSB]	dgettext [LSB]
dngettext [LSB]	duplocale(GLIBC_2.3) [LSB]	freelocale(GLIBC_2.3) [LSB]	gettext [LSB]
iconv [SUSv3]	iconv_close [SUSv3]	iconv_open [SUSv3]	localeconv [SUSv3]
newlocale(GLIBC_2.3) [LSB]	ngettext [LSB]	nl_langinfo [SUSv3]	setlocale [SUSv3]
textdomain [LSB]	uselocale(GLIBC_2.3) [LSB]		

An LSB conforming implementation shall provide the generic data interfaces for Localization Functions specified in Table 12-14, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-14 libc - Localization Functions Data Interfaces

_nl_msg_cat_cntr [LSB]			

12.3.7 Posix Spawn Option

12.3.7.1 Interfaces for Posix Spawn Option

An LSB conforming implementation shall provide the generic functions for Posix Spawn Option specified in Table 12-15, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-15 libc - Posix Spawn Option Function Interfaces

posix_spawn [SUSv3]	posix_spawn_file_actions_addclose [SUSv3]	posix_spawn_file_actions_adddup2 [SUSv3]	posix_spawn_file_actions_addopen [SUSv3]
posix_spawn_file_actions_destroy [SUSv3]	posix_spawn_file_actions_init [SUSv3]	posix_spawnattr_destroy [SUSv3]	posix_spawnattr_getflags [SUSv3]
posix_spawnattr_getpgroup [SUSv3]	posix_spawnattr_getschedparam [SUSv3]	posix_spawnattr_getschedpolicy [SUSv3]	posix_spawnattr_getsigdefault [SUSv3]
posix_spawnattr_getsigmask [SUSv3]	posix_spawnattr_init [SUSv3]	posix_spawnattr_setflags [SUSv3]	posix_spawnattr_setpgroup [SUSv3]
posix_spawnattr_setschedparam [SUSv3]	posix_spawnattr_setschedpolicy [SUSv3]	posix_spawnattr_setsigdefault [SUSv3]	posix_spawnattr_setsigmask [SUSv3]
posix_spawnp [SUSv3]			

12.3.8 Posix Advisory Option

12.3.8.1 Interfaces for Posix Advisory Option

An LSB conforming implementation shall provide the generic functions for Posix Advisory Option specified in Table 12-16, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-16 libc - Posix Advisory Option Function Interfaces

posix_fadvise [SUSv3]	posix_fallocate [SUSv3]	posix_madvise [SUSv3]	posix_memalign [SUSv3]

12.3.9 Socket Interface

12.3.9.1 Interfaces for Socket Interface

An LSB conforming implementation shall provide the generic functions for Socket Interface specified in Table 12-17, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-17 libc - Socket Interface Function Interfaces

__gethostname_chk(GLIBC_2.4) [LSB]	__h_errno_location [LSB]	__recv_chk(GLIBC_2.4) [LSB]	__recvfrom_chk(GLIBC_2.4) [LSB]

accept [SUSv3]	bind [SUSv3]	bindresvport [LSB]	connect [SUSv3]
gethostid [SUSv3]	gethostname [SUSv3]	getpeername [SUSv3]	getsockname [SUSv3]
getsockopt [LSB]	if_freenameindex [SUSv3]	if_indextoname [SUSv3]	if_nameindex [SUSv3]
if_nametoindex [SUSv3]	listen [SUSv3]	recv [SUSv3]	recvfrom [SUSv3]
recvmsg [SUSv3]	send [SUSv4]	sendmsg [SUSv4]	sendto [SUSv4]
setsockopt [LSB]	shutdown [SUSv3]	sockatmark [SUSv3]	socket [SUSv3]
socketpair [SUSv3]			

An LSB conforming implementation shall provide the generic data interfaces for Socket Interface specified in Table 12-18, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-18 libc - Socket Interface Data Interfaces

in6addr_any [SUSv3]	in6addr_loopback [SUSv3]		

12.3.10 Wide Characters

12.3.10.1 Interfaces for Wide Characters

An LSB conforming implementation shall provide the generic functions for Wide Characters specified in Table 12-19, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-19 libc - Wide Characters Function Interfaces

__fgetws_chk(GLIBC_2.4) [LSB]	__fwprintf_chk(GLIBC_2.4) [LSB]	__mbsnrtowcs_chk(GLIBC_2.4) [LSB]	__mbsrtowcs_chk(GLIBC_2.4) [LSB]
__mbstowcs_chk(GLIBC_2.4) [LSB]	__swprintf_chk(GLIBC_2.4) [LSB]	__vfwprintf_chk(GLIBC_2.4) [LSB]	__vswprintf_chk(GLIBC_2.4) [LSB]
__vwprintf_chk(GLIBC_2.4) [LSB]	__wcpcpy_chk(GLIBC_2.4) [LSB]	__wcpncpy_chk(GLIBC_2.4) [LSB]	__wcrtomb_chk(GLIBC_2.4) [LSB]
__wcscat_chk(GLIBC_2.4) [LSB]	__wcscpy_chk(GLIBC_2.4) [LSB]	__wcsncat_chk(GLIBC_2.4) [LSB]	__wcsncpy_chk(GLIBC_2.4) [LSB]
__wcsnrtombs_chk(GLIBC_2.4) [LSB]	__wcsrtombs_chk(GLIBC_2.4) [LSB]	__wcstod_internal [LSB]	__wcstof_internal [LSB]
__wcstol_internal [LSB]	__wcstold_internal [LSB]	__wcstombs_chk(GLIBC_2.4) [LSB]	__wcstoul_internal [LSB]

__wctomb_chk(GLIBC_2.4) [LSB]	__wmemcpy_chk (GLIBC_2.4) [LSB]	__wmemmove_chk(GLIBC_2.4) [LSB]	__wmempcpy_chk(GLIBC_2.4) [LSB]
__wmemset_chk(GLIBC_2.4) [LSB]	__wprintf_chk(GLIBC_2.4) [LSB]	btowc [SUSv3]	fgetwc [SUSv3]
fgetws [SUSv3]	fputwc [SUSv3]	fputws [SUSv3]	fwide [SUSv3]
fwprintf [SUSv3]	fwscanf [LSB]	getwc [SUSv3]	getwchar [SUSv3]
mblen [SUSv3]	mbrlen [SUSv3]	mbrtowc [SUSv3]	mbsinit [SUSv3]
mbsnrtowcs [LSB]	mbsrtowcs [SUSv3]	mbstowcs [SUSv3]	mbtowc [SUSv3]
putwc [SUSv3]	putwchar [SUSv3]	swprintf [SUSv3]	swscanf [LSB]
towctrans [SUSv3]	towlower [SUSv3]	towupper [SUSv3]	ungetwc [SUSv3]
vfwprintf [SUSv3]	vfwscanf [LSB]	vswprintf [SUSv3]	vswscanf [LSB]
vwprintf [SUSv3]	vwscanf [LSB]	wcpcpy [LSB]	wcpncpy [LSB]
wcrtomb [SUSv3]	wcscasecmp [LSB]	wcscat [SUSv3]	wcschr [SUSv3]
wcscmp [SUSv3]	wcscoll [SUSv3]	wcscpy [SUSv3]	wcscspn [SUSv3]
wcsdup [LSB]	wcsftime [SUSv3]	wcslen [SUSv3]	wcsncasecmp [LSB]
wcsncat [SUSv3]	wcsncmp [SUSv3]	wcsncpy [SUSv3]	wcsnlen [LSB]
wcsnrtombs [LSB]	wcspbrk [SUSv3]	wcsrchr [SUSv3]	wcsrtombs [SUSv3]
wcsspn [SUSv3]	wcsstr [SUSv3]	wcstod [SUSv3]	wcstof [SUSv3]
wcstoimax [SUSv3]	wcstok [SUSv3]	wcstol [SUSv3]	wcstold [SUSv3]
wcstoll [SUSv3]	wcstombs [SUSv3]	wcstoq [LSB]	wcstoul [SUSv3]
wcstoull [SUSv3]	wcstoumax [SUSv3]	wcstouq [LSB]	wcswcs [SUSv3]
wcswidth [SUSv3]	wcsxfrm [SUSv3]	wctob [SUSv3]	wctomb [SUSv3]
wctrans [SUSv3]	wctype [SUSv3]	wcwidth [SUSv3]	wmemchr [SUSv3]
wmemcmp [SUSv3]	wmemcpy [SUSv3]	wmemmove [SUSv3]	wmemset [SUSv3]

| wprintf [SUSv3] | wscanf [LSB] | | |

12.3.11 String Functions

12.3.11.1 Interfaces for String Functions

An LSB conforming implementation shall provide the generic functions for String Functions specified in Table 12-20, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-20 libc - String Functions Function Interfaces

__memcpy_chk(GLIBC_2.3.4) [LSB]	__memmove_ch k(GLIBC_2.3.4) [LSB]	__mempcpy [LSB]	__mempcpy_chk (GLIBC_2.3.4) [LSB]
__memset_chk(G LIBC_2.3.4) [LSB]	__rawmemchr [LSB]	__stpcpy [LSB]	__stpcpy_chk(GL IBC_2.3.4) [LSB]
__stpncpy_chk(G LIBC_2.4) [LSB]	__strcat_chk(GLI BC_2.3.4) [LSB]	__strcpy_chk(GL IBC_2.3.4) [LSB]	__strdup [LSB]
__strncat_chk(G LIBC_2.3.4) [LSB]	__strncpy_chk(G LIBC_2.3.4) [LSB]	__strtod_internal [LSB]	__strtof_internal [LSB]
__strtok_r [LSB]	__strtol_internal [LSB]	__strtold_interna l [LSB]	__strtoll_internal [LSB]
__strtoul_interna l [LSB]	__strtoull_intern al [LSB]	__xpg_strerror_r(GLIBC_2.3.4) [LSB]	bcmp [SUSv3]
bcopy [SUSv3]	bzero [SUSv3]	ffs [SUSv3]	index [SUSv3]
memccpy [SUSv3]	memchr [SUSv3]	memcmp [SUSv3]	memcpy [SUSv3]
memmove [SUSv3]	memrchr [LSB]	memset [SUSv3]	rindex [SUSv3]
stpcpy [LSB]	stpncpy [LSB]	strcasecmp [SUSv3]	strcasestr [LSB]
strcat [SUSv3]	strchr [SUSv3]	strcmp [SUSv3]	strcoll [SUSv3]
strcpy [SUSv3]	strcspn [SUSv3]	strdup [SUSv3]	strerror [SUSv3]
strerror_r [LSB]	strfmon [SUSv3]	strftime [SUSv3]	strlen [SUSv3]
strncasecmp [SUSv3]	strncat [SUSv3]	strncmp [SUSv3]	strncpy [SUSv3]
strndup [LSB]	strnlen [LSB]	strpbrk [SUSv3]	strptime [LSB]
strrchr [SUSv3]	strsep [LSB]	strsignal [LSB]	strspn [SUSv3]
strstr [SUSv3]	strtof [SUSv3]	strtoimax [SUSv3]	strtok [SUSv3]
strtok_r [SUSv3]	strtold [SUSv3]	strtoll [SUSv3]	strtoq [LSB]
strtoull [SUSv3]	strtoumax	strtouq [LSB]	strxfrm [SUSv3]

	[SUSv3]		
swab [SUSv3]			

An LSB conforming implementation shall provide the generic deprecated functions for String Functions specified in Table 12-21, with the full mandatory functionality as described in the referenced underlying specification.

> **Note:** These interfaces are deprecated, and applications should avoid using them. These interfaces may be withdrawn in future releases of this specification.

Table 12-21 libc - String Functions Deprecated Function Interfaces

strerror_r [LSB]			

12.3.12 IPC Functions

12.3.12.1 Interfaces for IPC Functions

An LSB conforming implementation shall provide the generic functions for IPC Functions specified in Table 12-22, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-22 libc - IPC Functions Function Interfaces

ftok [SUSv3]	msgctl [SUSv3]	msgget [SUSv3]	msgrcv [SUSv3]
msgsnd [SUSv3]	semctl [SUSv3]	semget [SUSv3]	semop [SUSv3]
shmat [SUSv3]	shmctl [SUSv3]	shmdt [SUSv3]	shmget [SUSv3]

12.3.13 Regular Expressions

12.3.13.1 Interfaces for Regular Expressions

An LSB conforming implementation shall provide the generic functions for Regular Expressions specified in Table 12-23, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-23 libc - Regular Expressions Function Interfaces

regcomp [SUSv3]	regerror [SUSv3]	regexec [LSB]	regfree [SUSv3]

12.3.14 Character Type Functions

12.3.14.1 Interfaces for Character Type Functions

An LSB conforming implementation shall provide the generic functions for Character Type Functions specified in Table 12-24, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-24 libc - Character Type Functions Function Interfaces

__ctype_b_loc(GLIBC_2.3) [LSB]	__ctype_get_mb_cur_max [LSB]	__ctype_tolower_loc(GLIBC_2.3) [LSB]	__ctype_toupper_loc(GLIBC_2.3) [LSB]
_tolower [SUSv3]	_toupper [SUSv3]	isalnum [SUSv3]	isalpha [SUSv3]

isascii [SUSv3]	iscntrl [SUSv3]	isdigit [SUSv3]	isgraph [SUSv3]
islower [SUSv3]	isprint [SUSv3]	ispunct [SUSv3]	isspace [SUSv3]
isupper [SUSv3]	iswalnum [SUSv3]	iswalpha [SUSv3]	iswblank [SUSv3]
iswcntrl [SUSv3]	iswctype [SUSv3]	iswdigit [SUSv3]	iswgraph [SUSv3]
iswlower [SUSv3]	iswprint [SUSv3]	iswpunct [SUSv3]	iswspace [SUSv3]
iswupper [SUSv3]	iswxdigit [SUSv3]	isxdigit [SUSv3]	toascii [SUSv3]
tolower [SUSv3]	toupper [SUSv3]		

12.3.15 Time Manipulation

12.3.15.1 Interfaces for Time Manipulation

An LSB conforming implementation shall provide the generic functions for Time Manipulation specified in Table 12-25, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-25 libc - Time Manipulation Function Interfaces

adjtime [LSB]	asctime [SUSv3]	asctime_r [SUSv3]	ctime [SUSv3]
ctime_r [SUSv3]	difftime [SUSv3]	gmtime [SUSv3]	gmtime_r [SUSv3]
localtime [SUSv3]	localtime_r [SUSv3]	mktime [SUSv3]	tzset [SUSv3]
ualarm [SUSv3]			

An LSB conforming implementation shall provide the generic data interfaces for Time Manipulation specified in Table 12-26, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-26 libc - Time Manipulation Data Interfaces

__daylight [LSB]	__timezone [LSB]	__tzname [LSB]	daylight [SUSv3]
timezone [SUSv3]	tzname [SUSv3]		

12.3.16 Terminal Interface Functions

12.3.16.1 Interfaces for Terminal Interface Functions

An LSB conforming implementation shall provide the generic functions for Terminal Interface Functions specified in Table 12-27, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-27 libc - Terminal Interface Functions Function Interfaces

cfgetispeed [SUSv3]	cfgetospeed [SUSv3]	cfmakeraw [LSB]	cfsetispeed [SUSv3]
cfsetospeed [SUSv3]	cfsetspeed [LSB]	tcdrain [SUSv3]	tcflow [SUSv3]
tcflush [SUSv3]	tcgetattr [SUSv3]	tcgetpgrp [SUSv3]	tcgetsid [SUSv3]
tcsendbreak [SUSv3]	tcsetattr [SUSv3]	tcsetpgrp [SUSv3]	

12.3.17 System Database Interface

12.3.17.1 Interfaces for System Database Interface

An LSB conforming implementation shall provide the generic functions for System Database Interface specified in Table 12-28, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-28 libc - System Database Interface Function Interfaces

endgrent [SUSv3]	endprotoent [SUSv3]	endpwent [SUSv3]	endservent [SUSv3]
endutent [LSB]	endutxent [SUSv3]	getgrent [SUSv3]	getgrent_r [LSB]
getgrgid [SUSv3]	getgrgid_r [SUSv3]	getgrnam [SUSv3]	getgrnam_r [SUSv3]
getgrouplist [LSB]	gethostbyaddr [SUSv3]	gethostbyaddr_r [LSB]	gethostbyname [SUSv3]
gethostbyname2 [LSB]	gethostbyname2 _r [LSB]	gethostbyname_r [LSB]	getprotobyname [SUSv3]
getprotobyname _r [LSB]	getprotobynumb er [SUSv3]	getprotobynumb er_r [LSB]	getprotoent [SUSv3]
getprotoent_r [LSB]	getpwent [SUSv3]	getpwent_r [LSB]	getpwnam [SUSv3]
getpwnam_r [SUSv3]	getpwuid [SUSv3]	getpwuid_r [SUSv3]	getservbyname [SUSv3]
getservbyname_r [LSB]	getservbyport [SUSv3]	getservbyport_r [LSB]	getservent [SUSv3]
getservent_r [LSB]	getutent [LSB]	getutent_r [LSB]	getutxent [SUSv3]
getutxid [SUSv3]	getutxline [SUSv3]	pututxline [SUSv3]	setgrent [SUSv3]
setgroups [LSB]	setprotoent [SUSv3]	setpwent [SUSv3]	setservent [SUSv3]
setutent [LSB]	setutxent [SUSv3]	utmpname [LSB]	

An LSB conforming implementation shall provide the generic deprecated functions for System Database Interface specified in Table 12-29, with the full mandatory functionality as described in the referenced underlying specification.

> **Note:** These interfaces are deprecated, and applications should avoid using them. These interfaces may be withdrawn in future releases of this specification.

Table 12-29 libc - System Database Interface Deprecated Function Interfaces

gethostbyaddr [SUSv3]	gethostbyaddr_r [LSB]	gethostbyname [SUSv3]	gethostbyname2 [LSB]
gethostbyname2 _r [LSB]	gethostbyname_r [LSB]		

12.3.18 Language Support

12.3.18.1 Interfaces for Language Support

An LSB conforming implementation shall provide the generic functions for Language Support specified in Table 12-30, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-30 libc - Language Support Function Interfaces

__libc_start_main [LSB]	__register_atfork (GLIBC_2.3.2) [LSB]		

12.3.19 Large File Support

12.3.19.1 Interfaces for Large File Support

An LSB conforming implementation shall provide the generic functions for Large File Support specified in Table 12-31, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-31 libc - Large File Support Function Interfaces

__fxstat64 [LSB]	__fxstatat64(GLIBC_2.4) [LSB]	__lxstat64 [LSB]	__xstat64 [LSB]
creat64 [LFS]	fgetpos64 [LFS]	fopen64 [LFS]	freopen64 [LFS]
fseeko64 [LFS]	fsetpos64 [LFS]	fstatfs64 [LSB]	fstatvfs64 [LFS]
ftello64 [LFS]	ftruncate64 [LFS]	ftw64 [LFS]	getrlimit64 [LFS]
lockf64 [LFS]	lseek64 [LFS]	mkstemp64 [LSB]	mmap64 [LFS]
nftw64 [LFS]	open64 [LFS]	openat64(GLIBC_2.4) [LSB]	posix_fadvise64 [LSB]
posix_fallocate64 [LSB]	pread64 [LSB]	pwrite64 [LSB]	readdir64 [LFS]
readdir64_r [LSB]	statfs64 [LSB]	statvfs64 [LFS]	tmpfile64 [LFS]
truncate64 [LFS]			

An LSB conforming implementation shall provide the generic deprecated functions for Large File Support specified in Table 12-32, with the full mandatory functionality as described in the referenced underlying specification.

> **Note:** These interfaces are deprecated, and applications should avoid using them. These interfaces may be withdrawn in future releases of this specification.

Table 12-32 libc - Large File Support Deprecated Function Interfaces

fstatfs64 [LSB]	statfs64 [LSB]		

12.3.20 Inotify

12.3.20.1 Interfaces for Inotify

An LSB conforming implementation shall provide the generic functions for Inotify specified in Table 12-33, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-33 libc - Inotify Function Interfaces

inotify_add_watch(GLIBC_2.4) [LSB]	inotify_init(GLIBC_2.4) [LSB]	inotify_rm_watch(GLIBC_2.4) [LSB]	

12.3.21 Standard Library

12.3.21.1 Interfaces for Standard Library

An LSB conforming implementation shall provide the generic functions for Standard Library specified in Table 12-34, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-34 libc - Standard Library Function Interfaces

_Exit [SUSv3]	__assert_fail [LSB]	__confstr_chk(GLIBC_2.4) [LSB]	__cxa_atexit [LSB]
__cxa_finalize [LSB]	__errno_location [LSB]	__fpending [LSB]	__getcwd_chk(GLIBC_2.4) [LSB]
__getlogin_r_chk(GLIBC_2.4) [LSB]	__getpagesize [LSB]	__isinf [LSB]	__isinff [LSB]
__isinfl [LSB]	__isnan [LSB]	__isnanf [LSB]	__isnanl [LSB]
__pread64_chk(GLIBC_2.4) [LSB]	__pread_chk(GLIBC_2.4) [LSB]	__realpath_chk(GLIBC_2.4) [LSB]	__sysconf [LSB]
__syslog_chk(GLIBC_2.4) [LSB]	__ttyname_r_chk(GLIBC_2.4) [LSB]	__vsyslog_chk(GLIBC_2.4) [LSB]	__xpg_basename [LSB]
_exit [SUSv3]	_longjmp [SUSv3]	_setjmp [SUSv3]	a64l [SUSv3]
abort [SUSv3]	abs [SUSv3]	alphasort [SUSv4]	alphasort64 [LSB]

atof [SUSv3]	atoi [SUSv3]	atol [SUSv3]	atoll [SUSv3]
basename [LSB]	bsearch [SUSv3]	calloc [SUSv3]	closelog [SUSv3]
confstr [SUSv3]	cuserid [SUSv2]	daemon [LSB]	dirfd [SUSv4]
dirname [SUSv3]	div [SUSv3]	dl_iterate_phdr [LSB]	drand48 [SUSv3]
drand48_r [LSB]	ecvt [SUSv3]	erand48 [SUSv3]	erand48_r [LSB]
err [LSB]	error [LSB]	errx [LSB]	fcvt [SUSv3]
fmemopen [SUSv4]	fmtmsg [SUSv3]	fnmatch [SUSv3]	fpathconf [SUSv3]
free [SUSv3]	freeaddrinfo [SUSv3]	ftrylockfile [SUSv3]	ftw [SUSv3]
funlockfile [SUSv3]	gai_strerror [SUSv3]	gcvt [SUSv3]	getaddrinfo [SUSv3]
getcwd [SUSv3]	getdate [SUSv3]	getdomainname [LSB]	getenv [SUSv3]
getlogin [SUSv3]	getlogin_r [SUSv3]	getnameinfo [SUSv3]	getopt [LSB]
getopt_long [LSB]	getopt_long_only [LSB]	getsubopt [SUSv3]	gettimeofday [SUSv3]
glob [SUSv3]	glob64 [LSB]	globfree [SUSv3]	globfree64 [LSB]
grantpt [SUSv3]	hcreate [SUSv3]	hcreate_r [LSB]	hdestroy [SUSv3]
hdestroy_r [LSB]	hsearch [SUSv3]	hsearch_r [LSB]	htonl [SUSv3]
htons [SUSv3]	imaxabs [SUSv3]	imaxdiv [SUSv3]	inet_addr [SUSv3]
inet_aton [LSB]	inet_ntoa [SUSv3]	inet_ntop [SUSv3]	inet_pton [SUSv3]
initstate [SUSv3]	initstate_r [LSB]	insque [SUSv3]	isatty [SUSv3]
isblank [SUSv3]	jrand48 [SUSv3]	jrand48_r [LSB]	l64a [SUSv3]
labs [SUSv3]	lcong48 [SUSv3]	lcong48_r [LSB]	ldiv [SUSv3]
lfind [SUSv3]	llabs [SUSv3]	lldiv [SUSv3]	longjmp [SUSv3]
lrand48 [SUSv3]	lrand48_r [LSB]	lsearch [SUSv3]	makecontext [SUSv3]
malloc [SUSv3]	memmem [LSB]	mkdtemp [SUSv4]	mkstemp [SUSv3]
mktemp [SUSv3]	mrand48 [SUSv3]	mrand48_r [LSB]	nftw [SUSv3]
nrand48 [SUSv3]	nrand48_r [LSB]	ntohl [SUSv3]	ntohs [SUSv3]
open_memstream [SUSv4]	open_wmemstream(GLIBC_2.4) [SUSv4]	openlog [SUSv3]	perror [SUSv3]

posix_openpt [SUSv3]	ptsname [SUSv3]	putenv [SUSv3]	qsort [SUSv3]
rand [SUSv3]	rand_r [SUSv3]	random [SUSv3]	random_r [LSB]
realloc [SUSv3]	realpath [SUSv3]	remque [SUSv3]	scandir [SUSv4]
scandir64 [LSB]	seed48 [SUSv3]	seed48_r [LSB]	sendfile [LSB]
sendfile64(GLIBC_2.3) [LSB]	setenv [SUSv3]	sethostname [LSB]	setlogmask [SUSv3]
setstate [SUSv3]	setstate_r [LSB]	srand [SUSv3]	srand48 [SUSv3]
srand48_r [LSB]	srandom [SUSv3]	srandom_r [LSB]	strtod [SUSv3]
strtol [SUSv3]	strtoul [SUSv3]	swapcontext [SUSv3]	syslog [SUSv3]
system [LSB]	tdelete [SUSv3]	tfind [SUSv3]	tmpfile [SUSv3]
tmpnam [SUSv3]	tsearch [SUSv3]	ttyname [SUSv3]	ttyname_r [SUSv3]
twalk [SUSv3]	unlockpt [SUSv3]	unsetenv [SUSv3]	usleep [SUSv3]
verrx [LSB]	vfscanf [LSB]	vscanf [LSB]	vsscanf [LSB]
vsyslog [LSB]	warn [LSB]	warnx [LSB]	wordexp [SUSv3]
wordfree [SUSv3]			

An LSB conforming implementation shall provide the generic deprecated functions for Standard Library specified in Table 12-35, with the full mandatory functionality as described in the referenced underlying specification.

> **Note:** These interfaces are deprecated, and applications should avoid using them. These interfaces may be withdrawn in future releases of this specification.

Table 12-35 libc - Standard Library Deprecated Function Interfaces

basename [LSB]	getdomainname [LSB]	inet_aton [LSB]	tmpnam [SUSv3]

An LSB conforming implementation shall provide the generic data interfaces for Standard Library specified in Table 12-36, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-36 libc - Standard Library Data Interfaces

__environ [LSB]	_environ [LSB]	_sys_errlist [LSB]	environ [SUSv3]
getdate_err [SUSv3]	optarg [SUSv3]	opterr [SUSv3]	optind [SUSv3]
optopt [SUSv3]			

12.3.22 GNU Extensions for libc

12.3.22.1 Interfaces for GNU Extensions for libc

An LSB conforming implementation shall provide the generic functions for GNU Extensions for libc specified in Table 12-37, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-37 libc - GNU Extensions for libc Function Interfaces

gnu_get_libc_release [LSB]	gnu_get_libc_version [LSB]		

12.4 Data Definitions for libc

This section defines global identifiers and their values that are associated with interfaces contained in libc. These definitions are organized into groups that correspond to system headers. This convention is used as a convenience for the reader, and does not imply the existence of these headers, or their content. Where an interface is defined as requiring a particular system header file all of the data definitions for that system header file presented here shall be in effect.

This section gives data definitions to promote binary application portability, not to repeat source interface definitions available elsewhere. System providers and application developers should use this ABI to supplement - not to replace - source interface definition specifications.

This specification uses the ISO C (1999) C Language as the reference programming language, and data definitions are specified in ISO C format. The C language is used here as a convenient notation. Using a C language description of these data objects does not preclude their use by other programming languages.

12.4.1 arpa/inet.h

```
extern uint32_t htonl(uint32_t);
extern uint16_t htons(uint16_t);
extern in_addr_t inet_addr(const char *__cp);
extern int inet_aton(const char *__cp, struct in_addr *__inp);
extern char *inet_ntoa(struct in_addr __in);
extern const char *inet_ntop(int __af, const void *__cp, char
*__buf,
                            socklen_t __len);
extern int inet_pton(int __af, const char *__cp, void *__buf);
extern uint32_t ntohl(uint32_t);
extern uint16_t ntohs(uint16_t);
```

12.4.2 assert.h

```
#ifdef NDEBUG
#define assert(expr) ((void)0)
#else
#define assert(expr)      ((void) ((expr) ? 0 : (__assert_fail
(#expr, __FILE__, __LINE__, __PRETTY_FUNCTION__), 0)))
#endif

extern void __assert_fail(const char *__assertion, const char
*__file,
                          unsigned int __line, const char
*__function);
```

12.4.3 cpio.h

```
#define C_IXOTH 000001
#define C_IWOTH 000002
#define C_IROTH 000004
#define C_IXGRP 000010
#define C_IWGRP 000020
#define C_IRGRP 000040
#define C_IXUSR 000100
#define C_IWUSR 000200
#define C_IRUSR 000400
#define C_ISVTX 001000
#define C_ISGID 002000
#define C_ISUID 004000
#define C_ISFIFO        010000
#define C_ISREG 0100000
#define C_ISCTG 0110000
#define C_ISLNK 0120000
#define C_ISSOCK        0140000
#define C_ISCHR 020000
#define C_ISDIR 040000
#define C_ISBLK 060000
#define MAGIC   "070707"
```

12.4.4 ctype.h

```
extern const unsigned short **__ctype_b_loc(void);
extern const int32_t **__ctype_tolower_loc(void);
extern const int32_t **__ctype_toupper_loc(void);
extern int _tolower(int);
extern int _toupper(int);
extern int isalnum(int);
extern int isalpha(int);
extern int isascii(int __c);
extern int isblank(int);
extern int iscntrl(int);
extern int isdigit(int);
extern int isgraph(int);
extern int islower(int);
extern int isprint(int);
extern int ispunct(int);
extern int isspace(int);
extern int isupper(int);
extern int isxdigit(int);
extern int toascii(int __c);
extern int tolower(int __c);
extern int toupper(int __c);
```

12.4.5 dirent.h

```
typedef struct __dirstream DIR;

struct dirent {
    long int d_ino;
    off_t d_off;
    unsigned short d_reclen;
    unsigned char d_type;
    char d_name[256];
};
struct dirent64 {
    uint64_t d_ino;
    int64_t d_off;
```

```
    unsigned short d_reclen;
    unsigned char d_type;
    char d_name[256];
};
extern int alphasort(const struct dirent **__e1,
                    const struct dirent **__e2);
extern int alphasort64(const struct dirent64 **__e1,
                      const struct dirent64 **__e2);
extern int closedir(DIR * __dirp);
extern int dirfd(DIR * __dirp);
extern DIR *fdopendir(int __fd);
extern DIR *opendir(const char *__name);
extern struct dirent *readdir(DIR * __dirp);
extern struct dirent64 *readdir64(DIR * __dirp);
extern int readdir64_r(DIR * __dirp, struct dirent64 *__entry,
                      struct dirent64 **__result);
extern int readdir_r(DIR * __dirp, struct dirent *__entry,
                    struct dirent **__result);
extern void rewinddir(DIR * __dirp);
extern   int   scandir(const   char   *__dir,   struct   dirent
***__namelist,
                    int (*__selector) (const struct dirent *),
                    int (*__cmp) (const struct dirent * *,
                                 const struct dirent * *));
extern   int   scandir64(const   char   *__dir,   struct   dirent64
***__namelist,
                    int (*__selector) (const struct dirent64 *),
                    int (*__cmp) (const struct dirent64 * *,
                                 const struct dirent64 * *));
extern void seekdir(DIR * __dirp, long int __pos);
extern long int telldir(DIR * __dirp);
```

12.4.6 elf.h

```
#define ELFMAG1 'E'
#define ELFMAG3 'F'
#define ELFMAG2 'L'
#define ELF32_ST_INFO(bind,type)         (((bind) << 4) + ((type)
& 0xf))
#define ELF32_ST_BIND(val)      (((unsigned char) (val)) >> 4)
#define ELF32_ST_TYPE(val)      ((val) & 0xf)
#define PF_X    (1 << 0)
#define SHF_WRITE       (1 << 0)
#define PF_W    (1 << 1)
#define SHF_ALLOC       (1 << 1)
#define SHF_TLS (1 << 10)
#define PF_R    (1 << 2)
#define SHF_EXECINSTR   (1 << 2)
#define SHF_MERGE       (1 << 4)
#define SHF_STRINGS     (1 << 5)
#define SHF_LINK_ORDER  (1 << 7)
#define EI_NIDENT       (16)
#define DT_ADDRTAGIDX(tag)      (DT_ADDRRNGHI - (tag))
#define DT_VALTAGIDX(tag)       (DT_VALRNGHI - (tag))
#define DT_VERSIONTAGIDX(tag)   (DT_VERNEEDNUM - (tag))
#define PT_IA_64_UNWIND (PT_LOPROC + 1)
#define SHT_IA_64_EXT   (SHT_LOPROC + 0)
#define SHT_IA_64_UNWIND        (SHT_LOPROC + 1)
#define DT_NULL 0
#define EI_MAG0 0
#define ELFCLASSNONE    0
#define ELFDATANONE     0
#define ELFOSABI_NONE   0
#define ELFOSABI_SYSV   0
#define ET_NONE 0
```

```
#define EV_NONE 0
#define PT_NULL 0
#define SHN_UNDEF        0
#define SHT_NULL         0
#define STB_LOCAL        0
#define STT_NOTYPE       0
#define DF_ORIGIN           0x00000001        /* Object  may  use
DF_ORIGIN */
#define DF_SYMBOLIC      0x00000002        /* Symbol  resolutions
start with this object */
#define DF_TEXTREL       0x00000004       /* Object contains text
relocations */
#define DF_BIND_NOW      0x00000008       /* No lazy binding for
this object */
#define DF_STATIC_TLS    0x00000010      /* Module uses the static
TLS model */
#define SHF_IA_64_SHORT 0x10000000
#define PT_LOOS 0x60000000
#define DT_LOOS 0x6000000d
#define PT_GNU_EH_FRAME 0x6474e550
#define PT_GNU_STACK    0x6474e551
#define PT_GNU_RELRO    0x6474e552
#define DT_HIOS 0x6ffff000
#define DT_VALRNGLO      0x6ffffd00
#define DT_GNU_PRELINKED        0x6ffffdf5
#define DT_GNU_CONFLICTSZ       0x6ffffdf6
#define DT_GNU_LIBLISTSZ        0x6ffffdf7
#define DT_CHECKSUM     0x6ffffdf8
#define DT_PLTPADSZ     0x6ffffdf9
#define DT_MOVEENT      0x6ffffdfa
#define DT_MOVESZ       0x6ffffdfb
#define DT_FEATURE_1    0x6ffffdfc
#define DT_POSFLAG_1    0x6ffffdfd
#define DT_SYMINSZ      0x6ffffdfe
#define DT_SYMINENT     0x6ffffdff
#define DT_VALRNGHI     0x6ffffdff
#define DT_ADDRRNGLO    0x6ffffe00
#define DT_GNU_HASH     0x6ffffef5
#define DT_TLSDESC_PLT  0x6ffffef6
#define DT_TLSDESC_GOT  0x6ffffef7
#define DT_GNU_CONFLICT 0x6ffffef8
#define DT_GNU_LIBLIST  0x6ffffef9
#define DT_CONFIG       0x6ffffefa
#define DT_DEPAUDIT     0x6ffffefb
#define DT_AUDIT        0x6ffffefc
#define DT_PLTPAD       0x6ffffefd
#define DT_MOVETAB      0x6ffffefe
#define DT_ADDRRNGHI    0x6ffffeff
#define DT_SYMINFO      0x6ffffeff
#define DT_VERSYM       0x6ffffff0
#define DT_RELACOUNT    0x6ffffff9
#define DT_RELCOUNT     0x6ffffffa
#define DT_FLAGS_1      0x6ffffffb
#define DT_VERDEF       0x6ffffffc
#define DT_VERDEFNUM    0x6ffffffd
#define SHT_GNU_verdef  0x6ffffffd
#define DT_VERNEED      0x6ffffffe
#define SHT_GNU_verneed 0x6ffffffe
#define DT_VERNEEDNUM   0x6fffffff
#define SHT_GNU_versym  0x6fffffff
#define DT_LOPROC       0x70000000
#define PT_LOPROC       0x70000000
#define SHT_LOPROC      0x70000000
#define ELFMAG0 0x7f
#define DT_AUXILIARY    0x7ffffffd
#define DT_FILTER       0x7fffffff
```

```
#define DT_HIPROC        0x7fffffff
#define PT_HIPROC        0x7fffffff
#define SHT_HIPROC       0x7fffffff
#define SHT_LOUSER       0x80000000
#define SHT_HIUSER       0x8fffffff
#define ET_LOOS 0xfe00
#define ET_HIOS 0xfeff
#define ET_LOPROC        0xff00
#define SHN_LOPROC       0xff00
#define SHN_LORESERVE    0xff00
#define SHN_HIPROC       0xff1f
#define SHN_LOOS         0xff20
#define SHN_HIOS         0xff3f
#define SHN_ABS 0xfff1
#define SHN_COMMON       0xfff2
#define ET_HIPROC        0xffff
#define SHN_HIRESERVE    0xffff
#define SHN_XINDEX       0xffff
#define DT_NEEDED        1
#define EI_MAG1 1
#define ELFCLASS32       1
#define ELFDATA2LSB      1
#define ET_REL  1
#define EV_CURRENT       1
#define PT_LOAD 1
#define SHT_PROGBITS     1
#define STB_GLOBAL       1
#define STT_OBJECT       1
#define DT_STRSZ         10
#define SHT_SHLIB        10
#define STB_LOOS         10
#define DT_ADDRNUM       11
#define DT_SYMENT        11
#define SHT_DYNSYM       11
#define DT_INIT 12
#define DT_VALNUM        12
#define STB_HIOS         12
#define DT_FINI 13
#define STB_LOPROC       13
#define DT_SONAME        14
#define SHT_INIT_ARRAY   14
#define DT_RPATH         15
#define SHT_FINI_ARRAY   15
#define STB_HIPROC       15
#define DT_SYMBOLIC      16
#define DT_VERSIONTAGNUM         16
#define SHT_PREINIT_ARRAY        16
#define DT_REL  17
#define DT_RELSZ         18
#define DT_RELENT        19
#define DT_PLTRELSZ      2
#define EI_MAG2 2
#define ELFCLASS64       2
#define ELFDATA2MSB      2
#define ET_EXEC 2
#define EV_NUM  2
#define PT_DYNAMIC       2
#define SHT_SYMTAB       2
#define STB_WEAK         2
#define STT_FUNC         2
#define DT_PLTREL        20
#define DT_DEBUG         21
#define DT_TEXTREL       22
#define DT_JMPREL        23
#define DT_BIND_NOW      24
#define DT_INIT_ARRAY    25
```

```
#define DT_FINI_ARRAY   26
#define DT_INIT_ARRAYSZ 27
#define DT_FINI_ARRAYSZ 28
#define DT_RUNPATH      29
#define DT_EXTRANUM     3
#define DT_PLTGOT       3
#define EI_MAG3 3
#define ELFCLASSNUM     3
#define ELFDATANUM      3
#define ELFOSABI_LINUX  3
#define ET_DYN  3
#define PT_INTERP       3
#define SHT_STRTAB      3
#define STB_NUM 3
#define DT_FLAGS        30
#define DT_ENCODING     32
#define DT_PREINIT_ARRAY        32
#define DT_PREINIT_ARRAYSZ      33
#define DT_NUM  34
#define DT_HASH 4
#define EI_CLASS        4
#define ET_CORE 4
#define PT_NOTE 4
#define SELFMAG 4
#define SHT_RELA        4
#define DT_STRTAB       5
#define EI_DATA 5
#define ET_NUM  5
#define PT_SHLIB        5
#define SHT_HASH        5
#define DT_SYMTAB       6
#define EI_VERSION      6
#define PT_PHDR 6
#define SHT_DYNAMIC     6
#define DT_RELA 7
#define EI_OSABI        7
#define PT_TLS  7
#define SHT_NOTE        7
#define DT_RELASZ       8
#define EI_ABIVERSION   8
#define PT_NUM  8
#define SHT_NOBITS      8
#define DT_RELAENT      9
#define SHT_REL 9
#define ELF64_ST_BIND(val)      ELF32_ST_BIND (val)
#define ELF64_ST_INFO(bind,type)        ELF32_ST_INFO ((bind),
(type))
#define ELF64_ST_TYPE(val)      ELF32_ST_TYPE (val)
#define ELFMAG  "\177ELF"

typedef uint32_t Elf32_Addr;
typedef uint64_t Elf64_Addr;
typedef uint32_t Elf32_Word;
typedef uint32_t Elf64_Word;
typedef int32_t Elf32_Sword;
typedef int32_t Elf64_Sword;
typedef uint64_t Elf32_Xword;
typedef uint64_t Elf64_Xword;
typedef int64_t Elf32_Sxword;
typedef int64_t Elf64_Sxword;
typedef uint32_t Elf32_Off;
typedef uint64_t Elf64_Off;
typedef struct {
    Elf32_Word p_type;          /* Segment type */
    Elf32_Off p_offset;         /* Segment file offset */
    Elf32_Addr p_vaddr;         /* Segment virtual address */
```

```
    Elf32_Addr p_paddr;            /* Segment physical address */
    Elf32_Word p_filesz;           /* Segment size in file */
    Elf32_Word p_memsz;            /* Segment size in memory */
    Elf32_Word p_flags;            /* Segment flags */
    Elf32_Word p_align;            /* Segment alignment */
} Elf32_Phdr;
typedef struct {
    Elf64_Word p_type;             /* Segment type */
    Elf64_Word p_flags;            /* Segment flags */
    Elf64_Off p_offset;            /* Segment file offset */
    Elf64_Addr p_vaddr;            /* Segment virtual address */
    Elf64_Addr p_paddr;            /* Segment physical address */
    Elf64_Xword p_filesz;          /* Segment size in file */
    Elf64_Xword p_memsz;           /* Segment size in memory */
    Elf64_Xword p_align;           /* Segment alignment */
} Elf64_Phdr;
typedef uint16_t Elf32_Half;
typedef uint16_t Elf64_Half;
typedef uint16_t Elf32_Section;
typedef uint16_t Elf64_Section;
typedef struct {
    Elf32_Word n_namesz;
    Elf32_Word n_descsz;
    Elf32_Word n_type;
} Elf32_Nhdr;
typedef struct {
    Elf64_Word n_namesz;
    Elf64_Word n_descsz;
    Elf64_Word n_type;
} Elf64_Nhdr;
typedef struct {
    Elf64_Word st_name;
    unsigned char st_info;
    unsigned char st_other;
    Elf64_Section st_shndx;
    Elf64_Addr st_value;
    Elf64_Xword st_size;
} Elf64_Sym;
typedef struct {
    Elf32_Word st_name;
    Elf32_Addr st_value;
    Elf32_Word st_size;
    unsigned char st_info;
    unsigned char st_other;
    Elf32_Section st_shndx;
} Elf32_Sym;
typedef struct {
    Elf64_Addr r_offset;
    Elf64_Xword r_info;
} Elf64_Rel;
typedef struct {
    Elf32_Addr r_offset;
    Elf32_Word r_info;
} Elf32_Rel;
typedef struct {
    Elf64_Addr r_offset;
    Elf64_Xword r_info;
    Elf64_Sxword r_addend;
} Elf64_Rela;
typedef struct {
    Elf32_Addr r_offset;
    Elf32_Word r_info;
    Elf32_Sword r_addend;
} Elf32_Rela;
typedef struct {
    Elf32_Half vd_version;
```

```
                Elf32_Half vd_flags;
                Elf32_Half vd_ndx;
                Elf32_Half vd_cnt;
                Elf32_Word vd_hash;
                Elf32_Word vd_aux;
                Elf32_Word vd_next;
            } Elf32_Verdef;
            typedef struct {
                Elf64_Half vd_version;
                Elf64_Half vd_flags;
                Elf64_Half vd_ndx;
                Elf64_Half vd_cnt;
                Elf64_Word vd_hash;
                Elf64_Word vd_aux;
                Elf64_Word vd_next;
            } Elf64_Verdef;
            typedef struct {
                Elf64_Word vda_name;
                Elf64_Word vda_next;
            } Elf64_Verdaux;
            typedef struct {
                Elf32_Word vda_name;
                Elf32_Word vda_next;
            } Elf32_Verdaux;
            typedef struct {
                Elf32_Half vn_version;
                Elf32_Half vn_cnt;
                Elf32_Word vn_file;
                Elf32_Word vn_aux;
                Elf32_Word vn_next;
            } Elf32_Verneed;
            typedef struct {
                Elf64_Half vn_version;
                Elf64_Half vn_cnt;
                Elf64_Word vn_file;
                Elf64_Word vn_aux;
                Elf64_Word vn_next;
            } Elf64_Verneed;
            typedef struct {
                Elf32_Word vna_hash;
                Elf32_Half vna_flags;
                Elf32_Half vna_other;
                Elf32_Word vna_name;
                Elf32_Word vna_next;
            } Elf32_Vernaux;
            typedef struct {
                Elf64_Word vna_hash;
                Elf64_Half vna_flags;
                Elf64_Half vna_other;
                Elf64_Word vna_name;
                Elf64_Word vna_next;
            } Elf64_Vernaux;
            typedef struct {
                unsigned char e_ident[EI_NIDENT];
                Elf64_Half e_type;
                Elf64_Half e_machine;
                Elf64_Word e_version;
                Elf64_Addr e_entry;
                Elf64_Off e_phoff;
                Elf64_Off e_shoff;
                Elf64_Word e_flags;
                Elf64_Half e_ehsize;
                Elf64_Half e_phentsize;
                Elf64_Half e_phnum;
                Elf64_Half e_shentsize;
                Elf64_Half e_shnum;
```

```
    Elf64_Half e_shstrndx;
} Elf64_Ehdr;
typedef struct {
    unsigned char e_ident[EI_NIDENT];
    Elf32_Half e_type;
    Elf32_Half e_machine;
    Elf32_Word e_version;
    Elf32_Addr e_entry;
    Elf32_Off e_phoff;
    Elf32_Off e_shoff;
    Elf32_Word e_flags;
    Elf32_Half e_ehsize;
    Elf32_Half e_phentsize;
    Elf32_Half e_phnum;
    Elf32_Half e_shentsize;
    Elf32_Half e_shnum;
    Elf32_Half e_shstrndx;
} Elf32_Ehdr;
typedef struct {
    Elf32_Word sh_name;
    Elf32_Word sh_type;
    Elf32_Word sh_flags;
    Elf32_Addr sh_addr;
    Elf32_Off sh_offset;
    Elf32_Word sh_size;
    Elf32_Word sh_link;
    Elf32_Word sh_info;
    Elf32_Word sh_addralign;
    Elf32_Word sh_entsize;
} Elf32_Shdr;
typedef struct {
    Elf64_Word sh_name;
    Elf64_Word sh_type;
    Elf64_Xword sh_flags;
    Elf64_Addr sh_addr;
    Elf64_Off sh_offset;
    Elf64_Xword sh_size;
    Elf64_Word sh_link;
    Elf64_Word sh_info;
    Elf64_Xword sh_addralign;
    Elf64_Xword sh_entsize;
} Elf64_Shdr;
typedef struct {
    Elf32_Sword d_tag;
    union {
        Elf32_Word d_val;
        Elf32_Addr d_ptr;
    } d_un;
} Elf32_Dyn;
typedef struct {
    Elf64_Sxword d_tag;
    union {
        Elf64_Xword d_val;
        Elf64_Addr d_ptr;
    } d_un;
} Elf64_Dyn;
```

12.4.7 endian.h

```
#define __LITTLE_ENDIAN 1234
#define __BIG_ENDIAN    4321
#define BIG_ENDIAN      __BIG_ENDIAN
#define BYTE_ORDER      __BYTE_ORDER
#define LITTLE_ENDIAN   __LITTLE_ENDIAN
```

12.4.8 err.h

```
extern void err(int __status, const char *__format, ...);
extern void error(int, int, const char *, ...);
extern void errx(int __status, const char *__format, ...);
extern void warn(const char *__format, ...);
extern void warnx(const char *__format, ...);
```

12.4.9 errno.h

```
#define errno   (*__errno_location())

#define EPERM   1               /* Operation not permitted */
#define ECHILD  10              /* No child processes */
#define ENETDOWN        100     /* Network is down */
#define ENETUNREACH     101     /* Network is unreachable */
#define ENETRESET       102      /* Network dropped connection
because of reset */
#define ECONNABORTED    103      /* Software caused connection
abort */
#define ECONNRESET      104     /* Connection reset by peer */
#define ENOBUFS 105             /* No buffer space available */
#define EISCONN 106              /* Transport endpoint is already
connected */
#define ENOTCONN        107      /* Transport endpoint is not
connected */
#define ESHUTDOWN       108      /* Cannot send after transport
endpoint shutdown */
#define ETOOMANYREFS    109      /* Too many references: cannot
splice */
#define EAGAIN  11              /* Try again */
#define ETIMEDOUT       110     /* Connection timed out */
#define ECONNREFUSED    111     /* Connection refused */
#define EHOSTDOWN       112     /* Host is down */
#define EHOSTUNREACH    113     /* No route to host */
#define EALREADY        114      /* Operation already in progress
*/
#define EINPROGRESS     115     /* Operation now in progress */
#define ESTALE  116             /* Stale NFS file handle */
#define EUCLEAN 117             /* Structure needs cleaning */
#define ENOTNAM 118             /* Not a XENIX named type file */
#define ENAVAIL 119              /* No XENIX semaphores available
*/
#define ENOMEM  12              /* Out of memory */
#define EISNAM  120             /* Is a named type file */
#define EREMOTEIO       121     /* Remote I/O error */
#define EDQUOT  122             /* Quota exceeded */
#define ENOMEDIUM       123     /* No medium found */
#define EMEDIUMTYPE     124     /* Wrong medium type */
#define ECANCELED       125     /* Operation Canceled */
#define EACCES  13              /* Permission denied */
#define EOWNERDEAD      130
#define ENOTRECOVERABLE 131
#define EFAULT  14              /* Bad address */
#define ENOTBLK 15              /* Block device required */
#define EBUSY   16              /* Device or resource busy */
#define EEXIST  17              /* File exists */
#define EXDEV   18              /* Cross-device link */
#define ENODEV  19              /* No such device */
#define ENOENT  2               /* No such file or directory */
#define ENOTDIR 20              /* Not a directory */
#define EISDIR  21              /* Is a directory */
#define EINVAL  22              /* Invalid argument */
#define ENFILE  23              /* File table overflow */
```

```
#define EMFILE  24              /* Too many open files */
#define ENOTTY  25              /* Not a typewriter */
#define ETXTBSY 26              /* Text file busy */
#define EFBIG   27              /* File too large */
#define ENOSPC  28              /* No space left on device */
#define ESPIPE  29              /* Illegal seek */
#define ESRCH   3               /* No such process */
#define EROFS   30              /* Read-only file system */
#define EMLINK  31              /* Too many links */
#define EPIPE   32              /* Broken pipe */
#define EDOM    33               /* Math argument out of domain of
func */
#define ERANGE  34                /* Math result not representable
*/
#define EDEADLK 35                /* Resource deadlock would occur
*/
#define ENAMETOOLONG    36      /* File name too long */
#define ENOLCK  37              /* No record locks available */
#define ENOSYS  38              /* Function not implemented */
#define ENOTEMPTY       39      /* Directory not empty */
#define EINTR   4               /* Interrupted system call */
#define ELOOP    40                     /* Too many symbolic links
encountered */
#define ENOMSG  42              /* No message of desired type */
#define EIDRM   43              /* Identifier removed */
#define ECHRNG  44              /* Channel number out of range */
#define EL2NSYNC        45      /* Level 2 not synchronized */
#define EL3HLT  46              /* Level 3 halted */
#define EL3RST  47              /* Level 3 reset */
#define ELNRNG  48              /* Link number out of range */
#define EUNATCH 49               /* Protocol driver not attached
*/
#define EIO     5               /* I/O error */
#define ENOANO  55              /* No anode */
#define EBADRQC 56              /* Invalid request code */
#define EBADSLT 57              /* Invalid slot */
#define EBFONT  59              /* Bad font file format */
#define ENXIO   6               /* No such device or address */
#define ENOSTR  60              /* Device not a stream */
#define ENODATA 61              /* No data available */
#define ETIME   62              /* Timer expired */
#define ENOSR   63              /* Out of streams resources */
#define ENONET  64               /* Machine is not on the network
*/
#define ENOPKG  65              /* Package not installed */
#define EREMOTE 66              /* Object is remote */
#define ENOLINK 67              /* Link has been severed */
#define EADV    68              /* Advertise error */
#define ESRMNT  69              /* Srmount error */
#define E2BIG   7               /* Argument list too long */
#define ECOMM   70              /* Communication error on send */
#define EPROTO  71              /* Protocol error */
#define EMULTIHOP       72      /* Multihop attempted */
#define EDOTDOT 73              /* RFS specific error */
#define EBADMSG 74              /* Not a data message */
#define EOVERFLOW       75       /* Value too large for defined
data type */
#define ENOTUNIQ        76      /* Name not unique on network */
#define EBADFD  77               /* File descriptor in bad state
*/
#define EREMCHG 78              /* Remote address changed */
#define ELIBACC 79              /* Can not access a needed shared
library */
#define ENOEXEC 8               /* Exec format error */
#define ELIBBAD 80               /* Accessing a corrupted shared
library */
```

```
#define ELIBSCN 81                      /* .lib section in a.out
corrupted */
#define ELIBMAX 82              /* Attempting to link in too many
shared libraries */
#define ELIBEXEC        83      /* Cannot exec a shared library
directly */
#define EILSEQ  84             /* Illegal byte sequence */
#define ERESTART        85      /* Interrupted system call should
be restarted */
#define ESTRPIPE        86      /* Streams pipe error */
#define EUSERS  87             /* Too many users */
#define ENOTSOCK        88      /* Socket operation on non-socket
*/
#define EDESTADDRREQ    89       /* Destination address required
*/
#define EBADF   9              /* Bad file number */
#define EMSGSIZE        90      /* Message too long */
#define EPROTOTYPE      91      /* Protocol wrong type for socket
*/
#define ENOPROTOOPT     92     /* Protocol not available */
#define EPROTONOSUPPORT 93     /* Protocol not supported */
#define ESOCKTNOSUPPORT 94     /* Socket type not supported */
#define EOPNOTSUPP      95       /* Operation not supported on
transport endpoint */
#define EPFNOSUPPORT    96      /* Protocol family not supported
*/
#define EAFNOSUPPORT    97       /* Address family not supported
by protocol */
#define EADDRINUSE      98      /* Address already in use */
#define EADDRNOTAVAIL   99          /* Cannot assign requested
address */
#define EWOULDBLOCK     EAGAIN /* Operation would block */
#define ENOTSUP EOPNOTSUPP

extern int *__errno_location(void);
```

12.4.10 execinfo.h

```
extern int backtrace(void **__array, int __size);
extern  char  **backtrace_symbols(void  *const  *__array,  int
__size);
extern  void  backtrace_symbols_fd(void  *const  *__array,  int
__size,
                                 int __fd);
```

12.4.11 fcntl.h

```
#define POSIX_FADV_NORMAL       0
#define O_RDONLY        00
#define O_ACCMODE       0003
#define O_WRONLY        01
#define O_CREAT 0100
#define O_TRUNC 01000
#define O_DSYNC 010000
#define O_RSYNC 010000
#define O_SYNC  010000
#define O_RDWR  02
#define O_EXCL  0200
#define O_APPEND        02000
#define O_ASYNC 020000
#define O_NOCTTY        0400
#define O_NDELAY        04000
#define O_NONBLOCK      04000
#define FD_CLOEXEC      1
```

```
#define POSIX_FADV_RANDOM       1
#define POSIX_FADV_SEQUENTIAL   2
#define POSIX_FADV_WILLNEED     3

struct flock {
    short l_type;
    short l_whence;
    off_t l_start;
    off_t l_len;
    pid_t l_pid;
};
struct flock64 {
    short l_type;
    short l_whence;
    loff_t l_start;
    loff_t l_len;
    pid_t l_pid;
};

#define AT_FDCWD            -100
#define AT_SYMLINK_NOFOLLOW     0x100
#define AT_EACCESS      0x200
#define AT_REMOVEDIR    0x200
#define AT_SYMLINK_FOLLOW       0x400

#define F_DUPFD 0
#define F_RDLCK 0
#define F_GETFD 1
#define F_WRLCK 1
#define F_SETSIG        10
#define F_GETSIG        11
#define F_SETFD 2
#define F_UNLCK 2
#define F_GETFL 3
#define F_SETFL 4
#define F_GETLK 5
#define F_SETLK 6
#define F_SETLKW        7
#define F_SETOWN        8
#define F_GETOWN        9

extern int creat(const char *__file, mode_t __mode);
extern int creat64(const char *__file, mode_t __mode);
extern int fcntl(int __fd, int __cmd, ...);
extern int open(const char *__file, int __oflag, ...);
extern int open64(const char *__file, int __oflag, ...);
extern int openat(int __fd, const char *__file, int __oflag,
...);
extern int openat64(int __fd, const char *__file, int __oflag,
...);
extern int posix_fadvise(int __fd, off_t __offset, off_t __len,
                        int __advise);
extern int posix_fadvise64(int __fd, off64_t __offset, off64_t
__len,
                        int __advise);
extern int posix_fallocate(int __fd, off_t __offset, off_t
__len);
extern int posix_fallocate64(int __fd, off64_t __offset, off64_t
__len);
```

12.4.12 fmtmsg.h

```
#define MM_HARD 1                   /* Source of the condition is
hardware. */
#define MM_NRECOV       128     /* Non-recoverable error. */
```

```
#define MM_UTIL 16                    /* Condition detected by utility.
*/
#define MM_SOFT 2                       /* Source of the condition is
software. */
#define MM_PRINT        256      /* Display message in standard
error. */
#define MM_OPSYS          32         /* Condition detected by
operating system. */
#define MM_FIRM 4                       /* Source of the condition is
firmware. */
#define MM_CONSOLE        512       /* Display message on system
console. */
#define MM_RECOVER      64       /* Recoverable error. */
#define MM_APPL 8                        /* Condition detected by
application. */

#define MM_NOSEV        0         /* No severity level provided for
the message. */
#define MM_HALT 1                     /* Error causing application to
halt. */
#define MM_ERROR        2        /* Application has encountered a
non-fatal fault. */
#define MM_WARNING      3           /* Application has detected
unusual non-error condition. */
#define MM_INFO 4                /* Informative message. */

#define MM_NULLACT      ((char *) 0)
#define MM_NULLLBL      ((char *) 0)
#define MM_NULLTAG      ((char *) 0)
#define MM_NULLTXT      ((char *) 0)
#define MM_NULLMC       ((long int) 0)
#define MM_NULLSEV      0

#define MM_NOTOK                -1          /* The function failed
completely. */
#define MM_OK   0                 /* The function succeeded. */
#define MM_NOMSG        1          /* The function was unable to
generate a message on standard error, but otherwise succeeded. */
#define MM_NOCON        4        /* The function was unable to
generate a console message, but otherwise succeeded. */

extern int fmtmsg(long int __classification, const char *__label,
              int __severity, const char *__text, const char
*__action,
              const char *__tag);
```

12.4.13 fnmatch.h

```
#define FNM_PATHNAME    (1<<0)
#define FNM_NOESCAPE    (1<<1)
#define FNM_PERIOD      (1<<2)
#define FNM_NOMATCH     1

extern int fnmatch(const char *__pattern, const char *__name, int
__flags);
```

12.4.14 ftw.h

```
#define FTW_D   FTW_D
#define FTW_DNR FTW_DNR
#define FTW_DP  FTW_DP
#define FTW_F   FTW_F
#define FTW_NS  FTW_NS
#define FTW_SL  FTW_SL
```

```
#define FTW_SLN FTW_SLN

enum {
    FTW_F,
    FTW_D,
    FTW_DNR,
    FTW_NS,
    FTW_SL,
    FTW_DP,
    FTW_SLN
};

enum {
    FTW_PHYS = 1,
    FTW_MOUNT = 2,
    FTW_CHDIR = 4,
    FTW_DEPTH = 8
};

struct FTW {
    int base;
    int level;
};

typedef int (*__ftw_func_t) (const char *__filename,
                              const struct stat * __status, int
__flag);
typedef int (*__ftw64_func_t) (const char *__filename,
                               const struct stat64 * __status,
int __flag);
typedef int (*__nftw_func_t) (const char *__filename,
                              const struct stat * __status, int
__flag,
                              struct FTW * __info);
typedef int (*__nftw64_func_t) (const char *__filename,
                                const struct stat64 * __status,
int __flag,
                                struct FTW * __info);
extern int ftw(const char *__dir, __ftw_func_t __func, int
__descriptors);
extern int ftw64(const char *__dir, __ftw64_func_t __func,
               int __descriptors);
extern int nftw(const char *__dir, __nftw_func_t __func, int
__descriptors,
               int __flag);
extern int nftw64(const char *__dir, __nftw64_func_t __func,
               int __descriptors, int __flag);
```

12.4.15 getopt.h

```
#define no_argument     0
#define required_argument       1
#define optional_argument       2

struct option {
    const char *name;
    int has_arg;
    int *flag;
    int val;
};
extern int getopt_long(int ___argc, char *const ___argv[],
                    const char *__shortopts,
                    const struct option *__longopts, int
*__longind);
extern int getopt_long_only(int ___argc, char *const ___argv[],
```

```
                                     const char *__shortopts,
                                     const struct option *__longopts,
                                     int *__longind);
```

12.4.16 glob.h

```
#define GLOB_ERR        (1<<0)
#define GLOB_MARK       (1<<1)
#define GLOB_BRACE      (1<<10)
#define GLOB_NOMAGIC    (1<<11)
#define GLOB_TILDE      (1<<12)
#define GLOB_ONLYDIR    (1<<13)
#define GLOB_TILDE_CHECK        (1<<14)
#define GLOB_NOSORT     (1<<2)
#define GLOB_DOOFFS     (1<<3)
#define GLOB_NOCHECK    (1<<4)
#define GLOB_APPEND     (1<<5)
#define GLOB_NOESCAPE   (1<<6)
#define GLOB_PERIOD     (1<<7)
#define GLOB_MAGCHAR    (1<<8)
#define GLOB_ALTDIRFUNC (1<<9)

#define GLOB_NOSPACE    1
#define GLOB_ABORTED    2
#define GLOB_NOMATCH    3
#define GLOB_NOSYS      4

typedef struct {
    size_t gl_pathc;
    char **gl_pathv;
    size_t gl_offs;
    int gl_flags;
    void (*gl_closedir) (void *);
    struct dirent *(*gl_readdir) (void *);
    void *(*gl_opendir) (const char *);
    int (*gl_lstat) (const char *, struct stat *);
    int (*gl_stat) (const char *, struct stat *);
} glob_t;

typedef struct {
    size_t gl_pathc;
    char **gl_pathv;
    size_t gl_offs;
    int gl_flags;
    void (*gl_closedir) (void *);
    struct dirent64 *(*gl_readdir) (void *);
    void *(*gl_opendir) (const char *);
    int (*gl_lstat) (const char *, struct stat *);
    int (*gl_stat) (const char *, struct stat *);
} glob64_t;
extern int glob(const char *__pattern, int __flags,
                int (*__errfunc) (const char *, int), glob_t *
__pglob);
extern int glob64(const char *__pattern, int __flags,
                  int (*__errfunc) (const char *, int),
                  glob64_t * __pglob);
extern void globfree(glob_t * __pglob);
extern void globfree64(glob64_t * __pglob);
```

12.4.17 gnu/libc-version.h

```
extern const char *gnu_get_libc_release(void);
extern const char *gnu_get_libc_version(void);
```

12.4.18 grp.h

```
struct group {
    char *gr_name;
    char *gr_passwd;
    gid_t gr_gid;
    char **gr_mem;
};

extern void endgrent(void);
extern struct group *getgrent(void);
extern int getgrent_r(struct group *__resultbuf, char *__buffer,
                      size_t __buflen, struct group **__result);
extern struct group *getgrgid(gid_t __gid);
extern int getgrgid_r(gid_t __gid, struct group *__resultbuf,
                      char *__buffer, size_t __buflen,
                      struct group **__result);
extern struct group *getgrnam(const char *__name);
extern   int   getgrnam_r(const   char   *__name,   struct   group
*__resultbuf,
                      char *__buffer, size_t __buflen,
                      struct group **__result);
extern int getgrouplist(const char *__user, gid_t __group,
                        gid_t * __groups, int *__ngroups);
extern int initgroups(const char *__user, gid_t __group);
extern void setgrent(void);
extern int setgroups(size_t __n, const gid_t * __groups);
```

12.4.19 iconv.h

```
typedef void *iconv_t;
extern  size_t  iconv(iconv_t  __cd,  char  **__inbuf,  size_t  *
__inbytesleft,
                    char **__outbuf, size_t * __outbytesleft);
extern int iconv_close(iconv_t __cd);
extern  iconv_t  iconv_open(const  char  *__tocode,  const  char
*__fromcode);
```

12.4.20 inttypes.h

```
typedef lldiv_t imaxdiv_t;

#define __PDP_ENDIAN    3412
#define PDP_ENDIAN      __PDP_ENDIAN

extern intmax_t imaxabs(intmax_t __n);
extern imaxdiv_t imaxdiv(intmax_t __numer, intmax_t __denom);
extern  intmax_t strtoimax(const  char  *__nptr,  char  **__endptr,
int __base);
extern uintmax_t strtoumax(const char *__nptr, char **__endptr,
                           int __base);
extern  intmax_t  wcstoimax(const  wchar_t  *  __nptr,  wchar_t  *
*__endptr,
                           int __base);
extern  uintmax_t  wcstoumax(const  wchar_t  *  __nptr,  wchar_t  *
*__endptr,
                           int __base);
```

12.4.21 langinfo.h

```
#define ABDAY_1 0x20000        /* Sun. */
```

```
#define ABDAY_2 0x20001
#define ABDAY_3 0x20002
#define ABDAY_4 0x20003
#define ABDAY_5 0x20004
#define ABDAY_6 0x20005
#define ABDAY_7 0x20006

#define DAY_1   0x20007
#define DAY_2   0x20008
#define DAY_3   0x20009
#define DAY_4   0x2000A
#define DAY_5   0x2000B
#define DAY_6   0x2000C
#define DAY_7   0x2000D

#define ABMON_1 0x2000E
#define ABMON_2 0x2000F
#define ABMON_3 0x20010
#define ABMON_4 0x20011
#define ABMON_5 0x20012
#define ABMON_6 0x20013
#define ABMON_7 0x20014
#define ABMON_8 0x20015
#define ABMON_9 0x20016
#define ABMON_10        0x20017
#define ABMON_11        0x20018
#define ABMON_12        0x20019

#define MON_1   0x2001A
#define MON_2   0x2001B
#define MON_3   0x2001C
#define MON_4   0x2001D
#define MON_5   0x2001E
#define MON_6   0x2001F
#define MON_7   0x20020
#define MON_8   0x20021
#define MON_9   0x20022
#define MON_10  0x20023
#define MON_11  0x20024
#define MON_12  0x20025

#define AM_STR  0x20026
#define PM_STR  0x20027

#define D_T_FMT 0x20028
#define D_FMT   0x20029
#define T_FMT   0x2002A
#define T_FMT_AMPM      0x2002B

#define ERA     0x2002C
#define ERA_D_FMT       0x2002E
#define ALT_DIGITS      0x2002F
#define ERA_D_T_FMT     0x20030
#define ERA_T_FMT       0x20031

#define CODESET 14

#define CRNCYSTR        0x4000F

#define RADIXCHAR       0x10000
#define THOUSEP 0x10001
#define YESEXPR 0x50000
#define NOEXPR  0x50001
#define YESSTR  0x50002
#define NOSTR   0x50003
```

```
extern char *nl_langinfo(nl_item __item);
```

12.4.22 libgen.h

```
#define basename __xpg_basename

extern char *__xpg_basename(char *__path);
extern char *dirname(char *__path);
```

12.4.23 libintl.h

```
extern char *bind_textdomain_codeset(const char *__domainname,
                                     const char *__codeset);
extern char *bindtextdomain(const char *__domainname,
                            const char *__dirname);
extern char *dcgettext(const char *__domainname, const char
*__msgid,
                       int __category);
extern char *dcngettext(const char *__domainname, const char
*__msgid1,
                        const char *__msgid2, unsigned long int
__n,
                        int __category);
extern char *dgettext(const char *__domainname, const char
*__msgid);
extern char *dngettext(const char *__domainname, const char
*__msgid1,
                       const char *__msgid2, unsigned long int
__n);
extern char *gettext(const char *__msgid);
extern char *ngettext(const char *__msgid1, const char *__msgid2,
                      unsigned long int __n);
extern char *textdomain(const char *__domainname);
```

12.4.24 limits.h

```
#define LLONG_MIN         (-LLONG_MAX-1LL)
#define _POSIX_AIO_MAX  1
#define _POSIX_QLIMIT   1
#define _POSIX2_BC_STRING_MAX   1000
#define _POSIX2_CHARCLASS_NAME_MAX      14
#define _POSIX_NAME_MAX 14
#define _POSIX_UIO_MAXIOV       16
#define ULLONG_MAX        18446744073709551615ULL
#define _POSIX2_COLL_WEIGHTS_MAX        2
#define _POSIX_AIO_LISTIO_MAX   2
#define _POSIX_OPEN_MAX 20
#define _POSIX_CLOCKRES_MIN     20000000
#define CHARCLASS_NAME_MAX      2048
#define LINE_MAX        2048
#define _POSIX2_BC_DIM_MAX      2048
#define _POSIX2_LINE_MAX        2048
#define _POSIX_CHILD_MAX        25
#define COLL_WEIGHTS_MAX        255
#define _POSIX2_RE_DUP_MAX      255
#define _POSIX_HOST_NAME_MAX    255
#define _POSIX_MAX_CANON        255
#define _POSIX_MAX_INPUT        255
#define _POSIX_RE_DUP_MAX       255
#define _POSIX_SYMLINK_MAX      255
#define _POSIX_PATH_MAX 256
#define _POSIX_SEM_NSEMS_MAX    256
```

```
#define NGROUPS_MAX       32
#define _POSIX2_EXPR_NEST_MAX   32
#define _POSIX_DELAYTIMER_MAX   32
#define _POSIX_MQ_PRIO_MAX      32
#define _POSIX_SIGQUEUE_MAX     32
#define _POSIX_TIMER_MAX        32
#define _POSIX_SEM_VALUE_MAX    32767
#define _POSIX_SSIZE_MAX        32767
#define PATH_MAX        4096
#define _POSIX_ARG_MAX  4096
#define _POSIX_PIPE_BUF 512
#define _POSIX_TZNAME_MAX       6
#define _POSIX_LINK_MAX 8
#define _POSIX_MQ_OPEN_MAX      8
#define _POSIX_NGROUPS_MAX      8
#define _POSIX_RTSIG_MAX        8
#define _POSIX_STREAM_MAX       8
#define _POSIX_SYMLOOP_MAX      8
#define _POSIX_LOGIN_NAME_MAX   9
#define _POSIX_TTY_NAME_MAX     9
#define LLONG_MAX        9223372036854775807LL
#define _POSIX2_BC_BASE_MAX     99
#define _POSIX2_BC_SCALE_MAX    99
#define SSIZE_MAX        LONG_MAX          /* Maximum value of an
object of type ssize_t */
#define BC_BASE_MAX     _POSIX2_BC_BASE_MAX
#define BC_DIM_MAX      _POSIX2_BC_DIM_MAX
#define BC_SCALE_MAX    _POSIX2_BC_SCALE_MAX
#define BC_STRING_MAX   _POSIX2_BC_STRING_MAX
#define EXPR_NEST_MAX   _POSIX2_EXPR_NEST_MAX
#define _POSIX_FD_SETSIZE       _POSIX_OPEN_MAX
#define _POSIX_HIWAT    _POSIX_PIPE_BUF

#define MB_LEN_MAX      16

#define SCHAR_MIN       (-128)
#define SCHAR_MAX       127
#define UCHAR_MAX       255
#define CHAR_BIT        8

#define SHRT_MIN        (-32768)
#define SHRT_MAX        32767
#define USHRT_MAX       65535

#define INT_MIN (-INT_MAX-1)
#define INT_MAX 2147483647
#define UINT_MAX        4294967295U

#define LONG_MIN        (-LONG_MAX-1L)

#define PTHREAD_KEYS_MAX        1024
#define PTHREAD_THREADS_MAX     16384
#define PTHREAD_DESTRUCTOR_ITERATIONS   4
```

12.4.25 link.h

```
extern int
dl_iterate_phdr(int (*callback) (struct dl_phdr_info *, size_t,
void *),
                void *data);
```

12.4.26 locale.h

```
struct lconv {
```

```
    char *decimal_point;
    char *thousands_sep;
    char *grouping;
    char *int_curr_symbol;
    char *currency_symbol;
    char *mon_decimal_point;
    char *mon_thousands_sep;
    char *mon_grouping;
    char *positive_sign;
    char *negative_sign;
    char int_frac_digits;
    char frac_digits;
    char p_cs_precedes;
    char p_sep_by_space;
    char n_cs_precedes;
    char n_sep_by_space;
    char p_sign_posn;
    char n_sign_posn;
    char int_p_cs_precedes;
    char int_p_sep_by_space;
    char int_n_cs_precedes;
    char int_n_sep_by_space;
    char int_p_sign_posn;
    char int_n_sign_posn;
};

#define LC_GLOBAL_LOCALE        ((locale_t) -1L)
#define LC_CTYPE        0
#define LC_NUMERIC      1
#define LC_TELEPHONE    10
#define LC_MEASUREMENT  11
#define LC_IDENTIFICATION       12
#define LC_TIME 2
#define LC_COLLATE      3
#define LC_MONETARY     4
#define LC_MESSAGES     5
#define LC_ALL  6
#define LC_PAPER        7
#define LC_NAME 8
#define LC_ADDRESS      9

struct __locale_struct {
    struct locale_data *__locales[13];
    const unsigned short *__ctype_b;
    const int *__ctype_tolower;
    const int *__ctype_toupper;
    const char *__names[13];
};
typedef struct __locale_struct *__locale_t;

typedef struct __locale_struct *locale_t;

#define LC_ADDRESS_MASK (1 << LC_ADDRESS)
#define LC_COLLATE_MASK (1 << LC_COLLATE)
#define LC_IDENTIFICATION_MASK  (1 << LC_IDENTIFICATION)
#define LC_MEASUREMENT_MASK     (1 << LC_MEASUREMENT)
#define LC_MESSAGES_MASK        (1 << LC_MESSAGES)
#define LC_MONETARY_MASK        (1 << LC_MONETARY)
#define LC_NAME_MASK    (1 << LC_NAME)
#define LC_NUMERIC_MASK (1 << LC_NUMERIC)
#define LC_PAPER_MASK   (1 << LC_PAPER)
#define LC_TELEPHONE_MASK       (1 << LC_TELEPHONE)
#define LC_TIME_MASK    (1 << LC_TIME)
#define LC_CTYPE_MASK   (1<<LC_CTYPE)
#define LC_ALL_MASK        \
```

```
             (LC_CTYPE_MASK|         LC_NUMERIC_MASK|         LC_TIME_MASK|
LC_COLLATE_MASK| LC_MONETARY_MASK|\
             LC_MESSAGES_MASK|       LC_PAPER_MASK|        LC_NAME_MASK|
LC_ADDRESS_MASK| LC_TELEPHONE_MASK|\
             LC_MEASUREMENT_MASK| LC_IDENTIFICATION_MASK)

extern locale_t duplocale(locale_t __dataset);
extern void freelocale(locale_t __dataset);
extern struct lconv *localeconv(void);
extern  locale_t  newlocale(int  __category_mask,  const  char
*__locale,
                          locale_t __base);
extern char *setlocale(int __category, const char *__locale);
extern locale_t uselocale(locale_t __dataset);
```

12.4.27 monetary.h

```
extern ssize_t strfmon(char *__s, size_t __maxsize, const char
*__format,
                          ...);
```

12.4.28 net/if.h

```
#define IF_NAMESIZE     16

#define IFF_UP  0x01          /* Interface is up. */
#define IFF_BROADCAST   0x02    /* Broadcast address valid. */
#define IFF_DEBUG       0x04    /* Turn on debugging. */
#define IFF_LOOPBACK    0x08    /* Is a loopback net. */
#define IFF_POINTOPOINT 0x10     /* Interface is point-to-point
link. */
#define IFF_PROMISC     0x100  /* Receive all packets. */
#define IFF_MULTICAST   0x1000 /* Supports multicast. */
#define IFF_NOTRAILERS 0x20    /* Avoid use of trailers. */
#define IFF_RUNNING     0x40   /* Resources allocated. */
#define IFF_NOARP          0x80      /* No  address  resolution
protocol. */

struct if_nameindex {
    unsigned int if_index;      /* 1, 2, ... */
    char *if_name;              /* null terminated name: */
};

struct ifaddr {
    struct sockaddr ifa_addr;   /* Address of interface. */
    union {
        struct sockaddr ifu_broadaddr;
        struct sockaddr ifu_dstaddr;
    } ifa_ifu;
    void *ifa_ifp;
    void *ifa_next;
};

#define ifr_name        ifr_ifrn.ifrn_name      /* interface name
*/
#define ifr_addr        ifr_ifru.ifru_addr      /* address */
#define  ifr_broadaddr     ifr_ifru.ifru_broadaddr /* broadcast
address */
#define ifr_data        ifr_ifru.ifru_data      /* for use by
interface */
#define ifr_dstaddr     ifr_ifru.ifru_dstaddr   /* other end of
p-p lnk */
#define ifr_flags       ifr_ifru.ifru_flags    /* flags */
```

```
#define ifr_hwaddr       ifr_ifru.ifru_hwaddr   /* interface name
*/
#define ifr_bandwidth   ifr_ifru.ifru_ivalue   /* link bandwidth
*/
#define  ifr_ifindex       ifr_ifru.ifru_ivalue      /* interface
index */
#define ifr_metric      ifr_ifru.ifru_ivalue   /* metric */
#define ifr_qlen         ifr_ifru.ifru_ivalue    /* queue length
*/
#define ifr_mtu ifr_ifru.ifru_mtu       /* mtu */
#define ifr_netmask     ifr_ifru.ifru_netmask   /* interface net
mask */
#define ifr_slave        ifr_ifru.ifru_slave     /* slave device
*/
#define IFNAMSIZ        IF_NAMESIZE

struct ifreq {
    union {
        char ifrn_name[IFNAMSIZ];
    } ifr_ifrn;
    union {
        struct sockaddr ifru_addr;
        struct sockaddr ifru_dstaddr;
        struct sockaddr ifru_broadaddr;
        struct sockaddr ifru_netmask;
        struct sockaddr ifru_hwaddr;
        short ifru_flags;
        int ifru_ivalue;
        int ifru_mtu;
        char ifru_slave[IFNAMSIZ];
        char ifru_newname[IFNAMSIZ];
        caddr_t ifru_data;
        struct ifmap ifru_map;
    } ifr_ifru;
};

#define ifc_buf ifc_ifcu.ifcu_buf      /* Buffer address. */
#define ifc_req ifc_ifcu.ifcu_req       /* Array of structures.
*/

struct ifconf {
    int ifc_len;
    union {
        caddr_t ifcu_buf;
        struct ifreq *ifcu_req;
    } ifc_ifcu;
};
extern void if_freenameindex(struct if_nameindex *__ptr);
extern   char   *if_indextoname(unsigned   int   __ifindex,   char
*__ifname);
extern struct if_nameindex *if_nameindex(void);
extern unsigned int if_nametoindex(const char *__ifname);
```

12.4.29 netdb.h

```
#define h_errno (*__h_errno_location ())
#define NETDB_INTERNAL  -1      /* See errno. */
#define NETDB_SUCCESS   0       /* No problem. */
#define HOST_NOT_FOUND  1        /* Authoritative Answer Host not
found. */
#define IPPORT_RESERVED 1024
#define NI_MAXHOST      1025
#define TRY_AGAIN        2         /* Non-Authoritative Host not
found, or SERVERFAIL. */
```

```
#define  NO_RECOVERY      3            /* Non  recoverable errors,
FORMERR, REFUSED, NOTIMP. */
#define NI_MAXSERV      32
#define NO_DATA 4                 /* Valid name, no data record of
requested type. */
#define h_addr  h_addr_list[0]
#define  NO_ADDRESS         NO_DATA /* No address, look for  MX
record. */

struct servent {
    char *s_name;
    char **s_aliases;
    int s_port;
    char *s_proto;
};
struct hostent {
    char *h_name;
    char **h_aliases;
    int h_addrtype;
    int h_length;
    char **h_addr_list;
};
struct protoent {
    char *p_name;
    char **p_aliases;
    int p_proto;
};
struct netent {
    char *n_name;
    char **n_aliases;
    int n_addrtype;
    unsigned int n_net;
};

#define AI_PASSIVE       0x0001  /* Socket address is intended for
`bind' */
#define AI_CANONNAME     0x0002  /* Request for canonical name */
#define AI_NUMERICHOST   0x0004  /* Don't use name resolution */
#define AI_V4MAPPED       0x0008   /* IPv4 mapped addresses are
acceptable. */
#define AI_ALL   0x0010               /* Return IPv4 mapped and IPv6
addresses. */
#define AI_ADDRCONFIG    0x0020  /* Use configuration of this host
to choose returned address type.. */
#define AI_NUMERICSERV 0x0400  /* Don't use name resolution */

struct addrinfo {
    int ai_flags;
    int ai_family;
    int ai_socktype;
    int ai_protocol;
    socklen_t ai_addrlen;
    struct sockaddr *ai_addr;
    char *ai_canonname;
    struct addrinfo *ai_next;
};

#define NI_NUMERICHOST  1
#define NI_DGRAM        16
#define NI_NUMERICSERV  2
#define NI_NOFQDN       4
#define NI_NAMEREQD     8

#define EAI_BADFLAGS     -1       /* Invalid value for `ai_flags'
field. */
#define EAI_MEMORY       -10    /* Memory allocation failure. */
```

```
#define EAI_SYSTEM        -11       /* System error returned in
`errno'. */
#define EAI_NONAME      -2       /* NAME or SERVICE is unknown. */
#define EAI_AGAIN        -3         /* Temporary failure in name
resolution. */
#define EAI_FAIL         -4        /* Non-recoverable failure in
name res. */
#define EAI_NODATA       -5        /* No address associated with
NAME. */
#define EAI_FAMILY      -6      /* `ai_family' not supported. */
#define EAI_SOCKTYPE    -7      /* `ai_family' not supported. */
#define EAI_SERVICE      -8        /* SERVICE not supported for
`ai_socktype'. */
#define EAI_ADDRFAMILY  -9        /* Address family for NAME not
supported. */


extern int *__h_errno_location(void);
extern void endprotoent(void);
extern void endservent(void);
extern void freeaddrinfo(struct addrinfo *__ai);
extern const char *gai_strerror(int __ecode);
extern int getaddrinfo(const char *__name, const char *__service,
                       const struct addrinfo *__req,
                       struct addrinfo **__pai);
extern struct hostent *gethostbyaddr(const void *__addr,
socklen_t __len,
                                      int __type);
extern int gethostbyaddr_r(const void *__addr, socklen_t __len,
int __type,
                           struct hostent *__result_buf, char
*__buf,
                           size_t __buflen, struct hostent
**__result,
                           int *__h_errnop);
extern struct hostent *gethostbyname(const char *__name);
extern struct hostent *gethostbyname2(const char *__name, int
__af);
extern int gethostbyname2_r(const char *__name, int __af,
                           struct hostent *__result_buf, char
*__buf,
                           size_t __buflen, struct hostent
**__result,
                           int *__h_errnop);
extern int gethostbyname_r(const char *__name,
                           struct hostent *__result_buf, char
*__buf,
                           size_t __buflen, struct hostent
**__result,
                           int *__h_errnop);
extern struct protoent *getprotobyname(const char *__name);
extern int getprotobyname_r(const char *__name,
                           struct protoent *__result_buf, char
*__buf,
                           size_t __buflen, struct protoent
**__result);
extern struct protoent *getprotobynumber(int __proto);
extern int getprotobynumber_r(int __proto, struct protoent
*__result_buf,
                            char *__buf, size_t __buflen,
                            struct protoent **__result);
extern struct protoent *getprotoent(void);
extern int getprotoent_r(struct protoent *__result_buf, char
*__buf,
                           size_t __buflen, struct protoent
**__result);
extern struct servent *getservbyname(const char *__name,
```

```
                                            const char *__proto);
extern  int  getservbyname_r(const  char  *__name,  const  char
*__proto,
                        struct   servent   *__result_buf,   char
*__buf,
                        size_t    __buflen,   struct   servent
**__result);
extern  struct  servent  *getservbyport(int  __port,  const  char
*__proto);
extern int getservbyport_r(int __port, const char *__proto,
                        struct   servent   *__result_buf,   char
*__buf,
                        size_t    __buflen,    struct   servent
**__result);
extern struct servent *getservent(void);
extern   int   getservent_r(struct   servent   *__result_buf,  char
*__buf,
                        size_t     __buflen,    struct    servent
**__result);
extern void setprotoent(int __stay_open);
extern void setservent(int __stay_open);
```

12.4.30 netinet/icmp6.h

```
#define  ICMP6_FILTER_WILLBLOCK(type,filterp)        ((((filterp)-
>icmp6_filt[(type) >> 5]) & (1 << ((type) & 31))) != 0)
#define  ICMP6_FILTER_WILLPASS(type,filterp)         ((((filterp)-
>icmp6_filt[(type) >> 5]) & (1 << ((type) & 31))) == 0)
#define  ICMP6_FILTER_SETPASS(type,filterp)          ((((filterp)-
>icmp6_filt[(type) >> 5]) &= ~(1 << ((type) & 31))))
#define  ICMP6_FILTER_SETBLOCK(type,filterp)         ((((filterp)-
>icmp6_filt[(type) >> 5]) |= (1 << ((type) & 31))))
#define ICMP6_DST_UNREACH_NOROUTE        0
#define ICMP6_PARAMPROB_HEADER  0
#define ICMP6_TIME_EXCEED_TRANSIT        0
#define ICMP6_RR_FLAGS_PREVDONE 0x08
#define ICMP6_RR_FLAGS_SPECSITE 0x10
#define ICMP6_RR_PCOUSE_RAFLAGS_AUTO     0x10
#define ICMP6_RR_FLAGS_FORCEAPPLY        0x20
#define ICMP6_RR_PCOUSE_RAFLAGS_ONLINK  0x20
#define ND_OPT_PI_FLAG_RADDR    0x20
#define ND_RA_FLAG_HOME_AGENT   0x20
#define ICMP6_RR_FLAGS_REQRESULT         0x40
#define ND_OPT_PI_FLAG_AUTO     0x40
#define ND_RA_FLAG_OTHER        0x40
#define ICMP6_INFOMSG_MASK      0x80
#define ICMP6_RR_FLAGS_TEST     0x80
#define ND_OPT_PI_FLAG_ONLINK   0x80
#define ND_RA_FLAG_MANAGED      0x80
#define ICMP6_DST_UNREACH       1
#define ICMP6_DST_UNREACH_ADMIN 1
#define ICMP6_FILTER    1
#define ICMP6_FILTER_BLOCK      1
#define ICMP6_PARAMPROB_NEXTHEADER      1
#define ICMP6_TIME_EXCEED_REASSEMBLY    1
#define ND_OPT_SOURCE_LINKADDR 1
#define RPM_PCO_ADD     1
#define ICMP6_ECHO_REQUEST      128
#define ICMP6_ECHO_REPLY        129
#define MLD_LISTENER_QUERY      130
#define MLD_LISTENER_REPORT     131
#define MLD_LISTENER_REDUCTION 132
#define ND_ROUTER_SOLICIT       133
#define ND_ROUTER_ADVERT        134
#define ND_NEIGHBOR_SOLICIT     135
```

```
#define ND_NEIGHBOR_ADVERT        136
#define ND_REDIRECT       137
#define ICMP6_ROUTER_RENUMBERING        138
#define ICMP6_DST_UNREACH_BEYONDSCOPE   2
#define ICMP6_FILTER_PASS        2
#define ICMP6_PACKET_TOO_BIG      2
#define ICMP6_PARAMPROB_OPTION    2
#define ND_OPT_TARGET_LINKADDR    2
#define RPM_PCO_CHANGE    2
#define ICMP6_DST_UNREACH_ADDR    3
#define ICMP6_FILTER_BLOCKOTHERS        3
#define ICMP6_TIME_EXCEEDED       3
#define ND_OPT_PREFIX_INFORMATION       3
#define RPM_PCO_SETGLOBAL         3
#define ICMP6_DST_UNREACH_NOPORT        4
#define ICMP6_FILTER_PASSONLY     4
#define ICMP6_PARAM_PROB          4
#define ND_OPT_REDIRECTED_HEADER        4
#define ND_OPT_MTU        5
#define ND_OPT_RTR_ADV_INTERVAL 7
#define ND_OPT_HOME_AGENT_INFO 8
#define icmp6_id          icmp6_data16[0]
#define icmp6_maxdelay  icmp6_data16[0]
#define icmp6_seq         icmp6_data16[1]
#define icmp6_mtu         icmp6_data32[0]
#define icmp6_pptr        icmp6_data32[0]
#define icmp6_data16      icmp6_dataun.icmp6_un_data16
#define icmp6_data32      icmp6_dataun.icmp6_un_data32
#define icmp6_data8       icmp6_dataun.icmp6_un_data8
#define ICMP6_FILTER_SETPASSALL(filterp)        memset (filterp,
0, sizeof (struct icmp6_filter));
#define ICMP6_FILTER_SETBLOCKALL(filterp)       memset (filterp,
0xFF, sizeof (struct icmp6_filter));
#define mld_cksum         mld_icmp6_hdr.icmp6_cksum
#define mld_code          mld_icmp6_hdr.icmp6_code
#define mld_maxdelay    mld_icmp6_hdr.icmp6_data16[0]
#define mld_reserved    mld_icmp6_hdr.icmp6_data16[1]
#define mld_type          mld_icmp6_hdr.icmp6_type
#define nd_na_cksum       nd_na_hdr.icmp6_cksum
#define nd_na_code        nd_na_hdr.icmp6_code
#define nd_na_flags_reserved    nd_na_hdr.icmp6_data32[0]
#define nd_na_type        nd_na_hdr.icmp6_type
#define nd_ns_cksum       nd_ns_hdr.icmp6_cksum
#define nd_ns_code        nd_ns_hdr.icmp6_code
#define nd_ns_reserved  nd_ns_hdr.icmp6_data32[0]
#define nd_ns_type        nd_ns_hdr.icmp6_type
#define nd_ra_cksum       nd_ra_hdr.icmp6_cksum
#define nd_ra_code        nd_ra_hdr.icmp6_code
#define nd_ra_router_lifetime   nd_ra_hdr.icmp6_data16[1]
#define nd_ra_curhoplimit       nd_ra_hdr.icmp6_data8[0]
#define nd_ra_flags_reserved    nd_ra_hdr.icmp6_data8[1]
#define nd_ra_type        nd_ra_hdr.icmp6_type
#define nd_rd_cksum       nd_rd_hdr.icmp6_cksum
#define nd_rd_code        nd_rd_hdr.icmp6_code
#define nd_rd_reserved  nd_rd_hdr.icmp6_data32[0]
#define nd_rd_type        nd_rd_hdr.icmp6_type
#define nd_rs_cksum       nd_rs_hdr.icmp6_cksum
#define nd_rs_code        nd_rs_hdr.icmp6_code
#define nd_rs_reserved  nd_rs_hdr.icmp6_data32[0]
#define nd_rs_type        nd_rs_hdr.icmp6_type
#define rr_cksum          rr_hdr.icmp6_cksum
#define rr_code rr_hdr.icmp6_code
#define rr_seqnum         rr_hdr.icmp6_data32[0]
#define rr_type rr_hdr.icmp6_type

struct icmp6_filter {
```

```
                    uint32_t icmp6_filt[8];
                };
                struct icmp6_hdr {
                    uint8_t icmp6_type;
                    uint8_t icmp6_code;
                    uint16_t icmp6_cksum;
                    union {
                        uint32_t icmp6_un_data32[1];
                        uint16_t icmp6_un_data16[2];
                        uint8_t icmp6_un_data8[4];
                    } icmp6_dataun;
                };
                struct nd_router_solicit {
                    struct icmp6_hdr nd_rs_hdr;
                };
                struct nd_router_advert {
                    struct icmp6_hdr nd_ra_hdr;
                    uint32_t nd_ra_reachable;
                    uint32_t nd_ra_retransmit;
                };
                struct nd_neighbor_solicit {
                    struct icmp6_hdr nd_ns_hdr;
                    struct in6_addr nd_ns_target;
                };
                struct nd_neighbor_advert {
                    struct icmp6_hdr nd_na_hdr;
                    struct in6_addr nd_na_target;
                };
                struct nd_redirect {
                    struct icmp6_hdr nd_rd_hdr;
                    struct in6_addr nd_rd_target;
                    struct in6_addr nd_rd_dst;
                };
                struct nd_opt_hdr {
                    uint8_t nd_opt_type;
                    uint8_t nd_opt_len;
                };
                struct nd_opt_prefix_info {
                    uint8_t nd_opt_pi_type;
                    uint8_t nd_opt_pi_len;
                    uint8_t nd_opt_pi_prefix_len;
                    uint8_t nd_opt_pi_flags_reserved;
                    uint32_t nd_opt_pi_valid_time;
                    uint32_t nd_opt_pi_preferred_time;
                    uint32_t nd_opt_pi_reserved2;
                    struct in6_addr nd_opt_pi_prefix;
                };
                struct nd_opt_rd_hdr {
                    uint8_t nd_opt_rh_type;
                    uint8_t nd_opt_rh_len;
                    uint16_t nd_opt_rh_reserved1;
                    uint32_t nd_opt_rh_reserved2;
                };
                struct nd_opt_mtu {
                    uint8_t nd_opt_mtu_type;
                    uint8_t nd_opt_mtu_len;
                    uint16_t nd_opt_mtu_reserved;
                    uint32_t nd_opt_mtu_mtu;
                };
                struct mld_hdr {
                    struct icmp6_hdr mld_icmp6_hdr;
                    struct in6_addr mld_addr;
                };
                struct icmp6_router_renum {
                    struct icmp6_hdr rr_hdr;
                    uint8_t rr_segnum;
```

```
    uint8_t rr_flags;
    uint16_t rr_maxdelay;
    uint32_t rr_reserved;
};
struct rr_pco_match {
    uint8_t rpm_code;
    uint8_t rpm_len;
    uint8_t rpm_ordinal;
    uint8_t rpm_matchlen;
    uint8_t rpm_minlen;
    uint8_t rpm_maxlen;
    uint16_t rpm_reserved;
    struct in6_addr rpm_prefix;
};
struct rr_pco_use {
    uint8_t rpu_uselen;
    uint8_t rpu_keeplen;
    uint8_t rpu_ramask;
    uint8_t rpu_raflags;
    uint32_t rpu_vltime;
    uint32_t rpu_pltime;
    uint32_t rpu_flags;
    struct in6_addr rpu_prefix;
};
struct rr_result {
    uint16_t rrr_flags;
    uint8_t rrr_ordinal;
    uint8_t rrr_matchedlen;
    uint32_t rrr_ifid;
    struct in6_addr rrr_prefix;
};
struct nd_opt_adv_interval {
    uint8_t nd_opt_adv_interval_type;
    uint8_t nd_opt_adv_interval_len;
    uint16_t nd_opt_adv_interval_reserved;
    uint32_t nd_opt_adv_interval_ival;
};
struct nd_opt_home_agent_info {
    uint8_t nd_opt_home_agent_info_type;
    uint8_t nd_opt_home_agent_info_len;
    uint16_t nd_opt_home_agent_info_reserved;
    int16_t nd_opt_home_agent_info_preference;
    uint16_t nd_opt_home_agent_info_lifetime;
};
```

12.4.31 netinet/igmp.h

```
#define IGMP_MEMBERSHIP_QUERY    0x11
#define IGMP_V1_MEMBERSHIP_REPORT        0x12
#define IGMP_DVMRP      0x13
#define IGMP_PIM        0x14
#define IGMP_TRACE      0x15
#define IGMP_V2_MEMBERSHIP_REPORT        0x16
#define IGMP_V2_LEAVE_GROUP     0x17
#define IGMP_MTRACE_RESP        0x1e
#define IGMP_MTRACE     0x1f
#define IGMP_DELAYING_MEMBER    1
#define IGMP_v1_ROUTER  1
#define IGMP_MAX_HOST_REPORT_DELAY       10
#define IGMP_TIMER_SCALE        10
#define IGMP_IDLE_MEMBER        2
#define IGMP_v2_ROUTER  2
#define IGMP_LAZY_MEMBER        3
#define IGMP_SLEEPING_MEMBER    4
#define IGMP_AWAKENING_MEMBER   5
```

```
#define IGMP_MINLEN      8
#define IGMP_HOST_MEMBERSHIP_QUERY      IGMP_MEMBERSHIP_QUERY
#define IGMP_HOST_MEMBERSHIP_REPORT     IGMP_V1_MEMBERSHIP_REPORT
#define IGMP_HOST_LEAVE_MESSAGE IGMP_V2_LEAVE_GROUP
#define IGMP_HOST_NEW_MEMBERSHIP_REPORT IGMP_V2_MEMBERSHIP_REPORT

struct igmp {
    u_int8_t igmp_type;
    u_int8_t igmp_code;
    u_int16_t igmp_cksum;
    struct in_addr igmp_group;
};
```

12.4.32 netinet/in.h

```
#define IPPROTO_IP      0
#define IPPROTO_ICMP    1
#define IPPROTO_UDP     17
#define IPPROTO_IGMP    2
#define IPPROTO_RAW     255
#define IPPROTO_IPV6    41
#define IPPROTO_ICMPV6  58
#define IPPROTO_TCP     6

typedef uint16_t in_port_t;

struct in_addr {
    uint32_t s_addr;
};
typedef uint32_t in_addr_t;

#define INADDR_NONE     ((in_addr_t) 0xffffffff)
#define INADDR_BROADCAST        (0xffffffff)
#define INADDR_ANY      0
#define INADDR_LOOPBACK 0x7f000001      /* 127.0.0.1 */

#define s6_addr16       in6_u.u6_addr16
#define s6_addr32       in6_u.u6_addr32
#define s6_addr in6_u.u6_addr8

struct in6_addr {
    union {
        uint8_t u6_addr8[16];
        uint16_t u6_addr16[8];
        uint32_t u6_addr32[4];
    } in6_u;
};

#define   IN6ADDR_ANY_INIT                      {    {    {
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0 } } }
#define     IN6ADDR_LOOPBACK_INIT               {      {      {
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1 } } }

#define                                 IN_MULTICAST(a)
((((in_addr_t)(a))&0xf0000000)==0xe0000000)
#define INET_ADDRSTRLEN 16

struct sockaddr_in {
    sa_family_t sin_family;
    unsigned short sin_port;
    struct in_addr sin_addr;
    unsigned char sin_zero[8];
};
```

```
#define  IN6_IS_ADDR_LINKLOCAL(a)          ((((const  uint32_t *)
(a))[0] & htonl (0xffc00000)) == htonl (0xfe800000))
#define  IN6_IS_ADDR_SITELOCAL(a)          ((((const  uint32_t *)
(a))[0] & htonl (0xffc00000)) == htonl (0xfec00000))
#define  IN6_ARE_ADDR_EQUAL(a,b) (((((const uint32_t *) (a))[0] ==
((const uint32_t *) (b))[0]) && (((const uint32_t *) (a))[1] ==
((const uint32_t *) (b))[1]) && (((const uint32_t *) (a))[2] ==
((const uint32_t *) (b))[2]) && (((const uint32_t *) (a))[3] ==
((const uint32_t *) (b))[3]))
#define  IN6_IS_ADDR_V4COMPAT(a) (((((const uint32_t *) (a))[0] ==
0) && (((const uint32_t *) (a))[1] == 0) && (((const uint32_t *)
(a))[2] == 0) && (ntohl (((const uint32_t *) (a))[3]) > 1))
#define  IN6_IS_ADDR_V4MAPPED(a) (((((const uint32_t *) (a))[0] ==
0) && (((const uint32_t *) (a))[1] == 0) && (((const uint32_t *)
(a))[2] == htonl (0xffff)))
#define  IN6_IS_ADDR_UNSPECIFIED(a)          (((const  uint32_t  *)
(a))[0] == 0 && ((const uint32_t *) (a))[1] == 0 && ((const
uint32_t *) (a))[2] == 0 && ((const uint32_t *) (a))[3] == 0)
#define  IN6_IS_ADDR_LOOPBACK(a) (((const uint32_t *) (a))[0] == 0
&& ((const uint32_t *) (a))[1] == 0 && ((const uint32_t *)
(a))[2] == 0 && ((const uint32_t *) (a))[3] == htonl (1))
#define  IN6_IS_ADDR_MULTICAST(a)          (((const  uint8_t  *)
(a))[0] == 0xff)
#define  IN6_IS_ADDR_MC_NODELOCAL(a)    (IN6_IS_ADDR_MULTICAST(a)
&& ((((const uint8_t *) (a))[1] & 0xf) == 0x1))
#define  IN6_IS_ADDR_MC_LINKLOCAL(a)    (IN6_IS_ADDR_MULTICAST(a)
&& ((((const uint8_t *) (a))[1] & 0xf) == 0x2))
#define  IN6_IS_ADDR_MC_SITELOCAL(a)    (IN6_IS_ADDR_MULTICAST(a)
&& ((((const uint8_t *) (a))[1] & 0xf) == 0x5))
#define  IN6_IS_ADDR_MC_ORGLOCAL(a)    (IN6_IS_ADDR_MULTICAST(a)
&& ((((const uint8_t *) (a))[1] & 0xf) == 0x8))
#define  IN6_IS_ADDR_MC_GLOBAL(a)        (IN6_IS_ADDR_MULTICAST(a)
&& ((((const uint8_t *) (a))[1] & 0xf) == 0xe))
#define INET6_ADDRSTRLEN        46

struct sockaddr_in6 {
    unsigned short sin6_family; /* AF_INET6 */
    uint16_t sin6_port;         /* Transport layer port # */
    uint32_t sin6_flowinfo;     /* IPv6 flow information */
    struct in6_addr sin6_addr;  /* IPv6 address */
    uint32_t sin6_scope_id;     /* scope id (new in RFC2553) */
};

#define SOL_IP  0
#define IP_TOS  1                    /* IP type of service and
precedence */
#define IPV6_UNICAST_HOPS        16
#define IPV6_MULTICAST_IF        17
#define IPV6_MULTICAST_HOPS      18
#define IPV6_MULTICAST_LOOP      19
#define IP_TTL  2                /* IP time to live */
#define IPV6_JOIN_GROUP 20
#define IPV6_LEAVE_GROUP        21
#define IPV6_V6ONLY     26
#define IP_MULTICAST_IF 32       /* set/get IP multicast i/f */
#define IP_MULTICAST_TTL        33      /* set/get IP multicast
ttl */
#define IP_MULTICAST_LOOP       34      /* set/get IP multicast
loopback */
#define IP_ADD_MEMBERSHIP       35       /* add an IP group
membership */
#define IP_DROP_MEMBERSHIP      36      /* drop an IP group
membership */
#define IP_OPTIONS     4       /* IP per-packet options */
#define IPV6_ADD_MEMBERSHIP    IPV6_JOIN_GROUP
#define IPV6_DROP_MEMBERSHIP   IPV6_LEAVE_GROUP
```

```
struct ipv6_mreq {
    struct in6_addr ipv6mr_multiaddr;   /* IPv6 multicast address
of group */
    int ipv6mr_interface;             /* local  IPv6  address  of
interface */
};
struct ip_mreq {
    struct in_addr imr_multiaddr;         /* IP multicast address
of group */
    struct in_addr imr_interface;          /* local IP address of
interface */
};
extern int bindresvport(int, struct sockaddr_in *);
extern const struct in6_addr in6addr_any;
extern const struct in6_addr in6addr_loopback;
```

12.4.33 netinet/in_systm.h

```
typedef u_int16_t n_short;
typedef u_int32_t n_long;
typedef u_int32_t n_time;
```

12.4.34 netinet/ip.h

```
#define IPOPT_CLASS(o) ((o) & IPOPT_CLASS_MASK)
#define IPOPT_COPIED(o) ((o) & IPOPT_COPY)
#define IPOPT_NUMBER(o) ((o) & IPOPT_NUMBER_MASK)
#define IPOPT_EOL       0
#define IPOPT_OPTVAL    0
#define IPOPT_TS_TSONLY 0
#define IPOPT_CONTROL   0x00
#define IPOPT_SECUR_UNCLASS     0x0000
#define IPOPT_NUMBER_MASK       0x1f
#define IP_OFFMASK      0x1fff
#define IPOPT_RESERVED1 0x20
#define IP_MF   0x2000
#define IPOPT_DEBMEAS   0x40
#define IP_DF   0x4000
#define IPOPT_CLASS_MASK        0x60
#define IPOPT_RESERVED2 0x60
#define IPOPT_SECUR_TOPSECRET   0x6bc5
#define IPOPT_SECUR_EFTO        0x789a
#define IPOPT_COPY      0x80
#define IP_RF   0x8000
#define IPOPT_SECUR_RESTR       0xaf13
#define IPOPT_SECUR_MMMM        0xbc4d
#define IPOPT_SECUR_SECRET      0xd788
#define IPOPT_SECUR_CONFID      0xf135
#define IPOPT_NOP       1
#define IPOPT_OLEN      1
#define IPOPT_TS_TSANDADDR      1
#define IPTTLDEC        1
#define IPOPT_SECURITY  130
#define IPOPT_LSRR      131
#define IPOPT_SATID     136
#define IPOPT_SSRR      137
#define IPOPT_RA        148
#define IPOPT_OFFSET    2
#define MAXTTL  255
#define IPOPT_TS_PRESPEC        3
#define IPOPT_MINOFF    4
#define IPVERSION       4
#define MAX_IPOPTLEN    40
```

```
#define IP_MSS  576
#define IPFRAGTTL        60
#define IPDEFTTL         64
#define IP_MAXPACKET     65535
#define IPOPT_TS         68
#define IPOPT_RR         7
#define IPOPT_MEASUREMENT        IPOPT_DEBMEAS
#define IPOPT_END        IPOPT_EOL
#define IPOPT_NOOP       IPOPT_NOP
#define IPOPT_SID        IPOPT_SATID
#define IPOPT_SEC        IPOPT_SECURITY
#define IPOPT_TIMESTAMP  IPOPT_TS

#define IPTOS_TOS(tos)  ((tos) & IPTOS_TOS_MASK)
#define IPTOS_LOWCOST    0x02
#define IPTOS_RELIABILITY        0x04
#define IPTOS_THROUGHPUT         0x08
#define IPTOS_LOWDELAY   0x10
#define IPTOS_TOS_MASK   0x1e
#define IPTOS_MINCOST    IPTOS_LOWCOST

#define IPTOS_PREC(tos) ((tos) & IPTOS_PREC_MASK)
#define IPTOS_PREC_MASK 0xe0
```

12.4.35 netinet/ip6.h

```
#define IP6OPT_TYPE(o)  ((o) & 0xc0)
#define IP6OPT_PAD1       0
#define IP6OPT_TYPE_SKIP        0x00
#define IP6OPT_TUNNEL_LIMIT     0x04
#define IP6OPT_ROUTER_ALERT     0x05
#define IP6OPT_TYPE_MUTABLE     0x20
#define IP6OPT_TYPE_DISCARD     0x40
#define IP6OPT_TYPE_FORCEICMP   0x80
#define IP6OPT_TYPE_ICMP        0xc0
#define IP6OPT_JUMBO    0xc2
#define IP6OPT_NSAP_ADDR        0xc3
#define IP6OPT_PADN     1
#define IP6OPT_JUMBO_LEN        6
#define ip6_flow        ip6_ctlun.ip6_un1.ip6_un1_flow
#define ip6_hlim        ip6_ctlun.ip6_un1.ip6_un1_hlim
#define ip6_hops        ip6_ctlun.ip6_un1.ip6_un1_hlim
#define ip6_nxt ip6_ctlun.ip6_un1.ip6_un1_nxt
#define ip6_plen        ip6_ctlun.ip6_un1.ip6_un1_plen
#define ip6_vfc ip6_ctlun.ip6_un2_vfc

struct ip6_hdrctl {
    uint32_t ip6_un1_flow;
    uint16_t ip6_un1_plen;
    uint8_t ip6_un1_nxt;
    uint8_t ip6_un1_hlim;
};
struct ip6_hdr {
    struct in6_addr ip6_src;
    struct in6_addr ip6_dst;
};
struct ip6_ext {
    uint8_t ip6e_nxt;
    uint8_t ip6e_len;
};
struct ip6_hbh {
    uint8_t ip6h_nxt;
    uint8_t ip6h_len;
};
struct ip6_dest {
```

```
    uint8_t ip6d_nxt;
    uint8_t ip6d_len;
};
struct ip6_rthdr {
    uint8_t ip6r_nxt;
    uint8_t ip6r_len;
    uint8_t ip6r_type;
    uint8_t ip6r_segleft;
};
struct ip6_frag {
    uint8_t ip6f_nxt;
    uint8_t ip6f_reserved;
    uint16_t ip6f_offlg;
    uint32_t ip6f_ident;
};
struct ip6_opt {
    uint8_t ip6o_type;
    uint8_t ip6o_len;
};
struct ip6_opt_jumbo {
    uint8_t ip6oj_type;
    uint8_t ip6oj_len;
    uint8_t ip6oj_jumbo_len[4];
};
struct ip6_opt_nsap {
    uint8_t ip6on_type;
    uint8_t ip6on_len;
    uint8_t ip6on_src_nsap_len;
    uint8_t ip6on_dst_nsap_len;
};
struct ip6_opt_tunnel {
    uint8_t ip6ot_type;
    uint8_t ip6ot_len;
    uint8_t ip6ot_encap_limit;
};
struct ip6_opt_router {
    uint8_t ip6or_type;
    uint8_t ip6or_len;
    uint8_t ip6or_value[2];
};
```

12.4.36 netinet/ip_icmp.h

```
#define ICMP_INFOTYPE(type)        ((type) == ICMP_ECHOREPLY ||
(type) == ICMP_ECHO || (type) == ICMP_ROUTERADVERT || (type) ==
ICMP_ROUTERSOLICIT  ||  (type)  ==  ICMP_TSTAMP   ||   (type)  ==
ICMP_TSTAMPREPLY  ||  (type)  ==  ICMP_IREQ   ||   (type)   ==
ICMP_IREQREPLY  ||  (type)  ==  ICMP_MASKREQ   ||   (type)   ==
ICMP_MASKREPLY)
#define ICMP_ADVLEN(p)  (8 + ((p)->icmp_ip.ip_hl << 2) + 8)
#define ICMP_TSLEN      (8 + 3 * sizeof (n_time))
#define ICMP_ADVLENMIN  (8 + sizeof (struct ip) + 8)
#define ICMP_ECHOREPLY  0
#define ICMP_EXC_TTL    0
#define ICMP_NET_UNREACH        0
#define ICMP_REDIRECT_NET       0
#define ICMP_REDIR_NET  0
#define ICMP_TIMXCEED_INTRANS   0
#define ICMP_UNREACH_NET        0
#define ICMP_EXC_FRAGTIME       1
#define ICMP_HOST_UNREACH       1
#define ICMP_PARAMPROB_OPTABSENT        1
#define ICMP_REDIRECT_HOST      1
#define ICMP_REDIR_HOST 1
#define ICMP_TIMXCEED_REASS     1
```

```
#define ICMP_UNREACH_HOST        1
#define ICMP_HOST_ANO   10
#define ICMP_ROUTERSOLICIT       10
#define ICMP_UNREACH_HOST_PROHIB        10
#define ICMP_NET_UNR_TOS         11
#define ICMP_TIME_EXCEEDED       11
#define ICMP_TIMXCEED   11
#define ICMP_UNREACH_TOSNET      11
#define ICMP_HOST_UNR_TOS        12
#define ICMP_MASKLEN    12
#define ICMP_PARAMETERPROB       12
#define ICMP_PARAMPROB  12
#define ICMP_UNREACH_TOSHOST     12
#define ICMP_PKT_FILTERED        13
#define ICMP_TIMESTAMP  13
#define ICMP_TSTAMP     13
#define ICMP_UNREACH_FILTER_PROHIB      13
#define ICMP_PREC_VIOLATION      14
#define ICMP_TIMESTAMPREPLY      14
#define ICMP_TSTAMPREPLY         14
#define ICMP_UNREACH_HOST_PRECEDENCE    14
#define ICMP_INFO_REQUEST        15
#define ICMP_IREQ       15
#define ICMP_PREC_CUTOFF         15
#define ICMP_UNREACH_PRECEDENCE_CUTOFF  15
#define NR_ICMP_UNREACH 15
#define ICMP_INFO_REPLY 16
#define ICMP_IREQREPLY  16
#define ICMP_ADDRESS    17
#define ICMP_MASKREQ    17
#define ICMP_ADDRESSREPLY        18
#define ICMP_MASKREPLY  18
#define ICMP_MAXTYPE    18
#define NR_ICMP_TYPES   18
#define ICMP_PROT_UNREACH        2
#define ICMP_REDIRECT_TOSNET     2
#define ICMP_REDIR_NETTOS        2
#define ICMP_UNREACH_PROTOCOL    2
#define ICMP_DEST_UNREACH        3
#define ICMP_PORT_UNREACH        3
#define ICMP_REDIRECT_TOSHOST    3
#define ICMP_REDIR_HOSTTOS       3
#define ICMP_UNREACH    3
#define ICMP_UNREACH_PORT        3
#define ICMP_FRAG_NEEDED         4
#define ICMP_SOURCEQUENCH        4
#define ICMP_SOURCE_QUENCH       4
#define ICMP_UNREACH_NEEDFRAG    4
#define ICMP_REDIRECT   5
#define ICMP_SR_FAILED  5
#define ICMP_UNREACH_SRCFAIL     5
#define ICMP_NET_UNKNOWN         6
#define ICMP_UNREACH_NET_UNKNOWN        6
#define ICMP_HOST_UNKNOWN        7
#define ICMP_UNREACH_HOST_UNKNOWN       7
#define ICMP_ECHO       8
#define ICMP_HOST_ISOLATED       8
#define ICMP_MINLEN     8
#define ICMP_UNREACH_ISOLATED    8
#define ICMP_NET_ANO    9
#define ICMP_ROUTERADVERT        9
#define ICMP_UNREACH_NET_PROHIB 9
#define icmp_data       icmp_dun.id_data
#define icmp_ip icmp_dun.id_ip.idi_ip
#define icmp_mask       icmp_dun.id_mask
#define icmp_radv       icmp_dun.id_radv
```

```
#define icmp_otime      icmp_dun.id_ts.its_otime
#define icmp_rtime      icmp_dun.id_ts.its_rtime
#define icmp_ttime      icmp_dun.id_ts.its_ttime
#define icmp_gwaddr     icmp_hun.ih_gwaddr
#define icmp_id icmp_hun.ih_idseq.icd_id
#define icmp_seq        icmp_hun.ih_idseq.icd_seq
#define icmp_nextmtu    icmp_hun.ih_pmtu.ipm_nextmtu
#define icmp_pmvoid     icmp_hun.ih_pmtu.ipm_void
#define icmp_pptr       icmp_hun.ih_pptr
#define icmp_lifetime   icmp_hun.ih_rtradv.irt_lifetime
#define icmp_num_addrs  icmp_hun.ih_rtradv.irt_num_addrs
#define icmp_wpa        icmp_hun.ih_rtradv.irt_wpa
#define icmp_void       icmp_hun.ih_void

struct icmphdr {
    u_int8_t type;
    u_int8_t code;
    u_int16_t checksum;
    union {
        struct {
            u_int16_t id;
            u_int16_t sequence;
        } echo;
        u_int32_t gateway;
        struct {
            u_int16_t __unused;
            u_int16_t mtu;
        } frag;
    } un;
};
struct icmp_ra_addr {
    u_int32_t ira_addr;
    u_int32_t ira_preference;
};
struct ih_idseq {
    u_int16_t icd_id;
    u_int16_t icd_seq;
};
struct ih_pmtu {
    u_int16_t ipm_void;
    u_int16_t ipm_nextmtu;
};
struct ih_rtradv {
    u_int8_t irt_num_addrs;
    u_int8_t irt_wpa;
    u_int16_t irt_lifetime;
};
struct icmp {
    u_int8_t icmp_type;
    u_int8_t icmp_code;
    u_int16_t icmp_cksum;
    union {
        u_int16_t ih_pptr;
        struct in_addr ih_gwaddr;
        struct ih_idseq ih_idseq;
        u_int32_t ih_void;
        struct ih_pmtu ih_pmtu;
        struct ih_rtradv ih_rtradv;
    } icmp_hun;
    union {
        struct {
            u_int32_t its_otime;
            u_int32_t its_rtime;
            u_int32_t its_ttime;
        } id_ts;
        struct {
```

```
            struct ip idi_ip;
        } id_ip;
        struct icmp_ra_addr id_radv;
        u_int32_t id_mask;
        u_int8_t id_data[1];
    } icmp_dun;
};
```

12.4.37 netinet/tcp.h

```
#define TCPOLEN_TSTAMP_APPA      (TCPOLEN_TIMESTAMP+2)
#define                                          TCPOPT_TSTAMP_HDR
(TCPOPT_NOP<<24|TCPOPT_NOP<<16|TCPOPT_TIMESTAMP<<8|TCPOLEN_TIMEST
AMP)
#define TCPOPT_EOL        0
#define TCPI_OPT_TIMESTAMPS    1
#define TCPOPT_NOP       1
#define TCP_NODELAY      1
#define TCPOLEN_TIMESTAMP        10
#define TCP_WINDOW_CLAMP         10
#define TCP_INFO         11
#define TCP_QUICKACK     12
#define TCP_CONGESTION   13
#define TCP_MAX_WINSHIFT         14
#define TCPI_OPT_SACK    2
#define TCPOLEN_SACK_PERMITTED  2
#define TCPOPT_MAXSEG    2
#define TCP_MAXSEG       2
#define TCPOLEN_WINDOW   3
#define TCPOPT_WINDOW    3
#define TCP_CORK         3
#define TCPI_OPT_WSCALE 4
#define TCPOLEN_MAXSEG  4
#define TCPOPT_SACK_PERMITTED   4
#define TCP_KEEPIDLE     4
#define TCPOPT_SACK      5
#define TCP_KEEPINTVL    5
#define TCP_MSS 512
#define SOL_TCP 6
#define TCP_KEEPCNT      6
#define TCP_MAXWIN       65535
#define TCP_SYNCNT       7
#define TCPI_OPT_ECN     8
#define TCPOPT_TIMESTAMP         8
#define TCP_LINGER2      8
#define TCP_DEFER_ACCEPT         9

enum tcp_ca_state {
    TCP_CA_Open,
    TCP_CA_Disorder,
    TCP_CA_CWR,
    TCP_CA_Recovery,
    TCP_CA_Loss
};
struct tcp_info {
    uint8_t tcpi_state;
    uint8_t tcpi_ca_state;
    uint8_t tcpi_retransmits;
    uint8_t tcpi_probes;
    uint8_t tcpi_backoff;
    uint8_t tcpi_options;
    uint8_t tcpi_snd_wscale:4;
    uint8_t tcpi_rcv_wscale:4;
    uint32_t tcpi_rto;
    uint32_t tcpi_ato;
```

```
    uint32_t tcpi_snd_mss;
    uint32_t tcpi_rcv_mss;
    uint32_t tcpi_unacked;
    uint32_t tcpi_sacked;
    uint32_t tcpi_lost;
    uint32_t tcpi_retrans;
    uint32_t tcpi_fackets;
    uint32_t tcpi_last_data_sent;
    uint32_t tcpi_last_ack_sent;
    uint32_t tcpi_last_data_recv;
    uint32_t tcpi_last_ack_recv;
    uint32_t tcpi_pmtu;
    uint32_t tcpi_rcv_ssthresh;
    uint32_t tcpi_rtt;
    uint32_t tcpi_rttvar;
    uint32_t tcpi_snd_ssthresh;
    uint32_t tcpi_snd_cwnd;
    uint32_t tcpi_advmss;
    uint32_t tcpi_reordering;
};
enum {
    TCP_ESTABLISHED = 1,
    TCP_SYN_SENT = 2,
    TCP_SYN_RECV = 3,
    TCP_FIN_WAIT1 = 4,
    TCP_FIN_WAIT2 = 5,
    TCP_TIME_WAIT = 6,
    TCP_CLOSE = 7,
    TCP_CLOSE_WAIT = 8,
    TCP_LAST_ACK = 9,
    TCP_LISTEN = 10,
    TCP_CLOSING = 11
};
```

12.4.38 netinet/udp.h

```
#define SOL_UDP 17

struct udphdr {
    u_int16_t source;
    u_int16_t dest;
    u_int16_t len;
    u_int16_t check;
};
```

12.4.39 nl_types.h

```
#define NL_CAT_LOCALE   1
#define NL_SETD 1

typedef void *nl_catd;

typedef int nl_item;
extern int catclose(nl_catd __catalog);
extern char *catgets(nl_catd __catalog, int __set, int __number,
                const char *__string);
extern nl_catd catopen(const char *__cat_name, int __flag);
```

12.4.40 poll.h

```
extern  int  poll(struct  pollfd  *__fds,  nfds_t  __nfds,  int
__timeout);
```

12.4.41 pty.h

```
extern int forkpty(int *__amaster, char *__name,
                   const struct termios *__termp,
                   const struct winsize *__winp);
extern int openpty(int *__amaster, int *__aslave, char *__name,
                   const struct termios *__termp,
                   const struct winsize *__winp);
```

12.4.42 pwd.h

```
struct passwd {
    char *pw_name;
    char *pw_passwd;
    uid_t pw_uid;
    gid_t pw_gid;
    char *pw_gecos;
    char *pw_dir;
    char *pw_shell;
};
extern void endpwent(void);
extern struct passwd *getpwent(void);
extern int getpwent_r(struct passwd *__resultbuf, char *__buffer,
                      size_t __buflen, struct passwd **__result);
extern struct passwd *getpwnam(const char *__name);
extern int getpwnam_r(const char *__name, struct passwd
*__resultbuf,
                      char *__buffer, size_t __buflen,
                      struct passwd **__result);
extern struct passwd *getpwuid(uid_t __uid);
extern int getpwuid_r(uid_t __uid, struct passwd *__resultbuf,
                      char *__buffer, size_t __buflen,
                      struct passwd **__result);
extern void setpwent(void);
```

12.4.43 regex.h

```
#define RE_DUP_MAX      (0x7fff)

typedef unsigned long int reg_syntax_t;

typedef struct re_pattern_buffer {
    unsigned char *buffer;
    unsigned long int allocated;
    unsigned long int used;
    reg_syntax_t syntax;
    char *fastmap;
    char *translate;
    size_t re_nsub;
    unsigned int can_be_null:1;
    unsigned int regs_allocated:2;
    unsigned int fastmap_accurate:1;
    unsigned int no_sub:1;
    unsigned int not_bol:1;
    unsigned int not_eol:1;
    unsigned int newline_anchor:1;
} regex_t;
typedef int regoff_t;
typedef struct {
    regoff_t rm_so;
    regoff_t rm_eo;
} regmatch_t;
```

```
#define REG_ICASE       (REG_EXTENDED<<1)
#define REG_NEWLINE     (REG_ICASE<<1)
#define REG_NOSUB       (REG_NEWLINE<<1)
#define REG_EXTENDED    1

#define REG_NOTEOL      (1<<1)
#define REG_NOTBOL      1

typedef enum {
    REG_ENOSYS = -1,
    REG_NOERROR = 0,
    REG_NOMATCH = 1,
    REG_BADPAT = 2,
    REG_ECOLLATE = 3,
    REG_ECTYPE = 4,
    REG_EESCAPE = 5,
    REG_ESUBREG = 6,
    REG_EBRACK = 7,
    REG_EPAREN = 8,
    REG_EBRACE = 9,
    REG_BADBR = 10,
    REG_ERANGE = 11,
    REG_ESPACE = 12,
    REG_BADRPT = 13,
    REG_EEND = 14,
    REG_ESIZE = 15,
    REG_ERPAREN = 16
} reg_errcode_t;
extern int regcomp(regex_t * __preg, const char *__pattern, int
__cflags);
extern size_t regerror(int __errcode, const regex_t * __preg,
                    char *__errbuf, size_t __errbuf_size);
extern int regexec(const regex_t * __preg, const char *__string,
                size_t __nmatch, regmatch_t __pmatch[], int
__eflags);
extern void regfree(regex_t * __preg);
```

12.4.44 rpc/auth.h

```
#define   auth_destroy(auth)                ((*((auth)->ah_ops-
>ah_destroy))(auth))

enum auth_stat {
    AUTH_OK = 0,
    AUTH_BADCRED = 1,               /* bogus credentials (seal
broken) */
    AUTH_REJECTEDCRED = 2,          /* client should begin new
session */
    AUTH_BADVERF = 3,              /* bogus verifier (seal broken)
*/
    AUTH_REJECTEDVERF = 4,          /* verifier expired or was
replayed */
    AUTH_TOOWEAK = 5,              /* Rpc calls return an enum
clnt_stat. */
    AUTH_INVALIDRESP = 6,      /* bogus response verifier */
    AUTH_FAILED = 7            /* some unknown reason */
};

union des_block {
    struct {
        u_int32_t high;
        u_int32_t low;
    } key;
    char c[8];
```

```
};

struct opaque_auth {
    enum_t oa_flavor;           /* flavor of auth */
    caddr_t oa_base;            /* address of more auth stuff */
    u_int oa_length;             /* not to exceed MAX_AUTH_BYTES
*/
};

typedef struct AUTH {
    struct opaque_auth ah_cred;
    struct opaque_auth ah_verf;
    union des_block ah_key;
    struct auth_ops *ah_ops;
    caddr_t ah_private;
} AUTH;

struct auth_ops {
    void (*ah_nextverf) (struct AUTH *);
    int (*ah_marshal) (struct AUTH *, XDR *);     /* nextverf &
serialize */
    int (*ah_validate) (struct AUTH *, struct opaque_auth *);
/* validate verifier */
    int (*ah_refresh) (struct AUTH *);  /* refresh credentials */
    void (*ah_destroy) (struct AUTH *); /* Rpc calls return an
enum clnt_stat. */
};
extern struct AUTH *authnone_create(void);
extern int key_decryptsession(char *, union des_block *);
extern bool_t xdr_opaque_auth(XDR *, struct opaque_auth *);
```

12.4.45 rpc/clnt.h

```
#define      clnt_control(cl,rq,in)              ((*(cl)->cl_ops-
>cl_control)(cl,rq,in))
#define clnt_abort(rh)  ((*(rh)->cl_ops->cl_abort)(rh))
#define clnt_destroy(rh)        ((*(rh)->cl_ops->cl_destroy)(rh))
#define  clnt_freeres(rh,xres,resp)             ((*(rh)->cl_ops-
>cl_freeres)(rh,xres,resp))
#define  clnt_geterr(rh,errp)      ((*(rh)->cl_ops->cl_geterr)(rh,
errp))
#define  NULLPROC          ((u_long)0)        /* By convention,
procedure 0 takes null arguments and returns */
#define CLSET_TIMEOUT   1       /* set timeout (timeval) */
#define CLGET_XID       10      /* Get xid */
#define CLSET_XID       11      /* Set xid */
#define CLGET_VERS      12      /* Get version number */
#define CLSET_VERS      13      /* Set version number */
#define CLGET_PROG      14      /* Get program number */
#define CLSET_PROG      15      /* Set program number */
#define CLGET_TIMEOUT   2       /* get timeout (timeval) */
#define CLGET_SERVER_ADDR      3         /* get server's address
(sockaddr) */
#define CLSET_RETRY_TIMEOUT      4          /* set retry timeout
(timeval) */
#define CLGET_RETRY_TIMEOUT      5          /* get retry timeout
(timeval) */
#define CLGET_FD           6             /* get connections file
descriptor */
#define CLGET_SVC_ADDR  7       /* get server's address (netbuf)
*/
#define CLSET_FD_CLOSE  8       /* close fd while clnt_destroy */
#define CLSET_FD_NCLOSE 9              /* Do not close fd while
clnt_destroy */
#define clnt_call(rh, proc, xargs, argsp, xres, resp, secs)     \
```

```
                ((*(rh)->cl_ops->cl_call)(rh, proc, xargs, argsp, xres,
        resp, secs))

        enum clnt_stat {
            RPC_SUCCESS = 0,            /* call succeeded */
            RPC_CANTENCODEARGS = 1,     /* can't encode arguments */
            RPC_CANTDECODERES = 2,      /* can't decode results */
            RPC_CANTSEND = 3,           /* failure in sending call */
            RPC_CANTRECV = 4,           /* failure in receiving result */
            RPC_TIMEDOUT = 5,           /* call timed out */
            RPC_VERSMISMATCH = 6,       /* rpc versions not compatible */
            RPC_AUTHERROR = 7,          /* authentication error */
            RPC_PROGUNAVAIL = 8,        /* program not available */
            RPC_PROGVERSMISMATCH = 9,   /* program version mismatched */
            RPC_PROCUNAVAIL = 10,       /* procedure unavailable */
            RPC_CANTDECODEARGS = 11,    /* decode arguments error */
            RPC_SYSTEMERROR = 12,       /* generic "other problem" */
            RPC_NOBROADCAST = 21,       /* Broadcasting not supported */
            RPC_UNKNOWNHOST = 13,       /* unknown host name */
            RPC_UNKNOWNPROTO = 17,      /* unknown protocol */
            RPC_UNKNOWNADDR = 19,       /* Remote address unknown */
            RPC_RPCBFAILURE = 14,        /* portmapper failed in its call
        */
            RPC_PROGNOTREGISTERED  =  15,  /*  remote  program  is  not
        registered */
            RPC_N2AXLATEFAILURE = 22,      /* Name  to  addr  translation
        failed */
            RPC_FAILED = 16,
            RPC_INTR = 18,
            RPC_TLIERROR = 20,
            RPC_UDERROR = 23,
            RPC_INPROGRESS = 24,
            RPC_STALERACHANDLE = 25
        };
        struct rpc_err {
            enum clnt_stat re_status;
            union {
                int RE_errno;
                enum auth_stat RE_why;
                struct {
                    u_long low;
                    u_long high;
                } RE_vers;
                struct {
                    long int s1;
                    long int s2;
                } RE_lb;
            } ru;
        };

        typedef struct CLIENT {
            struct AUTH *cl_auth;
            struct clnt_ops *cl_ops;
            caddr_t cl_private;
        } CLIENT;

        struct clnt_ops {
            enum  clnt_stat  (*cl_call) (struct  CLIENT  *,  u_long,
        xdrproc_t, caddr_t,
                                        xdrproc_t,    caddr_t,    struct
        timeval);
            void (*cl_abort) (void);
            void (*cl_geterr) (struct CLIENT *, struct rpc_err *);
            bool_t(*cl_freeres) (struct CLIENT *, xdrproc_t, caddr_t);
            void (*cl_destroy) (struct CLIENT *);
            bool_t(*cl_control) (struct CLIENT *, int, char *);
```

```
};
extern int callrpc(const char *__host, const u_long __prognum,
                  const    u_long    __versnum,    const    u_long
__procnum,
                  const xdrproc_t __inproc, const char *__in,
                  const xdrproc_t __outproc, char *__out);
extern  struct  CLIENT  *clnt_create(const  char  *__host,  const
u_long __prog,
                                     const u_long __vers, const char
*__prot);
extern void clnt_pcreateerror(const char *__msg);
extern void clnt_perrno(enum clnt_stat __num);
extern  void  clnt_perror(struct  CLIENT  *__clnt,  const  char
*__msg);
extern char *clnt_spcreateerror(const char *__msg);
extern char *clnt_sperrno(enum clnt_stat __num);
extern  char  *clnt_sperror(struct  CLIENT  *__clnt,  const  char
*__msg);
extern  struct  CLIENT  *clntraw_create(u_long  __prog,  u_long
__vers);
extern struct CLIENT *clnttcp_create(struct sockaddr_in *__raddr,
                                     u_long    __prog,    u_long
__version,
                                     int    *__sockp,    u_int
__sendsz,
                                     u_int __recvsz);
extern   struct   CLIENT   *clntudp_bufcreate(struct   sockaddr_in
*__raddr,
                                     u_long __program, u_long
__version,
                                     struct           timeval
__wait_resend,
                                     int    *__sockp,    u_int
__sendsz,
                                     u_int __recvsz);
extern struct CLIENT *clntudp_create(struct sockaddr_in *__raddr,
                                     u_long    __program,   u_long
__version,
                                     struct           timeval
__wait_resend,
                                     int *__sockp);
```

12.4.46 rpc/pmap_clnt.h

```
extern u_short pmap_getport(struct sockaddr_in *__address,
                           const u_long __program, const u_long
__version,
                           u_int __protocol);
extern  bool_t  pmap_set(const  u_long  __program,  const  u_long
__vers,
                         int __protocol, u_short __port);
extern bool_t pmap_unset(u_long __program, u_long __vers);
```

12.4.47 rpc/rpc_msg.h

```
enum msg_type {
    CALL = 0,
    REPLY = 1
};
enum reply_stat {
    MSG_ACCEPTED = 0,
    MSG_DENIED = 1
};
enum accept_stat {
```

```
        SUCCESS = 0,
        PROG_UNAVAIL = 1,
        PROG_MISMATCH = 2,
        PROC_UNAVAIL = 3,
        GARBAGE_ARGS = 4,
        SYSTEM_ERR = 5
};
enum reject_stat {
        RPC_MISMATCH = 0,
        AUTH_ERROR = 1
};

#define ar_results      ru.AR_results
#define ar_vers ru.AR_versions

struct accepted_reply {
        struct opaque_auth ar_verf;
        enum accept_stat ar_stat;
        union {
            struct {
                unsigned long int low;
                unsigned long int high;
            } AR_versions;
            struct {
                caddr_t where;
                xdrproc_t proc;
            } AR_results;
        } ru;
};

#define rj_vers ru.RJ_versions
#define rj_why  ru.RJ_why

struct rejected_reply {
        enum reject_stat rj_stat;
        union {
            struct {
                unsigned long int low;
                unsigned long int high;
            } RJ_versions;
            enum  auth_stat RJ_why;   /* why  authentication  did  not
work */
        } ru;
};

#define rp_acpt ru.RP_ar
#define rp_rjct ru.RP_dr

struct reply_body {
        enum reply_stat rp_stat;
        union {
            struct accepted_reply RP_ar;
            struct rejected_reply RP_dr;
        } ru;
};

struct call_body {
        unsigned long int cb_rpcvers;         /* must be equal to two
*/
        unsigned long int cb_prog;
        unsigned long int cb_vers;
        unsigned long int cb_proc;
        struct opaque_auth cb_cred;
        struct opaque_auth cb_verf; /* protocol specific - provided
by client */
};
```

```
#define rm_call        ru.RM_cmb
#define rm_reply       ru.RM_rmb
#define acpted_rply    ru.RM_rmb.ru.RP_ar
#define rjcted_rply    ru.RM_rmb.ru.RP_dr

struct rpc_msg {
    unsigned long int rm_xid;
    enum msg_type rm_direction;
    union {
        struct call_body RM_cmb;
        struct reply_body RM_rmb;
    } ru;
};
extern bool_t xdr_accepted_reply(XDR *, struct accepted_reply *);
extern bool_t xdr_callhdr(XDR * __xdrs, struct rpc_msg *__cmsg);
extern bool_t xdr_callmsg(XDR * __xdrs, struct rpc_msg *__cmsg);
extern bool_t xdr_rejected_reply(XDR *, struct rejected_reply *);
extern bool_t xdr_replymsg(XDR * __xdrs, struct rpc_msg *__rmsg);
```

12.4.48 rpc/svc.h

```
#define svc_getcaller(x)         (&(x)->xp_raddr)
#define    svc_destroy(xprt)                          (*(xprt)->xp_ops-
>xp_destroy)(xprt)
#define    svc_recv(xprt,msg)                         (*(xprt)->xp_ops-
>xp_recv)((xprt), (msg))
#define    svc_reply(xprt,msg)        (*(xprt)->xp_ops->xp_reply)
((xprt), (msg))
#define svc_stat(xprt)  (*(xprt)->xp_ops->xp_stat)(xprt)
#define RPC_ANYSOCK    -1
#define svc_freeargs(xprt,xargs, argsp) \
        (*(xprt)->xp_ops->xp_freeargs)((xprt), (xargs), (argsp))
#define svc_getargs(xprt,xargs, argsp)  \
        (*(xprt)->xp_ops->xp_getargs)((xprt), (xargs), (argsp))

enum xprt_stat {
    XPRT_DIED,
    XPRT_MOREREQS,
    XPRT_IDLE
};

typedef struct SVCXPRT {
    int xp_sock;
    u_short xp_port;
    struct xp_ops *xp_ops;
    int xp_addrlen;
    struct sockaddr_in xp_raddr;
    struct opaque_auth xp_verf;
    caddr_t xp_p1;
    caddr_t xp_p2;
    char xp_pad[256];
} SVCXPRT;

struct svc_req {
    rpcprog_t rq_prog;
    rpcvers_t rq_vers;
    rpcproc_t rq_proc;
    struct opaque_auth rq_cred;
    caddr_t rq_clntcred;
    SVCXPRT *rq_xprt;
};

typedef void (*__dispatch_fn_t) (struct svc_req *, SVCXPRT *);
```

```
struct xp_ops {
    bool_t(*xp_recv) (SVCXPRT * __xprt, struct rpc_msg * __msg);
    enum xprt_stat (*xp_stat) (SVCXPRT * __xprt);
     bool_t(*xp_getargs) (SVCXPRT * __xprt, xdrproc_t __xdr_args,
                        caddr_t args_ptr);
     bool_t(*xp_reply) (SVCXPRT  *  __xprt,  struct  rpc_msg  *
__msg);
      bool_t(*xp_freeargs)   (SVCXPRT   *   __xprt,   xdrproc_t
__xdr_args,
                        caddr_t args_ptr);
    void (*xp_destroy) (SVCXPRT * __xprt);
};
extern void svc_getreqset(fd_set * __readfds);
extern bool_t svc_register(SVCXPRT * __xprt, rpcprog_t __prog,
                        rpcvers_t    __vers,    __dispatch_fn_t
__dispatch,
                        rpcprot_t __protocol);
extern void svc_run(void);
extern   bool_t   svc_sendreply(SVCXPRT   *   xprt,   xdrproc_t
__xdr_results,
                        caddr_t __xdr_location);
extern void svcerr_auth(SVCXPRT * __xprt, enum auth_stat __why);
extern void svcerr_decode(SVCXPRT * __xprt);
extern void svcerr_noproc(SVCXPRT * __xprt);
extern void svcerr_noprog(SVCXPRT * __xprt);
extern   void   svcerr_progvers(SVCXPRT   *   __xprt,   rpcvers_t
__low_vers,
                        rpcvers_t __high_vers);
extern void svcerr_systemerr(SVCXPRT * __xprt);
extern void svcerr_weakauth(SVCXPRT * __xprt);
extern SVCXPRT *svcraw_create(void);
extern SVCXPRT *svctcp_create(int __sock, u_int __sendsize,
                        u_int __recvsize);
extern SVCXPRT *svcudp_create(int __sock);
```

12.4.49 rpc/types.h

```
typedef int bool_t;
typedef int enum_t;
typedef unsigned long int rpcprog_t;
typedef unsigned long int rpcvers_t;
typedef unsigned long int rpcproc_t;
typedef unsigned long int rpcprot_t;
```

12.4.50 rpc/xdr.h

```
#define XDR_DESTROY(xdrs)        \
  do  {  if  ((xdrs)->x_ops->x_destroy)  (*(xdrs)->x_ops-
>x_destroy)(xdrs); \
    } while (0)
#define xdr_destroy(xdrs)        \
  do  {  if  ((xdrs)->x_ops->x_destroy)  (*(xdrs)->x_ops-
>x_destroy)(xdrs); \
    } while (0)
#define  XDR_GETBYTES(xdrs,addr,len)           (*(xdrs)->x_ops-
>x_getbytes)(xdrs, addr, len)
#define  xdr_getbytes(xdrs,addr,len)           (*(xdrs)->x_ops-
>x_getbytes)(xdrs, addr, len)
#define  XDR_GETINT32(xdrs,int32p)             (*(xdrs)->x_ops-
>x_getint32)(xdrs, int32p)
#define  xdr_getint32(xdrs,int32p)             (*(xdrs)->x_ops-
>x_getint32)(xdrs, int32p)
#define  XDR_GETLONG(xdrs,longp) (*(xdrs)->x_ops->x_getlong)(xdrs,
longp)
```

```
#define xdr_getlong(xdrs,longp) (*(xdrs)->x_ops->x_getlong)(xdrs,
longp)
#define    XDR_GETPOS(xdrs)                        (*(xdrs)->x_ops-
>x_getpostn)(xdrs)
#define    xdr_getpos(xdrs)                        (*(xdrs)->x_ops-
>x_getpostn)(xdrs)
#define XDR_INLINE(xdrs,len)     (*(xdrs)->x_ops->x_inline)(xdrs,
len)
#define xdr_inline(xdrs,len)     (*(xdrs)->x_ops->x_inline)(xdrs,
len)
#define    XDR_PUTBYTES(xdrs,addr,len)             (*(xdrs)->x_ops-
>x_putbytes)(xdrs, addr, len)
#define    xdr_putbytes(xdrs,addr,len)             (*(xdrs)->x_ops-
>x_putbytes)(xdrs, addr, len)
#define    XDR_PUTINT32(xdrs,int32p)               (*(xdrs)->x_ops-
>x_putint32)(xdrs, int32p)
#define    xdr_putint32(xdrs,int32p)               (*(xdrs)->x_ops-
>x_putint32)(xdrs, int32p)
#define XDR_PUTLONG(xdrs,longp) (*(xdrs)->x_ops->x_putlong)(xdrs,
longp)
#define xdr_putlong(xdrs,longp) (*(xdrs)->x_ops->x_putlong)(xdrs,
longp)
#define     XDR_SETPOS(xdrs,pos)                   (*(xdrs)->x_ops-
>x_setpostn)(xdrs, pos)
#define     xdr_setpos(xdrs,pos)                   (*(xdrs)->x_ops-
>x_setpostn)(xdrs, pos)

enum xdr_op {
    XDR_ENCODE,
    XDR_DECODE,
    XDR_FREE
};
typedef struct XDR {
    enum xdr_op x_op;
    struct xdr_ops *x_ops;
    caddr_t x_public;
    caddr_t x_private;
    caddr_t x_base;
    int x_handy;
} XDR;

struct xdr_ops {
    bool_t(*x_getlong) (XDR * __xdrs, long int *__lp);
    bool_t(*x_putlong) (XDR * __xdrs, long int *__lp);
    bool_t(*x_getbytes) (XDR  * __xdrs, caddr_t __addr, u_int
__len);
    bool_t(*x_putbytes) (XDR  *  __xdrs, char  *__addr, u_int
__len);
    u_int(*x_getpostn) (XDR * __xdrs);
    bool_t(*x_setpostn) (XDR * __xdrs, u_int __pos);
    int32_t *(*x_inline) (XDR * __xdrs, int __len);
    void (*x_destroy) (XDR * __xdrs);
     bool_t(*x_getint32) (XDR * __xdrs, int32_t * __ip);
     bool_t(*x_putint32) (XDR * __xdrs, int32_t * __ip);
};

typedef bool_t(*xdrproc_t) (XDR *, void *, ...);

struct xdr_discrim {
    int value;
    xdrproc_t proc;
};
extern bool_t xdr_array(XDR * _xdrs, caddr_t * __addrp, u_int *
__sizep,
                        u_int __maxsize, u_int __elsize,
                        xdrproc_t __elproc);
```

```
extern bool_t xdr_bool(XDR * __xdrs, bool_t * __bp);
extern  bool_t xdr_bytes(XDR  *  __xdrs,  char  **__cpp,  u_int  *
__sizep,
                    u_int __maxsize);
extern bool_t xdr_char(XDR * __xdrs, char *__cp);
extern bool_t xdr_double(XDR * __xdrs, double *__dp);
extern bool_t xdr_enum(XDR * __xdrs, enum_t * __ep);
extern bool_t xdr_float(XDR * __xdrs, float *__fp);
extern void xdr_free(xdrproc_t __proc, char *__objp);
extern bool_t xdr_int(XDR * __xdrs, int *__ip);
extern bool_t xdr_long(XDR * __xdrs, long int *__lp);
extern  bool_t  xdr_opaque(XDR  *  __xdrs,  caddr_t  __cp,  u_int
__cnt);
extern  bool_t  xdr_pointer(XDR  *  __xdrs,  char  **__objpp,  u_int
__obj_size,
                    xdrproc_t __xdr_obj);
extern bool_t xdr_reference(XDR * __xdrs, caddr_t * __xpp, u_int
__size,
                    xdrproc_t __proc);
extern bool_t xdr_short(XDR * __xdrs, short *__sp);
extern  bool_t  xdr_string(XDR  *  __xdrs,  char  **__cpp,  u_int
__maxsize);
extern bool_t xdr_u_char(XDR * __xdrs, u_char * __cp);
extern bool_t xdr_u_int(XDR * __xdrs, u_int * __up);
extern bool_t xdr_u_long(XDR * __xdrs, u_long * __ulp);
extern bool_t xdr_u_short(XDR * __xdrs, u_short * __usp);
extern  bool_t  xdr_union(XDR  *  __xdrs,  enum_t  *  __dscmp,  char
*__unp,
                    const struct xdr_discrim *__choices,
                    xdrproc_t dfault);
extern  bool_t  xdr_vector(XDR  *  __xdrs,  char  *__basep,  u_int
__nelem,
                    u_int __elemsize, xdrproc_t __xdr_elem);
extern bool_t xdr_void(void);
extern bool_t xdr_wrapstring(XDR * __xdrs, char **__cpp);
extern  void xdrmem_create(XDR  *  __xdrs,  caddr_t  __addr,  u_int
__size,
                    enum xdr_op __xop);
extern void xdrrec_create(XDR * __xdrs, u_int __sendsize, u_int
__recvsize,
                    caddr_t  __tcp_handle,  int  (*__readit)
(char *,

char *,

int),
                    int  (*__writeit)  (char  *,  char  *,
int));
extern bool_t xdrrec_endofrecord(XDR * __xdrs, bool_t __sendnow);
extern bool_t xdrrec_eof(XDR * __xdrs);
extern bool_t xdrrec_skiprecord(XDR * __xdrs);
extern void xdrstdio_create(XDR * __xdrs, FILE * __file,
                    enum xdr_op __xop);
```

12.4.51 sched.h

```
#define __CPU_ALLOC_SIZE(count) (((((count) + __NCPUBITS - 1) /
__NCPUBITS) * 8)
#define __CPUELT(cpu)    ((cpu) / __NCPUBITS)
#define __CPUMASK(cpu)   ((__cpu_mask) 1 << ((cpu) % __NCPUBITS))
#define __NCPUBITS       (8 * sizeof (__cpu_mask))
#define SCHED_OTHER      0
#define SCHED_FIFO       1
#define __CPU_SETSIZE    1024
#define SCHED_RR         2
```

```
#define __CPU_OP_S(setsize, destset, srcset1, srcset2, op)       \
  (__extension__\
   ({ cpu_set_t *__dest = (destset); \
      cpu_set_t *__arr1 = (srcset1); \
      cpu_set_t *__arr2 = (srcset2); \
      size_t __imax = (setsize) / sizeof (__cpu_mask); \
      size_t __i; \
      for (__i = 0; __i < __imax; ++__i)\
        __dest->__bits[__i]  =  __arr1->__bits[__i]  op  __arr2-
>__bits[__i]; \
 __dest; }))
#define __CPU_SET_S(cpu, setsize, cpusetp)       \
  (__extension__\
   ({ size_t __cpu = (cpu); \
      __cpu < 8 * (setsize) \
      ? ((cpusetp)->__bits[__CPUELT (__cpu)] |= __CPUMASK (__cpu))
: 0; }))
#define __CPU_ISSET_S(cpu, setsize, cpusetp)     \
  (__extension__\
   ({ size_t __cpu = (cpu); \
      __cpu < 8 * (setsize)\
      ?  (((cpusetp)->__bits[__CPUELT  (__cpu)]  &  __CPUMASK
(__cpu))) != 0 \
 : 0; }))
#define __CPU_CLR_S(cpu, setsize, cpusetp)       \
  (__extension__\
   ({ size_t __cpu = (cpu); \
      __cpu < 8 * (setsize)\
      ?  ((cpusetp)->__bits[__CPUELT  (__cpu)]  &=  ~__CPUMASK
(__cpu)) : 0; }))
#define __CPU_ZERO_S(setsize, cpusetp)  \
  do {\
    size_t __i; \
    size_t __imax = (setsize) / sizeof (__cpu_mask); \
    cpu_set_t *__arr = (cpusetp); \
    for (__i = 0; __i < __imax; ++__i)\
      __arr->__bits[__i] = 0; \
  } while (0)
#define CPU_ALLOC_SIZE(count)   __CPU_ALLOC_SIZE (count)
#define  CPU_CLR(cpu,  cpusetp)      __CPU_CLR_S  (cpu,  sizeof
(cpu_set_t), cpusetp)
#define  CPU_ISSET(cpu,  cpusetp)  __CPU_ISSET_S  (cpu,  sizeof
(cpu_set_t), cpusetp)
#define   CPU_AND_S(setsize,   destset,   srcset1,   srcset2)
__CPU_OP_S (setsize, destset, srcset1, srcset2, &)
#define   CPU_XOR_S(setsize,   destset,   srcset1,   srcset2)
__CPU_OP_S (setsize, destset, srcset1, srcset2, ^)
#define   CPU_OR_S(setsize,   destset,   srcset1,   srcset2)
__CPU_OP_S (setsize, destset, srcset1, srcset2, |)
#define  CPU_AND(destset,  srcset1,  srcset2)         __CPU_OP_S
(sizeof (cpu_set_t), destset, srcset1, srcset2, &)
#define  CPU_XOR(destset,  srcset1,  srcset2)         __CPU_OP_S
(sizeof (cpu_set_t), destset, srcset1, srcset2, ^)
#define  CPU_OR(destset,  srcset1,  srcset2)          __CPU_OP_S
(sizeof (cpu_set_t), destset, srcset1, srcset2, |)
#define CPU_SETSIZE     __CPU_SETSIZE
#define  CPU_SET(cpu,  cpusetp)         __CPU_SET_S  (cpu,  sizeof
(cpu_set_t), cpusetp)
#define CPU_ZERO(cpusetp)       __CPU_ZERO_S (sizeof (cpu_set_t),
cpusetp)

struct sched_param {
    int sched_priority;
};
typedef unsigned long int __cpu_mask;
typedef struct {
```

```
        __cpu_mask __bits[__CPU_SETSIZE / __NCPUBITS];
} cpu_set_t;
extern int sched_get_priority_max(int __algorithm);
extern int sched_get_priority_min(int __algorithm);
extern int sched_getaffinity(pid_t __pid, size_t __cpusetsize,
                             cpu_set_t * __cpuset);
extern  int  sched_getparam(pid_t  __pid,  struct  sched_param
*__param);
extern int sched_getscheduler(pid_t __pid);
extern  int  sched_rr_get_interval(pid_t  __pid,  struct  timespec
*__t);
extern int sched_setaffinity(pid_t __pid, size_t __cpusetsize,
                             const cpu_set_t * __cpuset);
extern int sched_setparam(pid_t __pid, const struct sched_param
*__param);
extern int sched_setscheduler(pid_t __pid, int __policy,
                              const struct sched_param *__param);
extern int sched_yield(void);
```

12.4.52 search.h

```
typedef struct entry {
    char *key;
    void *data;
} ENTRY;
typedef enum {
    FIND,
    ENTER
} ACTION;
struct _ENTRY;
typedef enum {
    preorder,
    postorder,
    endorder,
    leaf
} VISIT;
struct hsearch_data {
    struct _ENTRY *table;
    unsigned int size;
    unsigned int filled;
};

typedef  void  (*__action_fn_t)  (const  void  *__nodep,  VISIT
__value,
                                 int __level);
extern int hcreate(size_t __nel);
extern int hcreate_r(size_t __nel, struct hsearch_data *__htab);
extern void hdestroy(void);
extern void hdestroy_r(struct hsearch_data *__htab);
extern ENTRY *hsearch(ENTRY __item, ACTION __action);
extern  int  hsearch_r(ENTRY  __item,  ACTION  __action,  ENTRY  *
*__retval,
                       struct hsearch_data *__htab);
extern void insque(void *__elem, void *__prev);
extern void *lfind(const void *__key, const void *__base, size_t
* __nmemb,
                   size_t __size, __compar_fn_t __compar);
extern void *lsearch(const void *__key, void *__base, size_t *
__nmemb,
                   size_t __size, __compar_fn_t __compar);
extern void remque(void *__elem);
extern void *tdelete(const void *__key, void **__rootp,
                   __compar_fn_t __compar);
extern void *tfind(const void *__key, void *const *__rootp,
                   __compar_fn_t __compar);
```

```
extern void *tsearch(const void *__key, void **__rootp,
                     __compar_fn_t __compar);
extern void twalk(const void *__root, __action_fn_t __action);
```

12.4.53 setjmp.h

```
#define setjmp(env)     _setjmp(env)
#define sigsetjmp(a,b)  __sigsetjmp(a,b)

struct __jmp_buf_tag {
    __jmp_buf __jmpbuf;
    int __mask_was_saved;
    sigset_t __saved_mask;
};

typedef struct __jmp_buf_tag jmp_buf[1];
typedef jmp_buf sigjmp_buf;
extern int __sigsetjmp(jmp_buf __env, int __savemask);
extern void _longjmp(jmp_buf __env, int __val);
extern int _setjmp(jmp_buf __env);
extern void longjmp(jmp_buf __env, int __val);
extern void siglongjmp(sigjmp_buf __env, int __val);
```

12.4.54 signal.h

```
#define sigpause __xpg_sigpause

#define _SIGSET_NWORDS  (1024/(8*sizeof(unsigned long)))
#define SIGRTMAX        (__libc_current_sigrtmax ())
#define SIGRTMIN        (__libc_current_sigrtmin ())
#define NSIG    65
#define SIG_BLOCK       0       /* Block signals. */
#define SIG_UNBLOCK     1       /* Unblock signals. */
#define SIG_SETMASK       2              /* Set the set of blocked
signals. */

typedef int sig_atomic_t;

typedef void (*sighandler_t) (int);

#define SIG_HOLD        ((sighandler_t) 2)      /* Request that
signal be held. */
#define SIG_DFL ((sighandler_t)0)       /* Request for default
signal handling. */
#define SIG_IGN ((sighandler_t)1)       /* Request that signal be
ignored. */
#define SIG_ERR ((sighandler_t)-1)      /* Return value from
signal() in case of error. */

#define SIGHUP  1               /* Hangup. */
#define SIGINT  2               /* Terminal interrupt signal. */
#define SIGQUIT 3               /* Terminal quit signal. */
#define SIGILL  4               /* Illegal instruction. */
#define SIGTRAP 5               /* Trace/breakpoint trap. */
#define SIGABRT 6               /* Process abort signal. */
#define SIGIOT  6               /* IOT trap */
#define SIGBUS  7                /* Access to an undefined portion
of a memory object. */
#define SIGFPE   8                      /* Erroneous arithmetic
operation. */
#define SIGKILL 9               /* Kill (cannot be caught or
ignored). */
#define SIGUSR1 10              /* User-defined signal 1. */
#define SIGSEGV 11              /* Invalid memory reference. */
```

```
#define SIGUSR2 12                  /* User-defined signal 2. */
#define SIGPIPE 13                   /* Write  on a pipe with no one
to read it. */
#define SIGALRM 14                  /* Alarm clock. */
#define SIGTERM 15                  /* Termination signal. */
#define SIGSTKFLT      16           /* Stack fault. */
#define SIGCHLD 17                      /* Child process terminated,
stopped, or continued. */
#define SIGCLD  SIGCHLD             /* Same as SIGCHLD */
#define SIGCONT 18                       /* Continue executing, if
stopped. */
#define SIGSTOP 19                     /* Stop executing (cannot be
caught or ignored). */
#define SIGTSTP 20                  /* Terminal stop signal. */
#define SIGTTIN 21                   /* Background process attempting
read. */
#define SIGTTOU 22                   /* Background process attempting
write. */
#define SIGURG  23                      /* High bandwidth data is
available at a socket. */
#define SIGXCPU 24                  /* CPU time limit exceeded. */
#define SIGXFSZ 25                  /* File size limit exceeded. */
#define SIGVTALRM      26           /* Virtual timer expired. */
#define SIGPROF 27                  /* Profiling timer expired. */
#define SIGWINCH       28           /* Window size change. */
#define SIGIO   29                  /* I/O now possible. */
#define SIGPOLL SIGIO               /* Pollable event. */
#define SIGPWR  30                  /* Power failure restart */
#define SIGSYS  31                  /* Bad system call. */
#define SIGUNUSED      31

#define SV_ONSTACK       (1<<0)  /* Take the signal on the signal
stack. */
#define SV_INTERRUPT     (1<<1)  /* Do not restart system calls.
*/
#define SV_RESETHAND     (1<<2)  /* Reset handler to SIG_DFL on
receipt. */

typedef union sigval {
    int sival_int;
    void *sival_ptr;
} sigval_t;

#define SIGEV_SIGNAL    0      /* Notify via signal. */
#define SIGEV_NONE         1             /* Other  notification:
meaningless. */
#define SIGEV_THREAD    2       /* Deliver via thread creation.
*/
#define SIGEV_MAX_SIZE 64

typedef struct sigevent {
    sigval_t sigev_value;
    int sigev_signo;
    int sigev_notify;
    union {
        int _pad[SIGEV_PAD_SIZE];
        struct {
            void (*_function) (sigval_t);
            void *_attribute;
        } _sigev_thread;
    } _sigev_un;
} sigevent_t;

#define SI_MAX_SIZE    128
#define si_pid  _sifields._kill._pid
#define si_uid  _sifields._kill._uid
```

```
#define si_value        _sifields._rt._sigval
#define si_int  _sifields._rt._sigval.sival_int
#define si_ptr  _sifields._rt._sigval.sival_ptr
#define si_status       _sifields._sigchld._status
#define si_stime        _sifields._sigchld._stime
#define si_utime        _sifields._sigchld._utime
#define si_addr _sifields._sigfault._addr
#define si_band _sifields._sigpoll._band
#define si_fd   _sifields._sigpoll._fd
#define si_timer1       _sifields._timer._timer1
#define si_timer2       _sifields._timer._timer2

typedef struct siginfo {
    int si_signo;               /* Signal number. */
    int si_errno;
    int si_code;                /* Signal code. */
    union {
        int _pad[SI_PAD_SIZE];
        struct {
            pid_t _pid;
            uid_t _uid;
        } _kill;
        struct {
            unsigned int _timer1;
            unsigned int _timer2;
        } _timer;
        struct {
            pid_t _pid;
            uid_t _uid;
            sigval_t _sigval;
        } _rt;
        struct {
            pid_t _pid;
            uid_t _uid;
            int _status;
            clock_t _utime;
            clock_t _stime;
        } _sigchld;
        struct {
            void *_addr;
        } _sigfault;
        struct {
            int _band;
            int _fd;
        } _sigpoll;
    } _sifields;
} siginfo_t;

#define SI_QUEUE        -1      /* Sent by sigqueue. */
#define SI_TIMER        -2      /* Sent by timer expiration. */
#define SI_MESGQ         -3      /* Sent by real time mesq state
change. */
#define SI_ASYNCIO      -4      /* Sent by AIO completion. */
#define SI_SIGIO        -5      /* Sent by queued SIGIO. */
#define SI_TKILL        -6      /* Sent by tkill. */
#define SI_ASYNCNL        -60     /* Sent by asynch name lookup
completion. */
#define SI_USER 0                /* Sent by kill, sigsend, raise.
*/
#define SI_KERNEL       0x80    /* Sent by kernel. */

#define ILL_ILLOPC      1       /* Illegal opcode. */
#define ILL_ILLOPN      2       /* Illegal operand. */
#define ILL_ILLADR      3       /* Illegal addressing mode. */
#define ILL_ILLTRP      4       /* Illegal trap. */
#define ILL_PRVOPC      5       /* Privileged opcode. */
```

```
#define ILL_PRVREG      6           /* Privileged register. */
#define ILL_COPROC      7           /* Coprocessor error. */
#define ILL_BADSTK      8           /* Internal stack error. */

#define FPE_INTDIV      1           /* Integer divide by zero. */
#define FPE_INTOVF      2           /* Integer overflow. */
#define FPE_FLTDIV      3            /*  Floating-point divide by
zero. */
#define FPE_FLTOVF      4           /* Floating-point overflow. */
#define FPE_FLTUND      5           /* Floating-point underflow. */
#define FPE_FLTRES      6             /*  Floating-point inexact
result. */
#define FPE_FLTINV      7              /* Invalid floating-point
operation. */
#define FPE_FLTSUB      8           /* Subscript out of range. */

#define SEGV_MAPERR     1            /* Address not mapped to object.
*/
#define SEGV_ACCERR     2             /*  Invalid permissions for
mapped object. */

#define BUS_ADRALN      1           /* Invalid address alignment. */
#define BUS_ADRERR      2            /* Nonexistent physical address.
*/
#define BUS_OBJERR      3             /*  Object-specific hardware
error. */

#define TRAP_BRKPT      1           /* Process breakpoint. */
#define TRAP_TRACE      2           /* Process trace trap. */

#define CLD_EXITED      1           /* Child has exited. */
#define CLD_KILLED      2              /* Child has terminated
abnormally and did not create a core fi */
#define CLD_DUMPED      3              /* Child has terminated
abnormally and created a core file. */
#define CLD_TRAPPED     4           /* Traced child has trapped. */
#define CLD_STOPPED     5           /* Child has stopped. */
#define CLD_CONTINUED   6            /* Stopped child has continued.
*/

#define POLL_IN 1                   /* Data input available. */
#define POLL_OUT        2           /* Output buffers available. */
#define POLL_MSG        3           /* Input message available. */
#define POLL_ERR        4           /* I/O error. */
#define POLL_PRI        5            /* High priority input available.
*/
#define POLL_HUP        6           /* Device disconnected. */

typedef struct {
    unsigned long int sig[_SIGSET_NWORDS];
} sigset_t;

#define SA_INTERRUPT    0x20000000
#define sa_handler      __sigaction_handler._sa_handler
#define sa_sigaction    __sigaction_handler._sa_sigaction
#define SA_ONSTACK      0x08000000       /* Use signal stack by
using `sa_restorer`. */
#define SA_RESETHAND    0x80000000       /* Reset to SIG_DFL on
entry to handler. */
#define SA_NOCLDSTOP    0x00000001        /* Don't send SIGCHLD
when children stop. */
#define SA_SIGINFO      0x00000004       /* Invoke signal-catching
function with three arguments instead of one. */
#define SA_NODEFER      0x40000000       /* Don't automatically
block the signal when its handler is being executed. */
```

```
#define SA_RESTART        0x10000000        /* Restart syscall on
signal return. */
#define SA_NOCLDWAIT    0x00000002      /* Don't create zombie on
child death. */
#define SA_NOMASK         SA_NODEFER
#define SA_ONESHOT        SA_RESETHAND

typedef struct sigaltstack {
    void *ss_sp;
    int ss_flags;
    size_t ss_size;
} stack_t;

#define SS_ONSTACK      1
#define SS_DISABLE      2

extern int __libc_current_sigrtmax(void);
extern int __libc_current_sigrtmin(void);
extern   sighandler_t   __sysv_signal(int   __sig,   sighandler_t
__handler);
extern int __xpg_sigpause(int);
extern char *const _sys_siglist[];
extern   sighandler_t   bsd_signal(int   __sig,   sighandler_t
__handler);
extern int kill(pid_t __pid, int __sig);
extern int killpg(pid_t __pgrp, int __sig);
extern void psignal(int __sig, const char *__s);
extern int pthread_kill(pthread_t, int);
extern int pthread_sigmask(int, const sigset_t *, sigset_t *);
extern int raise(int __sig);
extern int sigaction(int __sig, const struct sigaction *__act,
                  struct sigaction *__oact);
extern int sigaddset(sigset_t * __set, int __signo);
extern int sigaltstack(const struct sigaltstack *__ss,
                  struct sigaltstack *__oss);
extern int sigandset(sigset_t * __set, const sigset_t * __left,
                  const sigset_t * __right);
extern int sigdelset(sigset_t * __set, int __signo);
extern int sigemptyset(sigset_t * __set);
extern int sigfillset(sigset_t * __set);
extern int sighold(int __sig);
extern int sigignore(int __sig);
extern int siginterrupt(int __sig, int __interrupt);
extern int sigisemptyset(const sigset_t * __set);
extern int sigismember(const sigset_t * __set, int __signo);
extern sighandler_t signal(int __sig, sighandler_t __handler);
extern int sigorset(sigset_t * __set, const sigset_t * __left,
                const sigset_t * __right);
extern int sigpending(sigset_t * __set);
extern int sigprocmask(int __how, const sigset_t * __set,
                  sigset_t * __oset);
extern int sigqueue(pid_t __pid, int __sig, const union sigval
__val);
extern int sigrelse(int __sig);
extern int sigreturn(struct sigcontext *__scp);
extern sighandler_t sigset(int __sig, sighandler_t __disp);
extern int sigsuspend(const sigset_t * __set);
extern int sigtimedwait(const sigset_t * __set, siginfo_t *
__info,
                  const struct timespec *__timeout);
extern int sigwait(const sigset_t * __set, int *__sig);
extern int sigwaitinfo(const sigset_t * __set, siginfo_t *
__info);
```

12.4.55 spawn.h

```
#define POSIX_SPAWN_RESETIDS    0x01
#define POSIX_SPAWN_SETPGROUP   0x02
#define POSIX_SPAWN_SETSIGDEF   0x04
#define POSIX_SPAWN_SETSIGMASK  0x08
#define POSIX_SPAWN_SETSCHEDPARAM       0x10
#define POSIX_SPAWN_SETSCHEDULER        0x20

typedef struct {
    int __allocated;
    int __used;
    struct __spawn_action *__actions;
    int __pad[16];
} posix_spawn_file_actions_t;
typedef struct {
    short __flags;
    pid_t __pgrp;
    sigset_t __sd;
    sigset_t __ss;
    struct sched_param __sp;
    int __policy;
    int __pad[16];
} posix_spawnattr_t;
extern int posix_spawn(pid_t * __pid, const char *__path,
                    const     posix_spawn_file_actions_t     *
__file_actions,
                    const posix_spawnattr_t * __attrp,
                    char *const argv[], char *const envp[]);
extern                                                    int
posix_spawn_file_actions_addclose(posix_spawn_file_actions_t *
                                            __file_actions,  int
__fd);
extern                                                    int
posix_spawn_file_actions_adddup2(posix_spawn_file_actions_t *
                                            __file_actions,  int
__fd,
                                            int __newfd);
extern                                                    int
posix_spawn_file_actions_addopen(posix_spawn_file_actions_t *
                                            __file_actions,  int
__fd,
                                            const char *__path,
                                            int  __oflag,  mode_t
__mode);
extern                                                    int
posix_spawn_file_actions_destroy(posix_spawn_file_actions_t *
                                            __file_actions);
extern                                                    int
posix_spawn_file_actions_init(posix_spawn_file_actions_t *
                                    __file_actions);
extern int posix_spawnattr_destroy(posix_spawnattr_t * __attr);
extern  int  posix_spawnattr_getflags(const  posix_spawnattr_t  *
__attr,
                                    short int *__flags);
extern  int  posix_spawnattr_getpgroup(const  posix_spawnattr_t  *
__attr,
                                    pid_t * __pgroup);
extern int  posix_spawnattr_getschedparam(const posix_spawnattr_t
* __attr,
                                        struct        sched_param
*__schedparam);
extern int posix_spawnattr_getschedpolicy(const posix_spawnattr_t
* __attr,
                                        int *__schedpolicy);
```

```
extern int posix_spawnattr_getsigdefault(const posix_spawnattr_t
* __attr,
                                         sigset_t            *
__sigdefault);
extern int posix_spawnattr_getsigmask(const posix_spawnattr_t *
__attr,
                              sigset_t * __sigmask);
extern int posix_spawnattr_init(posix_spawnattr_t * __attr);
extern int posix_spawnattr_setflags(posix_spawnattr_t * _attr,
                            short int __flags);
extern int posix_spawnattr_setpgroup(posix_spawnattr_t * __attr,
                            pid_t __pgroup);
extern  int  posix_spawnattr_setschedparam(posix_spawnattr_t   *
__attr,
                                      const struct sched_param
                                      *__schedparam);
extern  int  posix_spawnattr_setschedpolicy(posix_spawnattr_t  *
__attr,
                                     int __schedpolicy);
extern  int  posix_spawnattr_setsigdefault(posix_spawnattr_t   *
__attr,
                                     const    sigset_t     *
__sigdefault);
extern int posix_spawnattr_setsigmask(posix_spawnattr_t * __attr,
                             const     sigset_t      *
__sigmask);
extern int posix_spawnp(pid_t * __pid, const char *__file,
                   const    posix_spawn_file_actions_t    *
__file_actions,
                   const posix_spawnattr_t * __attrp,
                   char *const argv[], char *const envp[]);
```

12.4.56 stddef.h

```
#define offsetof(TYPE,MEMBER)   ((size_t)&((TYPE*)0)->MEMBER)
#ifndef NULL
#  ifdef __cplusplus
#    define NULL         (0L)
#  else
#    define NULL         ((void*) 0)
#  endif
#endif
```

12.4.57 stdint.h

```
#define INT16_C(c)      c
#define INT32_C(c)      c
#define INT8_C(c)       c
#define UINT16_C(c)     c
#define UINT8_C(c)      c
#define UINT32_C(c)     c ## U

#define INT8_MIN        (-128)
#define INT_FAST8_MIN   (-128)
#define INT_LEAST8_MIN  (-128)
#define INT32_MIN       (-2147483647-1)
#define INT_LEAST32_MIN (-2147483647-1)
#define SIG_ATOMIC_MIN  (-2147483647-1)
#define INT16_MIN       (-32767-1)
#define INT_LEAST16_MIN (-32767-1)
#define INT64_MIN       (-__INT64_C(9223372036854775807)-1)
#define INTMAX_MIN      (-__INT64_C(9223372036854775807)-1)
#define INT_FAST64_MIN  (-__INT64_C(9223372036854775807)-1)
#define INT_LEAST64_MIN (-__INT64_C(9223372036854775807)-1)
```

```
#define WINT_MIN        (0u)
#define INT8_MAX        (127)
#define INT_FAST8_MAX   (127)
#define INT_LEAST8_MAX  (127)
#define INT32_MAX       (2147483647)
#define INT_LEAST32_MAX (2147483647)
#define SIG_ATOMIC_MAX  (2147483647)
#define UINT8_MAX       (255)
#define UINT_FAST8_MAX  (255)
#define UINT_LEAST8_MAX (255)
#define INT16_MAX       (32767)
#define INT_LEAST16_MAX (32767)
#define UINT32_MAX      (4294967295U)
#define UINT_LEAST32_MAX        (4294967295U)
#define WINT_MAX        (4294967295u)
#define UINT16_MAX      (65535)
#define UINT_LEAST16_MAX        (65535)
#define INT64_MAX       (__INT64_C(9223372036854775807))
#define INTMAX_MAX      (__INT64_C(9223372036854775807))
#define INT_FAST64_MAX  (__INT64_C(9223372036854775807))
#define INT_LEAST64_MAX (__INT64_C(9223372036854775807))
#define UINT64_MAX      (__UINT64_C(18446744073709551615))
#define UINTMAX_MAX     (__UINT64_C(18446744073709551615))
#define UINT_FAST64_MAX (__UINT64_C(18446744073709551615))
#define                                         UINT_LEAST64_MAX
(__UINT64_C(18446744073709551615))

typedef signed char int8_t;
typedef short int16_t;
typedef int int32_t;
typedef unsigned char uint8_t;
typedef unsigned short uint16_t;
typedef unsigned int uint32_t;
typedef signed char int_least8_t;
typedef short int int_least16_t;
typedef int int_least32_t;
typedef unsigned char uint_least8_t;
typedef unsigned short uint_least16_t;
typedef unsigned int uint_least32_t;
typedef signed char int_fast8_t;
typedef unsigned char uint_fast8_t;
```

12.4.58 stdio.h

```
#define EOF     (-1)
#define P_tmpdir        "/tmp"
#define FOPEN_MAX       16
#define L_tmpnam        20
#define TMP_MAX 238328
#define FILENAME_MAX    4096
#define BUFSIZ  8192
#define L_ctermid       9
#define L_cuserid       9

typedef struct {
    off_t __pos;
    mbstate_t __state;
} fpos_t;
typedef struct {
    off64_t __pos;
    mbstate_t __state;
} fpos64_t;

typedef struct _IO_FILE FILE;
```

```
#define _IOFBF  0
#define _IOLBF  1
#define _IONBF  2

extern char *__fgets_chk(char *, size_t, int, FILE *);
extern char *__fgets_unlocked_chk(char *, size_t, int, FILE *);
extern size_t __fpending(FILE *);
extern int __printf_chk(int, const char *, ...);
extern int __snprintf_chk(char *, size_t, int, size_t, const char
*, ...);
extern int __sprintf_chk(char *, int, size_t, const char *, ...);
extern int __vprintf_chk(int, const char *, va_list);
extern int __vsnprintf_chk(char *, size_t, int, size_t, const
char *,
                          va_list);
extern int __vsprintf_chk(char *, int, size_t, const char *,
va_list);
extern char *const _sys_errlist[];
extern int asprintf(char **__ptr, const char *__fmt, ...);
extern void clearerr(FILE * __stream);
extern void clearerr_unlocked(FILE * __stream);
extern int dprintf(int __fd, const char *__fmt, ...);
extern int fclose(FILE * __stream);
extern FILE *fdopen(int __fd, const char *__modes);
extern int feof(FILE * __stream);
extern int feof_unlocked(FILE * __stream);
extern int ferror(FILE * __stream);
extern int ferror_unlocked(FILE * __stream);
extern int fflush(FILE * __stream);
extern int fflush_unlocked(FILE * __stream);
extern int fgetc(FILE * __stream);
extern int fgetc_unlocked(FILE * __stream);
extern int fgetpos(FILE * __stream, fpos_t * __pos);
extern int fgetpos64(FILE * __stream, fpos64_t * __pos);
extern char *fgets(char *__s, int __n, FILE * __stream);
extern char *fgets_unlocked(char *__s, int __n, FILE * __stream);
extern int fileno(FILE * __stream);
extern int fileno_unlocked(FILE * __stream);
extern void flockfile(FILE * __stream);
extern FILE *fmemopen(void *__s, size_t __len, const char
*__modes);
extern FILE *fopen(const char *__filename, const char *__modes);
extern FILE *fopen64(const char *__filename, const char
*__modes);
extern int fprintf(FILE * __stream, const char *__format, ...);
extern int fputc(int __c, FILE * __stream);
extern int fputc_unlocked(int __c, FILE * __stream);
extern int fputs(const char *__s, FILE * __stream);
extern int fputs_unlocked(const char *__s, FILE * __stream);
extern size_t fread(void *__ptr, size_t __size, size_t __n,
                    FILE * __stream);
extern size_t fread_unlocked(void *__ptr, size_t __size, size_t
__n,
                             FILE * __stream);
extern FILE *freopen(const char *__filename, const char *__modes,
                     FILE * __stream);
extern FILE *freopen64(const char *__filename, const char
*__modes,
                       FILE * __stream);
extern int fscanf(FILE * __stream, const char *__format, ...);
extern int fseek(FILE * __stream, long int __off, int __whence);
extern int fseeko(FILE * __stream, off_t __off, int __whence);
extern int fseeko64(FILE * __stream, loff_t __off, int __whence);
extern int fsetpos(FILE * __stream, const fpos_t * __pos);
extern int fsetpos64(FILE * __stream, const fpos64_t * __pos);
extern long int ftell(FILE * __stream);
```

```
extern off_t ftello(FILE * __stream);
extern loff_t ftello64(FILE * __stream);
extern int ftrylockfile(FILE * __stream);
extern void funlockfile(FILE * __stream);
extern size_t fwrite(const void *__ptr, size_t __size, size_t
__n,
                    FILE * __s);
extern size_t fwrite_unlocked(const void *__ptr, size_t __size,
size_t __n,
                             FILE * __stream);
extern int getc(FILE * __stream);
extern int getc_unlocked(FILE * __stream);
extern int getchar(void);
extern int getchar_unlocked(void);
extern ssize_t getdelim(char **__lineptr, size_t * __n, int
__delimiter,
                    FILE * __stream);
extern ssize_t getline(char **__lineptr, size_t * __n, FILE *
__stream);
extern int getw(FILE * __stream);
extern FILE *open_memstream(char **__bufloc, size_t * __sizeloc);
extern int pclose(FILE * __stream);
extern void perror(const char *__s);
extern FILE *popen(const char *__command, const char *__modes);
extern int printf(const char *__format, ...);
extern int putc(int __c, FILE * __stream);
extern int putc_unlocked(int __c, FILE * __stream);
extern int putchar(int __c);
extern int putchar_unlocked(int __c);
extern int puts(const char *__s);
extern int putw(int __w, FILE * __stream);
extern int remove(const char *__filename);
extern int renameat(int __oldfd, const char *__old, int __newfd,
                    const char *__new);
extern void rewind(FILE * __stream);
extern int scanf(const char *__format, ...);
extern void setbuf(FILE * __stream, char *__buf);
extern void setbuffer(FILE * __stream, char *__buf, size_t
__size);
extern int setvbuf(FILE * __stream, char *__buf, int __modes,
size_t __n);
extern int snprintf(char *__s, size_t __maxlen, const char
*__format, ...);
extern int sprintf(char *__s, const char *__format, ...);
extern int sscanf(const char *__s, const char *__format, ...);
extern FILE *stderr;
extern FILE *stdin;
extern FILE *stdout;
extern char *tempnam(const char *__dir, const char *__pfx);
extern FILE *tmpfile(void);
extern FILE *tmpfile64(void);
extern char *tmpnam(char *__s);
extern int ungetc(int __c, FILE * __stream);
extern int vasprintf(char **__ptr, const char *__f, va_list
__arg);
extern int vdprintf(int __fd, const char *__fmt, va_list __arg);
extern int vfprintf(FILE * __s, const char *__format, va_list
__arg);
extern int vfscanf(FILE * __s, const char *__format, va_list
__arg);
extern int vprintf(const char *__format, va_list __arg);
extern int vscanf(const char *__format, va_list __arg);
extern int vsnprintf(char *__s, size_t __maxlen, const char
*__format,
                    va_list __arg);
```

```
extern  int  vsprintf(char  *__s,  const  char  *__format,  va_list
__arg);
extern  int  vsscanf(const  char  *__s,  const  char  *__format,  va_list
__arg);
```

12.4.59 stdlib.h

```
#define MB_CUR_MAX       (__ctype_get_mb_cur_max())
#define EXIT_SUCCESS     0
#define EXIT_FAILURE     1
#define RAND_MAX         2147483647

struct drand48_data {
    unsigned short __x[3];
    unsigned short __old_x[3];
    unsigned short __c;
    unsigned short __init;
    unsigned long long int __a;
};
typedef int (*__compar_fn_t) (const void *, const void *);
struct random_data {
    int32_t *fptr;                /* Front pointer. */
    int32_t *rptr;                /* Rear pointer. */
    int32_t *state;               /* Array of state values. */
    int rand_type;                        /* Type of  random  number
generator. */
    int rand_deg;                         /* Degree of random number
generator. */
    int rand_sep;                    /* Distance between front and
rear. */
    int32_t *end_ptr;             /* Pointer behind state table. */
};

typedef struct {
    int quot;
    int rem;
} div_t;

typedef struct {
    long int quot;
    long int rem;
} ldiv_t;

typedef struct {
    long long int quot;
    long long int rem;
} lldiv_t;
extern void _Exit(int __status);
extern size_t __ctype_get_mb_cur_max(void);
extern  size_t  __mbstowcs_chk(wchar_t  *,  const  char  *,  size_t,
size_t);
extern char *__realpath_chk(const char *, char *, size_t);
extern double __strtod_internal(const char *, char **, int);
extern float __strtof_internal(const char *, char **, int);
extern  long  int  __strtol_internal(const  char  *,  char  **,  int,
int);
extern  long  double  __strtold_internal(const  char  *,  char  **,
int);
extern  long  long  int  __strtoll_internal(const  char  *,  char  **,
int, int);
extern  unsigned  long  int  __strtoul_internal(const  char  *,  char
**, int,
                                                int);
extern  unsigned  long  long  int  __strtoull_internal(const  char  *,
char **,
```

```
                                                  int, int);
        extern size_t __wcstombs_chk(char *, const wchar_t *, size_t,
        size_t);
        extern int __wctomb_chk(char *, wchar_t, size_t);
        extern long int a64l(const char *__s);
        extern void abort(void);
        extern int abs(int __x);
        extern int atexit(void (*__func) (void));
        extern double atof(const char *__nptr);
        extern int atoi(const char *__nptr);
        extern long int atol(const char *__nptr);
        extern long long int atoll(const char *__nptr);
        extern void *bsearch(const void *__key, const void *__base,
        size_t __nmemb,
                          size_t __size, __compar_fn_t __compar);
        extern void *calloc(size_t __nmemb, size_t __size);
        extern div_t div(int __numer, int __denom);
        extern double drand48(void);
        extern int drand48_r(struct drand48_data *__buffer, double
        *__result);
        extern char *ecvt(double __value, int __ndigit, int *__decpt, int
        *__sign);
        extern char **environ;
        extern double erand48(unsigned short __xsubi[3]);
        extern int erand48_r(unsigned short __xsubi[3],
                          struct drand48_data *__buffer, double
        *__result);
        extern void exit(int __status);
        extern char *fcvt(double __value, int __ndigit, int *__decpt, int
        *__sign);
        extern void free(void *__ptr);
        extern char *gcvt(double __value, int __ndigit, char *__buf);
        extern char *getenv(const char *__name);
        extern int getloadavg(double __loadavg[], int __nelem);
        extern int getsubopt(char **__optionp, char *const *__tokens,
                          char **__valuep);
        extern int grantpt(int __fd);
        extern char *initstate(unsigned int __seed, char *__statebuf,
                           size_t __statelen);
        extern int initstate_r(unsigned int __seed, char *__statebuf,
                           size_t __statelen, struct random_data
        *__buf);
        extern long int jrand48(unsigned short __xsubi[3]);
        extern int jrand48_r(unsigned short __xsubi[3],
                          struct drand48_data *__buffer, long int
        *__result);
        extern char *l64a(long int __n);
        extern long int labs(long int __x);
        extern void lcong48(unsigned short __param[7]);
        extern int lcong48_r(unsigned short __param[7],
                          struct drand48_data *__buffer);
        extern ldiv_t ldiv(long int __numer, long int __denom);
        extern long long int llabs(long long int __x);
        extern lldiv_t lldiv(long long int __numer, long long int
        __denom);
        extern long int lrand48(void);
        extern int lrand48_r(struct drand48_data *__buffer, long int
        *__result);
        extern void *malloc(size_t __size);
        extern int mblen(const char *__s, size_t __n);
        extern size_t mbstowcs(wchar_t * __pwcs, const char *__s, size_t
        __n);
        extern int mbtowc(wchar_t * __pwc, const char *__s, size_t __n);
        extern char *mkdtemp(char *__template);
        extern int mkstemp64(char *__template);
        extern char *mktemp(char *__template);
```

```
extern long int mrand48(void);
extern int mrand48_r(struct drand48_data *__buffer, long int
*__result);
extern long int nrand48(unsigned short __xsubi[3]);
extern int nrand48_r(unsigned short __xsubi[3],
                     struct drand48_data *__buffer, long int
*__result);
extern int posix_memalign(void **__memptr, size_t __alignment,
                     size_t __size);
extern int posix_openpt(int __oflag);
extern char *ptsname(int __fd);
extern int putenv(char *__string);
extern void qsort(void *__base, size_t __nmemb, size_t __size,
                  const __compar_fn_t __compar);
extern int rand(void);
extern int rand_r(unsigned int *__seed);
extern long int random(void);
extern int random_r(struct random_data *__buf, int32_t *
__result);
extern void *realloc(void *__ptr, size_t __size);
extern char *realpath(const char *__name, char *__resolved);
extern unsigned short *seed48(unsigned short __seed16v[3]);
extern int seed48_r(unsigned short __seed16v[3],
                    struct drand48_data *__buffer);
extern int setenv(const char *__name, const char *__value, int
__replace);
extern char *setstate(char *__statebuf);
extern int setstate_r(char *__statebuf, struct random_data
*__buf);
extern void srand(unsigned int __seed);
extern void srand48(long int __seedval);
extern int srand48_r(long int __seedval, struct drand48_data
*__buffer);
extern void srandom(unsigned int __seed);
extern int srandom_r(unsigned int __seed, struct random_data
*__buf);
extern double strtod(const char *__nptr, char **__endptr);
extern float strtof(const char *__nptr, char **__endptr);
extern long int strtol(const char *__nptr, char **__endptr, int
__base);
extern long double strtold(const char *__nptr, char **__endptr);
extern long long int strtoll(const char *__nptr, char **__endptr,
                           int __base);
extern long long int strtoq(const char *__nptr, char **__endptr,
                           int __base);
extern unsigned long int strtoul(const char *__nptr, char
**__endptr,
                                  int __base);
extern unsigned long long int strtoull(const char *__nptr, char
**__endptr,
                                        int __base);
extern unsigned long long int strtouq(const char *__nptr, char
**__endptr,
                                        int __base);
extern int system(const char *__command);
extern int unlockpt(int __fd);
extern int unsetenv(const char *__name);
extern size_t wcstombs(char *__s, const wchar_t * __pwcs, size_t
__n);
extern int wctomb(char *__s, wchar_t __wchar);
```

12.4.60 string.h

```
#define strerror_r __xpg_strerror_r
```

```
extern void *__memcpy_chk(void *, const void *, size_t, size_t);
extern void *__memmove_chk(void *, const void *, size_t, size_t);
extern void *__mempcpy(void *__dest, const void *__src, size_t
__n);
extern void *__mempcpy_chk(void *, const void *, size_t, size_t);
extern void *__memset_chk(void *, int, size_t, size_t);
extern char *__stpcpy(char *__dest, const char *__src);
extern char *__stpcpy_chk(char *, const char *, size_t);
extern char *__strcat_chk(char *, const char *, size_t);
extern char *__strcpy_chk(char *, const char *, size_t);
extern char *__strncat_chk(char *, const char *, size_t, size_t);
extern char *__strncpy_chk(char *, const char *, size_t, size_t);
extern char *__strtok_r(char *__s, const char *__delim, char
**__save_ptr);
extern int __xpg_strerror_r(int, char *, size_t);
extern void *memccpy(void *__dest, const void *__src, int __c,
size_t __n);
extern void *memchr(const void *__s, int __c, size_t __n);
extern int memcmp(const void *__s1, const void *__s2, size_t
__n);
extern void *memcpy(void *__dest, const void *__src, size_t __n);
extern void *memmem(const void *__haystack, size_t __haystacklen,
                const void *__needle, size_t __needlelen);
extern void *memmove(void *__dest, const void *__src, size_t
__n);
extern void *memrchr(const void *__s, int __c, size_t __n);
extern void *memset(void *__s, int __c, size_t __n);
extern char *stpcpy(char *__dest, const char *__src);
extern char *stpncpy(char *__dest, const char *__src, size_t
__n);
extern char *strcasestr(const char *__haystack, const char
*__needle);
extern char *strcat(char *__dest, const char *__src);
extern char *strchr(const char *__s, int __c);
extern int strcmp(const char *__s1, const char *__s2);
extern int strcoll(const char *__s1, const char *__s2);
extern char *strcpy(char *__dest, const char *__src);
extern size_t strcspn(const char *__s, const char *__reject);
extern char *strdup(const char *__s);
extern char *strerror(int __errnum);
extern size_t strlen(const char *__s);
extern char *strncat(char *__dest, const char *__src, size_t
__n);
extern int strncmp(const char *__s1, const char *__s2, size_t
__n);
extern char *strncpy(char *__dest, const char *__src, size_t
__n);
extern char *strndup(const char *__string, size_t __n);
extern size_t strnlen(const char *__string, size_t __maxlen);
extern char *strpbrk(const char *__s, const char *__accept);
extern char *strrchr(const char *__s, int __c);
extern char *strsep(char **__stringp, const char *__delim);
extern char *strsignal(int __sig);
extern size_t strspn(const char *__s, const char *__accept);
extern char *strstr(const char *__haystack, const char
*__needle);
extern char *strtok(char *__s, const char *__delim);
extern char *strtok_r(char *__s, const char *__delim, char
**__save_ptr);
extern size_t strxfrm(char *__dest, const char *__src, size_t
__n);
```

12.4.61 strings.h

```
extern int bcmp(const void *__s1, const void *__s2, size_t __n);
```

```
extern void bcopy(const void *__src, void *__dest, size_t __n);
extern void bzero(void *__s, size_t __n);
extern int ffs(int __i);
extern char *index(const char *__s, int __c);
extern char *rindex(const char *__s, int __c);
extern int strcasecmp(const char *__s1, const char *__s2);
extern int strncasecmp(const char *__s1, const char *__s2, size_t
__n);
```

12.4.62 sys/epoll.h

```
#define EPOLL_CTL_ADD   1          /* Add a file decriptor to the
interface. */
#define EPOLL_CTL_DEL   2          /* Remove a file decriptor from
the interface. */
#define EPOLL_CTL_MOD    3              /* Change file decriptor
epoll_event structure. */
#define EPOLLIN 1
#define EPOLLPRI        2
#define EPOLLOUT        4
#define EPOLLERR        8
#define EPOLLHUP        16
#define EPOLLRDHUP      0x2000
#define EPOLLONESHOT    (1 << 30)
#define EPOLLET (1 << 31)

typedef union epoll_data {
    void *ptr;
    int fd;
    uint32_t u32;
    uint64_t u64;
} epoll_data_t;

struct epoll_event {
    uint32_t events;
    epoll_data_t data;
};
extern int epoll_create(int __size);
extern int epoll_ctl(int __epfd, int __op, int __fd,
                    struct epoll_event *__event);
extern int epoll_wait(int __epfd, struct epoll_event *__events,
                    int __maxevents, int __timeout);
```

12.4.63 sys/file.h

```
#define LOCK_SH 1
#define LOCK_EX 2
#define LOCK_NB 4
#define LOCK_UN 8

extern int flock(int __fd, int __operation);
```

12.4.64 sys/inotify.h

```
#define IN_ACCESS       0x00000001
#define IN_MODIFY       0x00000002
#define IN_ATTRIB       0x00000004
#define IN_CLOSE_WRITE  0x00000008
#define IN_CLOSE_NOWRITE        0x00000010
#define IN_OPEN 0x00000020
#define IN_MOVED_FROM   0x00000040
#define IN_MOVED_TO     0x00000080
```

```
#define IN_CREATE        0x00000100
#define IN_DELETE        0x00000200
#define IN_DELETE_SELF   0x00000400
#define IN_MOVE_SELF     0x00000800
#define IN_UNMOUNT       0x00002000
#define IN_Q_OVERFLOW    0x00004000
#define IN_IGNORED       0x00008000
#define IN_ISDIR         0x40000000
#define IN_ONESHOT       0x80000000
#define IN_CLOSE         (IN_CLOSE_WRITE | IN_CLOSE_NOWRITE)
#define IN_MOVE (IN_MOVED_FROM | IN_MOVED_TO)
#define IN_ALL_EVENTS    \
   (IN_ACCESS | IN_MODIFY | IN_ATTRIB | IN_CLOSE_WRITE | \
  IN_CLOSE_NOWRITE | IN_OPEN | IN_MOVED_FROM | IN_MOVED_TO |
IN_CREATE | \
 IN_DELETE | IN_DELETE_SELF | IN_MOVE_SELF)

struct inotify_event {
    int wd;
    uint32_t mask;
    uint32_t cookie;
    uint32_t len;
    char name[];
};
extern int inotify_add_watch(int __fd, const char *__name,
                             uint32_t __mask);
extern int inotify_init(void);
extern int inotify_rm_watch(int __fd, int __wd);
```

12.4.65 sys/ioctl.h

```
struct winsize {
    unsigned short ws_row;      /* Rows, in characters. */
    unsigned short ws_col;      /* Columns, in characters. */
    unsigned short ws_xpixel;   /* Horizontal pixels. */
    unsigned short ws_ypixel;   /* Vertical pixels. */
};
extern int ioctl(int __fd, unsigned long int __request, ...);
```

12.4.66 sys/ipc.h

```
#define IPC_PRIVATE     ((key_t)0)
#define IPC_RMID        0
#define IPC_CREAT       00001000
#define IPC_EXCL        00002000
#define IPC_NOWAIT      00004000
#define IPC_SET 1
#define IPC_STAT        2

extern key_t ftok(const char *__pathname, int __proj_id);
```

12.4.67 sys/mman.h

```
#define MAP_FAILED      ((void*)-1)
#define POSIX_MADV_NORMAL       0
#define PROT_NONE       0x0
#define MAP_SHARED      0x01
#define MAP_PRIVATE     0x02
#define PROT_READ       0x1
#define MAP_FIXED       0x10
#define PROT_WRITE      0x2
#define MAP_ANONYMOUS   0x20
```

```
#define PROT_EXEC        0x4
#define MREMAP_MAYMOVE   1
#define MS_ASYNC         1
#define POSIX_MADV_RANDOM        1
#define MREMAP_FIXED     2
#define MS_INVALIDATE    2
#define POSIX_MADV_SEQUENTIAL    2
#define POSIX_MADV_WILLNEED      3
#define MS_SYNC 4
#define POSIX_MADV_DONTNEED      4
#define MAP_ANON         MAP_ANONYMOUS

extern int mlock(const void *__addr, size_t __len);
extern int mlockall(int __flags);
extern void *mmap(void *__addr, size_t __len, int __prot, int
__flags,
                int __fd, off_t __offset);
extern void *mmap64(void *__addr, size_t __len, int __prot, int
__flags,
                int __fd, off64_t __offset);
extern int mprotect(void *__addr, size_t __len, int __prot);
extern void *mremap(void *__addr, size_t __old_len, size_t
__new_len,
                int __flags, ...);
extern int msync(void *__addr, size_t __len, int __flags);
extern int munlock(const void *__addr, size_t __len);
extern int munlockall(void);
extern int munmap(void *__addr, size_t __len);
extern int posix_madvise(void *__addr, size_t __len, int
__advice);
extern int shm_open(const char *__name, int __oflag, mode_t
__mode);
extern int shm_unlink(const char *__name);
```

12.4.68 sys/msg.h

```
#define MSG_NOERROR      010000

extern int msgctl(int __msqid, int __cmd, struct msqid_ds
*__buf);
extern int msgget(key_t __key, int __msgflg);
extern ssize_t msgrcv(int __msqid, void *__msgp, size_t __msgsz,
                long int __msgtyp, int __msgflg);
extern int msgsnd(int __msqid, const void *__msgp, size_t
__msgsz,
                int __msgflg);
```

12.4.69 sys/param.h

```
#define NOFILE  256
#define MAXPATHLEN       4096
```

12.4.70 sys/poll.h

```
#define POLLIN  0x0001          /* There is data to read */
#define POLLPRI 0x0002           /* There is urgent data to read
*/
#define POLLOUT 0x0004          /* Writing now will not block */
#define POLLERR 0x0008          /* Error condition */
#define POLLHUP 0x0010          /* Hung up */
#define POLLNVAL         0x0020  /* Invalid request: fd not open
*/
```

```
#define POLLRDNORM      0x0040  /* Normal data may be read */
#define POLLRDBAND      0x0080  /* Priority data may be read */
#define POLLWRNORM      0x0100  /* Writing now will not block */
#define POLLWRBAND       0x0200  /* Priority data may be written
*/

struct pollfd {
    int fd;                     /* File descriptor to poll. */
    short events;                /* Types of events poller cares
about. */
    short revents;               /* Types of events that actually
occurred. */
};
typedef unsigned long int nfds_t;
```

12.4.71 sys/ptrace.h

```
enum __ptrace_setoptions {
    PTRACE_O_TRACESYSGOOD = 0x00000001,
    PTRACE_O_TRACEFORK = 0x00000002,
    PTRACE_O_TRACEVFORK = 0x00000004,
    PTRACE_O_TRACECLONE = 0x00000008,
    PTRACE_O_TRACEEXEC = 0x00000010,
    PTRACE_O_TRACEVFORKDONE = 0x00000020,
    PTRACE_O_TRACEEXIT = 0x00000040,
    PTRACE_O_MASK = 0x0000007f
};
enum __ptrace_eventcodes {
    PTRACE_EVENT_FORK = 1,
    PTRACE_EVENT_VFORK = 2,
    PTRACE_EVENT_CLONE = 3,
    PTRACE_EVENT_EXEC = 4,
    PTRACE_EVENT_VFORK_DONE = 5,
    PTRACE_EVENT_EXIT = 6
};
extern long int ptrace(enum __ptrace_request, ...);
```

12.4.72 sys/resource.h

```
#define RUSAGE_CHILDREN (-1)
#define RLIM_INFINITY   (~0UL)
#define RLIM_SAVED_CUR  -1
#define RLIM_SAVED_MAX  -1
#define RLIMIT_CPU      0
#define RUSAGE_SELF     0
#define RLIMIT_FSIZE    1
#define RLIMIT_LOCKS    10
#define RLIM_NLIMITS    11
#define RLIMIT_DATA     2
#define RLIMIT_STACK    3
#define RLIMIT_CORE     4
#define RLIMIT_RSS      5
#define RLIMIT_NPROC    6
#define RLIMIT_NOFILE   7
#define RLIMIT_MEMLOCK  8
#define RLIMIT_AS       9

typedef unsigned long int rlim_t;
typedef unsigned long long int rlim64_t;
typedef int __rlimit_resource_t;

struct rlimit {
    rlim_t rlim_cur;            /* The current (soft) limit. */
    rlim_t rlim_max;            /* The hard limit. */
```

```
};
struct rlimit64 {
    rlim64_t rlim_cur;          /* The current (soft) limit. */
    rlim64_t rlim_max;          /* The hard limit. */
};

struct rusage {
    struct timeval ru_utime;      /* Total amount of user time
used. */
    struct timeval ru_stime;      /* Total amount of system time
used. */
    long int ru_maxrss;         /* Maximum resident set size (in
kilobytes). */
    long int ru_ixrss;            /* Amount of sharing of text
segment memory        with other p */
    long int ru_idrss;          /* Amount of data segment memory
used (kilobyte-seconds). */
    long int ru_isrss;            /* Amount of stack memory used
(kilobyte-seconds). */
    long int ru_minflt;         /* Number of soft page faults
(i.e. those serviced by reclaimin */
    long int ru_majflt;         /* Number of hard page faults
(i.e. those that required I/O). */
    long int ru_nswap;          /* Number of times a process was
swapped out of physical memory */
    long int ru_inblock;        /* Number of input operations via
the file system.  Note: This */
    long int ru_oublock;        /* Number of output operations
via the file system. */
    long int ru_msgsnd;         /* Number of IPC messages sent.
*/
    long  int  ru_msgrcv;             /*  Number  of  IPC  messages
received. */
    long int ru_nsignals;       /* Number of signals delivered.
*/
    long int ru_nvcsw;          /* Number of voluntary context
switches, i.e. because the proce */
    long int ru_nivcsw;         /* Number of involuntary context
switches, i.e. a higher priori */
};

enum __priority_which {
    PRIO_PROCESS = 0,           /* WHO is a process ID. */
    PRIO_PGRP = 1,              /* WHO is a process group ID. */
    PRIO_USER = 2               /* WHO is a user ID. */
};

#define PRIO_PGRP       PRIO_PGRP
#define PRIO_PROCESS    PRIO_PROCESS
#define PRIO_USER       PRIO_USER

typedef enum __priority_which __priority_which_t;
extern int getpriority(__priority_which_t __which, id_t __who);
extern int getrlimit(__rlimit_resource_t __resource,
                 struct rlimit *__rlimits);
extern  int  getrlimit64(id_t  __resource,  struct  rlimit64
*__rlimits);
extern int getrusage(int __who, struct rusage *__usage);
extern  int  setpriority(__priority_which_t  __which,  id_t  __who,
int __prio);
extern int setrlimit(__rlimit_resource_t __resource,
                 const struct rlimit *__rlimits);
extern int setrlimit64(__rlimit_resource_t __resource,
                 const struct rlimit64 *__rlimits);
```

12.4.73 sys/select.h

```
#define NFDBITS (8 * sizeof (long))

extern int pselect(int __nfds, fd_set * __readfds, fd_set *
__writefds,
                  fd_set * __exceptfds, const struct timespec
*__timeout,
                  const sigset_t * __sigmask);
```

12.4.74 sys/sem.h

```
#define SEM_UNDO        0x1000
#define GETPID  11
#define GETVAL  12
#define GETALL  13
#define GETNCNT 14
#define GETZCNT 15
#define SETVAL  16
#define SETALL  17

struct sembuf {
    short sem_num;
    short sem_op;
    short sem_flg;
};
extern int semctl(int __semid, int __semnum, int __cmd, ...);
extern int semget(key_t __key, int __nsems, int __semflg);
extern int semop(int __semid, struct sembuf *__sops, size_t
__nsops);
```

12.4.75 sys/sendfile.h

```
extern ssize_t sendfile(int __out_fd, int __in_fd, off_t *
__offset,
                        size_t __count);
extern ssize_t sendfile64(int __out_fd, int __in_fd, off64_t *
__offset,
                          size_t __count);
```

12.4.76 sys/shm.h

```
#define SHM_RDONLY      010000
#define SHM_W   0200
#define SHM_RND 020000
#define SHM_R   0400
#define SHM_REMAP       040000
#define SHM_LOCK        11
#define SHM_UNLOCK      12

extern int __getpagesize(void);
extern void *shmat(int __shmid, const void *__shmaddr, int
__shmflg);
extern int shmctl(int __shmid, int __cmd, struct shmid_ds
*__buf);
extern int shmdt(const void *__shmaddr);
extern int shmget(key_t __key, size_t __size, int __shmflg);
```

12.4.77 sys/socket.h

```
#define CMSG_FIRSTHDR(msg)          ((size_t) (msg)->msg_controllen
>= sizeof(struct cmsghdr) ? (struct cmsghdr *)(msg)->msg_control
: (struct cmsghdr *) NULL)
#define     CMSG_LEN(len)                    (CMSG_ALIGN(sizeof(struct
cmsghdr))+(len))
#define SCM_RIGHTS      0x01
#define SOL_SOCKET      1
#define SOMAXCONN       128
#define SOL_RAW 255
#define CMSG_ALIGN(len) \
        (((len)+sizeof(size_t)-1)&(size_t)~(sizeof(size_t)-1))
#define CMSG_DATA(cmsg) \
        ((unsigned  char  *)  (cmsg)  +  CMSG_ALIGN(sizeof(struct
cmsghdr)))
#define CMSG_SPACE(len) \
        (CMSG_ALIGN(sizeof(struct cmsghdr))+CMSG_ALIGN(len))
#define CMSG_NXTHDR(mhdr,cmsg)  \
        (((cmsg) == NULL) ? CMSG_FIRSTHDR(mhdr) : \
         (((u_char *)(cmsg) + CMSG_ALIGN((cmsg)->cmsg_len) \
                          + CMSG_ALIGN(sizeof(struct  cmsghdr))
> \
           (u_char     *)((mhdr)->msg_control)      +     (mhdr)-
>msg_controllen) ? \
          (struct cmsghdr *)NULL : \
          (struct      cmsghdr     *)((u_char     *)(cmsg)      +
CMSG_ALIGN((cmsg)->cmsg_len))))

struct linger {
    int l_onoff;
    int l_linger;
};
struct cmsghdr {
    size_t cmsg_len;
    int cmsg_level;
    int cmsg_type;
};
struct iovec {
    void *iov_base;
    size_t iov_len;
};

typedef unsigned short sa_family_t;
typedef unsigned int socklen_t;

struct sockaddr {
    sa_family_t sa_family;
    char sa_data[14];
};
struct sockaddr_storage {
    sa_family_t ss_family;
    __ss_aligntype __ss_align;
    char __ss_padding[(128 - (2 * sizeof(__ss_aligntype)))];
};

struct msghdr {
    void *msg_name;
    int msg_namelen;
    struct iovec *msg_iov;
    size_t msg_iovlen;
    void *msg_control;
    size_t msg_controllen;
    unsigned int msg_flags;
};

#define AF_UNSPEC       0
#define AF_UNIX 1
```

```
#define AF_INET6        10
#define AF_INET 2

#define PF_INET AF_INET
#define PF_INET6        AF_INET6
#define PF_UNIX AF_UNIX
#define PF_UNSPEC       AF_UNSPEC

#define SOCK_STREAM     1
#define SOCK_PACKET     10
#define SOCK_DGRAM      2
#define SOCK_RAW        3
#define SOCK_RDM        4
#define SOCK_SEQPACKET  5

#define SO_DEBUG        1
#define SO_OOBINLINE    10
#define SO_NO_CHECK     11
#define SO_PRIORITY     12
#define SO_LINGER       13
#define SO_BSDCOMPAT    14
#define SO_REUSEADDR    2
#define SO_TYPE 3
#define SO_ACCEPTCONN   30
#define SO_ERROR        4
#define SO_DONTROUTE    5
#define SO_BROADCAST    6
#define SO_SNDBUF       7
#define SO_RCVBUF       8
#define SO_KEEPALIVE    9

#define SIOCGIFNAME     0x8910
#define SIOCGIFCONF     0x8912
#define SIOCGIFFLAGS    0x8913
#define SIOCGIFADDR     0x8915
#define SIOCGIFDSTADDR  0x8917
#define SIOCGIFBRDADDR  0x8919
#define SIOCGIFNETMASK  0x891b
#define SIOCGIFMTU      0x8921
#define SIOCGIFHWADDR   0x8927

#define SHUT_RD 0
#define SHUT_WR 1
#define SHUT_RDWR       2

#define MSG_WAITALL     0x100
#define MSG_TRUNC       0x20
#define MSG_NOSIGNAL    0x4000
#define MSG_EOR 0x80
#define MSG_OOB 1
#define MSG_PEEK        2
#define MSG_DONTROUTE   4
#define MSG_CTRUNC      8

extern ssize_t __recv_chk(int, void *, size_t, size_t, int);
extern ssize_t __recvfrom_chk(int, void *, size_t, size_t, int,
                            struct sockaddr *, socklen_t *);
extern int accept(int __fd, struct sockaddr *__addr,
                socklen_t * __addr_len);
extern  int  bind(int __fd, const  struct  sockaddr  *__addr,
socklen_t __len);
extern int connect(int __fd, const struct sockaddr *__addr,
                socklen_t __len);
extern  int  getnameinfo(const  struct  sockaddr  *__sa, socklen_t
__salen,
```

```
                       char  *__host,  socklen_t  __hostlen,  char
*__serv,
                       socklen_t    __servlen,    unsigned    int
__flags);
extern int getpeername(int __fd, struct sockaddr *__addr,
                       socklen_t * __len);
extern int getsockname(int __fd, struct sockaddr *__addr,
                       socklen_t * __len);
extern int getsockopt(int __fd, int __level, int __optname, void
*__optval,
                       socklen_t * __optlen);
extern int listen(int __fd, int __n);
extern  ssize_t  recv(int  __fd,  void  *__buf,  size_t  __n,  int
__flags);
extern ssize_t recvfrom(int __fd, void *__buf, size_t __n, int
__flags,
                       struct  sockaddr  *__addr,  socklen_t  *
__addr_len);
extern ssize_t recvmsg(int  __fd,  struct  msghdr  *__message,  int
__flags);
extern ssize_t send(int __fd, const void *__buf, size_t __n, int
__flags);
extern ssize_t sendmsg(int __fd, const struct msghdr *__message,
                       int __flags);
extern ssize_t sendto(int __fd, const void *__buf, size_t __n,
int __flags,
                       const  struct  sockaddr  *__addr,  socklen_t
__addr_len);
extern int setsockopt(int __fd, int __level, int __optname,
                       const void *__optval, socklen_t __optlen);
extern int shutdown(int __fd, int __how);
extern int sockatmark(int __fd);
extern int socket(int __domain, int __type, int __protocol);
extern int socketpair(int __domain, int __type, int __protocol,
                       int __fds[2]);
```

12.4.78 sys/stat.h

```
#define S_ISBLK(m)       (((m)&S_IFMT)==S_IFBLK)
#define S_ISCHR(m)       (((m)&S_IFMT)==S_IFCHR)
#define S_ISDIR(m)       (((m)&S_IFMT)==S_IFDIR)
#define S_ISFIFO(m)      (((m)&S_IFMT)==S_IFIFO)
#define S_ISLNK(m)       (((m)&S_IFMT)==S_IFLNK)
#define S_ISREG(m)       (((m)&S_IFMT)==S_IFREG)
#define S_ISSOCK(m)      (((m)&S_IFMT)==S_IFSOCK)
#define S_TYPEISMQ(buf) ((buf)->st_mode - (buf)->st_mode)
#define S_TYPEISSEM(buf)         ((buf)->st_mode - (buf)->st_mode)
#define S_TYPEISSHM(buf)         ((buf)->st_mode - (buf)->st_mode)
#define S_IRWXU (S_IREAD|S_IWRITE|S_IEXEC)
#define S_IROTH (S_IRGRP>>3)
#define S_IRGRP (S_IRUSR>>3)
#define S_IRWXO (S_IRWXG>>3)
#define S_IRWXG (S_IRWXU>>3)
#define S_IWOTH (S_IWGRP>>3)
#define S_IWGRP (S_IWUSR>>3)
#define S_IXOTH (S_IXGRP>>3)
#define S_IXGRP (S_IXUSR>>3)
#define S_ISVTX 01000
#define S_IXUSR 0x0040
#define S_IWUSR 0x0080
#define S_IRUSR 0x0100
#define S_ISGID 0x0400
#define S_ISUID 0x0800
#define S_IFIFO 0x1000
#define S_IFCHR 0x2000
```

```
#define S_IFDIR 0x4000
#define S_IFBLK 0x6000
#define S_IFREG 0x8000
#define S_IFLNK 0xa000
#define S_IFSOCK        0xc000
#define S_IFMT  0xf000
#define st_atime        st_atim.tv_sec
#define st_ctime        st_ctim.tv_sec
#define st_mtime        st_mtim.tv_sec
#define S_IREAD S_IRUSR
#define S_IWRITE        S_IWUSR
#define S_IEXEC S_IXUSR


extern  int  __fxstat(int  __ver,  int  __fildes,  struct  stat
*__stat_buf);
extern  int  __fxstat64(int  __ver,  int  __fildes,  struct  stat64
*__stat_buf);
extern  int  __fxstatat(int  __ver,  int  __fildes,  const  char
*__filename,
                  struct stat *__stat_buf, int __flag);
extern  int  __fxstatat64(int  __ver,  int  __fildes,  const  char
*__filename,
                  struct stat64 *__stat_buf, int __flag);
extern int __lxstat(int __ver, const char *__filename,
                  struct stat *__stat_buf);
extern int __lxstat64(int __ver, const char *__filename,
                  struct stat64 *__stat_buf);
extern int __xmknod(int __ver, const char *__path, mode_t __mode,
                  dev_t * __dev);
extern int __xmknodat(int __ver, int __fd, const char *__path,
                  mode_t __mode, dev_t * __dev);
extern int __xstat(int __ver, const char *__filename,
                  struct stat *__stat_buf);
extern int __xstat64(int __ver, const char *__filename,
                  struct stat64 *__stat_buf);
extern int chmod(const char *__file, mode_t __mode);
extern int fchmod(int __fd, mode_t __mode);
extern  int  fchmodat(int  __fd,  const  char  *__file,  mode_t  mode,
int __flag);
extern int fstat(int __fd, struct stat *__buf);
extern int fstat64(int __fd, struct stat64 *__buf);
extern  int  fstatat(int  __fd,  const  char  *__file,  struct  stat
*__buf,
                  int __flag);
extern int fstatat64(int __fd, const char *__file, struct stat64
*__buf,
                  int __flag);
extern int lstat(const char *__file, struct stat *__buf);
extern int lstat64(const char *__file, struct stat64 *__buf);
extern int mkdir(const char *__path, mode_t __mode);
extern int mkdirat(int __fd, const char *__path, mode_t __mode);
extern int mkfifo(const char *__path, mode_t __mode);
extern int mkfifoat(int __fd, const char *__path, mode_t __mode);
extern int mknod(const char *__path, mode_t __mode, dev_t __dev);
extern int mknodat(int __fd, const char *__path, mode_t __mode,
                  dev_t __dev);
extern int stat(const char *__file, struct stat *__buf);
extern int stat64(const char *__file, struct stat64 *__buf);
extern mode_t umask(mode_t __mask);
```

12.4.79 sys/statfs.h

```
#define NFS_SUPER_MAGIC 0x6969

extern int fstatfs(int __fildes, struct statfs *__buf);
```

```
extern int fstatfs64(int __fildes, struct statfs64 *__buf);
extern int statfs(const char *__file, struct statfs *__buf);
extern int statfs64(const char *__file, struct statfs64 *__buf);
```

12.4.80 sys/statvfs.h

```
extern int fstatvfs(int __fildes, struct statvfs *__buf);
extern int fstatvfs64(int __fildes, struct statvfs64 *__buf);
extern int statvfs(const char *__file, struct statvfs *__buf);
extern  int  statvfs64(const  char  *__file,  struct  statvfs64
*__buf);
```

12.4.81 sys/sysinfo.h

```
struct sysinfo {
    long int uptime;            /* Seconds since boot */
    unsigned long int loads[3]; /* 1, 5, and 15 minute load
averages */
    unsigned long int totalram; /* Total usable main memory size
*/
    unsigned long int freeram;  /* Available memory size */
    unsigned long int sharedram;            /* Amount of shared
memory */
    unsigned long int bufferram;        /* Memory used by buffers
*/
    unsigned long int totalswap;         /* Total swap space size
*/
    unsigned long int freeswap; /* Swap space still available */
    unsigned short procs;       /* Number of current processes */
    unsigned short pad;         /* Padding for m68k */
    unsigned long int totalhigh;         /* Total high memory size
*/
    unsigned long int freehigh; /* Available high memory size */
    unsigned int mem_unit;      /* Memory unit size in bytes */
    char _f[20 - 2 * sizeof(long) - sizeof(int)];          /*
Padding for libc5 */
};
extern int sysinfo(struct sysinfo *info);
```

12.4.82 sys/time.h

```
#define ITIMER_REAL     0
#define ITIMER_VIRTUAL  1
#define ITIMER_PROF     2

struct timezone {
    int tz_minuteswest;
    int tz_dsttime;
};

typedef int __itimer_which_t;

struct timespec {
    time_t tv_sec;
    long int tv_nsec;
};

struct timeval {
    time_t tv_sec;
    suseconds_t tv_usec;
};
```

```
struct itimerval {
    struct timeval it_interval;
    struct timeval it_value;
};
extern int adjtime(const struct timeval *__delta,
                struct timeval *__olddelta);
extern int getitimer(__itimer_which_t __which, struct itimerval
*__value);
extern int gettimeofday(struct  timeval  *__tv, struct  timezone
*__tz);
extern int setitimer(__itimer_which_t __which,
                    const struct itimerval *__new,
                    struct itimerval *__old);
extern  int  utimes(const  char  *__file,  const  struct  timeval
*__tvp);
```

12.4.83 sys/timeb.h

```
struct timeb {
    time_t time;                     /* Seconds since epoch, as from
time. */
    unsigned short millitm;     /* Additional milliseconds. */
    short timezone;                 /* Minutes west of GMT. */
    short dstflag;                      /* Nonzero if Daylight Savings
Time used. */
};
extern int ftime(struct timeb *__timebuf);
```

12.4.84 sys/times.h

```
struct tms {
    clock_t tms_utime;
    clock_t tms_stime;
    clock_t tms_cutime;
    clock_t tms_cstime;
};
extern clock_t times(struct tms *__buffer);
```

12.4.85 sys/types.h

```
#ifndef FALSE
#define FALSE   0
#endif
#ifndef TRUE
#define TRUE    1
#endif
#define FD_SETSIZE      1024
#define FD_ZERO(fdsetp) bzero(fdsetp, sizeof(*(fdsetp)))
#define FD_ISSET(d,set) \
  (((set)-
>fds_bits[((d)/(8*sizeof(long)))]&(1L<<((d)%(8*sizeof(long)))))!=
0)
#define FD_CLR(d,set)   \
  ((set)-
>fds_bits[((d)/(8*sizeof(long)))]&=~(1L<<((d)%(8*sizeof(long)))))
#define FD_SET(d,set)   \
  ((set)-
>fds_bits[((d)/(8*sizeof(long)))]|=(1L<<((d)%(8*sizeof(long)))))

typedef unsigned char u_int8_t;
typedef unsigned short u_int16_t;
typedef unsigned int u_int32_t;
```

```
typedef unsigned long long int u_int64_t;
typedef unsigned int uid_t;
typedef int pid_t;
typedef long int off_t;
typedef int key_t;
typedef long int suseconds_t;
typedef unsigned int u_int;
typedef struct {
    int __val[2];
} fsid_t;
typedef unsigned int useconds_t;
typedef long int blksize_t;
typedef long int fd_mask;
typedef void *timer_t;
typedef int clockid_t;

typedef unsigned int id_t;

typedef unsigned long long int ino64_t;
typedef long long int loff_t;
typedef long int blkcnt_t;
typedef unsigned long int fsblkcnt_t;
typedef unsigned long int fsfilcnt_t;
typedef long long int blkcnt64_t;
typedef unsigned long long int fsblkcnt64_t;
typedef unsigned long long int fsfilcnt64_t;
typedef unsigned char u_char;
typedef unsigned short u_short;
typedef unsigned long int u_long;

typedef unsigned long int ino_t;
typedef unsigned int gid_t;
typedef unsigned long long int dev_t;
typedef unsigned int mode_t;
typedef unsigned long int nlink_t;
typedef char *caddr_t;

typedef struct {
    unsigned long int fds_bits[__FDSET_LONGS];
} fd_set;

typedef long int clock_t;
typedef long int time_t;
```

12.4.86 sys/uio.h

```
extern ssize_t readv(int __fd, const struct iovec *__iovec, int
__count);
extern ssize_t writev(int __fd, const struct iovec *__iovec, int
__count);
```

12.4.87 sys/un.h

```
#define UNIX_PATH_MAX   108

struct sockaddr_un {
    sa_family_t sun_family;     /* AF_UNIX */
    char sun_path[UNIX_PATH_MAX];
};
```

12.4.88 sys/utsname.h

```
#define SYS_NMLN        65

struct utsname {
    char sysname[65];
    char nodename[65];
    char release[65];
    char version[65];
    char machine[65];
    char domainname[65];
};
extern int uname(struct utsname *__name);
```

12.4.89 sys/wait.h

```
#define  WIFSIGNALED(status)                  (!WIFSTOPPED(status)  &&
!WIFEXITED(status))
#define WIFSTOPPED(status)      (((status) & 0xff) == 0x7f)
#define WEXITSTATUS(status)     (((status) & 0xff00) >> 8)
#define WTERMSIG(status)        ((status) & 0x7f)
#define WCOREDUMP(status)       ((status) & 0x80)
#define WIFEXITED(status)       (WTERMSIG(status) == 0)
#define WNOHANG 0x00000001
#define WUNTRACED       0x00000002
#define WCOREFLAG       0x80
#define WSTOPSIG(status)        WEXITSTATUS(status)

typedef enum {
    P_ALL,
    P_PID,
    P_PGID
} idtype_t;
extern pid_t wait(int *__stat_loc);
extern pid_t wait4(pid_t __pid, int *__stat_loc, int __options,
                struct rusage *__usage);
extern  int  waitid(idtype_t  __idtype,  id_t  __id,  siginfo_t  *
__infop,
                int __options);
extern  pid_t  waitpid(pid_t  __pid,  int  *__stat_loc,  int
__options);
```

12.4.90 syslog.h

```
#define LOG_MAKEPRI(fac, pri)   (((fac) << 3) | (pri))
#define LOG_PRI(p)          ((p) & LOG_PRIMASK)         /* extract
priority */
#define LOG_EMERG       0       /* system is unusable */
#define LOG_PRIMASK     0x07    /* mask to extract priority part
*/
#define  LOG_ALERT          1           /* action  must  be  taken
immediately */
#define LOG_CRIT        2       /* critical conditions */
#define LOG_ERR 3               /* error conditions */
#define LOG_WARNING     4       /* warning conditions */
#define  LOG_NOTICE        5            /*  normal  but  significant
condition */
#define LOG_INFO        6       /* informational */
#define LOG_DEBUG       7       /* debug-level messages */

#define  LOG_FAC(p)         (((p) & LOG_FACMASK) >> 3)        /*
facility of pri */
#define LOG_KERN        (0<<3) /* kernel messages */
#define  LOG_AUTHPRIV        (10<<3)  /*  security/authorization
messages (private) */
#define LOG_FTP (11<<3)         /* ftp daemon */
```

```
#define LOG_USER        (1<<3)  /* random user-level messages */
#define LOG_MAIL        (2<<3)  /* mail system */
#define LOG_DAEMON      (3<<3)  /* system daemons */
#define  LOG_AUTH               (4<<3)   /* security/authorization
messages */
#define LOG_SYSLOG      (5<<3)  /* messages generated internally
by syslogd */
#define LOG_LPR (6<<3)          /* line printer subsystem */
#define LOG_NEWS        (7<<3)  /* network news subsystem */
#define LOG_UUCP        (8<<3)  /* UUCP subsystem */
#define LOG_CRON        (9<<3)  /* clock daemon */
#define LOG_FACMASK     0x03f8  /* mask to extract facility part
*/

#define LOG_LOCAL0      (16<<3) /* reserved for local use */
#define LOG_LOCAL1      (17<<3) /* reserved for local use */
#define LOG_LOCAL2      (18<<3) /* reserved for local use */
#define LOG_LOCAL3      (19<<3) /* reserved for local use */
#define LOG_LOCAL4      (20<<3) /* reserved for local use */
#define LOG_LOCAL5      (21<<3) /* reserved for local use */
#define LOG_LOCAL6      (22<<3) /* reserved for local use */
#define LOG_LOCAL7      (23<<3) /* reserved for local use */

#define LOG_UPTO(pri)   ((1 << ((pri)+1)) - 1)  /* all priorities
through pri */
#define LOG_MASK(pri)   (1 << (pri))    /* mask for one priority
*/

#define LOG_PID 0x01            /* log the pid with each message
*/
#define LOG_CONS        0x02    /* log on the console if errors
in sending */
#define  LOG_ODELAY         0x04        /* delay  open  until  first
syslog() (default) */
#define LOG_NDELAY      0x08    /* don't delay open */
#define LOG_NOWAIT      0x10    /* don't wait for console forks:
DEPRECATED */
#define LOG_PERROR      0x20    /* log to stderr as well */

extern void __syslog_chk(int, int, const char *, ...);
extern void __vsyslog_chk(int, int, const char *, va_list);
extern void closelog(void);
extern  void  openlog(const  char  *__ident,  int  __option,  int
__facility);
extern int setlogmask(int __mask);
extern void syslog(int __pri, const char *__fmt, ...);
extern void vsyslog(int __pri, const char *__fmt, va_list __ap);
```

12.4.91 tar.h

```
#define REGTYPE '0'
#define LNKTYPE '1'
#define SYMTYPE '2'
#define CHRTYPE '3'
#define BLKTYPE '4'
#define DIRTYPE '5'
#define FIFOTYPE        '6'
#define CONTTYPE        '7'
#define AREGTYPE        '\0'
#define TVERSION        "00"
#define TOEXEC  00001
#define TOWRITE 00002
#define TOREAD  00004
#define TGEXEC  00010
#define TGWRITE 00020
```

```
#define TGREAD   00040
#define TUEXEC   00100
#define TUWRITE  00200
#define TUREAD   00400
#define TSVTX    01000
#define TSGID    02000
#define TSUID    04000
#define TVERSLEN        2
#define TMAGLEN 6
#define TMAGIC   "ustar"
```

12.4.92 termios.h

```
#define TCIFLUSH        0
#define TCOOFF  0
#define TCSANOW 0
#define BS0      0000000
#define CR0      0000000
#define FF0      0000000
#define NL0      0000000
#define TAB0     0000000
#define VT0      0000000
#define OPOST    0000001
#define OCRNL    0000010
#define ONOCR    0000020
#define ONLRET   0000040
#define OFILL    0000100
#define OFDEL    0000200
#define NL1      0000400
#define TCOFLUSH        1
#define TCOON    1
#define TCSADRAIN       1
#define TCIOFF  2
#define TCIOFLUSH       2
#define TCSAFLUSH       2
#define TCION    3

typedef unsigned int speed_t;
typedef unsigned char cc_t;
typedef unsigned int tcflag_t;

#define NCCS    32

struct termios {
    tcflag_t c_iflag;           /* input mode flags */
    tcflag_t c_oflag;           /* output mode flags */
    tcflag_t c_cflag;           /* control mode flags */
    tcflag_t c_lflag;           /* local mode flags */
    cc_t c_line;                /* line discipline */
    cc_t c_cc[NCCS];            /* control characters */
    speed_t c_ispeed;           /* input speed */
    speed_t c_ospeed;           /* output speed */
};

#define VINTR   0
#define VQUIT   1
#define VLNEXT  15
#define VERASE  2
#define VKILL   3
#define VEOF    4

#define IGNBRK  0000001
#define BRKINT  0000002
#define IGNPAR  0000004
#define PARMRK  0000010
```

```
#define INPCK   0000020
#define ISTRIP  0000040
#define INLCR   0000100
#define IGNCR   0000200
#define ICRNL   0000400
#define IXANY   0004000
#define IMAXBEL 0020000


#define CS5     0000000


#define ECHO    0000010


#define B0      0000000
#define B50     0000001
#define B75     0000002
#define B110    0000003
#define B134    0000004
#define B150    0000005
#define B200    0000006
#define B300    0000007
#define B600    0000010
#define B1200   0000011
#define B1800   0000012
#define B2400   0000013
#define B4800   0000014
#define B9600   0000015
#define B19200  0000016
#define B38400  0000017

extern speed_t cfgetispeed(const struct termios *__termios_p);
extern speed_t cfgetospeed(const struct termios *__termios_p);
extern void cfmakeraw(struct termios *__termios_p);
extern  int  cfsetispeed(struct  termios  *__termios_p,  speed_t
__speed);
extern  int  cfsetospeed(struct  termios  *__termios_p,  speed_t
__speed);
extern  int  cfsetspeed(struct  termios  *__termios_p,  speed_t
__speed);
extern int tcdrain(int __fd);
extern int tcflow(int __fd, int __action);
extern int tcflush(int __fd, int __queue_selector);
extern int tcgetattr(int __fd, struct termios *__termios_p);
extern pid_t tcgetsid(int __fd);
extern int tcsendbreak(int __fd, int __duration);
extern int tcsetattr(int __fd, int __optional_actions,
                   const struct termios *__termios_p);
```

12.4.93 time.h


```
#define CLK_TCK ((clock_t)sysconf(2))
#define timerclear(tvp) ((tvp)->tv_sec = (tvp)->tv_usec = 0)
#define timerisset(tvp) ((tvp)->tv_sec || (tvp)->tv_usec)
#define CLOCK_REALTIME  0
#define CLOCK_MONOTONIC 1
#define TIMER_ABSTIME   1
#define CLOCKS_PER_SEC  1000000l
#define CLOCK_PROCESS_CPUTIME_ID        2
#define CLOCK_THREAD_CPUTIME_ID 3
#define timeradd(a,b,result)    \
  do { \
    (result)->tv_sec = (a)->tv_sec + (b)->tv_sec; \
    (result)->tv_usec = (a)->tv_usec + (b)->tv_usec; \
    if ((result)->tv_usec >= 1000000) \
      { \
        ++(result)->tv_sec; \
```

```
                        (result)->tv_usec -= 1000000; \
                     } \
                } while (0)
            #define timersub(a,b,result)    \
              do { \
                 (result)->tv_sec = (a)->tv_sec - (b)->tv_sec; \
                 (result)->tv_usec = (a)->tv_usec - (b)->tv_usec; \
                 if ((result)->tv_usec < 0) { \
                   --(result)->tv_sec; \
                   (result)->tv_usec += 1000000; \
                 } \
              } while (0)
            #define timercmp(a,b,CMP)        \
             (((a)->tv_sec == (b)->tv_sec) ? \
              ((a)->tv_usec CMP (b)->tv_usec) : \
              ((a)->tv_sec CMP (b)->tv_sec))

            struct tm {
                int tm_sec;
                int tm_min;
                int tm_hour;
                int tm_mday;
                int tm_mon;
                int tm_year;
                int tm_wday;
                int tm_yday;
                int tm_isdst;
                long int tm_gmtoff;
                char *tm_zone;
            };
            struct itimerspec {
                struct timespec it_interval;
                struct timespec it_value;
            };

            extern int __daylight;
            extern long int __timezone;
            extern char *__tzname[];
            extern char *asctime(const struct tm *__tp);
            extern char *asctime_r(const struct tm *__tp, char *__buf);
            extern clock_t clock(void);
            extern   int   clock_getcpuclockid(pid_t   __pid,   clockid_t   *
            __clock_id);
            extern  int  clock_getres(clockid_t  __clock_id,  struct  timespec
            *__res);
            extern  int  clock_gettime(clockid_t  __clock_id,  struct  timespec
            *__tp);
            extern int clock_nanosleep(clockid_t __clock_id, int __flags,
                                  const struct timespec *__req,
                                  struct timespec *__rem);
            extern int clock_settime(clockid_t __clock_id,
                                  const struct timespec *__tp);
            extern char *ctime(const time_t * __timer);
            extern char *ctime_r(const time_t * __timer, char *__buf);
            extern int daylight;
            extern double difftime(time_t __time1, time_t __time0);
            extern struct tm *getdate(const char *__string);
            extern int getdate_err;
            extern struct tm *gmtime(const time_t * __timer);
            extern  struct  tm *gmtime_r(const  time_t  *  __timer,  struct  tm
            *__tp);
            extern struct tm *localtime(const time_t * __timer);
            extern  struct  tm *localtime_r(const  time_t  *  __timer,  struct  tm
            *__tp);
            extern time_t mktime(struct tm *__tp);
            extern int nanosleep(const struct timespec *__requested_time,
```

```
                           struct timespec *__remaining);
extern int stime(const time_t * __when);
extern size_t strftime(char *__s, size_t __maxsize, const char
*__format,
                       const struct tm *__tp);
extern char *strptime(const char *__s, const char *__fmt, struct
tm *__tp);
extern time_t time(time_t * __timer);
extern int timer_create(clockid_t __clock_id, struct sigevent
*__evp,
                        timer_t * __timerid);
extern int timer_delete(timer_t __timerid);
extern int timer_getoverrun(timer_t __timerid);
extern int timer_gettime(timer_t __timerid, struct itimerspec
*__value);
extern int timer_settime(timer_t __timerid, int __flags,
                         const struct itimerspec *__value,
                         struct itimerspec *__ovalue);
extern long int timezone;
extern char *tzname[];
extern void tzset(void);
```

12.4.94 ucontext.h

```
extern int getcontext(ucontext_t * __ucp);
extern void makecontext(ucontext_t * __ucp, void (*__func)
(void),
                        int __argc, ...);
extern int setcontext(const struct ucontext *__ucp);
extern int swapcontext(ucontext_t * __oucp, const struct ucontext
*__ucp);
```

12.4.95 ulimit.h

```
#define UL_GETFSIZE     1
#define UL_SETFSIZE     2

extern long int ulimit(int __cmd, ...);
```

12.4.96 unistd.h

```
#define SEEK_SET        0
#define STDIN_FILENO    0
#define SEEK_CUR        1
#define STDOUT_FILENO   1
#define SEEK_END        2
#define STDERR_FILENO   2

typedef long long int off64_t;

#define F_OK    0
#define X_OK    1
#define W_OK    2
#define R_OK    4

#define _POSIX_VDISABLE '\0'
#define _POSIX_CHOWN_RESTRICTED 1
#define _POSIX_JOB_CONTROL      1
#define _POSIX_NO_TRUNC 1
#define _POSIX_SHELL    1
#define _POSIX2_C_BIND  200112L
#define _POSIX2_VERSION 200112L
```

```
#define _POSIX_FSYNC    200112L
#define _POSIX_MAPPED_FILES    200112L
#define _POSIX_MEMLOCK 200112L
#define _POSIX_MEMLOCK_RANGE    200112L
#define _POSIX_MEMORY_PROTECTION        200112L
#define _POSIX_SEMAPHORES       200112L
#define _POSIX_SHARED_MEMORY_OBJECTS    200112L
#define _POSIX_THREADS 200112L
#define _POSIX_THREAD_PROCESS_SHARED    200112L
#define _POSIX_TIMERS   200112L
#define _POSIX_VERSION  200112L

#define _PC_LINK_MAX    0
#define _PC_MAX_CANON   1
#define _PC_ASYNC_IO    10
#define _PC_PRIO_IO     11
#define _PC_FILESIZEBITS        13
#define _PC_REC_INCR_XFER_SIZE  14
#define _PC_REC_MIN_XFER_SIZE   16
#define _PC_REC_XFER_ALIGN      17
#define _PC_ALLOC_SIZE_MIN      18
#define _PC_MAX_INPUT   2
#define _PC_2_SYMLINKS 20
#define _PC_NAME_MAX    3
#define _PC_PATH_MAX    4
#define _PC_PIPE_BUF    5
#define _PC_CHOWN_RESTRICTED    6
#define _PC_NO_TRUNC    7
#define _PC_VDISABLE    8
#define _PC_SYNC_IO     9

#define _SC_ARG_MAX     0
#define _SC_CHILD_MAX   1
#define _SC_PRIORITY_SCHEDULING 10
#define _SC_XOPEN_XPG4  100
#define _SC_CHAR_BIT    101
#define _SC_CHAR_MAX    102
#define _SC_CHAR_MIN    103
#define _SC_INT_MAX     104
#define _SC_INT_MIN     105
#define _SC_LONG_BIT    106
#define _SC_WORD_BIT    107
#define _SC_MB_LEN_MAX 108
#define _SC_NZERO       109
#define _SC_TIMERS      11
#define _SC_SSIZE_MAX   110
#define _SC_SCHAR_MAX   111
#define _SC_SCHAR_MIN   112
#define _SC_SHRT_MAX    113
#define _SC_SHRT_MIN    114
#define _SC_UCHAR_MAX   115
#define _SC_UINT_MAX    116
#define _SC_ULONG_MAX   117
#define _SC_USHRT_MAX   118
#define _SC_NL_ARGMAX   119
#define _SC_ASYNCHRONOUS_IO     12
#define _SC_NL_LANGMAX 120
#define _SC_NL_MSGMAX   121
#define _SC_NL_NMAX     122
#define _SC_NL_SETMAX   123
#define _SC_NL_TEXTMAX 124
#define _SC_XBS5_ILP32_OFF32    125
#define _SC_XBS5_ILP32_OFFBIG   126
#define _SC_XBS5_LP64_OFF64     127
#define _SC_XBS5_LPBIG_OFFBIG   128
#define _SC_XOPEN_LEGACY        129
```

```
#define _SC_PRIORITIZED_IO        13
#define _SC_XOPEN_REALTIME        130
#define _SC_XOPEN_REALTIME_THREADS        131
#define _SC_ADVISORY_INFO         132
#define _SC_BARRIERS     133
#define _SC_BASE         134
#define _SC_C_LANG_SUPPORT        135
#define _SC_C_LANG_SUPPORT_R      136
#define _SC_CLOCK_SELECTION       137
#define _SC_CPUTIME      138
#define _SC_THREAD_CPUTIME        139
#define _SC_SYNCHRONIZED_IO       14
#define _SC_DEVICE_IO    140
#define _SC_DEVICE_SPECIFIC       141
#define _SC_DEVICE_SPECIFIC_R     142
#define _SC_FD_MGMT      143
#define _SC_FIFO         144
#define _SC_PIPE         145
#define _SC_FILE_ATTRIBUTES       146
#define _SC_FILE_LOCKING          147
#define _SC_FILE_SYSTEM 148
#define _SC_MONOTONIC_CLOCK       149
#define _SC_FSYNC        15
#define _SC_MULTI_PROCESS         150
#define _SC_SINGLE_PROCESS        151
#define _SC_NETWORKING   152
#define _SC_READER_WRITER_LOCKS 153
#define _SC_SPIN_LOCKS   154
#define _SC_REGEXP       155
#define _SC_REGEX_VERSION         156
#define _SC_SHELL        157
#define _SC_SIGNALS      158
#define _SC_SPAWN        159
#define _SC_MAPPED_FILES          16
#define _SC_SPORADIC_SERVER       160
#define _SC_THREAD_SPORADIC_SERVER        161
#define _SC_SYSTEM_DATABASE       162
#define _SC_SYSTEM_DATABASE_R     163
#define _SC_TIMEOUTS     164
#define _SC_TYPED_MEMORY_OBJECTS          165
#define _SC_USER_GROUPS 166
#define _SC_USER_GROUPS_R         167
#define _SC_2_PBS        168
#define _SC_2_PBS_ACCOUNTING      169
#define _SC_MEMLOCK      17
#define _SC_2_PBS_LOCATE          170
#define _SC_2_PBS_MESSAGE         171
#define _SC_2_PBS_TRACK 172
#define _SC_SYMLOOP_MAX 173
#define _SC_STREAMS      174
#define _SC_2_PBS_CHECKPOINT      175
#define _SC_V6_ILP32_OFF32        176
#define _SC_V6_ILP32_OFFBIG       177
#define _SC_V6_LP64_OFF64         178
#define _SC_V6_LPBIG_OFFBIG       179
#define _SC_MEMLOCK_RANGE         18
#define _SC_HOST_NAME_MAX         180
#define _SC_TRACE        181
#define _SC_TRACE_EVENT_FILTER 182
#define _SC_TRACE_INHERIT         183
#define _SC_TRACE_LOG    184
#define _SC_LEVEL1_ICACHE_SIZE 185
#define _SC_LEVEL1_ICACHE_ASSOC 186
#define _SC_LEVEL1_ICACHE_LINESIZE        187
#define _SC_LEVEL1_DCACHE_SIZE 188
#define _SC_LEVEL1_DCACHE_ASSOC 189
```

```
#define _SC_MEMORY_PROTECTION   19
#define _SC_LEVEL1_DCACHE_LINESIZE      190
#define _SC_LEVEL2_CACHE_SIZE   191
#define _SC_LEVEL2_CACHE_ASSOC  192
#define _SC_LEVEL2_CACHE_LINESIZE       193
#define _SC_LEVEL3_CACHE_SIZE   194
#define _SC_LEVEL3_CACHE_ASSOC  195
#define _SC_LEVEL3_CACHE_LINESIZE       196
#define _SC_LEVEL4_CACHE_SIZE   197
#define _SC_LEVEL4_CACHE_ASSOC  198
#define _SC_LEVEL4_CACHE_LINESIZE       199
#define _SC_CLK_TCK     2
#define _SC_MESSAGE_PASSING     20
#define _SC_SEMAPHORES  21
#define _SC_SHARED_MEMORY_OBJECTS       22
#define _SC_AIO_LISTIO_MAX      23
#define _SC_IPV6        235
#define _SC_RAW_SOCKETS 236
#define _SC_AIO_MAX     24
#define _SC_AIO_PRIO_DELTA_MAX  25
#define _SC_DELAYTIMER_MAX      26
#define _SC_MQ_OPEN_MAX 27
#define _SC_MQ_PRIO_MAX 28
#define _SC_VERSION     29
#define _SC_NGROUPS_MAX 3
#define _SC_PAGESIZE    30
#define _SC_PAGE_SIZE   30
#define _SC_RTSIG_MAX   31
#define _SC_SEM_NSEMS_MAX       32
#define _SC_SEM_VALUE_MAX       33
#define _SC_SIGQUEUE_MAX        34
#define _SC_TIMER_MAX   35
#define _SC_BC_BASE_MAX 36
#define _SC_BC_DIM_MAX  37
#define _SC_BC_SCALE_MAX        38
#define _SC_BC_STRING_MAX       39
#define _SC_OPEN_MAX    4
#define _SC_COLL_WEIGHTS_MAX    40
#define _SC_EQUIV_CLASS_MAX     41
#define _SC_EXPR_NEST_MAX       42
#define _SC_LINE_MAX    43
#define _SC_RE_DUP_MAX  44
#define _SC_CHARCLASS_NAME_MAX  45
#define _SC_2_VERSION   46
#define _SC_2_C_BIND    47
#define _SC_2_C_DEV     48
#define _SC_2_FORT_DEV  49
#define _SC_STREAM_MAX  5
#define _SC_2_FORT_RUN  50
#define _SC_2_SW_DEV    51
#define _SC_2_LOCALEDEF 52
#define _SC_PII 53
#define _SC_PII_XTI     54
#define _SC_PII_SOCKET  55
#define _SC_PII_INTERNET        56
#define _SC_PII_OSI     57
#define _SC_POLL        58
#define _SC_SELECT      59
#define _SC_TZNAME_MAX  6
#define _SC_IOV_MAX     60
#define _SC_UIO_MAXIOV  60
#define _SC_PII_INTERNET_STREAM 61
#define _SC_PII_INTERNET_DGRAM 62
#define _SC_PII_OSI_COTS        63
#define _SC_PII_OSI_CLTS        64
#define _SC_PII_OSI_M   65
```

```
#define _SC_T_IOV_MAX   66
#define _SC_THREADS     67
#define _SC_THREAD_SAFE_FUNCTIONS       68
#define _SC_GETGR_R_SIZE_MAX    69
#define _SC_JOB_CONTROL 7
#define _SC_GETPW_R_SIZE_MAX    70
#define _SC_LOGIN_NAME_MAX      71
#define _SC_TTY_NAME_MAX        72
#define _SC_THREAD_DESTRUCTOR_ITERATIONS        73
#define _SC_THREAD_KEYS_MAX     74
#define _SC_THREAD_STACK_MIN    75
#define _SC_THREAD_THREADS_MAX  76
#define _SC_THREAD_ATTR_STACKADDR       77
#define _SC_THREAD_ATTR_STACKSIZE       78
#define _SC_THREAD_PRIORITY_SCHEDULING  79
#define _SC_SAVED_IDS   8
#define _SC_THREAD_PRIO_INHERIT 80
#define _SC_THREAD_PRIO_PROTECT 81
#define _SC_THREAD_PROCESS_SHARED       82
#define _SC_NPROCESSORS_CONF    83
#define _SC_NPROCESSORS_ONLN    84
#define _SC_PHYS_PAGES 85
#define _SC_AVPHYS_PAGES        86
#define _SC_ATEXIT_MAX 87
#define _SC_PASS_MAX    88
#define _SC_XOPEN_VERSION       89
#define _SC_REALTIME_SIGNALS    9
#define _SC_XOPEN_XCU_VERSION   90
#define _SC_XOPEN_UNIX 91
#define _SC_XOPEN_CRYPT 92
#define _SC_XOPEN_ENH_I18N      93
#define _SC_XOPEN_SHM   94
#define _SC_2_CHAR_TERM 95
#define _SC_2_C_VERSION 96
#define _SC_2_UPE       97
#define _SC_XOPEN_XPG2 98
#define _SC_XOPEN_XPG3 99

#define _CS_PATH        0
#define _POSIX_REGEXP   1
#define _CS_XBS5_ILP32_OFF32_CFLAGS     1100
#define _CS_XBS5_ILP32_OFF32_LDFLAGS    1101
#define _CS_XBS5_ILP32_OFF32_LIBS       1102
#define _CS_XBS5_ILP32_OFF32_LINTFLAGS 1103
#define _CS_XBS5_ILP32_OFFBIG_CFLAGS    1104
#define _CS_XBS5_ILP32_OFFBIG_LDFLAGS   1105
#define _CS_XBS5_ILP32_OFFBIG_LIBS      1106
#define _CS_XBS5_ILP32_OFFBIG_LINTFLAGS 1107
#define _CS_XBS5_LP64_OFF64_CFLAGS      1108
#define _CS_XBS5_LP64_OFF64_LDFLAGS     1109
#define _CS_XBS5_LP64_OFF64_LIBS        1110
#define _CS_XBS5_LP64_OFF64_LINTFLAGS   1111
#define _CS_XBS5_LPBIG_OFFBIG_CFLAGS    1112
#define _CS_XBS5_LPBIG_OFFBIG_LDFLAGS   1113
#define _CS_XBS5_LPBIG_OFFBIG_LIBS      1114
#define _CS_XBS5_LPBIG_OFFBIG_LINTFLAGS 1115

#define _XOPEN_XPG4     1
#define _XOPEN_VERSION  500

#define F_ULOCK 0
#define F_LOCK  1
#define F_TLOCK 2
#define F_TEST  3

extern size_t __confstr_chk(int, char *, size_t, size_t);
```

```
extern char **__environ;
extern char *__getcwd_chk(char *, size_t, size_t);
extern int __getgroups_chk(int, gid_t *, size_t);
extern int __gethostname_chk(char *, size_t, size_t);
extern int __getlogin_r_chk(char *, size_t, size_t);
extern pid_t __getpgid(pid_t __pid);
extern ssize_t __pread64_chk(int, void *, size_t, off64_t,
size_t);
extern ssize_t __pread_chk(int, void *, size_t, off_t, size_t);
extern ssize_t __read_chk(int, void *, size_t, size_t);
extern ssize_t __readlink_chk(const char *, char *, size_t,
size_t);
extern int __ttyname_r_chk(int, char *, size_t, size_t);
extern char **_environ;
extern void _exit(int __status);
extern int access(const char *__name, int __type);
extern int acct(const char *__name);
extern unsigned int alarm(unsigned int __seconds);
extern int brk(void *__addr);
extern int chdir(const char *__path);
extern int chown(const char *__file, uid_t __owner, gid_t
__group);
extern int chroot(const char *__path);
extern int close(int __fd);
extern size_t confstr(int __name, char *__buf, size_t __len);
extern char *crypt(const char *__key, const char *__salt);
extern char *ctermid(char *__s);
extern char *cuserid(char *__s);
extern int daemon(int __nochdir, int __noclose);
extern int dup(int __fd);
extern int dup2(int __fd, int __fd2);
extern void encrypt(char *__block, int __edflag);
extern int execl(const char *__path, const char *__arg, ...);
extern int execle(const char *__path, const char *__arg, ...);
extern int execlp(const char *__file, const char *__arg, ...);
extern int execv(const char *__path, char *const __argv[]);
extern int execve(const char *__path, char *const __argv[],
                  char *const __envp[]);
extern int execvp(const char *__file, char *const __argv[]);
extern int faccessat(int __fd, const char *__file, int __type,
int __flag);
extern int fchdir(int __fd);
extern int fchown(int __fd, uid_t __owner, gid_t __group);
extern int fchownat(int __fd, const char *__file, uid_t __owner,
                    gid_t __group, int __flag);
extern int fdatasync(int __fildes);
extern int fexecve(int __fd, char *const __argv[], char *const
__envp[]);
extern pid_t fork(void);
extern long int fpathconf(int __fd, int __name);
extern int fsync(int __fd);
extern int ftruncate(int __fd, off_t __length);
extern int ftruncate64(int __fd, off64_t __length);
extern char *getcwd(char *__buf, size_t __size);
extern int getdomainname(char *__name, size_t __len);
extern int getdtablesize(void);
extern gid_t getegid(void);
extern uid_t geteuid(void);
extern gid_t getgid(void);
extern int getgroups(int __size, gid_t __list[]);
extern long int gethostid(void);
extern int gethostname(char *__name, size_t __len);
extern char *getlogin(void);
extern int getlogin_r(char *__name, size_t __name_len);
extern int getopt(int ___argc, char *const ___argv[],
                  const char *__shortopts);
```

```
extern int getpagesize(void);
extern pid_t getpgid(pid_t __pid);
extern pid_t getpgrp(void);
extern pid_t getpid(void);
extern pid_t getppid(void);
extern pid_t getsid(pid_t __pid);
extern uid_t getuid(void);
extern char *getwd(char *__buf);
extern int isatty(int __fd);
extern  int  lchown(const  char  *__file, uid_t  __owner,  gid_t
__group);
extern int link(const char *__from, const char *__to);
extern int linkat(int __fromfd, const char *__from, int __tofd,
                  const char *__to, int __flags);
extern int lockf(int __fd, int __cmd, off_t __len);
extern int lockf64(int __fd, int __cmd, off64_t __len);
extern off_t lseek(int __fd, off_t __offset, int __whence);
extern loff_t lseek64(int __fd, loff_t __offset, int __whence);
extern int mkstemp(char *__template);
extern int nice(int __inc);
extern char *optarg;
extern int opterr;
extern int optind;
extern int optopt;
extern long int pathconf(const char *__path, int __name);
extern int pause(void);
extern int pipe(int __pipedes[2]);
extern ssize_t pread(int __fd, void *__buf, size_t __nbytes,
                     off_t __offset);
extern ssize_t pread64(int __fd, void *__buf, size_t __nbytes,
                       off64_t __offset);
extern ssize_t pwrite(int __fd, const void *__buf, size_t __n,
                     off_t __offset);
extern ssize_t pwrite64(int __fd, const void *__buf, size_t __n,
                        off64_t __offset);
extern ssize_t read(int __fd, void *__buf, size_t __nbytes);
extern ssize_t readlink(const char *__path, char *__buf, size_t
__len);
extern  ssize_t  readlinkat(int  __fd,  const  char  *__path,  char
*__buf,
                           size_t __len);
extern int rename(const char *__old, const char *__new);
extern int rmdir(const char *__path);
extern void *sbrk(intptr_t __delta);
extern  int  select(int  __nfds,  fd_set  *  __readfds,  fd_set  *
__writefds,
                  fd_set    *    __exceptfds,    struct    timeval
*__timeout);
extern int setegid(gid_t __gid);
extern int seteuid(uid_t __uid);
extern int setgid(gid_t __gid);
extern int sethostname(const char *__name, size_t __len);
extern void setkey(const char *__key);
extern int setpgid(pid_t __pid, pid_t __pgid);
extern int setpgrp(void);
extern int setregid(gid_t __rgid, gid_t __egid);
extern int setreuid(uid_t __ruid, uid_t __euid);
extern pid_t setsid(void);
extern int setuid(uid_t __uid);
extern unsigned int sleep(unsigned int __seconds);
extern void swab(const void *__from, void *__to, ssize_t __n);
extern int symlink(const char *__from, const char *__to);
extern  int  symlinkat(const  char  *__from,  int  __tofd,  const  char
*__to);
extern void sync(void);
extern long int sysconf(int __name);
```

```
extern pid_t tcgetpgrp(int __fd);
extern int tcsetpgrp(int __fd, pid_t __pgrp_id);
extern int truncate(const char *__file, off_t __length);
extern int truncate64(const char *__file, off64_t __length);
extern char *ttyname(int __fd);
extern int ttyname_r(int __fd, char *__buf, size_t __buflen);
extern   unsigned   int  ualarm(useconds_t   __value,   useconds_t
__interval);
extern int unlink(const char *__name);
extern int unlinkat(int __fd, const char *__name, int __flag);
extern int usleep(useconds_t __useconds);
extern pid_t vfork(void);
extern ssize_t write(int __fd, const void *__buf, size_t __n);
```

12.4.97 utime.h

```
struct utimbuf {
    time_t actime;
    time_t modtime;
};
extern  int  utime(const  char  *__file,  const  struct  utimbuf
*__file_times);
```

12.4.98 utmp.h

```
#define UT_HOSTSIZE    256
#define UT_LINESIZE    32
#define UT_NAMESIZE    32
#define ut_addr ut_addr_v6[0]
#define ut_time ut_tv.tv_sec
#define ut_name ut_user        /* Backwards compatability */

struct exit_status {
    short e_termination;        /* Process termination status. */
    short e_exit;               /* Process exit status. */
};

#define EMPTY   0                   /* No valid user accounting
information. */
#define RUN_LVL 1           /* The system's runlevel. */
#define BOOT_TIME     2       /* Time of system boot. */
#define NEW_TIME          3         /* Time after system clock
changed. */
#define OLD_TIME          4          /* Time when system clock
changed. */
#define INIT_PROCESS     5       /* Process spawned by the init
process. */
#define LOGIN_PROCESS   6       /* Session leader of a logged in
user. */
#define USER_PROCESS    7       /* Normal process. */
#define DEAD_PROCESS    8       /* Terminated process. */
#define ACCOUNTING      9

extern void endutent(void);
extern struct utmp *getutent(void);
extern   int   getutent_r(struct   utmp   *__buffer,   struct   utmp
**__result);
extern void login(const struct utmp *__entry);
extern int login_tty(int __fd);
extern int logout(const char *__ut_line);
extern void logwtmp(const char *__ut_line, const char *__ut_name,
               const char *__ut_host);
extern void setutent(void);
extern int utmpname(const char *__file);
```

12.4.99 utmpx.h

```
extern void endutxent(void);
extern struct utmpx *getutxent(void);
extern struct utmpx *getutxid(const struct utmpx *__id);
extern struct utmpx *getutxline(const struct utmpx *__line);
extern struct utmpx *pututxline(const struct utmpx *__utmpx);
extern void setutxent(void);
```

12.4.100 wchar.h

```
#define WEOF    (0xffffffffu)
#define WCHAR_MAX       0x7FFFFFFF
#define WCHAR_MIN       0x80000000

extern wchar_t *__fgetws_chk(wchar_t *, size_t, int, FILE *);
extern  wchar_t  *__fgetws_unlocked_chk(wchar_t  *,  size_t,  int,
FILE *);
extern int __fwprintf_chk(FILE *, int, const wchar_t *, ...);
extern size_t __mbsnrtowcs_chk(wchar_t *, const char **, size_t,
size_t,
                        mbstate_t *, size_t);
extern size_t __mbsrtowcs_chk(wchar_t *, const char **, size_t,
                        mbstate_t *, size_t);
extern int __swprintf_chk(wchar_t *, size_t, int, size_t, const
wchar_t *,
                        ...);
extern  int  __vfwprintf_chk(FILE  *,  int,  const  wchar_t  *,
va_list);
extern int __vswprintf_chk(wchar_t *, size_t, int, size_t, const
wchar_t *,
                        va_list);
extern int __vwprintf_chk(int, const wchar_t *, va_list);
extern wchar_t *__wcpcpy_chk(wchar_t *, const wchar_t *, size_t);
extern wchar_t *__wcpncpy_chk(wchar_t *, const wchar_t *, size_t,
size_t);
extern  size_t  __wcrtomb_chk(char  *,  wchar_t,  mbstate_t  *,
size_t);
extern wchar_t *__wcscat_chk(wchar_t *, const wchar_t *, size_t);
extern wchar_t *__wcscpy_chk(wchar_t *, const wchar_t *, size_t);
extern wchar_t *__wcsncat_chk(wchar_t *, const wchar_t *, size_t,
size_t);
extern wchar_t *__wcsncpy_chk(wchar_t *, const wchar_t *, size_t,
size_t);
extern size_t __wcsnrtombs_chk(char *, const wchar_t * *, size_t,
size_t,
                        mbstate_t *, size_t);
extern size_t __wcsrtombs_chk(char *, const wchar_t * *, size_t,
                        mbstate_t *, size_t);
extern  double  __wcstod_internal(const  wchar_t  *,  wchar_t  *  *,
int);
extern  float  __wcstof_internal(const  wchar_t  *,  wchar_t  *  *,
int);
extern long int __wcstol_internal(const wchar_t *, wchar_t * *,
int, int);
extern long double __wcstold_internal(const wchar_t *, wchar_t *
*, int);
extern  unsigned  long  int  __wcstoul_internal(const  wchar_t  *,
wchar_t * *,
                                        int, int);
extern wchar_t *__wmemcpy_chk(wchar_t *, const wchar_t *, size_t,
size_t);
extern  wchar_t  *__wmemmove_chk(wchar_t  *,  const  wchar_t  *,
size_t, size_t);
```

```
extern wchar_t *__wmempcpy_chk(wchar_t *, const wchar_t *,
size_t, size_t);
extern wchar_t *__wmemset_chk(wchar_t *, wchar_t, size_t,
size_t);
extern int __wprintf_chk(int, const wchar_t *, ...);
extern wint_t btowc(int __c);
extern wint_t fgetwc(FILE * __stream);
extern wint_t fgetwc_unlocked(FILE * __stream);
extern wchar_t *fgetws(wchar_t * __ws, int __n, FILE * __stream);
extern wchar_t *fgetws_unlocked(wchar_t * __ws, int __n, FILE *
__stream);
extern wint_t fputwc(wchar_t __wc, FILE * __stream);
extern wint_t fputwc_unlocked(wchar_t __wc, FILE * __stream);
extern int fputws(const wchar_t * __ws, FILE * __stream);
extern int fputws_unlocked(const wchar_t * __ws, FILE *
__stream);
extern int fwide(FILE * __fp, int __mode);
extern int fwprintf(FILE * __stream, const wchar_t * __format,
...);
extern int fwscanf(FILE * __stream, const wchar_t * __format,
...);
extern wint_t getwc(FILE * __stream);
extern wint_t getwc_unlocked(FILE * __stream);
extern wint_t getwchar(void);
extern wint_t getwchar_unlocked(void);
extern size_t mbrlen(const char *__s, size_t __n, mbstate_t *
__ps);
extern size_t mbrtowc(wchar_t * __pwc, const char *__s, size_t
__n,
              mbstate_t * __p);
extern int mbsinit(const mbstate_t * __ps);
extern size_t mbsnrtowcs(wchar_t * __dst, const char **__src,
size_t __nmc,
              size_t __len, mbstate_t * __ps);
extern size_t mbsrtowcs(wchar_t * __dst, const char **__src,
size_t __len,
              mbstate_t * __ps);
extern FILE *open_wmemstream(wchar_t * *__bufloc, size_t *
__sizeloc);
extern wint_t putwc(wchar_t __wc, FILE * __stream);
extern wint_t putwc_unlocked(wchar_t __wc, FILE * __stream);
extern wint_t putwchar(wchar_t __wc);
extern wint_t putwchar_unlocked(wchar_t __wc);
extern int swprintf(wchar_t * __s, size_t __n, const wchar_t *
__format,
              ...);
extern int swscanf(const wchar_t * __s, const wchar_t * __format,
...);
extern wint_t ungetwc(wint_t __wc, FILE * __stream);
extern int vfwprintf(FILE * __s, const wchar_t * __format,
va_list __arg);
extern int vfwscanf(FILE * __s, const wchar_t * __format, va_list
__arg);
extern int vswprintf(wchar_t * __s, size_t __n, const wchar_t *
__format,
              va_list __arg);
extern int vswscanf(const wchar_t * __s, const wchar_t *
__format,
              va_list __arg);
extern int vwprintf(const wchar_t * __format, va_list __arg);
extern int vwscanf(const wchar_t * __format, va_list __arg);
extern wchar_t *wcpcpy(wchar_t * __dest, const wchar_t * __src);
extern wchar_t *wcpncpy(wchar_t * __dest, const wchar_t * __src,
              size_t __n);
extern size_t wcrtomb(char *__s, wchar_t __wc, mbstate_t * __ps);
```

```
extern int wcscasecmp(const wchar_t * __s1, const wchar_t *
__s2);
extern wchar_t *wcscat(wchar_t * __dest, const wchar_t * __src);
extern wchar_t *wcschr(const wchar_t * __wcs, wchar_t __wc);
extern int wcscmp(const wchar_t * __s1, const wchar_t * __s2);
extern int wcscoll(const wchar_t * __s1, const wchar_t * __s2);
extern wchar_t *wcscpy(wchar_t * __dest, const wchar_t * __src);
extern size_t wcscspn(const wchar_t * __wcs, const wchar_t *
__reject);
extern wchar_t *wcsdup(const wchar_t * __s);
extern size_t wcsftime(wchar_t * __s, size_t __maxsize,
                    const wchar_t * __format, const struct tm
*__tp);
extern size_t wcslen(const wchar_t * __s);
extern int wcsncasecmp(const wchar_t * __s1, const wchar_t *
__s2,
                    size_t __n);
extern wchar_t *wcsncat(wchar_t * __dest, const wchar_t * __src,
                    size_t __n);
extern int wcsncmp(const wchar_t * __s1, const wchar_t * __s2,
size_t __n);
extern wchar_t *wcsncpy(wchar_t * __dest, const wchar_t * __src,
                    size_t __n);
extern size_t wcsnlen(const wchar_t * __s, size_t __maxlen);
extern size_t wcsnrtombs(char *__dst, const wchar_t * *__src,
size_t __nwc,
                    size_t __len, mbstate_t * __ps);
extern wchar_t *wcspbrk(const wchar_t * __wcs, const wchar_t *
__accept);
extern wchar_t *wcsrchr(const wchar_t * __wcs, wchar_t __wc);
extern size_t wcsrtombs(char *__dst, const wchar_t * *__src,
size_t __len,
                    mbstate_t * __ps);
extern size_t wcsspn(const wchar_t * __wcs, const wchar_t *
__accept);
extern wchar_t *wcsstr(const wchar_t * __haystack,
                    const wchar_t * __needle);
extern double wcstod(const wchar_t * __nptr, wchar_t *
*__endptr);
extern float wcstof(const wchar_t * __nptr, wchar_t * *__endptr);
extern wchar_t *wcstok(wchar_t * __s, const wchar_t * __delim,
                    wchar_t * *__ptr);
extern long int wcstol(const wchar_t * __nptr, wchar_t *
*__endptr,
                    int __base);
extern long double wcstold(const wchar_t * __nptr, wchar_t *
*__endptr);
extern long long int wcstoll(const wchar_t * __nptr, wchar_t *
*__endptr,
                        int __base);
extern long long int wcstoq(const wchar_t * __nptr, wchar_t *
*__endptr,
                        int __base);
extern unsigned long int wcstoul(const wchar_t * __nptr,
                            wchar_t * *__endptr, int
__base);
extern unsigned long long int wcstoull(const wchar_t * __nptr,
                                wchar_t * *__endptr, int
__base);
extern unsigned long long int wcstouq(const wchar_t * __nptr,
                                wchar_t * *__endptr, int
__base);
extern wchar_t *wcswcs(const wchar_t * __haystack,
                    const wchar_t * __needle);
extern int wcswidth(const wchar_t * __s, size_t __n);
```

```
extern  size_t  wcsxfrm(wchar_t  *  __s1,  const  wchar_t  *  __s2,
size_t __n);
extern int wctob(wint_t __c);
extern int wcwidth(wchar_t __c);
extern wchar_t *wmemchr(const wchar_t * __s, wchar_t __c, size_t
__n);
extern int wmemcmp(const wchar_t * __s1, const wchar_t * __s2,
size_t __n);
extern  wchar_t  *wmemcpy(wchar_t  *  __s1,  const  wchar_t  *  __s2,
size_t __n);
extern  wchar_t  *wmemmove(wchar_t  *  __s1,  const  wchar_t  *  __s2,
size_t __n);
extern wchar_t *wmemset(wchar_t * __s, wchar_t __c, size_t __n);
extern int wprintf(const wchar_t * __format, ...);
extern int wscanf(const wchar_t * __format, ...);
```

12.4.101 wctype.h

```
typedef unsigned long int wctype_t;
typedef unsigned int wint_t;
typedef const int32_t *wctrans_t;
typedef struct {
    int count;
    wint_t value;
} __mbstate_t;

typedef __mbstate_t mbstate_t;
extern int iswalnum(wint_t __wc);
extern int iswalpha(wint_t __wc);
extern int iswblank(wint_t __wc);
extern int iswcntrl(wint_t __wc);
extern int iswctype(wint_t __wc, wctype_t __desc);
extern int iswdigit(wint_t __wc);
extern int iswgraph(wint_t __wc);
extern int iswlower(wint_t __wc);
extern int iswprint(wint_t __wc);
extern int iswpunct(wint_t __wc);
extern int iswspace(wint_t __wc);
extern int iswupper(wint_t __wc);
extern int iswxdigit(wint_t __wc);
extern wint_t towctrans(wint_t __wc, wctrans_t __desc);
extern wint_t towlower(wint_t __wc);
extern wint_t towupper(wint_t __wc);
extern wctrans_t wctrans(const char *__property);
extern wctype_t wctype(const char *__property);
```

12.4.102 wordexp.h

```
enum {
    WRDE_DOOFFS = 1,
    WRDE_APPEND = 2,
    WRDE_NOCMD = 4,
    WRDE_REUSE = 8,
    WRDE_SHOWERR = 16,
    WRDE_UNDEF = 32
};

typedef struct {
    size_t we_wordc;
    char **we_wordv;
    size_t we_offs;
} wordexp_t;

enum {
```

```
        WRDE_NOSYS = -1,
        WRDE_NOSPACE = 1,
        WRDE_BADCHAR = 2,
        WRDE_BADVAL = 3,
        WRDE_CMDSUB = 4,
        WRDE_SYNTAX = 5
};
extern int wordexp(const char *__words, wordexp_t * __pwordexp,
                   int __flags);
extern void wordfree(wordexp_t * __wordexp);
```

12.5 Interface Definitions for libc

The interfaces defined on the following pages are included in libc and are defined by this specification. Unless otherwise noted, these interfaces shall be included in the source standard.

Other interfaces listed in Section 12.3 shall behave as described in the referenced base document.

_IO_feof

Name

`_IO_feof` — alias for feof

Synopsis

```
int _IO_feof(_IO_FILE * __fp);
```

Description

`_IO_feof()` tests the end-of-file indicator for the stream pointed to by `__fp`, returning a non-zero value if it is set.

`_IO_feof()` is not in the source standard; it is only in the binary standard.

_IO_getc

Name

`_IO_getc` — alias for getc

Synopsis

```
int _IO_getc(_IO_FILE * __fp);
```

Description

`_IO_getc()` reads the next character from `__fp` and returns it as an unsigned char cast to an int, or `EOF` on end-of-file or error.

`_IO_getc()` is not in the source standard; it is only in the binary standard.

_IO_putc

Name

`_IO_putc` — alias for putc

Synopsis

`int _IO_putc(int __c, _IO_FILE * __fp);`

Description

`_IO_putc()` writes the character `__c`, cast to an unsigned char, to `__fp`.

`_IO_putc()` is not in the source standard; it is only in the binary standard.

_IO_puts

Name

`_IO_puts` — alias for puts

Synopsis

`int _IO_puts(const char * __c);`

Description

`_IO_puts()` writes the string `__s` and a trailing newline to `stdout`.

`_IO_puts()` is not in the source standard; it is only in the binary standard.

__assert_fail

Name

`__assert_fail` — abort the program after false assertion

Synopsis

`void __assert_fail(const char * assertion, const char * file, unsigned int line, const char * function);`

Description

The `__assert_fail()` function is used to implement the `assert()` interface of POSIX 1003.1-2001 (ISO/IEC 9945-2003). The `__assert_fail()` function shall print the given `file` filename, `line` line number, `function` function name and a message on the standard error stream in an unspecified format, and abort program execution via the `abort()` function. For example:

   a.c:10: foobar: Assertion a == b failed.

If `function` is `NULL`, `__assert_fail()` shall omit information about the function.

`assertion`, `file`, and `line` shall be non-`NULL`.

The `__assert_fail()` function is not in the source standard; it is only in the binary standard. The `assert()` interface is not in the binary standard; it is only in the source standard. The `assert()` may be implemented as a macro.

__chk_fail

Name

`__chk_fail` — terminate a function in case of buffer overflow

Synopsis

```
#include <libc.h>
void __chk_fail(void);
```

Description

The interface `__chk_fail()` shall abort the function that called it with a message that a buffer overflow has been detected. The program that called the function shall then exit.

Application Usage (informative)

The interface `__chk_fail()` does not check for a buffer overflow itself. It merely reports one when invoked.

__confstr_chk

Name

`__confstr_chk` — get configuration dependent string variables, with buffer overflow checking

Synopsis

```
#include <unistd.h>
size_t __confstr_chk(int name, char * buf, size_t len, size_t
buflen);
```

Description

The interface `__confstr_chk()` shall function in the same way as the interface `confstr()`, except that `__confstr_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *buflen* specifies the size of the buffer *buf*. If *len* exceeds *buflen*, the function shall abort, and the program calling it shall exit.

The `__confstr_chk()` function is not in the source standard; it is only in the binary standard.

__ctype_b_loc

Name

`__ctype_b_loc` — accessor function for __ctype_b array for ctype functions

Synopsis

```
#include <ctype.h>
const unsigned short * * __ctype_b_loc (void);
```

Description

The `__ctype_b_loc()` function shall return a pointer into an array of characters in the current locale that contains characteristics for each character in the current character set. The array shall contain a total of `384` characters, and can be indexed with any signed or unsigned char (i.e. with an index value between `-128` and `255`). If the application is multithreaded, the array shall be local to the current thread.

This interface is not in the source standard; it is only in the binary standard.

Return Value

The `__ctype_b_loc()` function shall return a pointer to the array of characters to be used for the `ctype()` family of functions (see `<ctype.h>`).

__ctype_get_mb_cur_max

Name

`__ctype_get_mb_cur_max` — maximum length of a multibyte character in the current locale

Synopsis

```
size_t __ctype_get_mb_cur_max(void);
```

Description

`__ctype_get_mb_cur_max()` returns the maximum length of a multibyte character in the current locale.

`__ctype_get_mb_cur_max()` is not in the source standard; it is only in the binary standard.

__ctype_tolower_loc

Name

`__ctype_tolower_loc` — accessor function for __ctype_b_tolower array for ctype tolower() function

Synopsis

```
#include <ctype.h>
int32_t * * __ctype_tolower_loc(void);
```

Description

The `__ctype_tolower_loc()` function shall return a pointer into an array of characters in the current locale that contains lower case equivalents for each character in the current character set. The array shall contain a total of `384` characters, and can be indexed with any signed or unsigned char (i.e. with an index value between `-128` and `255`). If the application is multithreaded, the array shall be local to the current thread.

This interface is not in the source standard; it is only in the binary standard.

Return Value

The `__ctype_tolower_loc()` function shall return a pointer to the array of characters to be used for the `ctype()` family of functions (see `<ctype.h>`).

__ctype_toupper_loc

Name

`__ctype_toupper_loc` — accessor function for `__ctype_b_toupper()` array for ctype `toupper()` function

Synopsis

```
#include <ctype.h>
int32_t * * __ctype_toupper_loc(void);
```

Description

The `__ctype_toupper_loc()` function shall return a pointer into an array of characters in the current locale that contains upper case equivalents for each character in the current character set. The array shall contain a total of `384` characters, and can be indexed with any signed or unsigned char (i.e. with an index value between `-128` and `255`). If the application is multithreaded, the array shall be local to the current thread.

This interface is not in the source standard; it is only in the binary standard.

Return Value

The `__ctype_toupper_loc()` function shall return a pointer to the array of characters to be used for the `ctype()` family of functions (see `<ctype.h>`).

__cxa_atexit

Name

__cxa_atexit — register a function to be called by exit or when a shared library is unloaded

Synopsis

```
int __cxa_atexit(void (*func) (void *), void * arg, void *
dso_handle);
```

Description

As described in the Itanium™ C++ ABI, __cxa_atexit() registers a destructor function to be called by exit() or when a shared library is unloaded. When a shared library is unloaded, any destructor function associated with that shared library, identified by *dso_handle*, shall be called with the single argument *arg*, and then that function shall be removed, or marked as complete, from the list of functions to run at exit(). On a call to exit(), any remaining functions registered shall be called with the single argument *arg*. Destructor functions shall always be called in the reverse order to their registration (i.e. the most recently registered function shall be called first),

The __cxa_atexit() function is used to implement atexit(), as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003). Calling atexit(func) from the statically linked part of an application shall be equivalent to __cxa_atexit(func, NULL, NULL).

__cxa_atexit() is not in the source standard; it is only in the binary standard.

> **Note:** atexit() is not in the binary standard; it is only in the source standard.

__cxa_finalize

Name

`__cxa_finalize` — call destructors of global (or local static) C++ objects and exit functions registered with atexit

Synopsis

```
void __cxa_finalize(void * d);
```

Description

As described in the Itanium® C++ ABI, the C runtime library shall maintain a list of termination function entries containing the following information:

- A pointer to a termination function.
- An operand to be passed to the function.
- A handle identifying the home shared library of the entry.

The list is populated by entries of two kinds:

- Destructors of global (or local static) C++ objects that require destruction on exit.
- Functions registered by the user with atexit().

In the former case an entry consists of a pointer to the destructor, a pointer to the corresponding object and a handle for the home shared library of the object. In the latter case the pointer to the function is the pointer passed to atexit(), while the other pointers are NULL.

When __cxa_finalize(d) is called, it shall walk the termination function list, calling each in turn if d matches the handle of the termination function entry. If d is NULL, it shall call all the termination funtions. Multiple calls to __cxa_finalize shall not result in calling termination function entries multiple times; the implementation may either remove entries or mark them finished. The termination functions shall always be called in the reverse order of their registration (i.e. the most recently registered function shall be called first).

An application shall not call __cxa_finalize() directly. The implementation shall arrange for__cxa_finalize() to be called during early shared library unload (e.g. dlclose()) with a handle to the shared library. When the main program calls exit, the implementation shall cause any remaining __cxa_atexit-registered functions to be called, either by calling __cxa_finalize(NULL), or by walking the registration list itself.

__cxa_finalize() is not in the source standard; it is only in the binary standard.

__daylight

Name

`__daylight` — external daylight savings time flag

Synopsis

```
int __daylight;
```

Description

The external variable `__daylight` shall implement the daylight savings time flag `daylight` as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003). `__daylight` has the same specification as `daylight`.

__environ

Name

`__environ` — alias for environ - user environment

Synopsis

```
extern char **__environ;
```

Description

The external variable `__environ` shall implement the environment variable `environ` as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003). `__environ` has the same specification as `environ`.

__errno_location

Name

`__errno_location` — address of errno variable

Synopsis

```
int * __errno_location(void);
```

Description

The `__errno_location()` function shall return the address of the `errno` variable for the current thread.

`__errno_location()` is not in the source standard; it is only in the binary standard.

__fgets_chk

Name

`__fgets_chk` — string input, with buffer overflow checking

Synopsis

```
#include <stdio.h>
char * __fgets_chk(char * s, size_t size, int strsize, FILE *
stream);
```

Description

The interface `__fgets_chk()` shall function in the same way as the interface `fgets()`, except that `__fgets_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `strsize` specifies the size of the object pointed to by `stream`.

The `__fgets_chk()` function is not in the source standard; it is only in the binary standard.

__fgets_unlocked_chk

Name

`__fgets_unlocked_chk` — non-locking string input, with buffer overflow checking

Synopsis

```
#include <stdio.h>
char * __fgets_unlocked_chk(char * s, size_t size, int strsize, FILE
* stream);
```

Description

The interface `__fgets_unlocked_chk()` shall function in the same way as the interface `fgets_unlocked()`, except that `__fgets_unlocked_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `strsize` specifies the size of the object pointed to by `stream`.

The `__fgets_unlocked_chk()` function is not in the source standard; it is only in the binary standard.

__fgetws_chk

Name

`__fgetws_chk` — read a wide-character string from a FILE stream, with buffer overflow checking

Synopsis

```
#include <wchar.h>
wchar_t * __fgetws_chk(wchar_t * ws, size_t size, int strsize, FILE
* stream);
```

Description

The interface `__fgetws_chk()` shall function in the same way as the interface `fgetws()`, except that `__fgetws_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `strsize` specifies the size of the object pointed to by `stream`.

The `__fgetws_chk()` function is not in the source standard; it is only in the binary standard.

__fgetws_unlocked_chk

Name

`__fgetws_unlocked_chk` — read a wide-character string from a FILE stream in a non-locking manner, with stack checking

Synopsis

```
#include <wchar.h>
wchar_t * __fgetws_unlocked_chk(wchar_t * ws, size_t strsize, int n,
FILE * stream);
```

Description

The interface `__fgetws_unlocked_chk()` shall function in the same way as the interface `fgetws_unlocked()`, except that `__fgetws_unlocked_chk()` shall check for stack overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `strsize` specifies the size of the object pointed to by `stream`.

The `__fgetws_unlocked_chk()` function is not in the source standard; it is only in the binary standard.

__fpending

Name

__fpending — returns in bytes the amount of output pending on a stream

Synopsis

```
size_t __fpending(FILE * stream);
```

Description

__fpending() returns the amount of output in bytes pending on a stream.

__fpending() is not in the source standard; it is only in the binary standard.

__fprintf_chk

Name

__fprintf_chk — convert formatted output, with stack checking

Synopsis

```
#include <libc.h>
int __fprintf_chk(FILE * stream, int flag, const char * format);
```

Description

The interface __fprintf_chk() shall function in the same way as the interface fprintf(), except that __fprintf_chk() shall check for stack overflow before computing a result, depending on the value of the *flag* parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of *flag*, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The __fprintf_chk() function is not in the source standard; it is only in the binary standard.

__fwprintf_chk

Name

`__fwprintf_chk` − convert formatted wide-character output, with stack checking

Synopsis

```
#include <wchar.h>
int __fwprintf_chk(FILE * stream, int flag, const wchar_t * format);
```

Description

The interface `__fwprintf_chk()` shall function in the same way as the interface `fwprintf()`, except that `__fwprintf_chk()` shall check for stack overflow before computing a result, depending on the value of the `flag` parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of `flag`, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The `__fwprintf_chk()` function is not in the source standard; it is only in the binary standard.

__fxstatat

Name

`__fxstatat` − get file status relative to directory file descriptor

Synopsis

```
#include <fcntl.h>
#include <sys/stat.h>
int __fxstatat(int ver, int dirfd, const char * path, struct stat *
stat_buf, int flags);
```

Description

The `__fxstatat()` function shall implement the `fstatat()` function. The behavior of `__fxstatat()` for values of `ver` other than `_STAT_VER` is undefined. See Data Definitions in the architecture specific part of this specification for the correct value of `_STAT_VER`.

`__fxstatat(_STAT_VER,` `dirfd,` `stat_buf,` `flags)` shall behave as `fstatat(dirfd,` `stat_buf,` `flags)` as specified by POSIX 1003.1-2008 (ISO/IEC 9945-2009).

`__fxstatat()` is not in the source standard; it is only in the binary standard.

> **Note:** The `fstatat()` function is not in the binary standard; it is only in the source standard.

__fxstatat64, fstatat64

Name

`__fxstatat64`, `fstatat64` — get file status relative to a directory file descriptor (Large File Support)

Synopsis

```
#include <fcntl.h>
#include <sys/stat.h>
int __fxstatat64(int ver, int dirfd, const char * path, struct
stat64 * stat_buf, int flags);
int fstatat64(int dirfd, const char * file, struct stat64 * buf, int
flag);
```

Description

`fstatat64()` is a large-file version of the `fstatat()` function as defined in POSIX 1003.1-2008 (ISO/IEC 9945-2009). It differs from `fstatat()` only in that the *buf* parameter refers to a large-file version of the stat structure.

The `__fxstatat64()` function shall implement the `fstatat64()` function. The behavior of `__fxstatat64()` for values of *ver* other than `_STAT_VER` is undefined. See Data Definitions in the architecture specific part of this specification for the correct value of `_STAT_VER`.

`__fxstatat64(_STAT_VER, dirfd, stat_buf, flags)` shall behave as `fstatat64(dirfd, stat_buf, flags)`

`__fxstatat64()` is not in the source standard; it is only in the binary standard.

> **Note:** The `fstatat64()` function is not in the binary standard; it is only in the source standard.

__getcwd_chk

Name

`__getcwd_chk` — get current working directory, with buffer overflow checking

Synopsis

```
#include <unistd.h>
char * __getcwd_chk(char * buf, size_t len, size_t buflen);
```

Description

The interface `__getcwd_chk()` shall function in the same way as the interface `getcwd()`, except that `__getcwd_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *buflen* specifies the size of the buffer *buf*. If *len* exceeds *buflen*, the function shall abort, and the program calling it shall exit.

The `__getcwd_chk()` function is not in the source standard; it is only in the binary standard.

__getgroups_chk

Name

__getgroups_chk — get list of supplementary group IDs, with buffer overflow checking

Synopsis

```
#include <unistd.h>
int __getgroups_chk(int size, gid_t * list, size_t listlen);
```

Description

The interface `__getgroups_chk()` shall function in the same way as the interface `getgroups()`, except that `__getgroups_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *listlen* specifies the size in bytes of the object *list*.

The `__getgroups_chk()` function is not in the source standard; it is only in the binary standard.

__gethostname_chk

Name

__gethostname_chk — get host name, with buffer overflow checking

Synopsis

```
#include <unistd.h>
int __gethostname_chk(char * buf, size_t buflen, size_t maxlen);
```

Description

The interface `__gethostname_chk()` shall function in the same way as the interface `gethostname()`, except that `__gethostname_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *buflen* specifies the size of the buffer *buf*. If *buflen* exceeds *maxlen*, the function shall abort, and the program calling it shall exit.

The `__gethostname_chk()` function is not in the source standard; it is only in the binary standard.

__getlogin_r_chk

Name

`__getlogin_r_chk` — get user name, with buffer overflow checking (reentrant)

Synopsis

```
#include <unistd.h>
int __getlogin_r_chk(char * buf, size_t buflen, size_t maxlen);
```

Description

The interface `__getlogin_r_chk()` shall function in the same way as the interface `getlogin_r()`, except that `__getlogin_r_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `buflen` specifies the size of the buffer `buf`. If `buflen` exceeds `maxlen`, the function shall abort, and the program calling it shall exit.

The `__getlogin_r_chk()` function is not in the source standard; it is only in the binary standard.

__getpagesize

Name

`__getpagesize` — alias for getpagesize - get current page size

Synopsis

```
int __getpagesize(void);
```

Description

`__getpagesize()` is an alias for `getpagesize()` - get current page size.

`__getpagesize()` has the same specification as `getpagesize()`.

`__getpagesize()` is not in the source standard; it is only in the binary standard.

__getpgid

Name

`__getpgid` — get the process group id

Synopsis

```
pid_t __getpgid(pid_t pid);
```

Description

`__getpgid()` has the same specification as `getpgid()`.

`__getpgid()` is not in the source standard; it is only in the binary standard.

__h_errno_location

Name

`__h_errno_location` — address of h_errno variable

Synopsis

```
int * __h_errno_location(void);
```

Description

`__h_errno_location()` returns the address of the `h_errno` variable, where `h_errno` is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

`__h_errno_location()` is not in the source standard; it is only in the binary standard. Note that `h_errno` itself is only in the source standard; it is not in the binary standard.

__isinf

Name

`__isinf` — test for infinity

Synopsis

```
int __isinf(double arg);
```

Description

`__isinf()` has the same specification as `isinf()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that the argument type for `__isinf()` is known to be double.

`__isinf()` is not in the source standard; it is only in the binary standard.

__isinff

Name

`__isinff` — test for infinity

Synopsis

```
int __isinff(float arg);
```

Description

`__isinff()` has the same specification as `isinf()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003) except that the argument type for `__isinff()` is known to be float.

`__isinff()` is not in the source standard; it is only in the binary standard.

__isinfl

Name

__isinfl — test for infinity

Synopsis

```
int __isinfl(long double arg);
```

Description

__isinfl() has the same specification as isinf() in the POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that the argument type for __isinfl() is known to be long double.

__isinfl() is not in the source standard; it is only in the binary standard.

__isnan

Name

__isnan — test for infinity

Synopsis

```
int __isnan(double arg);
```

Description

__isnan() has the same specification as isnan() in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that the argument type for __isnan() is known to be double.

__isnan() is not in the source standard; it is only in the binary standard.

__isnanf

Name

__isnanf — test for infinity

Synopsis

```
int __isnanf(float arg);
```

Description

__isnanf() has the same specification as isnan() in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that the argument type for __isnanf() is known to be float.

__isnanf() is not in the source standard; it is only in the binary standard.

__isnanl

Name

`__isnanl` — test for infinity

Synopsis

```
int __isnanl(long double arg);
```

Description

`__isnanl()` has the same specification as `isnan()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that the argument type for `__isnanl()` is known to be long double.

`__isnanl()` is not in the source standard; it is only in the binary standard.

__libc_current_sigrtmax

Name

`__libc_current_sigrtmax` — return number of available real-time signal with lowest priority

Synopsis

```
int __libc_current_sigrtmax(void);
```

Description

`__libc_current_sigrtmax()` returns the number of an available real-time signal with the lowest priority.

`__libc_current_sigrtmax()` is not in the source standard; it is only in the binary standard.

__libc_current_sigrtmin

Name

`__libc_current_sigrtmin` — return number of available real-time signal with highest priority

Synopsis

```
int __libc_current_sigrtmin(void);
```

Description

`__libc_current_sigrtmin()` returns the number of an available real-time signal with the highest priority.

`__libc_current_sigrtmin()` is not in the source standard; it is only in the binary standard.

__libc_start_main

Name

`__libc_start_main` — initialization routine

Synopsis

```
int __libc_start_main(int (*main) (int, char **, char **), int argc,
char ** ubp_av, void (*init) (void), void (*fini) (void), void
(*rtld_fini) (void), void (*stack_end));
```

Description

The `__libc_start_main()` function shall perform any necessary initialization of the execution environment, call the *main* function with appropriate arguments, and handle the return from main(). If the main() function returns, the return value shall be passed to the exit() function.

> **Note:** While this specification is intended to be implementation independent, process and library initialization may include:
>
> * performing any necessary security checks if the effective user ID is not the same as the real user ID.
> * initialize the threading subsystem.
> * registering the *rtld_fini* to release resources when this dynamic shared object exits (or is unloaded).
> * registering the *fini* handler to run at program exit.
> * calling the initializer function `(*init)()`.
> * calling main() with appropriate arguments.
> * calling exit() with the return value from main().
>
> This list is an example only.

`__libc_start_main()` is not in the source standard; it is only in the binary standard.

See Also

The section on Process Initialization in each of the architecture specific parts of ISO/IEC 23360.

__mbsnrtowcs_chk

Name

__mbsnrtowcs_chk — convert a multibyte string to a wide-character string, with buffer overflow checking

Synopsis

```
#include <wchar.h>
size_t __mbsnrtowcs_chk(wchar_t * dest, const char * * src, size_t
nmc, size_t len, mbstate_t * ps, size_t destlen);
```

Description

The interface __mbsnrtowcs_chk() shall function in the same way as the interface mbsnrtowcs(), except that __mbsnrtowcs_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *destlen* specifies the size of the object *dest*. If *len* exceeds *destlen*, the function shall abort, and the program calling it shall exit.

The __mbsnrtowcs_chk() function is not in the source standard; it is only in the binary standard.

__mbsrtowcs_chk

Name

__mbsrtowcs_chk — convert a multibyte string to a wide-character string, with buffer overflow checking

Synopsis

```
#include <wchar.h>
size_t __mbsrtowcs_chk(wchar_t * dest, const char * * src, size_t
len, mbstate_t * ps, size_t destlen);
```

Description

The interface __mbsrtowcs_chk() shall function in the same way as the interface mbsrtowcs(), except that __mbsrtowcs_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *destlen* specifies the size of the object *dest*. If *len* exceeds *destlen*, the function shall abort, and the program calling it shall exit.

The __mbsrtowcs_chk() function is not in the source standard; it is only in the binary standard.

__mbstowcs_chk

Name

__mbstowcs_chk — convert a multibyte string to a wide-character string, with buffer overflow checking

Synopsis

```
#include <stdlib.h>
size_t __mbstowcs_chk(wchar_t * dest, const char * src, size_t len,
size_t destlen);
```

Description

The interface __mbstowcs_chk() shall function in the same way as the interface mbstowcs(), except that __mbstowcs_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *destlen* specifies the size of the object *dest*. If *len* exceeds *destlen*, the function shall abort, and the program calling it shall exit.

The __mbstowcs_chk() function is not in the source standard; it is only in the binary standard.

__memcpy_chk

Name

__memcpy_chk — copy memory area, with buffer overflow checking

Synopsis

```
#include <string.h>
void * __memcpy_chk(void * dest, const void * src, size_t len,
size_t destlen);
```

Description

The interface __memcpy_chk() shall function in the same way as the interface memcpy(), except that __memcpy_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *destlen* specifies the size of the object *dest*. If *len* exceeds *destlen*, the function shall abort, and the program calling it shall exit.

The __memcpy_chk() function is not in the source standard; it is only in the binary standard.

__memmove_chk

Name

__memmove_chk — copy memory area, with buffer overflow checking

Synopsis

```
#include <string.h>
void * __memmove_chk(void * dest, const void * src, size_t len,
size_t destlen);
```

Description

The interface __memmove_chk() shall function in the same way as the interface memmove(), except that __memmove_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *destlen* specifies the size of the object *dest*. If *len* exceeds *destlen*, the function shall abort, and the program calling it shall exit.

The __memmove_chk() function is not in the source standard; it is only in the binary standard.

__mempcpy

Name

__mempcpy — copy given number of bytes of source to destination

Synopsis

```
#include <string.h>
void * __mempcpy(void * restrict dest, const void * restrict src,
size_t n);
```

Description

__mempcpy() copies *n* bytes of *src* to *dest*, returning a pointer to the byte after the last written byte.

If copying takes place between objects that overlap, the behavior is undefined.

If either *dest* or *src* is a null pointer, the behavior is undefined.

If *n* is 0 and the other parameters are valid, the return value is *dest*.

__mempcpy() is not in the source standard; it is only in the binary standard.

__mempcpy_chk

Name

__mempcpy_chk — copy memory area, with buffer overflow checking

Synopsis

```
#include <string.h>
void * __mempcpy_chk(void * dest, const void * src, size_t len,
size_t destlen);
```

Description

The interface __mempcpy_chk() shall function in the same way as the interface mempcpy(), except that __mempcpy_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter destlen specifies the size of the object dest. If len exceeds destlen, the function shall abort, and the program calling it shall exit.

The __mempcpy_chk() function is not in the source standard; it is only in the binary standard.

__memset_chk

Name

__memset_chk — fill memory with a constant byte, using buffer overflow checking

Synopsis

```
#include <string.h>
void * __memset_chk(void * dest, int c, size_t len, size_t destlen);
```

Description

The interface __memset_chk() shall function in the same way as the interface memset(), except that __memset_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter destlen specifies the size of the object dest. If len exceeds destlen, the function shall abort, and the program calling it shall exit.

The __memset_chk() function is not in the source standard; it is only in the binary standard.

__pread64_chk

Name

`__pread64_chk` — read from a file descriptor at a given offset, with buffer overflow checking

Synopsis

```
#include <unistd.h>
ssize_t __pread64_chk(int fd, void * buf, size_t nbytes, off64_t
offset, size_t buflen);
```

Description

The interface `__pread64_chk()` shall function in the same way as the interface `pread64()`, except that `__pread64_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `buflen` specifies the size of the buffer `buf`. If `nbytes` exceeds `buflen`, the function shall abort, and the program calling it shall exit.

The `__pread64_chk()` function is not in the source standard; it is only in the binary standard.

__pread_chk

Name

`__pread_chk` — read from a file descriptor at a given offset, with buffer overflow checking

Synopsis

```
#include <unistd.h>
ssize_t __pread_chk(int fd, void * buf, size_t nbytes, off_t offset,
size_t buflen);
```

Description

The interface `__pread_chk()` shall function in the same way as the interface `pread()`, except that `__pread_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `buflen` specifies the size of the buffer `buf`. If `nbytes` exceeds `buflen`, the function shall abort, and the program calling it shall exit.

The `__pread_chk()` function is not in the source standard; it is only in the binary standard.

__printf_chk

Name

`__printf_chk` — format and print data, with stack checking

Synopsis

```
#include <stdio.h>
int __printf_chk(int flag, const char * format);
```

Description

The interface `__printf_chk()` shall function in the same way as the interface `printf()`, except that `__printf_chk()` shall check for stack overflow before computing a result, depending on the value of the `flag` parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of `flag`, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The `__printf_chk()` function is not in the source standard; it is only in the binary standard.

__rawmemchr

Name

`__rawmemchr` — scan memory

Synopsis

```
#include <string.h>
void * __rawmemchr(const void * s, int c);
```

Description

The `__rawmemchr()` function shall locate the first occurrence of `c` (converted to an unsigned char) in the object pointed to by `s`. If the byte does not occur in the object, then the behavior is undefined.

`__rawmemchr()` is a weak alias for `rawmemchr()`. It is similar to `memchr()`, but it has no length limit.

`__rawmemchr()` is not in the source standard; it is only in the binary standard.

Return Value

The `__rawmemchr()` function shall return a pointer to the located byte.

__read_chk

Name

`__read_chk` — read from a file descriptor, with buffer overflow checking

Synopsis

```
#include <unistd.h>
ssize_t __read_chk(int fd, void * buf, size_t nbytes, size_t
buflen);
```

Description

The interface `__read_chk()` shall function in the same way as the interface `read()`, except that `__read_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `buflen` specifies the size of the buffer `buf`. If `nbytes` exceeds `buflen`, the function shall abort, and the program calling it shall exit.

The `__read_chk()` function is not in the source standard; it is only in the binary standard.

__readlink_chk

Name

`__readlink_chk` — display value of a symbolic link, with buffer overflow checking

Synopsis

```
#include <unistd.h>
ssize_t __readlink_chk(const char * path, char * buf, size_t len,
size_t buflen);
```

Description

The interface `__readlink_chk()` shall function in the same way as the interface `readlink()`, except that `__readlink_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `buflen` specifies the size of the buffer `buf`. If `len` exceeds `buflen`, the function shall abort, and the program calling it shall exit.

The `__readlink_chk()` function is not in the source standard; it is only in the binary standard.

__realpath_chk

Name

__realpath_chk — return the canonicalized absolute pathname, with buffer overflow checking

Synopsis

```
#include <stdlib.h>
char * __realpath_chk(const char * path, char * resolved_path, size_t
resolved_len);
```

Description

The interface __realpath_chk() shall function in the same way as the interface realpath(), except that __realpath_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter resolved_len specifies the size of the string resolved_path. If resolved_len is less than PATH_MAX, then the function shall abort, and the program calling it shall exit.

The __realpath_chk() function is not in the source standard; it is only in the binary standard.

__recv_chk

Name

__recv_chk — receive a message from a socket, with buffer overflow checking

Synopsis

```
#include <sys/socket.h>
ssize_t __recv_chk(int fd, void * buf, size_t len, size_t buflen,
int flag);
```

Description

The interface __recv_chk() shall function in the same way as the interface recv(), except that __recv_chk() shall check for buffer overflow before computing a result, depending on the value of the flag parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of flag, the more security measures this interface shall take in the form of checking the buffer, parameter values, and so on.

The parameter buflen specifies the size of the buffer buf. If len exceeds buflen, the function shall abort, and the program calling it shall exit.

The __recv_chk() function is not in the source standard; it is only in the binary standard.

__recvfrom_chk

Name

`__recvfrom_chk` — receive a message from a socket, with buffer overflow checking

Synopsis

```
#include <sys/socket.h>
ssize_t __recvfrom_chk(int fd, void * buf, size_t len, size_t
buflen, int flag, struct sockaddr * from, socklen_t * fromlen);
```

Description

The interface `__recvfrom_chk()` shall function in the same way as the interface `recvfrom()`, except that `__recvfrom_chk()` shall check for buffer overflow before computing a result, depending on the value of the `flag` parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of `flag`, the more security measures this interface shall take in the form of checking the buffer, parameter values, and so on.

The parameter `buflen` specifies the size of the buffer `buf`. If `len` exceeds `buflen`, the function shall abort, and the program calling it shall exit.

The `__recvfrom_chk()` function is not in the source standard; it is only in the binary standard.

__register_atfork

Name

`__register_atfork` — alias for register_atfork

Synopsis

```
int __register_atfork(void (*prepare) (void), void (*parent) (void),
void (*child) (void), void *__dso_handle);
```

Description

`__register_atfork()` implements `pthread_atfork()` as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003). The additional parameter `__dso_handle` allows a shared object to pass in it's handle so that functions registered by `__register_atfork()` can be unregistered by the runtime when the shared object is unloaded.

__sigsetjmp

Name

__sigsetjmp — save stack context for non-local goto

Synopsis

```
int __sigsetjmp(jmp_buf env, int savemask);
```

Description

__sigsetjmp() has the same behavior as sigsetjmp() as specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003).

__sigsetjmp() is not in the source standard; it is only in the binary standard.

__snprintf_chk

Name

__snprintf_chk — convert formatted output, with buffer overflow checking

Synopsis

```
#include <stdio.h>
int __snprintf_chk(char * str, size_t maxlen, int flag, size_t
strlen, const char * format);
```

Description

The interface __snprintf_chk() shall function in the same way as the interface snprintf(), except that __snprintf_chk() shall check for buffer overflow before computing a result, depending on the value of the *flag* parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of *flag*, the more security measures this interface shall take in the form of checking the buffer, parameter values, and so on.

The parameter *strlen* specifies the size of the buffer *str*. If *strlen* is less than *maxlen*, the function shall abort, and the program calling it shall exit.

The __snprintf_chk() function is not in the source standard; it is only in the binary standard.

__sprintf_chk

Name

`__sprintf_chk` — convert formatted output, with stack checking

Synopsis

```
#include <stdio.h>
int __sprintf_chk(char * str, int flag, size_t strlen, const char *
format);
```

Description

The interface `__sprintf_chk()` shall function in the same way as the interface `sprintf()`, except that `__sprintf_chk()` shall check for stack overflow before computing a result, depending on the value of the `flag` parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of `flag`, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The parameter `strlen` specifies the size of the string `str`. If `strlen` is zero, the function shall abort, and the program calling it shall exit.

The `__sprintf_chk()` function is not in the source standard; it is only in the binary standard.

__stack_chk_fail

Name

`__stack_chk_fail` — terminate a function in case of stack overflow

Synopsis

```
#include <libc.h>
void __stack_chk_fail(void);
```

Description

The interface `__stack_chk_fail()` shall abort the function that called it with a message that a stack overflow has been detected. The program that called the function shall then exit.

Application Usage (informative)

The interface `__stack_chk_fail()` does not check for a stack overflow itself. It merely reports one when invoked.

__stpcpy

Name

__stpcpy — alias for stpcpy

Synopsis

```
#include <string.h>
char * __stpcpy(char * dest, const char * src);
```

Description

The __stpcpy() function has the same specification as the stpcpy().

__stpcpy() is not in the source standard; it is only in the binary standard.

__stpcpy_chk

Name

__stpcpy_chk — copy a string returning a pointer to its end, with buffer overflow checking

Synopsis

```
#include <string.h>
char * __stpcpy_chk(char * dest, const char * src, size_t destlen);
```

Description

The interface __stpcpy_chk() shall function in the same way as the interface stpcpy(), except that __stpcpy_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter destlen specifies the size of the object pointed to by dest.

The __stpcpy_chk() function is not in the source standard; it is only in the binary standard.

__stpncpy_chk

Name

`__stpncpy_chk` — copy a fixed-size string, returning a pointer to its end, with buffer overflow checking

Synopsis

```
#include <libc.h>
char * __stpncpy_chk(char * dest, const char * src, size_t n, size_t destlen);
```

Description

The interface `__stpncpy_chk()` shall function in the same way as the interface `stpncpy()`, except that `__stpncpy_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `destlen` specifies the size of the object pointed to by `dest`. If `n` exceeds `destlen`, the function shall abort, and the program calling it shall exit.

The `__stpncpy_chk()` function is not in the source standard; it is only in the binary standard.

__strcat_chk

Name

`__strcat_chk` — concatenate two strings, with buffer overflow checking

Synopsis

```
#include <string.h>
char * __strcat_chk(char * dest, const char * src, size_t destlen);
```

Description

The interface `__strcat_chk()` shall function in the same way as the interface `strcat()`, except that `__strcat_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `destlen` specifies the size of the object pointed to by `dest`.

The `__strcat_chk()` function is not in the source standard; it is only in the binary standard.

__strcpy_chk

Name

__strcpy_chk — copy a string, with buffer overflow checking

Synopsis

```
#include <string.h>
char * __strcpy_chk(char * dest, const char * src, size_t destlen);
```

Description

The interface __strcpy_chk() shall function in the same way as the interface strcpy(), except that __strcpy_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter destlen specifies the size of the object pointed to by dest.

The __strcpy_chk() function is not in the source standard; it is only in the binary standard.

__strdup

Name

__strdup — alias for strdup

Synopsis

```
char * __strdup(const char * string);
```

Description

__strdup() has the same specification as strdup().

__strdup() is not in the source standard; it is only in the binary standard.

__strncat_chk

Name

__strncat_chk — concatenate two strings, with buffer overflow checking

Synopsis

```
#include <string.h>
char * __strncat_chk(char * s1, const char * s2, size_t n, size_t
s1len);
```

Description

The interface __strncat_chk() shall function in the same way as the interface strncat(), except that __strncat_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter s1len specifies the size of the object pointed to by s1.

The __strncat_chk() function is not in the source standard; it is only in the binary standard.

__strncpy_chk

Name

`__strncpy_chk` — copy a string, with buffer overflow checking

Synopsis

```
#include <string.h>
char * __strncpy_chk(char * s1, const char * s2, size_t n, size_t
s1len);
```

Description

The interface `__strncpy_chk()` shall function in the same way as the interface `strncpy()`, except that `__strncpy_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `s1len` specifies the size of the object pointed to by `s1`.

The `__strncpy_chk()` function is not in the source standard; it is only in the binary standard.

__strtod_internal

Name

`__strtod_internal` — underlying function for strtod

Synopsis

```
double __strtod_internal(const char * __nptr, char * * __endptr, int
__group);
```

Description

`__group` shall be `0` or the behavior of `__strtod_internal()` is undefined.

`__strtod_internal(__nptr, __endptr, 0)()` has the same specification as `strtod(__nptr, __endptr)()`.

`__strtod_internal()` is not in the source standard; it is only in the binary standard.

__strtof_internal

Name

`__strtof_internal` — underlying function for strtof

Synopsis

```
float __strtof_internal(const char * __nptr, char * * __endptr, int __group);
```

Description

__group shall be `0` or the behavior of `__strtof_internal()` is undefined.

`__strtof_internal(__nptr, __endptr, 0)()` has the same specification as `strtof(__nptr, __endptr)()`.

`__strtof_internal()` is not in the source standard; it is only in the binary standard.

__strtok_r

Name

`__strtok_r` — alias for strtok_r

Synopsis

```
char * __strtok_r(char * restrict s, const char * restrict delim, char * * restrict save_ptr);
```

Description

`__strtok_r()` has the same specification as `strtok_r()`.

`__strtok_r()` is not in the source standard; it is only in the binary standard.

__strtol_internal

Name

`__strtol_internal` — alias for strtol

Synopsis

```
long int __strtol_internal(const char * __nptr, char * * __endptr, int __base, int __group);
```

Description

__group shall be `0` or the behavior of `__strtol_internal()` is undefined.

`__strtol_internal(__nptr, __endptr, __base, 0)` has the same specification as `strtol(__nptr, __endptr, __base)`.

`__strtol_internal()` is not in the source standard; it is only in the binary standard.

__strtold_internal

Name

`__strtold_internal` — underlying function for strtold

Synopsis

```
long double __strtold_internal(const char * __nptr, char * * __endptr,
int __group);
```

Description

__group shall be `0` or the behavior of `__strtold_internal()` is undefined.

`__strtold_internal(__nptr, __endptr, 0)` has the same specification as `strtold(__nptr, __endptr)`.

`__strtold_internal()` is not in the source standard; it is only in the binary standard.

__strtoll_internal

Name

`__strtoll_internal` — underlying function for strtoll

Synopsis

```
long long __strtoll_internal(const char * __nptr, char * * __endptr,
int __base, int __group);
```

Description

__group shall be `0` or the behavior of `__strtoll_internal()` is undefined.

`__strtoll_internal(__nptr, __endptr, __base, 0)` has the same specification as `strtoll(__nptr, __endptr, __base)`.

`__strtoll_internal()` is not in the source standard; it is only in the binary standard.

__strtoul_internal

Name

`__strtoul_internal` — underlying function for strtoul

Synopsis

```
unsigned long int __strtoul_internal(const char * __nptr, char * *
__endptr, int __base, int __group);
```

Description

__group shall be `0` or the behavior of `__strtoul_internal()` is undefined.

`__strtoul_internal(__nptr, __endptr, __base, 0)` has the same specification as `strtoul(__nptr, __endptr, __base)`.

`__strtoul_internal()` is not in the source standard; it is only in the binary standard.

__strtoull_internal

Name

__strtoull_internal — underlying function for strtoull

Synopsis

```
unsigned long long __strtoull_internal(const char * __nptr, char * *
__endptr, int __base, int __group);
```

Description

__group shall be 0 or the behavior of __strtoull_internal() is undefined.

__strtoull_internal(*__nptr*, *__endptr*, *__base*, 0) has the same specification as strtoull(*__nptr*, *__endptr*, *__base*).

__strtoull_internal() is not in the source standard; it is only in the binary standard.

__swprintf_chk

Name

__swprintf_chk — convert formatted wide-character output, with stack checking

Synopsis

```
#include <wchar.h>
int __swprintf_chk(wchar_t * s, size_t n, int flag, size_t slen,
const wchar_t * format);
```

Description

The interface __swprintf_chk() shall function in the same way as the interface swprintf(), except that __swprintf_chk() shall check for stack overflow before computing a result, depending on the value of the *flag* parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of *flag*, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The parameter *slen* specifies the size of the object pointed to by *s*. If *slen* is less than *maxlen*, the function shall abort and the program calling it shall exit.

In general, the higher the value of *flag*, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The __swprintf_chk() function is not in the source standard; it is only in the binary standard.

__sysconf

Name

`__sysconf` — get configuration information at runtime

Synopsis

```
#include <unistd.h>
long __sysconf(int name);
```

Description

`__sysconf()` gets configuration information at runtime.

`__sysconf()` is weak alias to `sysconf()`.

`__sysconf()` has the same specification as `sysconf()`.

`__sysconf()` is not in the source standard; it is only in the binary standard.

__syslog_chk

Name

`__syslog_chk` — send messages to the system logger, with stack checking

Synopsis

```
#include <syslog.h>
void __syslog_chk(int priority, int flag, const char * format);
```

Description

The interface `__syslog_chk()` shall function in the same way as the interface `syslog()`, except that `__syslog_chk()` shall check for stack overflow before computing a result, depending on the value of the `flag` parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of `flag`, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The `__syslog_chk()` function is not in the source standard; it is only in the binary standard.

__sysv_signal

Name

`__sysv_signal` — signal handling

Synopsis

```
__sighandler_t __sysv_signal(int sig, __sighandler_t handler);
```

Description

`__sysv_signal()` has the same behavior as `signal()` as specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003).

`__sysv_signal()` is not in the source standard; it is only in the binary standard.

__timezone

Name

`__timezone` — external variable containing timezone

Synopsis

```
long int __timezone;
```

Description

The external variable `__timezone` shall implement the timezone variable `timezone` as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003). `__timezone` has the same specification as `timezone`.

__ttyname_r_chk

Name

`__ttyname_r_chk` — return name of a terminal, with buffer overflow checking (reentrant)

Synopsis

```
#include <unistd.h>
int __ttyname_r_chk(int fd, char * buf, size_t buflen, size_t nreal);
```

Description

The interface `__ttyname_r_chk()` shall function in the same way as the interface `ttyname_r()`, except that `__ttyname_r_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `buflen` specifies the size of the object pointed to by `buf`. If `buflen` exceeds `nreal`, the function shall abort and the program calling it shall exit.

The `__ttyname_r_chk()` function is not in the source standard; it is only in the binary standard.

__tzname

Name

`__tzname` — external variable containing the timezone names

Synopsis

```
char * __tzname[2];
```

Description

The external variable `__tzname` shall implement the timezone name variable `tzname` as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003) function `tzset()`. `__tzname` has the same specification as `tzname`.

__vfprintf_chk

Name

`__vfprintf_chk` — convert formatted output, with stack checking

Synopsis

```
#include <libc.h>
int __vfprintf_chk(FILE * fp, int flag, const char * format, va_list
ap);
```

Description

The interface `__vfprintf_chk()` shall function in the same way as the interface `vfprintf()`, except that `__vfprintf_chk()` shall check for stack overflow before computing a result, depending on the value of the `flag` parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of `flag`, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The `__vfprintf_chk()` function is not in the source standard; it is only in the binary standard.

__vfwprintf_chk

Name

`__vfwprintf_chk` — convert formatted wide-character output, with stack checking

Synopsis

```
#include <wchar.h>
int __vfwprintf_chk(FILE * fp, int flag, const wchar_t * format,
va_list ap);
```

Description

The interface `__vfwprintf_chk()` shall function in the same way as the interface `vfwprintf()`, except that `__vfwprintf_chk()` shall check for stack overflow before computing a result, depending on the value of the `flag` parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of `flag`, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The `__vfwprintf_chk()` function is not in the source standard; it is only in the binary standard.

__vprintf_chk

Name

`__vprintf_chk` — convert formatted output, with stack checking

Synopsis

```
#include <stdio.h>
int __vprintf_chk(int flag, const char * format, va_list ap);
```

Description

The interface `__vprintf_chk()` shall function in the same way as the interface `vprintf()`, except that `__vprintf_chk()` shall check for stack overflow before computing a result, depending on the value of the `flag` parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of `flag`, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The `__vprintf_chk()` function is not in the source standard; it is only in the binary standard.

__vsnprintf_chk

Name

`__vsnprintf_chk` — convert formatted output, with stack checking

Synopsis

```
#include <stdio.h>
int __vsnprintf_chk(char * s, size_t maxlen, int flag, size_t slen,
const char * format, va_list args);
```

Description

The interface `__vsnprintf_chk()` shall function in the same way as the interface `vsnprintf()`, except that `__vsnprintf_chk()` shall check for stack overflow before computing a result, depending on the value of the `flag` parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of `flag`, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The parameter `slen` specifies the size of the object pointed to by `s`. If `slen` is less than `maxlen`, the function shall abort and the program calling it shall exit.

In general, the higher the value of `flag`, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The `__vsnprintf_chk()` function is not in the source standard; it is only in the binary standard.

__vsprintf_chk

Name

`__vsprintf_chk` — convert formatted output, with stack checking

Synopsis

```
#include <stdio.h>
int __vsprintf_chk(char * s, int flag, size_t slen, const char *
format, va_list args);
```

Description

The interface `__vsprintf_chk()` shall function in the same way as the interface `vsprintf()`, except that `__vsprintf_chk()` shall check for stack overflow before computing a result, depending on the value of the `flag` parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of `flag`, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The parameter `slen` specifies the size of the object pointed to by `s`. If its value is zero, the function shall abort and the program calling it shall exit.

The `__vsprintf_chk()` function is not in the source standard; it is only in the binary standard.

__vswprintf_chk

Name

`__vswprintf_chk` — convert formatted wide-character output, with stack checking

Synopsis

```
#include <wchar.h>
int __vswprintf_chk(wchar_t * s, size_t maxlen, int flag, size_t
slen, const wchar_t * format, va_list args);
```

Description

The interface `__vswprintf_chk()` shall function in the same way as the interface `vswprintf()`, except that `__vswprintf_chk()` shall check for stack overflow before computing a result, depending on the value of the `flag` parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of `flag`, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The parameter `slen` specifies the size of the object pointed to by `s`. If `slen` is less than `maxlen`, the function shall abort and the program calling it shall exit.

The `__vswprintf_chk()` function is not in the source standard; it is only in the binary standard.

__vsyslog_chk

Name

`__vsyslog_chk` — send messages to the system logger, with stack checking

Synopsis

```
#include <syslog.h>
void __vsyslog_chk(int priority, int flag, const char * format,
va_list ap);
```

Description

The interface `__vsyslog_chk()` shall function in the same way as the interface `vsyslog()`, except that `__vsyslog_chk()` shall check for stack overflow before computing a result, depending on the value of the *flag* parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of *flag*, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The `__vsyslog_chk()` function is not in the source standard; it is only in the binary standard.

__vwprintf_chk

Name

`__vwprintf_chk` — convert formatted wide-character output, with stack checking

Synopsis

```
#include <wchar.h>
int __vwprintf_chk(int flag, const wchar_t * format, va_list ap);
```

Description

The interface `__vwprintf_chk()` shall function in the same way as the interface `vwprintf()`, except that `__vwprintf_chk()` shall check for stack overflow before computing a result, depending on the value of the *flag* parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of *flag*, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The `__vwprintf_chk()` function is not in the source standard; it is only in the binary standard.

__wcpcpy_chk

Name

__wcpcpy_chk — copy a wide-character string, returning a pointer to its end, with buffer overflow checking

Synopsis

```
#include <wchar.h>
wchar_t * __wcpcpy_chk(wchar_t * dest, const wchar_t * src, size_t
destlen);
```

Description

The interface `__wcpcpy_chk()` shall function in the same way as the interface `wcpcpy()`, except that `__wcpcpy_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `destlen` specifies the size of the object pointed to by `dest`.

The `__wcpcpy_chk()` function is not in the source standard; it is only in the binary standard.

__wcpncpy_chk

Name

__wcpncpy_chk — copy a fixed-size string of wide characters, returning a pointer to its end, with buffer overflow checking

Synopsis

```
#include <wchar.h>
wchar_t * __wcpncpy_chk(wchar_t * dest, const wchar_t * src, size_t
n, size_t destlen);
```

Description

The interface `__wcpncpy_chk()` shall function in the same way as the interface `wcpncpy()`, except that `__wcpncpy_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `destlen` specifies the size of the object pointed to by `dest`. If `n` exceeds `destlen`, the function shall abort and the program calling it shall exit.

The `__wcpncpy_chk()` function is not in the source standard; it is only in the binary standard.

__wcrtomb_chk

Name

__wcrtomb_chk — convert a wide character to a multibyte sequence, with buffer overflow checking

Synopsis

```
#include <wchar.h>
size_t __wcrtomb_chk(char * s, wchar_t wchar, mbstate_t * ps, size_t
buflen);
```

Description

The interface __wcrtomb_chk() shall function in the same way as the interface wcrtomb(), except that __wcrtomb_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *buflen* specifies the size of the object pointed to by *s*. If it is less than MB_CUR_MAX, then the function shall abort and the program calling it shall exit.

The __wcrtomb_chk() function is not in the source standard; it is only in the binary standard.

__wcscat_chk

Name

__wcscat_chk — concatenate two wide-character strings, with buffer overflow checking

Synopsis

```
#include <wchar.h>
wchar_t * __wcscat_chk(wchar_t * dest, const wchar_t * src, size_t
destlen);
```

Description

The interface __wcscat_chk() shall function in the same way as the interface wcscat(), except that __wcscat_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *destlen* specifies the size of the object pointed to by *dest*.

The __wcscat_chk() function is not in the source standard; it is only in the binary standard.

__wcscpy_chk

Name

__wcscpy_chk — copy a wide-character string, with buffer overflow checking

Synopsis

```
#include <wchar.h>
wchar_t * __wcscpy_chk(wchar_t * dest, const wchar_t * src, size_t
n);
```

Description

The interface __wcscpy_chk() shall function in the same way as the interface wcscpy(), except that __wcscpy_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The __wcscpy_chk() function is not in the source standard; it is only in the binary standard.

__wcsncat_chk

Name

__wcsncat_chk — concatenate two wide-character strings, with buffer overflow checking

Synopsis

```
#include <wchar.h>
wchar_t * __wcsncat_chk(wchar_t * dest, const wchar_t * src, size_t
n, size_t destlen);
```

Description

The interface __wcsncat_chk() shall function in the same way as the interface wcsncat(), except that __wcsncat_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter destlen specifies the size of the object pointed to by dest.

The __wcsncat_chk() function is not in the source standard; it is only in the binary standard.

__wcsncpy_chk

Name

__wcsncpy_chk — copy a fixed-size string of wide characters, with buffer overflow checking

Synopsis

```
#include <wchar.h>
wchar_t * __wcsncpy_chk(wchar_t * dest, const wchar_t * src, size_t
n, size_t destlen);
```

Description

The interface __wcsncpy_chk() shall function in the same way as the interface wcsncpy(), except that __wcsncpy_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *destlen* specifies the size of the object pointed to by *dest*. If *len* exceeds *destlen*, the function shall abort and the program calling it shall exit.

The __wcsncpy_chk() function is not in the source standard; it is only in the binary standard.

__wcsnrtombs_chk

Name

__wcsnrtombs_chk — convert a wide-character string to a multibyte string, with buffer overflow checking

Synopsis

```
#include <wchar.h>
size_t __wcsnrtombs_chk(char * dest, const wchar_t * * src, size_t
nwc, size_t len, mbstate_t * ps, size_t destlen);
```

Description

The interface __wcsnrtombs_chk() shall function in the same way as the interface wcsnrtombs(), except that __wcsnrtombs_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *destlen* specifies the size of the object pointed to by *dest*. If *len* exceeds *destlen*, the function shall abort and the program calling it shall exit.

The __wcsnrtombs_chk() function is not in the source standard; it is only in the binary standard.

__wcsrtombs_chk

Name

__wcsrtombs_chk — convert a wide-character string to a multibyte string, with buffer overflow checking

Synopsis

```
#include <wchar.h>
size_t __wcsrtombs_chk(char * dest, const wchar_t * * src, size_t
len, mbstate_t * ps, size_t destlen);
```

Description

The interface __wcsrtombs_chk() shall function in the same way as the interface wcsrtombs(), except that __wcsrtombs_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *destlen* specifies the size of the object pointed to by *dest*. If *len* exceeds *destlen*, the function shall abort and the program calling it shall exit.

The __wcsrtombs_chk() function is not in the source standard; it is only in the binary standard.

__wcstod_internal

Name

__wcstod_internal — underlying function for wcstod

Synopsis

```
double __wcstod_internal(const wchar_t * nptr, wchar_t * * endptr,
int group);
```

Description

group shall be 0 or the behavior of __wcstod_internal() is undefined.

__wcstod_internal(*nptr*, *endptr*, 0) shall behave as wcstod(*nptr*, *endptr*) as specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003).

__wcstod_internal() is not in the source standard; it is only in the binary standard.

__wcstof_internal

Name

__wcstof_internal — underlying function for wcstof

Synopsis

```
float __wcstof_internal(const wchar_t * nptr, wchar_t * * endptr, int group);
```

Description

group shall be 0 or the behavior of __wcstof_internal() is undefined.

__wcstof_internal(*nptr*, *endptr*, 0) shall behave as wcstof(*nptr*, *endptr*) as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

__wcstof_internal() is not in the source standard; it is only in the binary standard.

__wcstol_internal

Name

__wcstol_internal — underlying function for wcstol

Synopsis

```
long __wcstol_internal(const wchar_t * nptr, wchar_t * * endptr, int base, int group);
```

Description

group shall be 0 or the behavior of __wcstol_internal() is undefined.

__wcstol_internal(*nptr*, *endptr*, *base*, 0) shall behave as wcstol(*nptr*, *endptr*, *base*) as specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003).

__wcstol_internal() is not in the source standard; it is only in the binary standard.

__wcstold_internal

Name

__wcstold_internal — underlying function for wcstold

Synopsis

```
long double __wcstold_internal(const wchar_t * nptr, wchar_t * * endptr, int group);
```

Description

group shall be 0 or the behavior of __wcstold_internal() is undefined.

__wcstold_internal(*nptr*, *endptr*, 0) shall behave as wcstold(*nptr*, *endptr*) as specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003).

__wcstold_internal() is not in the source standard; it is only in the binary standard.

__wcstombs_chk

Name

`__wcstombs_chk` — convert a wide-character string to a multibyte string, with buffer overflow checking

Synopsis

```
#include <stdlib.h>
size_t __wcstombs_chk(char * dest, const wchar_t * src, size_t len,
size_t destlen);
```

Description

The interface `__wcstombs_chk()` shall function in the same way as the interface `wcstombs()`, except that `__wcstombs_chk()` shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter `destlen` specifies the size of the object pointed to by `dest`. If `len` exceeds `destlen`, the function shall abort and the program calling it shall exit.

The `__wcstombs_chk()` function is not in the source standard; it is only in the binary standard.

__wcstoul_internal

Name

`__wcstoul_internal` — underlying function for wcstoul

Synopsis

```
unsigned long __wcstoul_internal(const wchar_t * restrict nptr,
wchar_t * * restrict endptr, int base, int group);
```

Description

`group` shall be `0` or the behavior of `__wcstoul_internal()` is undefined.

`__wcstoul_internal(nptr, endptr, base, 0)()` shall behave as `wcstoul(nptr, endptr, base)()` as specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003).

`__wcstoul_internal()` is not in the source standard; it is only in the binary standard.

__wctomb_chk

Name

__wctomb_chk — convert a wide character to a multibyte sequence, with buffer overflow checking

Synopsis

```
#include <stdlib.h>
int __wctomb_chk(char * s, wchar_t wchar, size_t buflen);
```

Description

The interface __wctomb_chk() shall function in the same way as the interface wctomb(), except that __wctomb_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *buflen* specifies the size of the object pointed to by *s*. If it is less than MB_CUR_MAX, then the function shall abort and the program calling it shall exit.

The __wctomb_chk() function is not in the source standard; it is only in the binary standard.

__wmemcpy_chk

Name

__wmemcpy_chk — copy an array of wide-characters, with buffer overflow checking

Synopsis

```
#include <wchar.h>
wchar_t * __wmemcpy_chk(wchar_t * s1, const wchar_t * s2, size_t n,
size_t ns1);
```

Description

The interface __wmemcpy_chk() shall function in the same way as the interface wmemcpy(), except that __wmemcpy_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *ns1* specifies the size of the object pointed to by *s1*. If *n* exceeds *ns1*, the function shall abort and the program calling it shall exit.

The __wmemcpy_chk() function is not in the source standard; it is only in the binary standard.

__wmemmove_chk

Name

__wmemmove_chk — copy an array of wide-characters, with buffer overflow checking

Synopsis

```
#include <wchar.h>
wchar_t * __wmemmove_chk(wchar_t * s1, const wchar_t * s2, size_t
n, size_t ns1);
```

Description

The interface __wmemmove_chk() shall function in the same way as the interface wmemmove(), except that __wmemmove_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *ns1* specifies the size of the object pointed to by *s1*. If *n* exceeds *ns1*, the function shall abort and the program calling it shall exit.

The __wmemmove_chk() function is not in the source standard; it is only in the binary standard.

__wmempcpy_chk

Name

__wmempcpy_chk — copy memory area, with buffer overflow checking

Synopsis

```
#include <wchar.h>
wchar_t * __wmempcpy_chk(wchar_t * s1, const wchar_t * s2, size_t
n, size_t ns1);
```

Description

The interface __wmempcpy_chk() shall function in the same way as the interface wmempcpy(), except that __wmempcpy_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *ns1* specifies the size of the object pointed to by *s1*. If *n* exceeds *ns1*, the function shall abort and the program calling it shall exit.

The __wmempcpy_chk() function is not in the source standard; it is only in the binary standard.

__wmemset_chk

Name

__wmemset_chk — fill an array of wide-characters with a constant wide character, with buffer overflow checking

Synopsis

```
#include <wchar.h>
wchar_t * __wmemset_chk(wchar_t * s, wchar_t c, size_t n, size_t
destlen);
```

Description

The interface __wmemset_chk() shall function in the same way as the interface wmemset(), except that __wmemset_chk() shall check for buffer overflow before computing a result. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

The parameter *destlen* specifies the size of the object pointed to by *s*. If *n* exceeds *destlen*, the function shall abort and the program calling it shall exit.

The __wmemset_chk() function is not in the source standard; it is only in the binary standard.

__wprintf_chk

Name

__wprintf_chk — convert formatted wide-character output, with stack checking

Synopsis

```
#include <wchar.h>
int __wprintf_chk(int flag, const wchar_t * format);
```

Description

The interface __wprintf_chk() shall function in the same way as the interface wprintf(), except that __wprintf_chk() shall check for stack overflow before computing a result, depending on the value of the *flag* parameter. If an overflow is anticipated, the function shall abort and the program calling it shall exit.

In general, the higher the value of *flag*, the more security measures this interface shall take in the form of checking the stack, parameter values, and so on.

The __wprintf_chk() function is not in the source standard; it is only in the binary standard.

__xmknod

Name

__xmknod — make a special file

Synopsis

```
#include <sys/stat.h>
int __xmknod(int ver, const char * path, mode_t mode, dev_t * dev);
```

Description

The __xmknod() function shall implement the mknod() interface. The behavior of __xmknod() for values of *ver* other than _MKNOD_VER is undefined. See Data Definitions in the architecture specific part of this specification for the correct value of _MKNOD_VER.

__xmknod(_MKNOD_VER, *path*, *mode*, *dev*) shall behave as mknod(*path*, *mode*, *dev*) as specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003).

The __xmknod() function is not in the source standard; it is only in the binary standard.

> **Note:** The mknod() function is not in the binary standard; it is only in the source standard.

__xmknodat

Name

__xmknodat — make a special file relative to a directory file descriptor

Synopsis

```
#include <sys/stat.h>
int __xmknodat(int ver, int dirfd, const char * path, mode_t path,
dev_t * dev);
```

Description

The __xmknodat() function shall implement the mknodat() function. The behavior of __xmknodat() for values of *ver* other than _MKNOD_VER is undefined. See Data Definitions in the architecture specific part of this specification for the correct value of _MKNOD_VER.

__xmknodat(_MKNOD_VER, *dirfd*, *path*, *mode*, *dev*) shall behave as mknodat(*dirfd*, *path*, *mode*, *dev*) as specified by POSIX 1003.1-2008 (ISO/IEC 9945-2009).

The __xmknodat() function is not in the source standard; it is only in the binary standard.

> **Note:** The mknodat() function is not in the binary standard; it is only in the source standard.

__xpg_basename

Name

`__xpg_basename` — return the last component of a file name

Synopsis

```
#include <libgen.h>
char * __xpg_basename(const char * path);
```

Description

The `__xpg_basename()` function shall return a pointer to the final component of the pathname named by `path`, as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003) `basename()`.

This function is not in the source standard, it is only in the binary standard.

Return Value

See POSIX 1003.1-2001 (ISO/IEC 9945-2003).

__xpg_sigpause

Name

`__xpg_sigpause` — remove a signal from the signal mask and suspend the thread

Synopsis

```
#include <signal.h>
int __xpg_sigpause(int sig);
```

Description

The `__xpg_sigpause()` function shall implement the `sigpause()` described in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

This function is not in the source standard, it is only in the binary standard.

Return Value

See POSIX 1003.1-2001 (ISO/IEC 9945-2003).

__xpg_strerror_r

Name

__xpg_strerror_r — return string describing error number

Synopsis

```
#include <string.h>
int __xpg_strerror_r(int errnum, char * buf, size_t buflen);
```

Description

The __xpg_strerror_r() function shall map the error number in *errnum* to a locale-dependent error message string and shall return the string in the buffer pointed to by *strerrbuf*, with length *buflen*, as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003) strerror_r().

This function is not in the source standard, it is only in the binary standard.

Return Value

See POSIX 1003.1-2001 (ISO/IEC 9945-2003).

__xstat

Name

__xstat — get File Status

Synopsis

```
#include <sys/stat.h>
#include <unistd.h>
int __xstat(int ver, const char * path, struct stat * stat_buf);
int __lxstat(int ver, const char * path, struct stat * stat_buf);
int __fxstat(int ver, int fildes, struct stat * stat_buf);
```

Description

The functions __xstat(), __lxstat(), and __fxstat() shall implement the functions stat(), lstat(), and fstat() respectively.

The behavior of these functions for values of *ver* other than _STAT_VER is undefined. See Data Definitions in the architecture specific part of this specification for the correct value of _STAT_VER.

__xstat(_STAT_VER, *path*, *stat_buf*) shall implement stat(*path*, *stat_buf*) as specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003).

__lxstat(_STAT_VER, *path*, *stat_buf*) shall implement lstat(*path*, *stat_buf*) as specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003).

__fxstat(_STAT_VER, *fildes*, *stat_buf*) shall implement fstat(*fildes*, *stat_buf*) as specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003).

__xstat(), __lxstat(), and __fxstat() are not in the source standard; they are only in the binary standard.

stat(), lstat(), and fstat() are not in the binary standard; they are only in the source standard.

__xstat64

Name

__xstat64 — get File Status

Synopsis

```
#define _LARGEFILE_SOURCE 1
#include <sys/stat.h>
#include <unistd.h>
int __xstat64(int ver, const char * path, struct stat64 * stat_buf);
int __lxstat64(int ver, const char * path, struct stat64 * stat_buf);
int __fxstat64(int ver, int fildes, struct stat64 * stat_buf);
```

Description

The functions __xstat64(), __lxstat64(), and __fxstat64() shall implement the functions stat64(), lstat64(), and fstat64() respectively.

The behavior of these functions for values of *ver* other than _STAT_VER is undefined. See Data Definitions in the architecture specific part of this specification for the correct value of _STAT_VER.

__xstat64(_STAT_VER, *path*, *stat_buf*) shall behave as stat64(*path*, *stat_buf*) as specified by Large File Support.

__lxstat64(_STAT_VER, *path*, *stat_buf*) shall behave as lstat64(*path*, *stat_buf*) as specified by Large File Support.

__fxstat64(_STAT_VER, *fildes*, *stat_buf*) shall behave as fstat64(*fildes*, *stat_buf*) as specified by Large File Support.

__xstat64(), __lxstat64(), and __fxstat64() are not in the source standard; they are only in the binary standard.

stat64(), lstat64(), and fstat64() are not in the binary standard; they are only in the source standard.

_environ

Name

_environ — alias for environ - user environment

Synopsis

```
extern char * *_environ;
```

Description

_environ is an alias for environ - user environment.

_nl_msg_cat_cntr

Name

_nl_msg_cat_cntr — new catalog load counter

Synopsis

```
#include <libintl.h>
```

```
extern int _nl_msg_cat_cntr;
```

Description

The global variable `_nl_msg_cat_cntr` is incremented each time a new catalog is loaded. This variable is only in the binary standard; it is not in the source standard.

_sys_errlist

Name

`_sys_errlist` — array containing the "C" locale strings used by strerror()

Synopsis

```
#include <stdio.h>

extern const char *const _sys_errlist[];
```

Description

`_sys_errlist` is an array containing the "C" locale strings used by `strerror()`. This normally should not be used directly. `strerror()` provides all of the needed functionality.

_sys_siglist

Name

`_sys_siglist` — array containing the names of the signal names

Synopsis

```
#include <signal.h>

extern const char *const _sys_siglist[NSIG];
```

Description

`_sys_siglist` is an array containing signal description strings ordered by signal number.

The `_sys_siglist` array is only in the binary standard; it is not in the source standard. Applications wishing to access signal descriptions should use the `strsignal()` function.

acct

Name

acct — switch process accounting on or off

Synopsis

```
#include <dirent.h>
int acct(const char * filename);
```

Description

When *filename* is the name of an existing file, acct() turns accounting on and appends a record to *filename* for each terminating process. When *filename* is NULL, acct() turns accounting off.

Return Value

On success, 0 is returned. On error, -1 is returned and the global variable errno is set appropriately.

Errors

ENOSYS

BSD process accounting has not been enabled when the operating system kernel was compiled. The kernel configuration parameter controlling this feature is *CONFIG_BSD_PROCESS_ACCT*.

ENOMEM

Out of memory.

EPERM

The calling process has no permission to enable process accounting.

EACCES

filename is not a regular file.

EIO

Error writing to the *filename*.

EUSERS

There are no more free file structures or we run out of memory.

adjtime

Name

`adjtime` — correct the time to allow synchronization of the system clock

Synopsis

```
#include <time.h>
int adjtime(const struct timeval * delta, struct timeval *
olddelta);
```

Description

`adjtime()` makes small adjustments to the system time as returned by `gettimeofday()`(2), advancing or retarding it by the time specified by the timeval `delta`. If `delta` is negative, the clock is slowed down by incrementing it more slowly than normal until the correction is complete. If `delta` is positive, a larger increment than normal is used. The skew used to perform the correction is generally a fraction of one percent. Thus, the time is always a monotonically increasing function. A time correction from an earlier call to `adjtime()` may not be finished when `adjtime()` is called again. If `olddelta` is non-`NULL`, the structure pointed to will contain, upon return, the number of microseconds still to be corrected from the earlier call.

`adjtime()` may be used by time servers that synchronize the clocks of computers in a local area network. Such time servers would slow down the clocks of some machines and speed up the clocks of others to bring them to the average network time.

Appropriate privilege is required to adjust the system time.

Return Value

On success, 0 is returned. On error, -1 is returned and the global variable `errno` is set appropriately.

Errors

EFAULT

An argument points outside the process's allocated address space.

EPERM

The process does not have appropriate privilege.

alphasort64

Name

`alphasort64` — Comparison function for directory scanning (Large File Support)

Synopsis

```
#include <dirent.h>
int alphasort64(const struct dirent64 ** d1, const struct dirent64
** d2);
```

Description

`alpahsort64()` is a large-file version of the `alphasort()` function as defined in POSIX 1003.1-2008 (ISO/IEC 9945-2009). If differs only in that the *d1* and *d2* parameters are of type `dirent64` instead of type `dirent`.

asprintf

Name

`asprintf` — write formatted output to a dynamically allocated string

Synopsis

```
#include <stdio.h>
int asprintf(char ** restrict ptr, const char * restrict format,
...);
```

Description

The `asprintf()` function shall behave as `sprintf()`, except that the output string shall be dynamically allocated space of sufficient length to hold the resulting string. The address of this dynamically allocated string shall be stored in the location referenced by *ptr*.

Return Value

Refer to `fprintf()`.

Errors

Refer to `fprintf()`.

backtrace, backtrace_symbols, backtrace_symbols_fd

Name

`backtrace`, `backtrace_symbols`, `backtrace_symbols_fd` — runtime stack back tracing

Synopsis

```
#include <execinfo.h>
int backtrace(void **array, int size);
char **backtrace_symbols(void *const *array, int size);
void backtrace_symbols_fd(void *const *array, int size, int fd);
```

Description

`backtrace()` obtains a backtrace for the current thread as a list of pointers filled in to *array*. The *size* parameter describes the number of elements that will fit into *array*, `backtrace()` will truncate the list if necessary. A backtrace is a list of currently active function calls in a thread; each function call allocates a new stack frame and `backtrace()` obtains the return address from each stack frame.

`backtrace_symbols()` translates the information obtained from `backtrace()` into an array of strings. *array* is a pointer to an array of addresses as obtained from `backtrace()`. *size* is the number of entries in *array*, and should be the return value of the call to `backtrace()`. The strings contain the function name if it can be determined, a hedxadecimal offset into the function, and the actual return address in hexadecimal. Note that the pointer returned by `backtrace_symbols()` is obtained by an internal call to `malloc()` and should be freed when no longer needed.

`backtrace_symbols_fd()` performs the same transformation as `backtrace_symbols()` given the same argument pair *array*, *size*, but writes the strings to the file descriptor contained in *fd*. This avoids the allocation of string space.

Return Value

`backtrace()` returns the number of entries placed into *array*, no more than *size*. If the value is less than *size*, the full backtrace was returned; else it may have been truncated.

On success, `backtrace_symbols()` returns a pointer to an array of strings, which will have *size* entries. On error, NULL is returned.

Errors

No errors are defined for these functions. If `backtrace_symbols_fd()` fails, it will be due to a failure in the call to `malloc()`, and `errno` will be set accordingly.

Notes

The ability to obtain useful backtrace information, in particular function names, is dependent on a number of factors at the time of program construction, such as compiler optimization options. Even if the program itself is constructed so as to make symbols visible, the call trace may descend into system libraries which have not been so constructed.

Inlined functions do not have stack frames, and functions declared as static are not exposed and so will not be available in the backtrace.

See Also

```
malloc()
```

basename

Name

basename — return the last component of a file name

Synopsis

```
#include <libgen.h>
char * basename(const char * path);
```

Description

In the source standard, `basename()` is implemented as a macro causing it to behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), and is equivalent to the function `__xpg_basename()`. If the macro is undefined, `basename()` from the binary standard is used, with differences as described here:

The string identified by `path` shall not be modified.

If `path` is `"/"`, or ends with a trailing `'/'` character, the `basename()` function shall return a pointer to an empty string.

Return Value

On success, the `basename()` function shall return a pointer to the final component of `path`. Otherwise, it shall return a null pointer.

See Also

```
__xpg_basename()
```

bind_textdomain_codeset

Name

`bind_textdomain_codeset` — specify encoding for message retrieval

Synopsis

```
#include <libintl.h>
char * bind_textdomain_codeset (const char * domainname , const char
* codeset );
```

Description

The `bind_textdomain_codeset()` function can be used to specify the output codeset for message catalogs for domain *domainname*. The *codeset* argument shall be a valid codeset name which can be used tor the *iconv_open* function, or a null pointer. If the *codeset* argument is the null pointer, then function returns the currently selected codeset for the domain with the name *domainname*. It shall return a null pointer if no codeset has yet been selected.

Each successive call to `bind_textdomain_codeset()` function overrrides the settings made by the preceding call with the same *domainname*.

The `bind_textdomain_codeset()` function shall return a pointer to a string containing the name of the selected codeset. The string shall be allocated internally in the function and shall not be changed or freed by the user.

Parameters

domainname

> The *domainname* argument is applied to the currently active LC_MESSAGE locale. It is equivalent in syntax and meaning to the *domainname* argument to *textdomain*, except that the selection of the domain is valid only for the duration of the call.

codeset

> The name of the output codeset for the selected domain, or NULL to select the current codeset.

> If *domainname* is the null pointer, or is an empty string, `bind_textdomain_codeset()` shall fail, but need not set `errno`.

Return Value

Returns the currently selected codeset name. It returns a null pointer if no codeset has yet been selected.

Errors

ENOMEM

> Insufficient memory available to allocate return value.

See Also

gettext, dgettext, ngettext, dngettext, dcgettext, dcngettext, textdomain, bindtextdomain

bindresvport

Name

bindresvport — bind socket to privileged IP port

Synopsis

```
#include <sys/types.h>
#include <rpc/rpc.h>
int bindresvport(int sd, struct sockaddr_in * sin);
```

Description

If the process has appropriate privilege, the `bindresvport()` function shall bind a socket to an anonymous privileged IP port, that is, arbitrarily selected from the range `512` through `1023`.

If the bind is successful and *sin* is not `NULL`, and the port number bound to is returned in the *sin_port* member of *sin*. Any caller-supplied value of *sin_port* is ignored.

If *sin* is `NULL`, the address family is taken to be `AF_INET` and an available privileged port is bound to. Since there is no `sockaddr_in` structure, the port number chosen cannot be returned. The `getsockname()` may be used to query for this information.

Return Value

On success, 0 is returned. On error, -1 is returned and `errno` is set to indicate the error.

Errors

`bindresvport()` may fail in the same way as `bind()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003). The following additional or differing failures may occur:

EADDRINUSE

All privileged ports are in use.

EAFNOSUPPORT

The specified address is not a valid address for the address family of the specified socket, or the address family is not supported.

EPFNOSUPPORT

The same meaning as `EAFNOSUPPORT`. Some older implementations may return this error instead.

Note: At this time, only `AF_INET` is supported. Applications should be prepared for either the `EAFNOSUPPORT` or `EPFNOSUPPORT` error to be indicated.

bindtextdomain

Name

`bindtextdomain` — specify the location of a message catalog

Synopsis

```
#include <libintl.h>
char * bindtextdomain(const char * domainname, const char * dirname);
```

Description

The `bindtextdomain()` shall set the the base directory of the hierarchy containing message catalogs for a given message domain.

The `bindtextdomain()` function specifies that the *domainname* message catalog can be found in the *dirname* directory hierarchy, rather than in the system default locale data base.

If *dirname* is not `NULL`, the base directory for message catalogs belonging to domain *domainname* shall be set to *dirname*. If *dirname* is `NULL`, the base directory for message catalogs shall not be altered.

The function shall make copies of the argument strings as needed.

dirname can be an absolute or relative pathname.

> **Note:** Applications that wish to use `chdir()` should always use absolute pathnames to avoid misadvertently selecting the wrong or non-existant directory.

If *domainname* is the null pointer, or is an empty string, `bindtextdomain()` shall fail, but need not set `errno`.

The `bindtextdomain()` function shall return a pointer to a string containing the name of the selected directory. The string shall be allocated internally in the function and shall not be changed or freed by the user.

Return Value

On success, `bindtextdomain()` shall return a pointer to a string containing the directory pathname currently bound to the domain. On failure, a `NULL` pointer is returned, and the global variable `errno` may be set to indicate the error.

Errors

`ENOMEM`

Insufficient memory was available.

See Also

gettext, dgettext, ngettext, dngettext, dcgettext, dcngettext, textdomain, bind_textdomain_codeset

cfmakeraw

Name

cfmakeraw — get and set terminal attributes

Synopsis

```
#include <termios.h>
void cfmakeraw(struct termios * termios_p);
```

Description

The `cfmakeraw()` function shall set the attributes of the `termios` structure referenced by `termios_p` as follows:

```
termios_p->c_iflag &= ~(IGNBRK|BRKINT|PARMRK|ISTRIP
                        |INLCR|IGNCR|ICRNL|IXON);

termios_p->c_oflag &= ~OPOST;

termios_p->c_lflag &= ~(ECHO|ECHONL|ICANON|ISIG|IEXTEN);

termios_p->c_cflag &= ~(CSIZE|PARENB);

termios_p->c_cflag |= CS8;
```

`termios_p` shall point to a `termios` structure that contains the following members:

```
tcflag_t c_iflag;       /* input modes */
tcflag_t c_oflag;       /* output modes */
tcflag_t c_cflag;       /* control modes */
tcflag_t c_lflag;       /* local modes */
cc_t c_cc[NCCS];        /* control chars */
```

cfsetspeed

Name

`cfsetspeed` — set terminal input and output data rate

Synopsis

```
#include <termios.h>
int cfsetspeed(struct termios *t, speed_t speed);
```

Description

The `cfsetspeed()` function shall set the input and output speeds in `t` to the value specified by `speed`. The effects of the function on the terminal as described below do not become effective, nor are all errors detected, until the `tcsetattr()` function is called. Certain values for baud rates set in `termios` and passed to `tcsetattr()` have special meanings.

Return Value

On success, 0 is returned. On error, -1 is returned and the global variable `errno` is set appropriately.

Errors

EINVAL

   Invalid `speed` argument

clearerr_unlocked

Name

`clearerr_unlocked` — non-thread-safe clearerr

Description

`clearerr_unlocked()` is the same as `clearerr()`, except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

daemon

Name

daemon — run in the background

Synopsis

```
#include <unistd.h>
int daemon(int nochdir, int noclose);
```

Description

The daemon() function shall create a new process, detached from the controlling terminal. If successful, the calling process shall exit and the new process shall continue to execute the application in the background. If *nochdir* evaluates to true, the current directory shall not be changed. Otherwise, daemon() shall change the current working directory to the root (`/'). If *noclose* evaluates to true the standard input, standard output, and standard error file descriptors shall not be altered. Otherwise, daemon() shall close the standard input, standard output and standard error file descriptors and reopen them attached to /dev/null.

Return Value

On error, -1 is returned, and the global variable errno is set to any of the errors specified for the library functions fork() and setsid().

dcgettext

Name

dcgettext — perform domain and category specific lookup in message catalog

Synopsis

```
#include <libintl.h>
```

```
#include <locale.h>
char * dcgettext(const char * domainname, const char * msgid, int
category);
```

Description

The `dcgettext()` function is a domain specified version of `gettext()`.

The `dcgettext()` function shall lookup the translation in the current locale of the message identified by *msgid* in the domain specified by *domainname* and in the locale category specified by *category*. If *domainname* is NULL, the current default domain shall be used. The *msgid* argument shall be a NULL-terminated string to be matched in the catalogue. *category* shall specify the locale category to be used for retrieving message strings. The category parameter shall be one of *LC_CTYPE*, *LC_COLLATE*, *LC_MESSAGES*, *LC_MONETARY*, *LC_NUMERIC*, or *LC_TIME*. The default domain shall not be changed by a call to `dcgettext()`.

Return Value

If a translation was found in one of the specified catalogs, it shall be converted to the current locale's codeset and returned. The resulting NULL-terminated string shall be allocated by the dcgettext function, and must not be modified or freed. If no translation was found, or category was invalid, *msgid* shall be returned.

Errors

`dcgettext()` shall not modify the `errno` global variable.

See Also

gettext, dgettext, ngettext, dngettext, dcngettext, textdomain, bindtextdomain, bind_textdomain_codeset

dcngettext

Name

`dcngettext` — perform domain and category specific lookup in message catalog with plural

Synopsis

```
#include <libintl.h>
```

```
#include <locale.h>
char * dcngettext(const char * domainname, const char * msgid1, const
char * msgid2, unsigned long int n, int category);
```

Description

The `dcngettext()` function is a domain specific version of gettext, capable of returning either a singular or plural form of the message. The `dcngettext()` function shall lookup the translation in the current locale of the message identified by *msgid1* in the domain specified by *domainname* and in the locale category specified by *category*. If *domainname* is NULL, the current default domain shall be used. The *msgid1* argument shall be a NULL-terminated string to be matched in the catalogue. *category* shall specify the locale category to be used for retrieving message strings. The *category* parameter shall be one of *LC_CTYPE*, *LC_COLLATE*, *LC_MESSAGES*, *LC_MONETARY*, *LC_NUMERIC*, or *LC_TIME*. The default domain shall not be changed by a call to `dcngettext()`. If *n* is 1 then the singular version of the message is returned, otherwise one of the plural forms is returned, depending on the value of *n* and the current locale settings.

Return Value

If a translation corresponding to the value of *n* was found in one of the specified catalogs for *msgid1*, it shall be converted to the current locale's codeset and returned. The resulting NULL-terminated string shall be allocated by the `dcngettext()` function, and must not be modified or freed. If no translation was found, or *category* was invalid, *msgid1* shall be returned if *n* has the value 1, otherwise *msgid2* shall be returned.

Errors

`dcngettext()` shall not modify the `errno` global variable.

See Also

gettext, dgettext, ngettext, dngettext, dcgettext, textdomain, bindtextdomain, bind_textdomain_codeset

dgettext

Name

dgettext — perform lookup in message catalog for the current LC_MESSAGES locale

Synopsis

```
#include <libintl.h>
char * dgettext(const char * domainname, const char * msgid);
```

Description

dgettext() is a domain specified version of gettext().

The dgettext() function shall search the currently selected message catalogs in the domain *domainname* for a string identified by the string *msgid*. If a string is located, that string shall be returned. The domain specified by *domainname* applies to the currently active LC_MESSAGE locale. The default domain shall not be changed by a call to dgettext().

> **Note:** The usage of *domainanme* is equivalent in syntax and meaning to the textdomain() function's application of *domainname*, except that the selection of the domain in dgettext() is valid only for the duration of the call.

The dgettext() function is equivalent to dcgettext(domainname, msgid, LC_MESSAGES).

Return Value

On success of a *msgid* query, the translated NULL-terminated string is returned. On error, the original *msgid* is returned. The length of the string returned is undetermined until dgettext() is called.

Errors

dgettext() shall not modify the errno global variable.

See Also

gettext, dgettext, ngettext, dngettext, dcgettext, dcngettext, textdomain, bindtextdomain, bind_textdomain_codeset

dl_iterate_phdr

Name

`dl_iterate_phdr` — iterate over a program's loaded shared objects

Synopsis

```
#include <link.h>
int dl_iterate_phdr(int(*callback) (struct dl_phdr_info *, size_t,
void *), void *data);
```

Description

`dl_iterate_phdr()` allows a program to iterate over the shared objects it has loaded. The function described by the *callback* parameter is called once for each loaded shared object, allowing an action to be taken for each one. *callback* is called with three arguments which are filled in by the implementation: a pointer to a structure of type `dl_phdr_info` containing information about the shared object; an integer size of the structure; and a copy of the *data* argument to `dl_iterate_phdr()`. If *callback* returns a non-zero value, `dl_iterate_phdr()` will stop processing, even if there are unprocessed shared objects. The order of processing is unspecified.

The `dl_phdr_info` structure has the following members (note that on 64-bit architectures the types here shown as Elf32_*type* will instead be Elf64_*type*):

```
Elf32_Addr dlpi_addr;
const char *dlpi_name;
const Elf32_Phdr *dlpi_phdr;
Elf32_Half dlpi_phnum;
unsigned long long int dlpi_adds;
unsigned long long int dlpi_subs;
size_t dlpi_tls_modid;
```

```
void *dlpi_tls_data;
```

dlpi_addr contains the base address of the shared object.

dlpi_name is a null-terminated string giving the pathname from which the shared object was loaded.

dlpi_phdr is a pointer to an array of program headers for this shared object, while *dlpi_phnum* is the number of entries in this array.

dlpi_adds and *dlpi_subs* are incremented when shared objects are added or removed, respectively.

dlpi_tls_modid contains the module ID used in TLS relocations, if there is a PT_TLS segment. Otherwise the value shall be zero.

dlpi_tls_data contains the address of the calling thread's instance of this module's PT_TLS segment, if there is one and it has been allocated in the calling thread. Otherwise the value shall be a null pointer.

Some implementations may not provide all fields in dl_phdr_info, although the first four are always mandatory. Applications are advised to have the callback function check the size parameter before examining the later members.

Return Value

The dl_iterate_phdr() function returns whatever value was returned by the last call to *callback*. This will be zero if processing completed normally, since processing does not continue unless the callback function returns zero.

Errors

No errors are defined by dl_iterate_phdr(); as noted the callback function must use a zero return to indicate success but may assign any meaning it wishes to non-zero returns.

dngettext

Name

dngettext — perform lookup in message catalog for the current locale

Synopsis

```
#include <libintl.h>
char * dngettext(const char * domainname, const char * msgid1, const
char * msgid2, unsigned long int n);
```

Description

dngettext() shall be equivalent to a call to

```
dcngettext(domainname, msgid1, msgid2, n, LC_MESSAGES)
```

See dcngettext() for more information.

See Also

gettext, dgettext, ngettext, dcgettext, dcngettext, textdomain, bindtextdomain, bind_textdomain_codeset

drand48_r

Name

drand48_r — reentrantly generate pseudorandom numbers in a uniform distribution

Synopsis

```
#include <stdlib.h>
int drand48_r(struct drand48_data * buffer, double * result);
```

Description

The interface `drand48_r()` shall function in the same way as the interface `drand48()`, except that `drand48_r()` shall use the data in *buffer* instead of the global random number generator state.

Before it is used, *buffer* must be initialized, for example, by calling `lcong48_r()`, `seed48_r()`, or `srand48_r()`, or by filling it with zeroes.

duplocale

Name

duplocale — provide new handle for selection of locale

Synopsis

```
#include <locale.h>
locale_t duplocale(locale_t locale);
```

Description

The `duplocale()` function shall provide a new locale object based on the locale object provided in *locale*, suitable for use in the `newlocale()` or `uselocale()` functions. The new object may be released by calling `freelocale()`.

Return Value

On success, the `duplocale()` function shall return a locale object. Otherwise, it shall return NULL, and set errno to indicate the error.

Errors

The `duplocale()` function shall fail if:

ENOMEM

    Insufficient memory.

See Also

`setlocale()`, `freelocale()`, `newlocale()`, `uselocale()`

endutent

Name

endutent — access utmp file entries

Synopsis

```
#include <utmp.h>
void endutent(void);
```

Description

endutent() closes the utmp file. It should be called when the user code is done accessing the file with the other functions.

epoll_create

Name

`epoll_create` — open an epoll file descriptor

Synopsis

```
#include <sys/epoll.h>
int epoll_create(int size);
```

Description

The epoll API, which consists of the interfaces `epoll_create()`, `epoll_ctl()`, and `epoll_wait()`, shall support all file descriptors compatible with `poll()`. These interfaces shall be usable in either level-triggered or edge-triggered mode. In level-triggered mode, epoll has similar semantics to `poll()`, and can be used as a faster replacement for it. In edge-triggered mode, epoll shall only report events for a file descriptor when changes occur on it.

The `epoll_create()` interface shall open an epoll file descriptor by allocating an event backing store of approximately size *size*. The *size* parameter is a hint to the kernel about how large the event storage should be, not a rigidly-defined maximum size.

Return Value

On success, `epoll_create()` shall return the file descriptor, a non-negative integer that shall be used for subsequent epoll calls. It should be closed with the `close()` function.

On failure, `epoll_create()` shall return –1 and set `errno` as follows.

Errors

EINVAL

The *size* parameter is not positive.

ENFILE

The maximum number of open files has been reached by the system.

ENOMEM

Not enough memory to create the kernel object.

See Also

`close()`, `epoll_ctl()`, `epoll_wait()`, `poll()`.

epoll_ctl

Name

`epoll_ctl` — control an epoll file descriptor

Synopsis

```
#include <sys/epoll.h>
int epoll_ctl(int epfd, int op, int fd, struct epoll_event * event);
```

Description

The interface `epoll_ctl()` shall control an epoll file descriptor.

The parameter `epfd` shall specify the epoll file descriptor to control.

The parameter `op` shall specify the operation to perform on the specified target file descriptor.

The parameter `fd` shall specify the target file descriptor on which to perform the specified operation.

The parameter `event` shall specify the object associated with the target file descriptor. The `events` member of the `event` parameter is a bit set composed of the event types listed below.

Event types

EPOLLERR

An error condition occurred on the target file descriptor. It shall not be necessary to set this event in `events`; this interface shall always wait for it.

EPOLLET

This event shall set edge-triggered behavior for the target file descriptor. The default epoll behavior shall be level-triggered.

EPOLLHUP

A hang up occurred on the target file descriptor. It shall not be necessary to set this event in `events`; this interface shall always wait for it.

EPOLLIN

The file is accessible to `read()` operations.

EPOLLONESHOT

This event shall set one-shot behavior for the target file descriptor. After `epoll_wait()` retrieves an event, the file descriptor shall be disabled and epoll shall not report any other events. To reenable the file descriptor with a new event mask, the user should invoke `epoll_ctl()` with `EPOLL_CTL_MOD` in the `op` parameter.

EPOLLOUT

The file is accessible to `write()` operations.

EPOLLPRI

Urgent data exists for `read()` operations.

EPOLLRDHUP

> A stream socket peer closed the connection, or else the peer shut down the writing half of the connection.

Values of the op parameter

EPOLL_CTL_ADD

> Associate *event* with the file described by *fd*, and add *fd* to the epoll descriptor *epfd*.

EPOLL_CTL_DEL

> Remove *fd* from *epfd*, and ignore *event*, which can be NULL.

EPOLL_CTL_MOD

> Change the event *event* associated with *fd*.

Return Value

On success, epoll_ctl() shall return 0.

On failure, epoll_ctl() shall return -1 and set errno as follows.

Errors

EBADF

> The parameter *epfd* or the parameter *fd* is an invalid file descriptor.

EEXIST

> The parameter *op* was EPOLL_CTL_ADD, but the file descriptor *fd* is already in *epfd*.

EINVAL

> The parameter *epfd* is invalid, or it is the same as *fd*, or the operation specified by the parameter *op* is unsupported.

ENOENT

> The parameter *op* was EPOLL_CTL_MOD or EPOLL_CTL_DEL, but the file descriptor *fd* is not in *epfd*.

ENOMEM

> Not enough memory for the operation specified by the parameter *op*.

EPERM

> The file specified by *fd* does not support epoll.

See Also

close(), epoll_create(), epoll_wait(), poll().

epoll_wait

Name

epoll_wait — wait for I/O events on an epoll file descriptor

Synopsis

```
#include <sys/epoll.h>
int epoll_wait(int epfd, struct epoll_event * events, int maxevents,
int timeout);
```

Description

The interface `epoll_wait()` shall wait for events on the epoll file descriptor specified by the parameter *epfd*.

Upon success, the output parameter *events* shall refer to an area of memory containing epoll_event structures available to the caller. The `data` members of these structures shall contain the data set by the user with the interface `epoll_ctl()`. The `events` members shall contain the event bit field that was returned.

The parameter *maxevents* shall specify the maximum number of events that `epoll_wait()` may return in the output parameter *events*. The value of this parameter should be greater than `0`.

The parameter *timeout* shall specify the maximum number of milliseconds that `epoll_wait()` shall wait for events. If the value of this parameter is `0`, then `epoll_wait()` shall return immediately, even if no events are available, in which case the return code shall be `0`. If the value of *timeout* is `-1`, then `epoll_wait()` shall block until either a requested event occurs or the call is interrupted.

Return Value

On success, `epoll_wait()` shall return the number of file descriptors that are ready for the I/O that was requested, or else `0` if no descriptors became ready during *timeout*.

On failure, `epoll_wait()` shall return `-1` and set `errno` as follows.

Errors

EBADF

> The parameter *epfd* is not a valid file descriptor.

EFAULT

> The area of memory referenced by the parameter *events* cannot be accessed with write permissions.

EINTR

> The call was interrupted by a signal handler before the *timeout* expired or any requested event took place.

EINVAL

> The parameter *epfd* is not a valid epoll file descriptor, or else the parameter *maxevents* is less than or equal to `0`.

See Also

`close()`, `epoll_ctl()`, `epoll_create()`, `poll()`.

erand48_r

Name

`erand48_r` — reentrantly generate pseudorandom numbers in a uniform distribution

Synopsis

```
#include <stdlib.h>
int erand48_r(unsigned short[3] xsubi, struct drand48_data *
buffer, double * result);
```

Description

The interface `erand48_r()` shall function in the same way as the interface `erand48()`, except that `erand48_r()` shall use the data in *buffer* instead of the global random number generator state.

Before it is used, *buffer* must be initialized, for example, by calling `lcong48_r()`, `seed48_r()`, or `srand48_r()`, or by filling it with zeroes.

err

Name

`err` — display formatted error messages

Synopsis

```
#include <err.h>
void err(int eval, const char * fmt, ...);
```

Description

The `err()` function shall display a formatted error message on the standard error stream. First, `err()` shall write the last component of the program name, a colon character, and a space character. If *fmt* is non-NULL, it shall be used as a format string for the `printf()` family of functions, and `err()` shall write the formatted message, a colon character, and a space. Finally, the error message string affiliated with the current value of the global variable `errno` shall be written, followed by a newline character.

The `err()` function shall not return, the program shall terminate with the exit value of *eval*.

See Also

`error()`, `errx()`

Return Value

None.

Errors

None.

error

Name

error — print error message

Synopsis

```
#include <err.h>
void error(int exitstatus, int errnum, const char * format, ...);
```

Description

`error()` shall print a message to standard error.

`error()` shall build the message from the following elements in their specified order:

1. the program name. If the application has provided a function named `error_print_progname()`, `error()` shall call this to supply the program name; otherwise, `error()` uses the content of the global variable `program_name`.

2. the colon and space characters, then the result of using the printf-style *format* and the optional arguments.

3. if *errnum* is nonzero, `error()` shall add the colon and space characters, then the result of `strerror(errnum)`.

4. a newline.

If *exitstatus* is nonzero, `error()` shall call `exit(exitstatus)`.

See Also

`err()`, `errx()`

errx

Name

errx — display formatted error message and exit

Synopsis

```
#include <err.h>
void errx(int eval, const char * fmt, ...);
```

Description

The errx() function shall display a formatted error message on the standard error stream. The last component of the program name, a colon character, and a space shall be output. If fmt is non-NULL, it shall be used as the format string for the printf() family of functions, and the formatted error message, a colon character, and a space shall be output. The output shall be followed by a newline character.

errx() does not return, but shall exit with the value of eval.

Return Value

None.

Errors

None.

See Also

error(), err()

fcntl

Name

fcntl — file control

Description

fcntl() is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

Implementation may set O_LARGEFILE

According to POSIX 1003.1-2001 (ISO/IEC 9945-2003), only an application sets fcntl() flags, for example O_LARGEFILE. However, this specification also allows an implementation to set the O_LARGEFILE flag in the case where the programming environment is one of _POSIX_V6_ILP32_OFFBIG, _POSIX_V6_LP64_OFF64, _POSIX_V6_LPBIG_OFFBIG. See **getconf** and **c99** in POSIX 1003.1-2001 (ISO/IEC 9945-2003) for a description of these environments. Thus, calling fcntl() with the *F_GETFL* command may return O_LARGEFILE as well as flags explicitly set by the application in the case that both the implementation and the application support an off_t of at least 64 bits.

Additional flags

In addition to the available values for *cmd*, as documented in POSIX 1003.1-2001 (ISO/IEC 9945-2003), this specification permits the following constants.

F_GETSIG shall get the number of the signal to be sent when input or output can occur. If the value is 0, then SIGIO shall be sent. Otherwise, the value retrieved shall be the signal sent, and the signal handler can discover more information when installed with the SA_SIGINFO flag.

F_SETSIG shall set the number of the signal to be sent when input or output can occur. If the value is 0, then SIGIO shall be sent. Otherwise, the value set shall be the signal to be sent, and the signal handler can discover more information when installed with the SA_SIGINFO flag.

F_GETLK64 is analogous to the F_GETLK constant in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but shall provide a 64-bit interface on non-64-bit architectures. It is identical to F_GETLK on a 64-bit machine, but is provided in 64-bit environments for source code consistency among architectures.

F_SETLK64 is analogous to the F_SETLK constant in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but shall provide a 64-bit interface on non-64-bit architectures. It is identical to F_SETLK on a 64-bit machine, but is provided in 64-bit environments for source code consistency among architectures.

F_SETLKW64 is analogous to the F_SETLKW constant in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but provides a 64-bit interface on non-64-bit architectures. It is identical to F_SETLKW on a 64-bit machine, but is provided in 64-bit environments for source code consistency among architectures.

feof_unlocked

Name

`feof_unlocked` — non-thread-safe feof

Description

`feof_unlocked()` is the same as `feof()`, except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

ferror_unlocked

Name

`ferror_unlocked` — non-thread-safe ferror

Description

`ferror_unlocked()` is the same as `ferror()`, except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

fflush_unlocked

Name

`fflush_unlocked` — non thread safe fflush

Description

`fflush_unlocked()` is the same as `fflush()` except that it need not be thread safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

fgetc_unlocked

Name

`fgetc_unlocked` — non-thread-safe fgetc

Description

`fgetc_unlocked()` is the same as `fgetc()`, except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

fgets_unlocked

Name

`fgets_unlocked` — non-thread-safe fgets

Description

`fgets_unlocked()` is the same as `fgets()`, except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

fgetwc_unlocked

Name

`fgetwc_unlocked` — non thread safe fgetwc

Description

`fgetwc_unlocked()` is the same as `fgetwc()` except that it need not be thread safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

fgetws_unlocked

Name

`fgetws_unlocked` — non-thread-safe fgetws

Description

`fgetws_unlocked()` is the same as `fgetws()`, except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

fileno_unlocked

Name

`fileno_unlocked` — non-thread-safe fileno

Description

`fileno_unlocked()` is the same as `fileno()`, except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

flock

Name

`flock` — apply or remove an advisory lock on an open file

Synopsis

```
int flock(int fd, int operation);
```

Description

`flock()` applies or removes an advisory lock on the open file `fd`. Valid `operation` types are:

LOCK_SH

> Shared lock. More than one process may hold a shared lock for a given file at a given time.

LOCK_EX

> Exclusive lock. Only one process may hold an exclusive lock for a given file at a given time.

LOCK_UN

> Unlock.

LOCK_NB

> Don't block when locking. May be specified (by *or*ing) along with one of the other operations.

A single file may not simultaneously have both shared and exclusive locks.

Return Value

On success, 0 is returned. On error, -1 is returned and the global variable `errno` is set appropriately.

Errors

EWOULDBLOCK

> The file is locked and the `LOCK_NB` flag was selected.

EBADF

> `fd` is not a not an open file descriptor.

EINTR

> While waiting to acquire a lock, the call was interrupted by delivery of a signal caught by a handler.

EINVAL

> The operation is invalid.

ENOLCK

> The implementation ran out of memory for allocating lock records.

fputc_unlocked

Name

fputc_unlocked — non-thread-safe fputc

Description

fputc_unlocked() is the same as fputc(), except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for getc_unlocked().

fputs_unlocked

Name

fputs_unlocked — non-thread-safe fputs

Description

fputs_unlocked() is the same as fputs(), except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for getc_unlocked().

fputwc_unlocked

Name

fputwc_unlocked — non-thread-safe fputwc

Description

fputwc_unlocked() is the same as fputwc(), except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for getc_unlocked().

fputws_unlocked

Name

fputws_unlocked — non-thread-safe fputws

Description

fputws_unlocked() is the same as fputws(), except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for getc_unlocked().

fread_unlocked

Name

fread_unlocked — non-thread-safe fread

Description

fread_unlocked() is the same as fread(), except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for getc_unlocked().

freelocale

Name

freelocale — free a locale object

Synopsis

```
#include <locale.h>
void freelocale(locale_t locale);
```

Description

The `freelocale()` function shall free the locale object *locale*, and release any resources associated with it.

Return Value

None.

Errors

None defined.

See Also

`setlocale()`, `newlocale()`, `duplocale()`, `uselocale()`

fscanf

Name

fscanf — convert formatted input

Description

The `scanf()` family of functions shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except as noted below.

Differences

The `%s`, `%S` and `%[` conversion specifiers shall accept an option length modifier `a`, which shall cause a memory buffer to be allocated to hold the string converted. In such a case, the argument corresponding to the conversion specifier should be a reference to a pointer value that will receive a pointer to the allocated buffer. If there is insufficient memory to allocate a buffer, the function may set `errno` to ENOMEM and a conversion error results.

Note: This directly conflicts with the ISO C (1999) usage of `%a` as a conversion specifier for hexadecimal float values. While this conversion specifier should be supported, a format specifier such as `"%aseconds"` will have a different meaning on an LSB conforming system.

fstatfs

Name

`fstatfs` — (deprecated)

Synopsis

```
#include <sys/statfs.h>
int fstatfs(int fd, struct statfs * buf);
```

Description

The `fstatfs()` function returns information about a mounted file system. The file system is identified by *fd*, a file descriptor of an open file within the mounted filesystem. The results are placed in the structure pointed to by *buf*.

Fields that are undefined for a particular file system shall be set to `0`.

> **Note:** Application developers should use the `fstatvfs()` function to obtain general file system information. Applications should only use the `fstatfs()` function if they must determine the file system type, which need not be provided by `fstatvfs()`.

Return Value

On success, the `fstatfs()` function shall return 0 and set the fields of the structure idenfitied by *buf* accordingly. On error, the `fstatfs()` function shall return -1 and set `errno` accordingly.

Errors

EBADF

> *fd* is not a valid open file descriptor.

EFAULT

> *buf* points to an invalid address.

EIO

> An I/O error occurred while reading from or writing to the file system.

ENOSYS

> The filesystem *fd* is open on does not support `statfs()`.

fstatfs64

Name

fstatfs64 — (deprecated)

Synopsis

```
#include <sys/statfs.h>
int fstatfs64(int fd, struct statfs64 * buf);
```

Description

The `fstatfs64()` function returns information about a mounted file system. The file system is identified by `fd`, a file descriptor of an open file within the mounted filesystem. The results are placed in the structure pointed to by `buf`.

Fields that are undefined for a particular file system shall be set to `0`.

`fstatfs64()` is a large-file version of the `fstatfs()` function.

> **Note:** Application developers should use the `fstatvfs64()` function to obtain general file system information. Applications should only use the `fstatfs64()` function if they must determine the file system type, which need not be provided by `fstatvfs64()`.

Return Value

On success, the `fstatfs64()` function shall return 0 and set the fields of the structure idenfitied by `buf` accordingly. On error, the `fstatfs64()` function shall return -1 and set `errno` accordingly.

Errors

See `fstatfs()`.

fwrite_unlocked

Name

fwrite_unlocked — non-thread-safe fwrite

Description

`fwrite_unlocked()` is the same as `fwrite()`, except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

fwscanf

Name

fwscanf — convert formatted input

Description

The scanf() family of functions shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except as noted below.

Differences

The %s, %S and %[conversion specifiers shall accept an option length modifier a, which shall cause a memory buffer to be allocated to hold the string converted. In such a case, the argument corresponding to the conversion specifier should be a reference to a pointer value that will receive a pointer to the allocated buffer. If there is insufficient memory to allocate a buffer, the function may set errno to ENOMEM and a conversion error results.

> **Note:** This directly conflicts with the ISO C (1999) usage of %a as a conversion specifier for hexadecimal float values. While this conversion specifier should be supported, a format specifier such as "%aseconds" will have a different meaning on an LSB conforming system.

getdomainname

Name

getdomainname — get NIS domain name (DEPRECATED).

Synopsis

```
#include <unistd.h>
int getdomainname (char * name , size_t namelen );
```

Description

If the Network Information System (NIS) is in use, getdomainname() shall copy the NIS domain name to the supplied buffer identified by *name*, with maximum length *namelen*. If the NIS domain name is not currently set, getdomainname() shall copy the string "(none)" to the *name*. If *namelen* is less than the length of the string to be copied, getdomainname() shall either truncate the string to *namelen* characters and place it in *name* (without a terminating null character), or shall fail with EINVAL.

> **Note:** The NIS domain name is not the same as the domain portion of a fully qualified domain name (for example, in DNS).
>
> The LSB does not include other NIS functions, nor does it specify how NIS may affect other database functions. No conforming application can make use of this information beyond noting whether or not the domain name has been set. If the name is set to a value other than the string "(none)", the application should not imply that NIS is in use. Similarly, if it is set to "(none)", the application should not assume that NIS is not in use, although NIS functionality may be restricted in this case.

Return Value

On success, getdomainname() shall return 0. Otherwise, it shall return -1 and set errno to indicate the error.

Errors

EINVAL

> *name* is a null pointer.

EINVAL

> The buffer identified by *name* and *namelen* is of insufficient size to store the NIS domain name string, and the implementation considers this an error.

Future Directions

The LSB does not include other NIS interfaces, and a future version of this specification may remove this interface. Application developers should avoid using this interface where possible.

getdtablesize

Name

getdtablesize — get file descriptor table size (DEPRECATED)

Synopsis

```
#include <unistd.h>
int getdtablesize (void );
```

Description

The function getdtablesize() returns the number of files a process can have open.

> **Note:** The getdtablesize() function is deprecated. Portable applications should call sysconf() with the _SC_OPEN_MAX option instead.

Return Value

The getdtablesize() function returns the current soft limit as if obtained by a call to sysconf() with the _SC_OPEN_MAX option.

Errors

No errors are defined.

getgrent_r

Name

`getgrent_r` — reentrantly get entry in group file

Synopsis

```
#include <grp.h>
int getgrent_r(struct group * gbuf, char * buf, size_t buflen,
struct group * * gbufp);
```

Description

The reentrant interface `getgrent_r()` shall function in the same way as the interface `getgrent()`, except that `getgrent_r()` shall return the group name, group password, and group members in buffers provided by the caller, rather than as a pointer to static storage.

The parameter `gbuf` contains the struct group that was read from the stream, if any.

The parameter `buf` contains additional strings, if any.

The parameter `buflen` specifies the size of `buf`.

The parameter `*gbufp` returns a pointer to the struct group in `*gbuf`.

Return Value

On success, `getgrent_r()` shall return `0`, and `*gbufp` shall contain a pointer to the result.

On failure, `*gbufp` shall contain `NULL`, and `getgrent_r()` shall return an error as follows.

Errors

ENOENT

No more group entries.

ERANGE

Not enough buffer space. Specify a larger buffer and try again.

getgrouplist

Name

`getgrouplist` — get groups a user belongs to

Synopsis

```
#include <grp.h>
int getgrouplist(const char * user, gid_t group, gid_t * groups, int
* ngroups);
```

Description

The `getgrouplist()` function shall fill in the array *groups* with the supplementary groups for the user specified by *user*. On entry, *ngroups* shall refer to an integer containing the maximum number of elements in the *groups* array. The group *group* shall also be included in the values returned in *groups*. It is expected that *group* would be specified as the user's primary group from the password file (obtainable via `getpwnam()` or a similar function).

Return Value

If on entry the value referenced by *ngroups* was greater than or equal to the number of supplementary group identifiers to be copied to the array identified by *groups*, `getgrouplist()` shall return the number of group identifiers actually copied, and shall set the value referenced by *ngroups* to this value.

If on entry the value referenced by *ngroups* was less than the number of supplementary group identifiers, `getgrouplist()` shall return `-1`. The initial *ngroups* entries in *groups* shall be overwritten.

If the number of groups exceeds the input *ngroups* value, then as well as returning `-1`, *ngroups* shall be set to the number of groups that would have been placed in *groups* if it had been large enough.

> **Note:** In such a case, the caller can use the information returned to make a further `getgrouplist()` call with a correctly sized *groups* array.

If *user* does not refer to a valid user on the system, then the behavior of this function is undefined.

Errors

None defined.

See Also

`getgroups()`

gethostbyaddr_r

Name

gethostbyaddr_r — find network host database entry matching host name
(DEPRECATED)

Synopsis

```
#include <netdb.h>
int gethostbyaddr_r(const void * restrict addr, socklen_t len, int
type, struct hostent * restrict result_buf, char * restrict buf,
size_t buflen, struct hostent * * restrict result, int * h_errnop);
```

Description

> **Note:** The gethostbyaddr_r() function is deprecated; applications should use
> getaddrinfo() instead.

gethostbyaddr_r() is a reentrant version of gethostbyaddr() that searches
the network host database for a host address match.

The gethostbyaddr_r() function shall search the network host database for an
entry of address family *type* with the host with address *addr*. The *len*
argument contains the length of the address referenced by *addr*.

If *type* is AF_INET, the *addr* argument shall be an in_addr structure. If *type* is
AF_INET6, the *addr* argument shall be an in6_addr structure. If *type* is any
other value, the behavior is unspecified.

The application must provide a buffer for the gethostbyaddr_r() to use
during the lookup process. The buffer is referenced by *buf*, and is of size
buflen. If the buffer is not of sufficient size, gethostbyaddr_r() may fail and
return ERANGE. If a matching entry is found in the database,
gethostbyaddr_r() shall copy the relevant information to the application
supplied hostent structure referenced by *result_buf*, and return a pointer to
this structure in **result*. If no matching entry is found, **result* shall be set to a
null pointer. Additional error information shall be set in the variable referenced
by *h_errnop*.

Return Value

On success, the gethostbyaddr_r() function shall return zero. If the return
value was ERANGE, the size of the buffer *buf*, indicated by *buflen*, was too
small. If the gethostbyaddr_r() function returns returns any other value, then
the variable referenced by *h_errnop* shall be set to indicate the cause as for
gethostbyaddr().

gethostbyname2

Name

`gethostbyname2` — find network host database entry matching host name (DEPRECATED)

Synopsis

```
int gethostbyname2(const char * restrict name, int af);
```

Description

Note: The `gethostbyname2()` function is deprecated; applications should use `getaddrinfo()` instead.

The `gethostbyname2()` function shall search the network host database for an entry with name *name*. This function is similar to the `gethostbyname()` function but additionally allows the search to be restricted to a particular address family specified by *af*.

Return Value

On success, the `gethostbyname2()` function shall return a pointer to a `hostent` structure if the requested entry was found, and a null pointer otherwise.

On unsuccessful completion, `gethostbyname2()` shall set `h_errno` as for `gethostbyname()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

Errors

The `gethostbyname2()` shall set `h_errno` as for `gethostbyname()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

gethostbyname2_r

Name

`gethostbyname2_r` — find network host database entry matching host name (DEPRECATED)

Synopsis

```
int gethostbyname2_r(const char * restrict name, int af, struct
hostent * restrict result_buf, char * restrict buf, size_t buflen,
struct hostent ** restrict result, int * restrict h_errnop);
```

Description

> **Note:** The `gethostbyname2_r()` function is deprecated; applications should use `getaddrinfo()` instead.

The `gethostbyname2_r()` function shall search the network host database for an entry with name *name*. `gethostbyname2_r()` is a reentrant version of `gethostbyname2()`. These functions are similar to the `gethostbyname()` and `gethostbyname_r()` functions but additionally allow the search to be restricted to a particular address family specified by *af*.

The application must provide a buffer for the `gethostbyname2_r()` function to use during the lookup process. The buffer is referenced by *buf*, and is of size *buflen*. If the buffer is not of sufficient size, `gethostbyname_r()` may fail and return ERANGE. If a matching entry is found in the database, `gethostbyname_r()` shall copy the relevant information to the application-supplied `hostent` structure referenced by *result_buf*, and return a pointer to this structure in *result. If no matching entry is found, *result shall be set to a null pointer. Additional error information shall be set in the variable referenced by *h_errnop*.

Return Value

On success, the `gethostbyname2_r()` function shall return zero. If the return value was ERANGE, the size of the buffer *buf*, indicated by *buflen*, was too small. If the `gethostbyname2_r()` function returns returns any other value, then the variable referenced by *h_errnop* shall be set to indicate the cause as for `gethostbyname_r()`.

gethostbyname_r

Name

`gethostbyname_r` — find network host database entry matching host name (DEPRECATED)

Synopsis

```
int gethostbyname_r(const char * restrict name, struct hostent *
restrict result_buf, char * restrict buf, size_t buflen, struct
hostent ** restrict result, int * restrict h_errnop);
```

Description

> **Note:** The `gethostbyname_r()` function is deprecated; applications should use `getaddrinfo()` instead.

`gethostbyname_r()` is a reentrant version of `gethostbyname()` that searches the network host database for a host name match.

The `gethostbyname_r()` function shall search the network host database for an entry with name *name*.

The application must provide a buffer for the `gethostbyname_r()` to use during the lookup process. The buffer is referenced by *buf*, and is of size *buflen*. If the buffer is not of sufficient size, `gethostbyname_r()` may fail and return ERANGE. If a matching entry is found in the database, `gethostbyname_r()` shall copy the relevant information to the application supplied `hostent` structure referenced by *result_buf*, and return a pointer to this structure in *result. If no matching entry is found, *result shall be set to a null pointer. Additional error information shall be set in the variable referenced by *h_errnop*.

Return Value

On success, the `gethostbyname_r()` function shall return zero. If the return value was ERANGE, the size of the buffer *buf*, indicated by *buflen*, was too small. If the `gethostbyname_r()` function returns returns any other value, then the variable referenced by *h_errnop* shall be set to indicate the cause as for `gethostbyname()`.

getloadavg

Name

getloadavg — get system load averages

Synopsis

```
#include <stdlib.h>
int getloadavg(double loadavg[], int nelem);
```

Description

getloadavg() returns the number of processes in the system run queue averaged over various periods of time. Up to *nelem* samples are retrieved and assigned to successive elements of *loadavg*[]. The system imposes a maximum of 3 samples, representing averages over the last 1, 5, and 15 minutes, respectively.

Return Value

If the load average could not be obtained, -1 is returned. Otherwise, the number of samples actually retrieved is returned.

getopt

Name

getopt — parse command line options

Synopsis

```
#include <unistd.h>
int getopt(int argc, char * const argv[], const char * optstring);

extern char *optarg;
```

```
extern int optind, opterr, optopt;
```

Description

The `getopt()` function shall parse command line arguments as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), with the following exceptions, where LSB and POSIX specifications vary. LSB systems shall implement the modified behaviors described below.

Argument Ordering

The `getopt()` function can process command line arguments referenced by *argv* in one of three ways:

PERMUTE

> the order of arguments in *argv* is altered so that all options (and their arguments) are moved in front of all of the operands. This is the default behavior.

> **Note:** This behavior has undefined results if *argv* is not modifiable. This is to support historic behavior predating the use of const and ISO C (1999). The function prototype was aligned with POSIX 1003.1-2001 (ISO/IEC 9945-2003) despite the fact that it modifies *argv*, and the library maintainers are unwilling to change this.

REQUIRE_ORDER

> The arguments in *argv* are processed in exactly the order given, and option processing stops when the first non-option argument is reached, or when the element of argv is "--". This ordering can be enforced either by setting the environment variable `POSIXLY_CORRECT`, or by setting the first character of *optstring* to '+'.

RETURN_IN_ORDER

> The order of arguments is not altered, and all arguments are processed. Non-option arguments (operands) are handled as if they were the argument to an option with the value 1 ('\001'). This ordering is selected by setting the first character of *optstring* to '-';

Option Characteristics

LSB specifies that:

• an element of *argv* that starts with "-" (and is not exactly "-" or "--") is an option element.

• characters of an option element, aside from the initial "-", are option characters.

POSIX specifies that:

• applications using `getopt()` shall obey the following syntax guidelines:

 • option name is a single alphanumeric character from the portable character set

 • option is preceded by the '-' delimiter character

 • options without option-arguments should be accepted when grouped behind one '-' delimiter

 • each option and option-argument is a separate argument

- option-arguments are not optional

- all options should precede operands on the command line

- the argument "--" is accepted as a delimiter indicating the end of options and the consideration of subsequent arguments, if any, as operands

- historical implementations of `getopt()` support other characters as options as an allowed extension, but applications that use extensions are not maximally portable.

- support for multi-byte option characters is only possible when such characters can be represented as type `int`.

- applications that call any utility with a first operand starting with '-' should usually specify "--" to mark the end of the options. Standard utilities that do not support this guideline indicate that fact in the OPTIONS section of the utility description.

Extensions

LSB specifies that:

- if a character is followed by two colons, the option takes an optional argument; if there is text in the current *argv* element, it is returned in *optarg*, otherwise *optarg* is set to `0`.

- if *optstring* contains `W` followed by a semi-colon (;), then `-W foo` is treated as the long option `--foo`.

   Note: See `getopt_long()` for a description of long options.

- The first character of *optstring* shall modify the behavior of `getopt()` as follows:

  - if the first character is '+', then `REQUIRE_ORDER` processing shall be in effect (see above)

  - if the first character is '-', then `RETURN_IN_ORDER` processing shall be in effect (see above)

  - if the first character is ':', then `getopt()` shall return ':' instead of '?' to indicate a missing option argument, and shall not print any diagnostic message to `stderr`.

POSIX specifies that:

- the `-W` option is reserved for implementation extensions.

Return Values

LSB specifies the following additional `getopt()` return values:

- '\001' is returned if `RETURN_IN_ORDER` argument ordering is in effect, and the next argument is an operand, not an option. The argument is available in `optarg`.

Any other return value has the same meaning as for *POSIX*.

POSIX specifies the following `getopt()` return values:

- the next option character is returned, if found successfully.

- ':' is returned if a parameter is missing for one of the options and the first character of `optstring` is ':'.

- '?' is returned if an unknown option character not in `optstring` is encountered, or if `getopt()` detects a missing argument and the first character of `optstring` is not ':'.

- -1 is returned for the end of the option list.

Environment Variables

LSB specifies that:

- if the variable `POSIXLY_CORRECT` is set, option processing stops as soon as a non-option argument is encountered.

- the variable `_[PID]_GNU_nonoption_argv_flags_` (where *[PID]* is the process ID for the current process), contains a space separated list of arguments that should not be treated as arguments even though they appear to be so.

    Rationale: This was used by bash 2.0 to communicate to *GNU* libc which arguments resulted from wildcard expansion and so should not be considered as options. This behavior was removed in bash version 2.01, but the support remains in *GNU* libc.

    This behavior is DEPRECATED in this version of the LSB; future revisions of this specification may not include this requirement.

getopt_long

Name

`getopt_long` — parse command line options

Synopsis

```
#define _GNU_SOURCE
#include <getopt.h>
int getopt_long(int argc, char * const argv[], const char * opstring,
const struct option * longopts, int * longindex);
```

Description

`getopt_long()` works like `getopt()` except that it also accepts long options, started out by two dashes. Long option names may be abbreviated if the abbreviation is unique or is an exact match for some defined option. A long option may take a parameter, of the form `--arg=param` or `--arg param`.

longopts is a pointer to the first element of an array of struct `option` declared in `getopt.h` as:

```
struct option {
        const char *name;
        int has_arg;
        int *flag;
        int val;
```

```
    };
```

The fields in this structure have the following meaning:

name

> The name of the long option.

has_arg

> One of:

> `argument` (or 0) if the option does not take an argument,
> `uired_argument` (or 1) if the option requires an argument, or
> `ional_argument` (or 2) if the option takes an optional argument.

flag

> specifies how results are returned for a long option. If flag is NULL, then
> `getopt_long()` shall return *val*. (For example, the calling program may set
> val to the equivalent short option character.) Otherwise, `getopt_long()`
> returns 0, and *flag* shall point to a variable which shall be set to *val* if the
> option is found, but left unchanged if the option is not found.

val

> The value to return, or to load into the variable pointed to by flag.

If *longindex* is not NULL, it points to a variable which is set to the index of the
long option relative to *longopts*.

Return Value

`getopt_long()` returns the option character if a short option was found
successfully, or ":" if there was a missing parameter for one of the options, or "?"
for an unknown option character, or -1 for the end of the option list.

For a long option, `getopt_long()` returns *val* if *flag* is NULL, and 0 otherwise.
Error and -1 returns are the same as for `getopt()`, plus "?" for an ambiguous
match or an extraneous parameter.

getopt_long_only

Name

`getopt_long_only` — parse command line options

Synopsis

```
#define _GNU_SOURCE
```

```
#include <getopt.h>
int getopt_long_only(int argc, char * const argv[], const char *
optstring, const struct option * longopts, int * longindex);
```

Description

getopt_long_only() is like getopt_long(), but "-" as well as "--" can indicate a long option. If an option that starts with "-" (not "--") doesn't match a long option, but does match a short option, it is parsed as a short option instead.

> **Note:** The getopt_long_only() function is intended only for supporting certain programs whose command line syntax was designed before the Utility Syntax Guidelines of POSIX 1003.1-2001 (ISO/IEC 9945-2003) were developed. New programs should generally call getopt_long() instead, which provides the --option syntax for long options, which is preferred by GNU and consistent with POSIX 1003.1-2001 (ISO/IEC 9945-2003).

Return Value

getopt_long_only() returns the option character if the option was found successfully, or ":" if there was a missing parameter for one of the options, or "?" for an unknown option character, or -1 for the end of the option list.

getopt_long_only() also returns the option character when a short option is recognized. For a long option, they return val if flag is NULL, and 0 otherwise. Error and -1 returns are the same as for getopt(), plus "?" for an ambiguous match or an extraneous parameter.

getpagesize

Name

getpagesize — get memory page size (DEPRECATED)

Synopsis

```
#include <unistd.h>
int getpagesize (void );
```

Description

The function getpagesize() returns the number of bytes in a meory page.

> **Note:** The getpagesize() function is deprecated. Portable applications should use sysconf(_SC_PAGE_SIZE) instead.

Return Value

The getpagesize() function returns the current page size.

Errors

No errors are defined.

getprotobyname_r

Name

getprotobyname_r — retrieve information from the network protocol database by protocol name, reentrantly

Synopsis

```
#include <netdb.h>
int getprotobyname_r(const char * name, struct protoent * result_buf,
char * buf, size_t buflen, struct protoent * * result);
```

Description

The getprotobyname_r() function is a reentrant version of the getprotobyname() function.

The getprotobyname_r() function shall search the network protocol database for an entry with the name *name*.

If a matching entry is found in the database, this function shall copy the relevant information to the application-supplied protoent structure referenced by *result_buf*, and return a pointer to this structure in *result. If no matching entry is found, *result shall be set to a null pointer.

The array *buf* shall contain the string fields referenced by the protoent structure that was returned. The parameter *buflen* shall specify the array's size. 1024 bytes should be enough for most uses.

Return Value

On success, the getprotobyname_r() function shall return 0. If the return value was ERANGE, the size of the buffer *buf*, indicated by *buflen*, was too small.

getprotobynumber_r

Name

`getprotobynumber_r` — retrieve information from the network protocol database by protocol number, reentrantly

Synopsis

```
#include <netdb.h>
int getprotobynumber_r(int proto, struct protoent * result_buf, char
* buf, size_t buflen, struct protoent * * result);
```

Description

The `getprotobynumber_r()` function is a reentrant version of the `getprotobynumber()` function.

The `getprotobynumber_r()` function shall search the network protocol database for an entry with protocol number *proto*.

If a matching entry is found in the database, this function shall copy the relevant information to the application-supplied `protoent` structure referenced by *result_buf*, and return a pointer to this structure in *result. If no matching entry is found, *result shall be set to a null pointer.

The array *buf* shall contain the string fields referenced by the `protoent` structure that was returned. The parameter *buflen* shall specify the array's size. 1024 bytes should be enough for most uses.

Return Value

On success, the `getprotobynumber_r()` function shall return `0`. If the return value was ERANGE, the size of the buffer *buf*, indicated by *buflen*, was too small.

getprotoent_r

Name

getprotoent_r — read the next entry of the protocol database, reentrantly

Synopsis

```
#include <netdb.h>
int getprotoent_r(struct protoent * result_buf, char * buf, size_t
buflen, struct protoent * * result);
```

Description

The getprotoent_r() function is a reentrant version of the getprotoent() function.

The getprotoent_r() function shall search the network protocol database for the next entry.

If the next entry is found in the database, this function shall copy the relevant information to the application-supplied protoent structure referenced by result_buf, and return a pointer to this structure in *result. If no next entry is found, *result shall be set to a null pointer.

The array buf shall contain the string fields referenced by the protoent structure that was returned. The parameter buflen shall specify the array's size. 1024 bytes should be enough for most uses.

Return Value

On success, the getprotoent_r() function shall return zero.

If the return value was ENOENT, there were no more entries in the database.

If the return value was ERANGE, the size of the buffer buf, indicated by buflen, was too small.

getpwent_r

Name

getpwent_r — reentrantly get entry in passwd file

Synopsis

```
#include <pwd.h>
int getpwent_r(struct passwd * pwbuf, char * buf, size_t buflen,
struct passwd * * pwbufp);
```

Description

The reentrant interface getpwent_r() shall function in the same way as the interface getpwent(), except that getpwent_r() shall return the user name, user password, GECOS field, home directory, and shell program in buffers provided by the caller, rather than as a pointer to static storage.

The parameter *pwbuf* contains the struct passwd that was read from the stream, if any.

The parameter *buf* contains additional strings, if any.

The parameter *buflen* specifies the size of *buf*.

The parameter **pwbufp* returns a pointer to the struct passwd in **pwbuf*.

Return Value

On success, getpwent_r() shall return 0, and **pwbufp* shall contain a pointer to the result.

On failure, **pwbufp* shall contain NULL, and getpwent_r() shall return an error as follows.

Errors

ENOENT

No more password entries.

ERANGE

Not enough buffer space. Specify a larger buffer and try again.

getservbyname_r

Name

getservbyname_r — retrieve information from the network services database by service name, reentrantly

Synopsis

```
#include <netdb.h>
int getservbyname_r(const char * name, const char * proto, struct
servent * result_buf, char * buf, size_t buflen, struct servent * *
result);
```

Description

The getservbyname_r() function is a reentrant version of the getservbyname() function.

The getservbyname_r() function shall search the network services database for an entry with the name *name*. The *proto* parameter shall restrict the search to entries with the specified protocol. If *proto* is NULL, getservbyname_r() may return entries with any protocol.

If a matching entry is found in the database, this function shall copy the relevant information to the application-supplied servent structure referenced by *result_buf*, and return a pointer to this structure in *result. If no matching entry is found, *result shall be set to a null pointer.

The array *buf* shall contain the string fields referenced by the servent structure that was returned. The parameter *buflen* shall specify the array's size. 1024 bytes should be enough for most uses.

Return Value

On success, the getservbyname_r() function shall return zero. If the return value was ERANGE, the size of the buffer *buf*, indicated by *buflen*, was too small.

getservbyport_r

Name

getservbyport_r — retrieve information from the network services database by service port, reentrantly

Synopsis

```
#include <netdb.h>
int getservbyport_r(int port, const char * proto, struct servent *
result_buf, char * buf, size_t buflen, struct servent * * result);
```

Description

The getservbyport_r() function is a reentrant version of the getservbyport() function.

The getservbyport_r() function shall search the network services database for an entry with the port *port*. The *proto* parameter shall restrict the search to entries with the specified protocol. If *proto* is NULL, getservbyport_r() may return entries with any protocol.

If a matching entry is found in the database, this function shall copy the relevant information to the application-supplied servent structure referenced by *result_buf*, and return a pointer to this structure in **result*. If no matching entry is found, **result* shall be set to a null pointer.

The array *buf* shall contain the string fields referenced by the servent structure that was returned. The parameter *buflen* shall specify the array's size. 1024 bytes should be enough for most uses.

Return Value

On success, the getservbyport_r() function shall return zero. If the return value was ERANGE, the size of the buffer *buf*, indicated by *buflen*, was too small.

getservent_r

Name

getservent_r — read the next entry of the network services database, reentrantly

Synopsis

```
#include <netdb.h>
int getservent_r(struct servent * result_buf, char * buf, size_t
buflen, struct servent * * result);
```

Description

The getservent_r() function is a reentrant version of the getservent() function.

The getservent_r() function shall search the network services database for the next entry.

If the next entry is found in the database, this function shall copy the relevant information to the application-supplied servent structure referenced by *result_buf*, and return a pointer to this structure in *result. If no next entry is found, *result shall be set to a null pointer.

The array *buf* shall contain the string fields referenced by the servent structure that was returned. The parameter *buflen* shall specify the array's size. 1024 bytes should be enough for most uses.

Return Value

On success, the getservent_r() function shall return 0.

If the return value was ENOENT, there were no more entries in the database.

If the return value was ERANGE, the size of the buffer *buf*, indicated by *buflen*, was too small.

getsockopt

Name

getsockopt — get socket options

Synopsis

```
#include <sys/socket.h>
```

```
#include <netinet/ip.h>
int getsockopt(int socket, int level, int option_name, void *
restrict option_value, socklen_t * restrict option_len);
```

Description

The `getsockopt()` function shall behave as specified in *POSIX 1003.1-2001 (ISO/IEC 9945-2003)*, with the following extensions.

IP Protocol Level Options

If the `level` parameter is IPPROTO_IP, the following values shall be supported for `option_name` (see RFC 791:Internet Protocol for further details):

IP_OPTIONS

Get the Internet Protocol options sent with every packet from this socket. The `option_value` shall point to a memory buffer in which the options shall be placed; on entry `option_len` shall point to an integer value indicating the maximum size of the memory buffer, in bytes. On successful return, the value referenced by `option_len` shall be updated to the size of data copied to the buffer. For IPv4, the maximum length of options is 40 bytes.

IP_TTL

Get the current unicast Internet Protocol Time To Live value used when sending packets with this socket. The `option_value` shall point to a buffer large enough to hold the time to live value (at least 1 byte), and `option_len` shall point to an integer value holding the maximum size of that buffer. On successful return, the value referenced by `option_len` shall be updated to contain the number of bytes copied into the buffer, which shall be no larger than the initial value, and `option_value` shall point to an integer containing the time to live value.

IP_TOS

Get the Internet Protocol type of service indicator used when sending packets with this socket. The `option_value` shall point to a buffer large enough to hold the type of service indicator (at least 1 byte), and `option_len` shall point to an integer value holding the maximum size of that buffer. On successful return, the value referenced by `option_len` shall be updated to contain the number of bytes copied into the buffer, which shall be no larger than the initial value, and `option_value` shall point to an integer containing the time to live value.

gettext

Name

`gettext` — search message catalogs for a string

Synopsis

```
#include <libintl.h>
char * gettext(const char * msgid);
```

Description

The `gettext()` function shall search the currently selected message catalogs for a string identified by the string *msgid*. If a string is located, that string shall be returned.

The `gettext()` function is equivalent to `dcgettext(NULL, msgid, LC_MESSAGES)`.

Return Value

If a string is found in the currently selected message catalogs for *msgid*, then a pointer to that string shall be returned. Otherwise, a pointer to *msgid* shall be returned.

Applications shall not modify the string returned by `gettext()`.

Errors

None.

The `gettext()` function shall not modify `errno`.

See Also

dgettext, ngettext, dngettext, dcgettext, dcngettext, textdomain, bindtextdomain, bind_textdomain_codeset

getutent

Name

`getutent` — access user accounting database entries

Synopsis

```
#include <utmp.h>
struct utmp *getutent(void);
```

Description

The `getutent()` function shall read the next entry from the user accounting database.

Return Value

Upon successful completion, `getutent()` shall return a pointer to a `utmp` structure containing a copy of the requested entry in the user accounting database. Otherwise, a null pointer shall be returned. The return value may point to a static area which is overwritten by a subsequent call to `getutent()`.

Errors

None defined.

getutent_r

Name

`getutent_r` — access user accounting database entries

Synopsis

```
int getutent_r(struct utmp * buffer, struct utmp ** result);
```

Description

The `getutent_r()` function is a reentrant version of the `getutent()` function. On entry, `buffer` should point to a user supplied buffer to which the next entry in the database will be copied, and `result` should point to a location where the result will be stored.

Return Value

On success, `getutent_r()` shall return 0 and set the location referenced by `result` to a pointer to `buffer`. Otherwise, `getutent_r()` shall return -1 and set the location referenced by `result` to NULL.

getwc_unlocked

Name

`getwc_unlocked` — non-thread-safe getwc

Description

`getwc_unlocked()` is the same as `getwc()`, except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

getwchar_unlocked

Name

`getwchar_unlocked` — non-thread-safe getwchar

Description

`getwchar_unlocked()` is the same as `getwchar()`, except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

glob64

Name

`glob64` — find pathnames matching a pattern (Large File Support)

Synopsis

```
#include <glob.h>
int glob64(const char * pattern, int flags, int (*errfunc) (const
char *, int), glob64_t * pglob);
```

Description

`glob64()` is a large-file version of the `glob()` function defined in POSIX 1003.1-2001 (ISO/IEC 9945-2003). It shall search for pathnames matching *pattern* according to the rules used by the shell, `/bin/sh`. No tilde expansion or parameter substitution is done; see `wordexp()`.

The results of a `glob64()` call are stored in the structure pointed to by *pglob*, which is a `glob64_t` declared in `glob.h` with the following members:

```
typedef struct
{
  size_t gl_pathc;
  char **gl_pathv;
  size_t gl_offs;
  int gl_flags;
  void (*gl_closedir) (void *);
  struct dirent64 *(*gl_readdir64) (void *);
  void *(*gl_opendir) (const char *);
  int (*gl_lstat) (const char *, struct stat *);
  int (*gl_stat) (const char *, struct stat *);
}
```

```
glob64_t;
```

Structure members with the same name as corresponding members of a `glob_t` as defined in POSIX 1003.1-2001 (ISO/IEC 9945-2003) shall have the same purpose.

Other members are defined as follows:

gl_flags

> reserved for internal use

gl_closedir

> pointer to a function capable of closing a directory opened by *gl_opendir*

gl_readdir64

> pointer to a function capable of reading entries in a large directory

gl_opendir

> pointer to a function capable of opening a large directory

gl_stat

> pointer to a function capable of returning file status for a large file

gl_lstat

> pointer to a function capable of returning file status information for a large file or symbolic link

A large file or large directory is one with a size which cannot be represented by a variable of type off_t.

Return Value

On success, 0 is returned. Other possible returns are:

GLOB_NOSPACE

> out of memory

GLOB_ABORTED

> read error

GLOB_NOMATCH

> no match found

globfree64

Name

`globfree64` — free memory from glob64() (Large File Support)

Synopsis

```
#include <glob.h>
void globfree64(glob64_t * pglob);
```

Description

`globfree64()` frees the dynamically allocated storage from an earlier call to `glob64()`.

`globfree64()` is a large-file version of the `globfree()` function defined in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

gnu_get_libc_version, gnu_get_libc_release

Name

`gnu_get_libc_version`, `gnu_get_libc_release` — get glibc-specific version and release

Synopsis

```
#include <gnu/libc-version.h>
const char * gnu_get_libc_version(void);
const char * gnu_get_libc_release(void);
```

Description

`gnu_get_libc_version()` returns a string that identifies the version of the C library running the program making the call.

`gnu_get_libc_release()` returns a string indicates the release status of the C library running the program making the call. This will be a string such as `"stable"`.

Return Value

The functions return strings. The contents of these strings are unspecified.

Errors

No errors are defined.

Notes

These functions are specific to GNU libc (glibc). This specification does not require the implementation of libc to be glibc, although it requires these functions.

The string returned by `gnu_get_libc_version()` will be a dotted version string, which may have meaning to developers otherwise familiar with glibc. These functions have been requested to aid in portability of software which also runs in non-LSB contexts, but decisions based on the return value should be tempered by an understanding of what the behavioral requirements of this specification are. That is, it may or may not be useful to discover that a running system, for example, has version `"2.10.1"` if that implies different behavior than described by this specification.

hcreate_r

Name

hcreate_r — allocate space for a hash search table, reentrantly

Synopsis

```
#include <search.h>
int hcreate_r(size_t nel, struct hsearch_data * htab);
```

Description

The `hcreate_r()` function is a reentrant version of the `hcreate()` function.

`hcreate_r()` shall initialize the object referenced by `htab` with a hash table containing at least `nel` elements. Unlike its non-reentrant equivalent, `hcreate()`, the `hcreate_r()` function may work with more than one hash table.

The memory for the `htab` object may be dynamically allocated. It must be initialized with `0` before `hcreate_r()` is called.

Return Value

On success, `hcreate_r()` shall return a non-zero value.

On failure, `hcreate_r()` shall return `0`. This usually happens because not enough memory was available.

hdestroy_r

Name

hdestroy_r — dispose of a hash search table, reentrantly

Synopsis

```
#include <search.h>
void hdestroy_r(struct hsearch_data * htab);
```

Description

The `hdestroy_r()` function is a reentrant version of the `hdestroy()` function.

`hdestroy_r()` frees the resources allocated by `hcreate_r()` for the object `htab`.

hsearch_r

Name

hsearch_r — search a hash table, reentrantly

Synopsis

```
#include <search.h>
int hsearch_r(ENTRY item, ACTION action, ENTRY * * retval, struct
hsearch_data * htab);
```

Description

The `hsearch_r()` is a reentrant version of the `hsearch()` function, but instead of operating on a single global hash table, `hsearch_r()` operates on the table described by the object that `htab` references. This object can be initialized with the function `hcreate_r()`.

Unlike the `hsearch()` function, `hsearch_r()` returns a pointer to the found entry in the variable referred to by `retval`, rather than directly.

Return Value

On success, `hsearch_r()` shall return a non-zero value.

On failure, `hsearch_r()` shall return 0 and set `errno` to an appropriate value.

Errors

ENOMEM

> `action` was set to ENTER, but the table was full.

ESRCH

> `action` was set to FIND, but no matching element was found in the table.

inet_aton

Name

inet_aton — Internet address manipulation routine

Synopsis

```
#include <sys/socket.h>
#include <netinet/in.h>
#include <arpa/inet.h>
int anet_iton(const char * cp, struct in_addr * inp);
```

Description

`inet_aton()` converts the Internet host address `cp` from the standard IPv4 numbers-and-dots notation into binary data and stores it in the structure that `inp` points to.

`inet_aton()` returns a nonzero value if the address is valid, 0 if not.

> **Note:** Note that on some LSB architectures, the host byte order is Least Significant Byte first, whereas the network byte order, as used on the Internet, is Most Significant Byte first.

initgroups

Name

`initgroups` — initialize the supplementary group access list

Synopsis

```
#include <grp.h>
#include <sys/types.h>
int initgroups(const char * user, gid_t group);
```

Description

If the process has appropriate privilege, the `initgroups()` function shall initialize the Supplementary Group IDs for the current process by reading the group database and using all groups of which *user* is a member. The additional group *group* is also added to the list.

Return Value

On success, 0 is returned. On error, -1 is returned and the global variable `errno` is set appropriately.

Errors

EPERM

    The calling process does not have sufficient privileges.

ENOMEM

    Insufficient memory to allocate group information structure.

See Also

`setgroups()`

initstate_r

Name

`initstate_r` — reentrantly initialize a state array for random number generator functions

Synopsis

```
#include <stdlib.h>
int initstate_r(unsigned int seed, char * statebuf, size_t statelen,
struct random_data * buffer);
```

Description

The interface `initstate_r()` shall function in the same way as the interface `initstate()`, except that `initstate_r()` shall use the data in *buffer* instead of the global random number generator state.

inotify_add_watch

Name

`inotify_add_watch` — add a watch to a watch list

Synopsis

```
#include <sys/inotify.h>
int inotify_add_watch(int fd, const char * path, uint32_t mask);
```

Description

`inotify_add_watch()` shall add a watch to, or modify an existing watch on, the watch list of the inotify instance specified by the file descriptor `fd`, for the file specified by `path`, to monitor the events specified by the bitmask `mask`. The caller must have read access to the file.

Return Value

On success, `inotify_add_watch()` shall return the unique, non-negative watch descriptor associated with the file `path` and the inotify instance specified by the file descriptor `fd`.

If `path` was already on the watch list, then `inotify_add_watch()` shall return the existing watch descriptor.

If `path` was not already on the watch list, then `inotify_add_watch()` shall allocate a new watch descriptor.

`inotify_add_watch()` shall not work recursively. Monitoring subdirectories of `path` shall require adding watches to them.

On failure, `inotify_add_watch()` shall return `-1` and set `errno` to an appropriate value.

Errors

EACCESS

> The caller does not have read access to `path`.

EBADF

> The file descriptor `fd` is invalid.

EFAULT

> `path` is outside of the address space accessible by the process.

EINVAL

> `mask` contains no legal events, or `fd` is not a valid inotify file descriptor.

ENOMEM

> There is not enough kernel memory available.

ENOSPC

> The maximum number of watches has been created for this user, or the kernel cannot allocate a resource.

Application Usage

Reading

The function `read()` can be used to determine which inotify events have occurred. A blocking file descriptor will make `read()` block until at least one event has occurred.

If successful, `read()` will return at least one of the following `inotify_event` structures in a buffer:

```
struct inotify_event {
    int      wd;
    uint32_t mask;
    uint32_t cookie;
    uint32_t len;
    char     path[];
};
```

`wd` is a watch descriptor that specifies the watch associated with the event. It is obtained from a previous invocation of `inotify_add_watch()`.

`mask` is a bit mask describing inotify events. See the section on masks below.

`cookie` is an integer associating related inotify events. The integer value is unique, and currently only enables the application to associate `IN_MOVE_FROM` and `IN_MOVE_TO` rename events.

`len` is a count of the bytes in `path`, including null bytes. This means that the total length of an `inotify_event` structure is

```
sizeof(inotify_event)+len
```

`path` is only returned when an event occurs for a file within a watched directory. This string is null-terminated, and it may contain more null bytes so that future reads will be aligned properly on an address boundary.

In kernels before 2.6.21, `read()` returns `0` when the buffer given to it is too small to return data about the next event. In subsequent kernels, it fails with the error `EINVAL`.

For a given file descriptor, the inotify events are returned in an ordered queue. Events on a file descriptor will always be returned in the correct order of occurrence. If two or more inotify events for a given file descriptor have identical values for all fields, then only one `inotify_event` will be returned to represent all of them.

The number of bytes that can be read from an inotify file descriptor can be determined by making a `FIONREAD ioctl()` call.

Masks

The *mask* argument of `inotify_add_watch()` and the `mask` field of the `inotify_event` structure are bit masks that specify inotify events. The bits in the list below can be set in the *mask* argument of `inotify_add_watch()` and returned in the `mask` field of `inotify_event`.

IN_ACCESS

    File was read.

IN_ALL_EVENTS

    Bit mask of all events in this list.

IN_ATTRIB

    File's metadata changed (including timestamps and permissions).

IN_CLOSE

    Same as

    `IN_CLOSE_WRITE | IN_CLOSE_NOWRITE`

IN_CLOSE_WRITE

File that was opened for writing was closed.

IN_CLOSE_NOWRITE

File that was not opened for writing was closed.

IN_CREATE

File or directory was created in a watched directory.

IN_DELETE

File or directory was deleted in a watched directory.

IN_DELETE_SELF

Watched file or directory was deleted.

IN_MODIFY

File was changed.

IN_MOVE

Same as

```
IN_MOVED_FROM | IN_MOVED_TO
```

IN_MOVE_SELF

> Watched file or directory was moved

IN_MOVED_FROM

> File was moved out of watched directory.

IN_MOVED_TO

> File was moved into watched directory.

IN_OPEN

> File was opened.

All of the events above, except for `IN_DELETE_SELF` and `IN_MOVE_SELF`, cause the name field of the `inotify_event` structure to contain the name of the file or directory being monitored.

The following bit is valid for `inotify_add_watch()` only.

IN_ONESHOT

> Monitor path for an event, and then remove it from the watch list.

The following bits are valid for the `inotify_event` structure only.

IN_IGNORED

> Watch was removed, either explicitly (via `inotify_rm_watch()`) or implicitly (file deletion or file system unmounting).

IN_ISDIR

> Object being watched is a directory.

IN_Q_OVERFLOW

> The event queue overflowed (*wd* is set to `-1`).

IN_UNMOUNT

> File system of object being watched was unmounted.

Notes

It is possible to monitor file descriptors with the functions `epoll()`, `poll()`, and `select()`.

When all of the file descriptors that point to an inotify instance have been closed, the instance and its associated resources and watches are freed by the kernel.

See Also

`inotify_init()`, `inotify_rm_watch()`

inotify_init

Name

`inotify_init` — instantiate inotify

Synopsis

```
#include <sys/inotify.h>
int inotify_init(void);
```

Description

`inotify_init()` shall create one instance of inotify.

Return Value

On success, `inotify_init()` shall return a file descriptor pointing to the new inotify instance.

On failure, `inotify_init()` shall return -1 and set `errno` to an appropriate value.

Errors

EMFILE

The maximum number of inotify instances has been created for this user.

ENFILE

The maximum number of file descriptors has been created on the system.

ENOMEM

There is not enough kernel memory available.

See Also

`inotify_add_watch()`,`inotify_rm_watch()`

inotify_rm_watch

Name

`inotify_rm_watch` — remove a watch from an inotify watch list

Synopsis

```
#include <sys/inotify.h>
int inotify_rm_watch(int fd, int wd);
```

Description

`inotify_rm_watch()` shall remove the watch associated with the watch descriptor *wd* from the watch list of the inotify instance associated with the file descriptor *fd*.

If a watch is removed, its watch descriptor shall generate the `IN_IGNORED` event.

Return Value

On success, `inotify_rm_watch()` shall return `0`.

On failure, `inotify_rm_watch()` shall return `-1` and set `errno` to an appropriate value.

Errors

EBADF

The file descriptor *fd* is invalid.

EINVAL

wd is invalid, or *fd* is not a valid inotify file descriptor.

See Also

`inotify_add_watch()`, `inotify_init()`

ioctl

Name

`ioctl` — control device

Synopsis

```
#include <sys/ioctl.h>
int ioctl (int fildes , int request , ...);
```

Description

The `ioctl()` function shall manipulate the underlying device parameters of special files. `fildes` shall be an open file descriptor referring to a special file. The `ioctl()` function shall take three parameters; the type and value of the third parameter is dependent on the device and `request`.

Conforming LSB applications shall not call `ioctl()` except in situations explicitly stated in this specification.

Return Value

On success, 0 is returned. An `ioctl()` may use the return value as an output parameter and return a non-negative value on success. On error, -1 is returned and the global variable `errno` is set appropriately.

Errors

EBADF

> `fildes` is not a valid descriptor.

EFAULT

> The third parameter references an inaccessible memory area.

ENOTTY

> `fildes` is not associated with a character special device.

ENOTTY

> The specified request does not apply to the kind of object that `fildes` references.

EINVAL

> `request` or the third parameter is not valid.

Relationship to POSIX (Informative)

It should be noted that POSIX 1003.1-2001 (ISO/IEC 9945-2003) contains an interface named `ioctl()`. The LSB only defines behavior when `fildes` refers to a socket (see sockio) or terminal device (see ttyio), while POSIX 1003.1-2001 (ISO/IEC 9945-2003) only defines behavior when `fildes` refers to a STREAMS device. An implementation may support both behaviors; the LSB does not require any STREAMS support.

sockio

Name

`sockio` — socket ioctl commands

Synopsis

```
#include <sys/ioctl.h>
#include <sys/socket.h>
#include <net/if.h>
```

```
#include <netinet/in.h>
int ioctl(int sockfd, int request, void * argp);
```

Description

Socket `ioctl()` commands are a subset of the `ioctl()` calls, which can perform a variety of functions on sockets. `sockfd` shall be an open file descriptor referring to a socket (see the `socket()` or `accept()` functions).

Socket `ioctl()` commands apply to the underlying network interfaces, and affect the entire system, not just the file descriptor used to issue the `ioctl()`.

The following values for `request` are accepted:

`SIOCGIFCONF` (Deprecated)

> Get the interface configuration list for the system.

> **Note:** The `SIOCGIFCONF` interface is superceded by the `if_nameindex()` family of functions (see POSIX 1003.1-2001 (ISO/IEC 9945-2003)). A future version of this specification may withdraw this value for `request`.

> `argp` shall point to a `ifconf` structure, as described in `<net/if.h>`. Before calling, the caller shall set the `ifc_ifcu.ifcu_req` field to point to an array of `ifreq` structures, and set `ifc_len` to the size in bytes of this allocated array. Upon return, `ifc_len` will contain the size in bytes of the array which was actually used. If it is the same as the length upon calling, the caller should assume that the array was too small and try again with a larger array.

> On success, `SIOCGIFCONF` shall return a nonnegative value.

> > **Rationale:** Historical UNIX systems disagree on the meaning of the return value.

`SIOCGIFFLAGS`

> Get the interface flags for the indicated interface. `argp` shall point to a `ifreq` structure. Before calling, the caller should fill in the `ifr_name` field with the interface name, and upon return, the `ifr_ifru.ifru_flags` field is set with the interface flags.

`SIOCGIFADDR`

> Get the interface address for the given interface. `argp` shall point to a `ifreq` structure. Before calling, the caller should fill in the `ifr_name` field with the interface name, and upon return, the `ifr_ifru.ifru_addr` field is set with the interface address.

`SIOCGIFBRDADDR`

> Get the interface broadcast address for the given interface. `argp` shall point to a `ifreq` structure. Before calling, the caller should fill in the `ifr_name` field with the interface name, and upon return, the `ifr_ifru.ifru_broadcast` field is set with the interface broadcast address.

`SIOCGIFDSTADDR`

Get the point-to-point address for the given interface. `argp` shall point to a `ifreq` structure. Before calling, the caller should fill in the `ifr_name` field with the interface name, and upon return, the `ifr_dstaddr` field is set with the point-to-point address.

SIOCGIFNAME

Get the name of an interface. `argp` shall point to a `ifreq` structure. Before calling, the caller should fill in the `ifr_ifindex` field with the number (index) of the interface, and upon return, the `ifr_name` field is set with the interface name.

SIOCGIFNETMASK

Get the network mask for the given interface. `argp` shall point to a `ifreq` structure. Before calling, the caller should fill in the `ifr_name` field with the interface name, and upon return, the `ifr_ifru.ifru_netmask` field is set with the network mask.

SIOCGIFMTU

Get the Maximum Transmission Unit (MTU) size for the given interface. `argp` shall point to a `ifreq` structure. Before calling, the caller should fill in the `ifr_name` field with the interface name, and upon return, the `ifr_ifru.ifru_mtu` field is set with the MTU. Note: The range of valid values for MTU varies for an interface depending on the interface type.

FIONREAD

Get the amount of queued unread data in the receive buffer. `argp` shall point to an integer where the result is to be placed.

Note: Some implementations may also support the use of FIONREAD on other types of file descriptor. However, the LSB only specifies its behavior for a socket related file descriptor.

Return Value

On success, if `request` is SIOCGIFCONF, a non-negative integer shall be returned. If request is not SIOCGIFCONF, on success 0 is returned. On error, -1 is returned and the global variable `errno` is set appropriately.

Errors

EBADF

`sockfd` is not a valid descriptor.

EFAULT

`argp` references an inaccessible memory area.

ENOTTY

The specified `request` does not apply to the kind of object that the descriptor `sockfd` references.

EINVAL

Either `request` or `argp` is invalid.

ENOTCONN

The operation is only defined on a connected socket, but the socket wasn't connected.

ttyio

Name

`ttyio` — tty ioctl commands

Synopsis

```
#include <sys/ioctl.h>
#include <fcntl.h>
int ioctl(int fd, unsigned long request, int * argp);
```

Description

Tty *ioctl* commands are a subset of the `ioctl()` calls, which can perform a variety of functions on tty devices. `fd` shall be an open file descriptor referring to a terminal device.

The following `ioctl()`s are provided:

`TIOCGWINSZ`

Get the size attributes of the terminal or pseudo-terminal identified by `fd`. On entry, `argp` shall reference a `winsize` structure. On return, the structure will have `ws_row` set to the number of rows of text (i.e. lines of text) that can be viewed on the device, and `ws_col` set to the number of columns (i.e. text width).

Note: The number of columns stored in `ws_col` assumes that the terminal device is using a mono-spaced font.

Return Value

On success, 0 is returned. On error, -1 is returned and the global variable `errno` is set appropriately.

Errors

EBADF

`fd` is not a valid descriptor.

EFAULT

`argp` references an inaccessible memory area.

EINVAL

`request` and `argp` are not valid.

jrand48_r

Name

`jrand48_r` — reentrantly generate pseudorandom numbers in a uniform distribution

Synopsis

```
#include <stdlib.h>
int  jrand48_r(unsigned  short[3]  xsubi,  struct  drand48_data  *
buffer, long int * result);
```

Description

The interface `jrand48_r()` shall function in the same way as the interface `jrand48()`, except that `jrand48_r()` shall use the data in `buffer` instead of the global random number generator state.

Before it is used, `buffer` must be initialized, for example, by calling `lcong48_r()`, `seed48_r()`, or `srand48_r()`, or by filling it with zeroes.

kill

Name

`kill` — send a signal

Synopsis

```
#include <signal.h>
int kill(pid_t pid, int sig);
```

Description

`kill()` is as specified in the *POSIX 1003.1-2001 (ISO/IEC 9945-2003)*, but with differences as listed below.

Process ID -1 doesn't affect calling process

If `pid` is specified as -1, `sig` shall not be sent to the calling process. Other than this, the rules in the *POSIX 1003.1-2001 (ISO/IEC 9945-2003)* apply.

> **Rationale:** This was a deliberate Linus decision after an unpopular experiment in including the calling process in the 2.5.1 kernel. See "What does it mean to signal everybody?", Linux Weekly News, 20 December 2001, http://lwn.net/2001/1220/kernel.php3

lcong48_r

Name

`lcong48_r` — reentrantly generate pseudorandom numbers in a uniform distribution

Synopsis

```
#include <libc.h>
int  lcong48_r(unsigned  short[7] param, struct  drand48_data  *
buffer);
```

Description

The interface `lcong48_r()` shall function in the same way as the interface `lcong48()`, except that `lcong48_r()` shall use the data in *buffer* instead of the global random number generator state.

link

Name

`link` — create a link to a file

Synopsis

```
#include <unistd.h>
int link(const char * path1, const char * path2);
```

Description

The `link()` function shall behave as specified in *POSIX 1003.1-2001 (ISO/IEC 9945-2003)*, except with differences as listed below.

Need Not Follow Symlinks

POSIX 1003.1-2001 (ISO/IEC 9945-2003) specifies that pathname resolution shall follow symbolic links during pathname resolution unless the function is required to act on the symbolic link itself, or certain arguments direct that the function act on the symbolic link itself. The `link()` function in POSIX 1003.1-2001 (ISO/IEC 9945-2003) contains no such requirement to operate on a symbolic link. However, a conforming LSB implementation need not follow a symbolic link for the *path1* argument.

lrand48_r

Name

`lrand48_r` — reentrantly generate pseudorandom numbers in a uniform distribution

Synopsis

```
#include <stdlib.h>
int lrand48_r(struct drand48_data * buffer, long int * result);
```

Description

The interface `lrand48_r()` shall function in the same way as the interface `lrand48()`, except that `lrand48_r()` shall use the data in *buffer* instead of the global random number generator state.

Before it is used, *buffer* must be initialized, for example, by calling `lcong48_r()`, `seed48_r()`, or `srand48_r()`, or by filling it with zeroes.

mbsnrtowcs

Name

`mbsnrtowcs` — convert a multibyte string to a wide character string

Synopsis

```
#include <wchar.h>
size_t mbsnrtowcs(wchar_t * dest, const char * * src, size_t nms,
size_t len, mbstate_t * ps);
```

Description

`mbsnrtowcs()` is like `mbsrtowcs()`, except that the number of bytes to be converted, starting at *src*, is limited to *nms*.

If *dest* is not a `NULL` pointer, `mbsnrtowcs()` converts at most *nms* bytes from the multibyte string *src* to a wide-character string starting at *dest*. At most, *len* wide characters are written to *dest*. The shift state *ps* is updated.

The conversion is effectively performed by repeatedly calling:

```
mbrtowc(dest, *src, n, ps)
```

where *n* is some positive number, as long as this call succeeds, and then incrementing *dest* by one and *src* by the number of bytes consumed.

The conversion can stop for three reasons:

- An invalid multibyte sequence has been encountered. In this case *src* is left pointing to the invalid multibyte sequence, (size_t)(-1) is returned, and `errno` is set to EILSEQ.

- The *nms* limit forces a stop, or *len* non-L'\0' wide characters have been stored at *dest*. In this case, *src* is left pointing to the next multibyte sequence to be converted, and the number of wide characters written to *dest* is returned.

- The multibyte string has been completely converted, including the terminating '\0' (which has the side effect of bringing back *ps* to the initial state). In this case, *src* is set to NULL, and the number of wide characters written to *dest*, excluding the terminating L'\0' character, is returned.

If *dest* is NULL, *len* is ignored, and the conversion proceeds as above, except that the converted wide characters are not written out to memory, and that no destination length limit exists.

In both of the above cases, if *ps* is a NULL pointer, a static anonymous state only known to `mbsnrtowcs()` is used instead.

The programmer shall ensure that there is room for at least *len* wide characters at *dest*.

Return Value

`mbsnrtowcs()` returns the number of wide characters that make up the converted part of the wide character string, not including the terminating null wide character. If an invalid multibyte sequence was encountered, (size_t)(-1) is returned, and the global variable `errno` is set to EILSEQ.

Notes

The behavior of `mbsnrtowcs()` depends on the LC_CTYPE category of the current locale.

Passing NULL as *ps* is not multi-thread safe.

memmem

Name

memmem — locate bytes

Synopsis

```
#define _GNU_SOURCE
```

```
#include <string.h>
void * memmem(const void * haystack, size_t haystacklen, const void *
needle, size_t needlelen);
```

Description

memmem() finds the start of the first occurrence of the byte array referenced by *needle* of length *needlelen* in the memory area *haystack* of length *haystacklen*.

Return Value

If *needle* is found, memmem() returns a pointer to it. If *needlelen* is 0, *memmem* returns *haystack*. If *needle* is not found in *haystack*, memmem() returns NULL.

Notes

Earlier versions of the C library (prior to glibc 2.1) contained a memmem() with various problems, and application developers should treat this function with care.

memrchr

Name

memrchr — scan memory for a character

Synopsis

```
#include <string.h>
void * memrchr(const void * s, int c, size_t n);
```

Description

The memrchr() function shall locate the last occurence of *c* (converted to an unsigned char) in the initial *n* bytes (each interpreted as an unsigned char) of the object pointed to by *s*.

Return Value

The memrchr() shall return a pointer to the located byte, or a null pointer if the byte does not occur in the object.

Errors

No errors are defined.

See Also

memchr()

mkstemp64

Name

mkstemp64 — create a unique temporary file (Large File Support)

Synopsis

```
#include <stdio.h>
```

```
#include <stdlib.h>
int mkstemp64(char * template);
```

Description

`mkstemp64()` shall generates a unique temporary file name from *template*. The last six characters of template shall be xxxxxx and these are replaced with a string that makes the file name unique; the file is then created and an open file descriptor returned as described for `mkstemp()`.

`mkstemp64()` is a large-file version of the `mkstemp()` function as defined in POSIX 1003.1-2001 (ISO/IEC 9945-2003). The only difference is that the temporary file is opened with `open64()` instead of with `open()`.

Return Value

On success, `mkstemp64()` returns the file descriptor of the temporary file. Otherwise `mkstemp64()` shall return -1 and set `errno` to indicate the error.

Errors

See `mkstemp()` for possible error values.

mrand48_r

Name

`mrand48_r` — reentrantly generate pseudorandom numbers in a uniform distribution

Synopsis

```
#include <stdlib.h>
int mrand48_r(struct drand48_data * buffer, long int * result);
```

Description

The interface `mrand48_r()` shall function in the same way as the interface `mrand48()`, except that `mrand48_r()` shall use the data in *buffer* instead of the global random number generator state.

Before it is used, *buffer* must be initialized, for example, by calling `lcong48_r()`, `seed48_r()`, or `srand48_r()`, or by filling it with zeroes.

mremap

Name

`mremap` — remap a virtual memory address

Synopsis

```
#include <sys/mman.h>
void * mremap(void * old_address, size_t old_size, size_t new_size,
int flags);
```

Description

The `mremap()` function expands (or shrinks) an existing memory mapping, potentially moving it at the same time, depending on the flags argument and the available virtual address space.

`old_address` is the old address of the virtual memory block to be resized. Note that `old_address` must be page aligned. `old_size` is the old size of the virtual memory block. `new_size` is the requested size of the virtual memory block after the resize.

In Linux the memory is divided into pages. A user process has (one or) several linear virtual memory segments. Each virtual memory segment has one or more mappings to real memory pages (in the page table). Each virtual memory segment has its own protection (access rights), which may cause a segmentation violation if the memory is accessed incorrectly (e.g., writing to a read-only segment). Accessing virtual memory outside of the segments will also cause a segmentation violation.

`mremap()` uses the Linux page table scheme. `mremap()` changes the mapping between virtual addresses and memory pages. This can be used to implement a very efficient form of `realloc()`.

The flags bit-mask argument may be 0, or include the following flag:

MREMAP_MAYMOVE

> By default, if there is not sufficient space to expand a mapping at its current location, then `mremap()` fails. If this flag is specified, then the kernel is permitted to relocate the mapping to a new virtual address, if necessary. If the mapping is relocated, then absolute pointers into the old mapping location become invalid (offsets relative to the starting address of the mapping should be employed).

MREMAP_FIXED

> This flag serves a similar purpose to the `MAP_FIXED` flag of `mmap()`. If this flag is specified, then `mremap()`accepts a fifth argument, void `*new_address`, which specifies a pagealigned address to which the mapping must be moved. Any previous mapping at the address range specified by `new_address` and `new_size` is unmapped. If `MREMAP_FIXED` is specified, then `MREMAP_MAYMOVE` must also be specified.

If the memory segment specified by `old_address` and `old_size` is locked (using `mlock()` or similar), then this lock is maintained when the segment is resized and/or relocated. As a consequence, the amount of memory locked by the process may change.

Return Value

The `mremap()` function returns a pointer to the new virtual memory area on success. On error, the value `MAP_FAILED` is returned, and `errno` is set appropriately.

Errors

EAGAIN

> The caller tried to expand a memory segment that is locked, but this was not possible without exceeding the `RLIMIT_MEMLOCK` resource limit.

EFAULT

> "Segmentation fault." Some address in the range old_address to `old_address+old_size` is an invalid virtual memory address for this process. You can also get EFAULT even if there exist mappings that cover the whole address space requested, but those mappings are of different types.

EINVAL

> An invalid argument was given. Possible causes are: `old_address` was not page aligned; a value other than `MREMAP_MAYMOVE` or `MREMAP_FIXED` was specified in `flags`; `new_size` was zero; `new_size` or `new_address` was invalid; or the new address range specified by `new_address` and `new_size` overlapped the old address range specified by `old_address` and `old_size`; or `MREMAP_FIXED` was specified without also specifying `MREMAP_MAYMOVE`.

ENOMEM

> The memory area cannot be expanded at the current virtual address, and the `MREMAP_MAYMOVE` flag is not set in `flags`, or, there is not enough (virtual) memory available.

newlocale

Name

newlocale — allocate a locale object

Synopsis

```
#include <locale.h>
locale_t newlocale(int category_mask, const char * locale, locale_t
base);
```

Description

The `newlocale()` function shall initialize a locale object. If `base` is `NULL`, then `newlocale()` shall first allocate the object; otherwise it shall use the locale object referenced by `base`.

The object shall be initialized for the locale named by `locale`, and for the categories selected in `category_mask`. The `category_mask` value is a bitwise inclusive OR of the required `LC_name_MASK` values, or the value `LC_ALL_MASK`.

Return Value

On success, the `newlocale()` function shall return the initialized locale object. Otherwise, it shall return `NULL`, and set `errno` to indicate the error.

Errors

The `newlocale()` function shall fail if:

ENOMEM

> Insufficient memory.

EINVAL

> An invalid `category_mask` was provided, or the `locale` was `NULL`.

ENOENT

> For any of the categories in `category_mask`, the locale data is not available.

Application Usage (Informative)

The only portable way to allocate a locale object is to call `newlocale()` with a `NULL` `base`. The allocated object may be reinitialized to a new locale by passing it back to `newlocale()`. The new object may be released by calling `freelocale()`.

See Also

`setlocale()`, `freelocale()`, `duplocale()`, `uselocale()`

ngettext

Name

ngettext — search message catalogs for plural string

Synopsis

```
#include <libintl.h>
char * ngettext(const char * msgid1, const char * msgid2, unsigned
long int n);
```

Description

The ngettext() function shall search the currently selected message catalogs for a string matching the singular string *msgid1*. If a string is located, and if *n* is 1, that string shall be returned. If *n* is not 1, a pluralized version (dependent on *n*) of the string shall be returned.

The ngettext() function is equivalent to dcngettext(NULL, msgid1, msgid2, n, LC_MESSAGES)().

Return Value

If a string is found in the currently selected message catalogs for *msgid1*, then if *n* is 1 a pointer to the located string shall be returned. If *n* is not 1, a pointer to an appropriately pluralized version of the string shall be returned. If no message could be found in the currently selected mesage catalogs, then if *n* is 1, a pointer to *msgid1* shall be returned, otherwise a pointer to *msgid2* shall be returned.

Applications shall not modify the string returned by ngettext().

Errors

None.

The ngettext() function shall not modify errno.

See Also

gettext, dgettext, ngettext, dngettext, dcgettext, dcngettext, textdomain, bindtextdomain, bind_textdomain_codeset

nrand48_r

Name

`nrand48_r` — reentrantly generate pseudorandom numbers in a uniform distribution

Synopsis

```
#include <stdlib.h>
int nrand48_r(unsigned  short[3]  xsubi,  struct  drand48_data  *
buffer, long int * result);
```

Description

The interface `nrand48_r()` shall function in the same way as the interface `nrand48()`, except that `nrand48_r()` shall use the data in `buffer` instead of the global random number generator state.

Before it is used, `buffer` must be initialized, for example, by calling `lcong48_r()`, `seed48_r()`, or `srand48_r()`, or by filling it with zeroes.

openat64

Name

`openat64` — open a file relative to a directory file descriptor (Large File Support)

Synopsis

```
#include <fcntl.h>
int openat64(int fd, const char * path, int oflag, ...);
```

Description

`openat64()` shall establish a connection between a file and a file descriptor. It shall be identical `open64()` except in the case where `path` specifies a relative path. In this case, the file to be opened shall be determined relative to the directory associated with the file descriptor `fd` instead of the current working directory.

`openat64()` is a large-file version of the `openat()` function as defined in POSIX 1003.1-2008 (ISO/IEC 9945-2009). It differs from `openat()` in the same way that `open64()` differs from `open()`, that the open is done in large-file mode.

Return Value

On success, `openat64()` returns a new file descriptor. Otherwise `openat64()` shall return -1 and set `errno` to indicate the error.

Errors

See `openat()` for possible error values.

pmap_getport

Name

`pmap_getport` — find the port number assigned to a service registered with a portmapper.

Synopsis

```
#include <rpc/pmap_clnt.h>
u_short * pmap_getport(struct sockaddr_in * address, const u_long
program, const u_long * version, u_int protocol);
```

Description

The `pmap_getport()` function shall return the port number assigned to a service registered with a RPC Binding service running on a given target system, using the protocol described in RFC 1833: Binding Protocols for ONC RPC Version 2. The `pmap_getport()` function shall be called given the RPC program number *program*, the program version *version*, and transport protocol *protocol*. Conforming implementations shall support both `IPPROTO_UDP` and `IPPROTO_TCP` protocols. On entry, *address* shall specify the address of the system on which the portmapper to be contacted resides. The value of `address->sin_port` shall be ignored, and the standard value for the portmapper port shall always be used.

> **Note:** Security and network restrictions may prevent a conforming application from contacting a remote RPC Binding Service.

Return Value

On success, the `pmap_getport()` function shall return the port number in host byte order of the RPC application registered with the remote portmapper. On failure, if either the program was not registered or the remote portmapper service could not be reached, the `pmap_getport()` function shall return 0. If the remote portmap service could not be reached, the status is left in the global variable `rpc_createerr`.

pmap_set

Name

`pmap_set` — establishes mapping to machine's RPC Bind service.

Synopsis

```
#include <rpc/pmap_clnt.h>
bool_t pmap_set(const u_long program, const u_long version, int
protocol, u_short port);
```

Description

`pmap_set()` establishes a mapping between the triple *[program,version,protocol]* and *port* on the machine's RPC Bind service. The value of *protocol* is most likely `IPPROTO_UDP` or `IPPROTO_TCP`. Automatically done by `svc_register()`.

Return Value

`pmap_set()` returns non-zero if it suceeds, 0 otherwise.

pmap_unset

Name

`pmap_unset` — destroys RPC Binding

Synopsis

```
#include <rpc/pmap_clnt.h>

bool_t pmap_unset(u_long prognum, u_long versnum);
```

Description

As a user interface to the RPC Bind service, `pmap_unset()` destroys all mapping between the triple [`prognum`,`versnum`, `*`] and `ports` on the machine's RPC Bind service.

Return Value

`pmap_unset()` returns non-zero if it succeeds, zero otherwise.

posix_fadvise64

Name

`posix_fadvise64` — File advisory information (Large File Support)

Synopsis

```
#include <fcntl.h>
int posix_fadvise64(int fd, off64_t offset, off64_t len, int advice);
```

Description

The `posix_fadvise64()` function is a large-file version of the `posix_fadvise()` function defined in POSIX 1003.1-2001 (ISO/IEC 9945-2003). It shall advise the implementation on the expected behavior of the application with respect to the data in the file associated with the open file descriptor, `fd`, starting at `offset` and continuing for `len` bytes. The specified range need not currently exist in the file. If `len` is zero, all data following `offset` is specified. The implementation may use this information to optimize handling of the specified data. The `posix_fadvise()` function shall have no effect on the semantics of other operations on the specified data, although it may affect the performance of other operations.

The advice to be applied to the data is specified by the `advice` parameter, as specified in `posix_fadvise()`.

Return Value

On success, `posix_fadvise64()` shall return 0. Otherwise an error number shall be returned to indicate the error. See `posix_fadvise()` for possible error values.

posix_fallocate64

Name

`posix_fallocate64` — file space control (Large File Support)

Synopsis

```
#include <fcntl.h>
int posix_fallocate64(int fd, off64_t offset, off64_t len);
```

Description

The `posix_fallocate64()` function is a large file version of `posix_fallocate()`. It shall behave as `posix_fallocate()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that the *offset* and *len* arguments are `off64_t` objects rather than `off_t`.

Return Value

See `posix_fallocate()`.

Errors

See `posix_fallocate()`.

pread64

Name

`pread64` — read from a file (Large File Support)

Synopsis

```
#include <unistd.h>
ssize_t pread64(int fd, void * buf, size_t count, off64_t offset);
```

Description

`pread64()` shall read *count* bytes into *buf* from the file associated with the open file descriptor *fd*, at the position specified by *offset*, without changing the file position.

`pread64()` is a large-file version of the `pread()` function as defined in POSIX 1003.1-2001 (ISO/IEC 9945-2003). It differs from `pread()` in that the *offset* parameter is an off64_t instead of an off_t

Return Value

On success, `pread64()` shall return the number of bytes actually read. Otherwise `pread64()` shall return -1 and set `errno` to indicate the error.

Errors

See `pread()` for possible error values.

psignal

Name

`psignal` — print signal message

Synopsis

```
#include <signal.h>
void psignal(int sig, const char * s);

extern const char *const sys_siglist[]
```

Description

The `psignal()` function shall display a message on the `stderr` stream. If `s` is not the null pointer, and does not point to an empty string (e.g. `"\0"`), the message shall consist of the string `s`, a colon, a space, and a string describing the signal number `sig`; otherwise `psignal()` shall display only a message describing the signal number `sig`. If `sig` is invalid, the message displayed shall indicate an unknown signal.

The array `sys_siglist` holds the signal description strings indexed by signal number.

Return Value

`psignal()` returns no value.

ptrace

Name

`ptrace` — process trace

Synopsis

```
#include <sys/ptrace.h>
long ptrace(enum __ptrace_request request, pid_t pid, void * addr,
void * data);
```

Description

The `ptrace()` system call shall enable a process to observe and control the execution of another process, as well as examine and change certain attributes of that process.

This function operates via requests, which act on the traced process using the other parameters in ways unique to each request type. The tracing process must initiate tracing, either via the `PTRACE_TRACEME` or `PTRACE_ATTACH` requests, before other requests may be performed. Except for `PTRACE_TRACEME` and `PTRACE_KILL`, all requests must be performed on a traced process that has been stopped.

All signals, except one, delivered to the traced process cause it to stop, irrespective of its registered signal handling, and cause an event to be delivered to the tracing process which can be detected using the wait(2) system call. The exception is the `SIGKILL` signal, which is delivered immediately and performs its usual specified behavior.

The following requests are defined:

`PTRACE_TRACEME`

This request initiates a trace from the perspective of the traced process, indicating that the parent of the current process shall be the tracing process. When this is called, a subsequent call to execve(2) shall cause the tracing process to receive a SIGTRAP signal, and shall stop the current process. This is the only request a traced process may perform, and a tracing process may not perform this request. The other parameters are ignored.

`PTRACE_ATTACH`

This request initiates a trace from the perspective of the tracing process on the process specified by *pid*. After this call succeeds, the traced process will appear to be a child of the tracing process, although the original parent will still be returned to the traced process via getppid(2). The traced process will receive a `SIGSTOP` signal; the tracing process should use wait(2) to ensure that the traced process has stopped. A tracing process is only guaranteed to be able to trace its child processes; the tracing of other processes may not be allowed by the system, and the process with process ID 1 may not be traced under any circumstances. The *addr* and *data* parameters are ignored.

`PTRACE_CONT`

This request restarts a traced process, given in *pid*, which has been stopped. The *data* parameter may point to a signal ID to deliver to the traced process; if it is zero or SIGSTOP, no signal is delivered to the child. The *addr* is ignored.

PTRACE_DETACH

> This request performs the same function, in the same way, as PTRACE_CONT, except that the tracing relationship between the tracing and traced processes is also undone. If the trace was initiated using PTRACE_ATTACH, the original parent-child relationships that existed beforehand are restored.

PTRACE_KILL

> This request causes a SIGKILL signal to be sent to the traced process specified in *pid*. The *addr* and *data* parameters are ignored.

PTRACE_PEEKTEXT

> This request reads a word at the location *addr* of the traced process *pid*, and returns it to the caller. The *data* parameter is ignored.

PTRACE_PEEKDATA

> This request performs identically to the PTRACE_PEEKTEXT request.

PTRACE_PEEKUSER

> This request reads a word at offset *addr* in the USER area of the traced process *pid*. The offset must be word-aligned. The *data* parameter is ignored.

PTRACE_POKETEXT

> This request writes the word pointed at by *data* to the location *addr* of the traced process *pid*.

PTRACE_POKEDATA

> This request performs identically to the PTRACE_POKETEXT request.

PTRACE_POKEUSER

> This request writes the word pointed at by *data* to offset *addr* in the USER area of the traced process *pid*. The offset must be word-aligned. Implementations may choose to disallow some modifications to the USER area.

PTRACE_GETREGS

> This request copies the general purpose registers from the traced process *pid* to the tracing process at location *data*. This parameter may not be available on all architectures. The *addr* parameter is ignored.

PTRACE_GETFPREGS

> This request copies the floating point registers from the traced process *pid* to the tracing process at location *data*. This parameter may not be available on all architectures. The *addr* parameter is ignored.

PTRACE_SETREGS

> This request writes the general purpose registers to the traced process *pid* from the tracing process at location *data*. This parameter may not be available on all architectures. Implementations may choose to disallow some register modifications. The *addr* parameter is ignored.

PTRACE_SETFPREGS

This request writes the floating point registers to the traced process `pid` from the tracing process at location `data`. This parameter may not be available on all architectures. Implementations may choose to disallow some register modifications. The `addr` parameter is ignored.

PTRACE_GETSIGINFO

This request writes information about the signal which caused the traced process `pid` to stop to the tracing process at location `data`, as a siginfo_t. The `addr` parameter is ignored.

PTRACE_SETSIGINFO

This request writes signal information to the traced process `pid` from a siginfo_t structure pointed at by `data`, such that it will be used as the signal information by the traced process when it is resumed. The `addr` parameter is ignored.

PTRACE_GETEVENTMSG

This request stores information about the most recent ptrace event for the traced process `pid` in the unsigned long pointed at by `data`. For PTRACE_EVENT_EXIT, this is the exit status of the traced process. For PTRACE_EVENT_FORK, PTRACE_EVENT_VFORK, or PTRACE_EVENT_CLONE, this is the PID of the newly created process. The `addr` parameter is ignored.

PTRACE_SYSCALL

This request performs the same function, in the same way, as PTRACE_CONT, but with the additional step of causing the traced process to stop at the next entry to or exit from a system call. The usual events that would also cause the traced process to stop continue to do so.

PTRACE_SINGLESTEP

This request performs the same function, in the same way, as PTRACE_CONT, but with the additional step of causing the traced process to stop after execution of a single instruction. The usual events that would also cause the traced process to stop continue to do so.

PTRACE_SYSEMU

This request performs the same function, in the same way, as PTRACE_CONT, but with the additional step of causing the traced process to stop on entry to the next syscall, which will then not be executed.

PTRACE_SYSEMU_SINGLESTEP

This request performs the same function, in the same way, as PTRACE_CONT, but with the additional step of causing the traced process to stop on entry to the next syscall, which will then not be executed. If the next instruction is not itself a syscall, the traced process will stop after a single instruction is executed.

PTRACE_SETOPTIONS

This request sets `ptrace()` options for the traced process `pid` from the location pointed to by `data`. The `addr` is ignored. This location is interpreted as a bitmask of options, as defined by the following flags:

PTRACE_O_TRACESYSGOOD

This option, when set, causes syscall traps to set bit 7 in the signal number.

`PTRACE_O_TRACEFORK`

This option, when set, causes the traced process to stop when it calls fork(2). The original traced process will stop with SIGTRAP | PTRACE_EVENT_FORK << 8, and the new process will be stopped with SIGSTOP. The new process will also be traced by the tracing process, as if the tracing process had sent the PTRACE_ATTACH request for that process. The PID of the new process may be retrieved with the PTRACE_GETEVENTMSG request.

`PTRACE_O_TRACEVFORK`

This option, when set, causes the traced process to stop when it calls vfork(2). The original traced process will stop with SIGTRAP | PTRACE_EVENT_VFORK << 8, and the new process will be stopped with SIGSTOP. The new process will also be traced by the tracing process, as if the tracing process had sent the PTRACE_ATTACH request for that process. The PID of the new process may be retrieved with the PTRACE_GETEVENTMSG request.

`PTRACE_O_TRACECLONE`

This option, when set, causes the traced process to stop when it calls clone(2). The original traced process will stop with SIGTRAP | PTRACE_EVENT_CLONE << 8, and the new process will be stopped with SIGSTOP. The new process will also be traced by the tracing process, as if the tracing process had sent the PTRACE_ATTACH request for that process. The PID of the new process may be retrieved with the PTRACE_GETEVENTMSG request. Under certain circumstances, clone(2) calls by the traced process will generate events and information consistent with the PTRACE_O_TRACEVFORK or PTRACE_O_TRACEFORK options above.

`PTRACE_O_TRACEEXEC`

This option, when set, causes the traced process to stop when it calls execve(2). The traced process will stop with SIGTRAP | PTRACE_EVENT_EXEC << 8.

`PTRACE_O_TRACEVFORKDONE`

This option, when set, causes the traced process to stop at the completion of its next vfork(2) call. The traced process will stop with SIGTRAP | PTRACE_EVENT_EXEC << 8.

`PTRACE_O_TRACEEXIT`

This option, when set, causes the traced process to stop upon exit. The traced process will stop with SIGTRAP | PTRACE_EVENT_EXIT << 8, and its exit status can be retrieved with the PTRACE_GETEVENTMSG request. The stop is guaranteed to be early in the process exit process, meaning that information such as register status at exit is preserved. Upon continuing, the traced process will immediately exit.

Return Value

On success, `ptrace()` shall return the requested data for `PTRACE_PEEK` requests, or zero for all other requests. On error, all requests return -1, with `errno` set to an appropriate value. Note that -1 may be a valid return value for `PTRACE_PEEK` requests; the application is responsible for distinguishing between an error condition and a valid return value in that case.

Errors

On error, `ptrace()` shall set `errno` to one of the regular error values below:

`EBUSY`

An error occurred while allocating or freeing a debug register.

`EFAULT`

The request attempted to read from or write to an invalid area in the memory space of the tracing or traced process.

`EIO`

The request was invalid, or it attempted to read from or write to an invalid area in the memory space of the tracing or traced process, or it violated a word-alignment boundary, or an invalid signal was given to continue the traced process.

`EINVAL`

An attempt was made to set an invalid option.

`EPERM`

The request to trace a process was denied by the system.

`ESRCH`

The process requested does not exist, is not being traced by the current process, or is not stopped.

putwc_unlocked

Name

`putwc_unlocked` — non-thread-safe putwc

Description

`putwc_unlocked()` is the same as `putwc()`, except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

putwchar_unlocked

Name

`putwchar_unlocked` — non-thread-safe putwchar

Description

`putwchar_unlocked()` is the same as `putwchar()`, except that it need not be thread-safe. That is, it may only be invoked in the ways which are legal for `getc_unlocked()`.

pwrite64

Name

`pwrite64` — write on a file (Large File Support)

Synopsis

```
#include <unistd.h>
ssize_t pwrite64(int fd, const void * buf, size_t count, off64_t
offset);
```

Description

`pwrite64()` shall write *count* bytes from *buf* to the file associated with the open file descriptor *fd*, at the position specified by *offset*, without changing the file position.

`pwrite64()` is a large-file version of the `pwrite()` function as defined in POSIX 1003.1-2001 (ISO/IEC 9945-2003). It differs from `pwrite()` in that the *offset* parameter is an off64_t instead of an off_t

Return Value

On success, `pwrite64()` shall return the number of bytes actually written. Otherwise `pwrite()` shall return -1 and set `errno` to indicate the error.

Errors

See `pwrite()` for possible error values.

random_r

Name

`random_r` — reentrantly generate pseudorandom numbers in a uniform distribution

Synopsis

```
#include <stdlib.h>
int random_r(struct random_data * buffer, int32_t * result);
```

Description

The interface `random_r()` shall function in the same way as the interface `random()`, except that `random_r()` shall use the data in *buffer* instead of the global random number generator state.

Before it is used, *buffer* must be initialized, for example, by calling `lcong48_r()`, `seed48_r()`, or `srand48_r()`, or by filling it with zeroes.

readdir64_r

Name

`readdir64_r` — read a directory (Large File Support)

Synopsis

```
#include <dirent.h>
int readdir64_r(DIR * dirp, struct dirent64 * entry, struct
dirent64 * * result);
```

Description

The `readdir64_r()` function is a large file version of `readdir_r()`. It shall behave as `readdir_r()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that the `entry` and `result` arguments are `dirent64` structures rather than `dirent`.

Return Value

See `readdir_r()`.

Errors

See `readdir_r()`.

regexec

Name

`regexec` — regular expression matching

Description

The `regexec()` function shall behave as specified in *POSIX 1003.1-2001 (ISO/IEC 9945-2003)*, except with differences as listed below.

Differences

Certain aspects of regular expression matching are optional; see Regular Expressions.

scandir64

Name

`scandir64` — scan a directory (Large File Support)

Synopsis

```
#include <dirent.h>
int scandir64(const char * dir, const struct dirent64 ** namelist,
int (*sel) (const struct dirent64 *), int (*compar) (const struct
dirent64 **, const struct dirent64 **));
```

Description

`scandir64()` is a large-file version of the `scandir()` function as defined in POSIX 1003.1-2008 (ISO/IEC 9945-2009). If differs only in that the `namelist` and the paramters to the selection function `sel` and comparison function `compar` are of type `dirent64` instead of type `dirent`.

scanf

Name

`scanf` — convert formatted input

Description

The `scanf()` family of functions shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except as noted below.

Differences

The `%s`, `%S` and `%[` conversion specifiers shall accept an option length modifier `a`, which shall cause a memory buffer to be allocated to hold the string converted. In such a case, the argument corresponding to the conversion specifier should be a reference to a pointer value that will receive a pointer to the allocated buffer. If there is insufficient memory to allocate a buffer, the function may set `errno` to ENOMEM and a conversion error results.

> **Note:** This directly conflicts with the ISO C (1999) usage of `%a` as a conversion specifier for hexadecimal float values. While this conversion specifier should be supported, a format specifier such as `"%aseconds"` will have a different meaning on an LSB conforming system.

sched_getaffinity

Name

sched_getaffinity — retrieve the affinity mask of a process

Synopsis

```
#include <sched.h>
int sched_getaffinity(pid_t pid, unsigned int cpusetsize, cpu_set_t *
mask);
```

Description

sched_getaffinity() shall retrieve the affinity mask of a process.

The parameter *pid* specifies the ID for the process. If *pid* is 0, then the calling process is specified instead.

The parameter *cpusetsize* specifies the length of the data pointed to by *mask*, in bytes. Normally, this parameter is specified as sizeof(cpu_set_t).

Return Value

On success, sched_getaffinity() shall return 0, and the structure pointed to by *mask* shall contain the affinity mask of the specified process.

On failure, sched_getaffinity() shall return -1 and set errno as follows.

Errors

EFAULT

   Bad address.

EINVAL

   mask does not specify any processors that exist in the system, or *cpusetsize* is smaller than the kernel's affinity mask.

ESRCH

   The specified process could not be found.

See Also

sched_setscheduler(), sched_setaffinity().

sched_setaffinity

Name

`sched_setaffinity` — set the CPU affinity mask for a process

Synopsis

```
#include <sched.h>
int sched_setaffinity(pid_t pid, unsigned int cpusetsize, cpu_set_t *
mask);
```

Description

`sched_setaffinity()` shall set the CPU affinity mask for a process.

The parameter `pid` specifies the ID for the process. If `pid` is 0, then the calling process is specified instead.

The parameter `cpusetsize` specifies the length of the data pointed to by `mask`, in bytes. Normally, this parameter is specified as `sizeof(cpu_set_t)`.

The parameter `mask` specifies the new value for the CPU affinity mask. The structure pointed to by `mask` represents the set of CPUs on which the process may run. If `mask` does not specify one of the CPUs on which the specified process is currently running, then `sched_setaffinity()` shall migrate the process to one of those CPUs.

Setting the mask on a multiprocessor system can improve performance. For example, setting the mask for one process to specify a particular CPU, and then setting the mask of all other processes to exclude the CPU, dedicates the CPU to the process so that the process runs as fast as possible. This technique also prevents loss of performance in case the process terminates on one CPU and starts again on another, invalidating cache.

Return Value

On success, `sched_setaffinity()` shall return `0`.

On failure, `sched_setaffinity()` shall return `-1` and set `errno` as follows.

Errors

EFAULT

Bad address.

EINVAL

`mask` does not specify any processors that exist in the system, or `cpusetsize` is smaller than the kernel's affinity mask.

EPERM

Insufficient privileges. The effective user ID of the process calling `sched_setaffinity()` is not equal to the user ID or effective user ID of the specified process, and the calling process does not have appropriate privileges.

ESRCH

The specified process could not be found.

See Also

sched_setscheduler(),sched_getaffinity().

sched_setscheduler

Name

sched_setscheduler — set scheduling policy and parameters

Synopsis

```
#include <sched.h>
int   sched_setscheduler(pid_t   pid,   int   policy,   const   struct
sched_param * param);
```

Description

The sched_setscheduler() shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except as noted below.

Return Value

On success, 0 is returned instead of the former scheduling policy.

seed48_r

Name

seed48_r — reentrantly generate pseudorandom numbers in a uniform distribution

Synopsis

```
#include <stdlib.h>
int seed48_r(unsigned   short[3]   seed16v,   struct   drand48_data   *
buffer);
```

Description

The interface seed48_r() shall function in the same way as the interface seed48(), except that seed48_r() shall use the data in *buffer* instead of the global random number generator state.

sendfile

Name

`sendfile` — transfer data between two file descriptors

Synopsis

```
#include <sys/sendfile.h>
ssize_t sendfile(int out_fd, int in_fd, off_t * offset, size_t
count);
```

Description

The `sendfile()` function shall copy data between the file descriptor *in_fd*, which must not be a socket, and the file descriptor *out_fd*, which must be a socket. *in_fd* should be opened for reading, and *out_fd* should be opened for writing.

The *offset* parameter points to a variable set to the file offset at which `sendfile()` shall start reading from *in_fd*, unless it is NULL. On exit, this variable shall contain the offset of the byte immediately after the last byte read. `sendfile()` shall not change the current file offset of *in_fd*, unless it is NULL. In that case, `sendfile()` shall adjust the current file offset to show how many bytes were read.

The *count* parameter specifies how many bytes to copy.

Return Value

On success, `sendfile()` shall return the number of bytes written to *out_fd*.

On failure, `sendfile()` shall return –1 and set `errno` appropriately, as follows.

Errors

EAGAIN

Non-blocking I/O with `O_NONBLOCK` has been chosen, but the write would block.

EBADF

The input file is not open for reading, or the output file is not open for writing.

EFAULT

Bad address.

EINVAL

An `mmap()`-like operation is unavailable for *in_fd*, or file descriptor is locked or invalid.

EIO

There was an unspecified error while reading.

ENOMEM

There is not enough memory to read from *in_fd*.

Notes

sendfile() is usually faster than combining read() and write() calls, because it is part of the kernel. However, if it fails with EINVAL, falling back to read() and write() may be advisable.

It is advisable for performance reasons to use the TCP_CORK option of the tcp() function when sending header data with file contents to a TCP socket. This minimizes the number of packets.

See Also

mmap(), open(), socket(), splice().

sendfile64

Name

sendfile64 — transfer data between two file descriptors (Large File Support)

Synopsis

```
#include <sys/sendfile.h>
ssize_t sendfile64(int out_fd, int in_fd, off64_t * offset, size_t count);
```

Description

The sendfile64() function is a large-file version of the sendfile() function.

setbuffer

Name

setbuffer — stream buffering operation

Synopsis

```
#include <stdio.h>
void setbuffer(FILE * stream, char * buf, size_t size);
```

Description

setbuffer() is an alias for the call to setvbuf(). It works the same, except that the size of the buffer in setbuffer() is up to the caller, rather than being determined by the default BUFSIZ.

setgroups

Name

setgroups — set list of supplementary group IDs

Synopsis

```
#include <grp.h>
int setgroups(size_t size, const gid_t * list);
```

Description

If the process has appropriate privilege, the setgroups() function shall set the supplementary group IDs for the current process. *list* shall reference an array of *size* group IDs. A process may have at most NGROUPS_MAX supplementary group IDs.

Return Value

On successful completion, 0 is returned. On error, -1 is returned and the errno is set to indicate the error.

Errors

EFAULT

> *list* has an invalid address.

EPERM

> The process does not have appropriate privileges.

EINVAL

> *size* is greater than NGROUPS_MAX.

sethostname

Name

sethostname — set host name

Synopsis

```
#include <unistd.h>
#include <sys/param.h.h>
```

```
#include <sys/utsname.h>
int sethostname(const char * name, size_t len);
```

Description

If the process has appropriate privileges, the `sethostname()` function shall change the host name for the current machine. The *name* shall point to a null-terminated string of at most *len* bytes that holds the new hostname.

If the symbol `HOST_NAME_MAX` is defined, or if `sysconf(_SC_HOST_NAME_MAX)()` returns a value greater than 0, this value shall represent the maximum length of the new hostname. Otherwise, if the symbol `MAXHOSTLEN` is defined, this value shall represent the maximum length for the new hostname. If none of these values are defined, the maximum length shall be the size of the *nodename* field of the `utsname` structure.

Return Value

On success, 0 is returned. On error, -1 is returned and the global variable `errno` is set appropriately.

Errors

EINVAL

> *len* is negative or larger than the maximum allowed size.

EPERM

> the process did not have appropriate privilege.

EFAULT

> *name* is an invalid address.

Rationale

POSIX 1003.1-2001 (ISO/IEC 9945-2003) guarantees that:

> Maximum length of a host name (not including the terminating null) as returned from the `gethostname()` function shall be at least 255 bytes.

The glibc C library does not currently define `HOST_NAME_MAX`, and although it provides the name `_SC_HOST_NAME_MAX` a call to `sysconf()` returns -1 and does not alter `errno` in this case (indicating that there is no restriction on the hostname length). However, the glibc manual idicates that some implementations may have `MAXHOSTNAMELEN` as a means of detecting the maximum length, while the Linux kernel at release 2.4 and 2.6 stores this hostname in the `utsname` structure. While the glibc manual suggests simply shortening the name until `sethostname()` succeeds, the LSB requires that one of the first four mechanisms works. Future versions of glibc may provide a more reasonable result from `sysconf(_SC_HOST_NAME_MAX)`.

setsockopt

Name

`setsockopt` — set socket options

Synopsis

```
#include <sys/socket.h>
```

```
#include <netinet/ip.h>
int setsockopt(int socket, int level, int option_name, const void *
option_value, socklen_t option_len);
```

Description

The `setsockopt()` function shall behave as specified in *POSIX 1003.1-2001 (ISO/IEC 9945-2003)*, with the following extensions.

IP Protocol Level Options

If the `level` parameter is `IPPROTO_IP`, the following values shall be supported for `option_name` (see RFC 791:Internet Protocol for further details):

IP_OPTIONS

Set the Internet Protocol options sent with every packet from this socket. The `option_value` shall point to a memory buffer containing the options and `option_len` shall contain the size in bytes of that buffer. For IPv4, the maximum length of options is 40 bytes.

IP_TOS

Set the Type of Service flags to use when sending packets with this socket. The `option_value` shall point to a value containing the type of service value. The least significant two bits of the value shall contain the new Type of Service indicator. Use of other bits in the value is unspecified. The `option_len` parameter shall hold the size, in bytes, of the buffer referred to by `option_value`.

IP_TTL

Set the current unicast Internet Protocol Time To Live value used when sending packets with this socket. The `option_value` shall point to a value containing the time to live value, which shall be between 1 and 255. The `option_len` parameter shall hold the size, in bytes, of the buffer referred to by `option_value`.

IP_MULTICAST_TTL

Sets the Time To Live value of outgoing multicast packets for this socket. `optval` shall point to an integer which contains the new TTL value. If the new TTL value is −1, the implementation should use an unspecified default TTL value. If the new TTL value is out of the range of acceptable values (0-255), `setsockopt()` shall return −1 and set `errno` to indicate the error.

IP_MULTICAST_LOOP

Sets a boolean flag indicating whether multicast packets originating locally should be looped back to the local sockets. `optval` shall point to an integer which contains the new flag value.

IP_ADD_MEMBERSHIP

Join a multicast group. `optval` shall point to a `ip_mreq` structure. Before calling, the caller should fill in the `imr_multiaddr` field with the multicast group address and the `imr_address` field with the address of the local interface. If `imr_address` is set to INADDR_ANY, then an appropriate interface is chosen by the system.

IP_DROP_MEMBERSHIP

Leave a multicast group. `optval` shall point to a `ip_mreq` structure containing the same values as were used with `IP_ADD_MEMBERSHIP`.

`IP_MULTICAST_IF`

Set the local device for a multicast socket. `optval` shall point to either an `ip_mreqn` structure or an `in_addr` structure. If using the `ip_mreqn` structure, the *imr_multiaddr* field should be set to multicast group address, the *imr_address* field to the address of the local interface, and the *imr_index* field to the interface index. If using the `in_addr` structure, the address of the local interface shall be specified. If *in_addr* or *imr_address* is set to `INADDR_ANY`, then an appropriate interface is chosen by the system. If *imr_index* is zero, then an appropriate interface index is chosen by the implementation.

The `ip_mreq` structure contains two `struct in_addr` fields: *imr_multiaddr* and *imr_address*.

Return Value

On success, 0 is returned. On error, -1 is returned and the global variable `errno` is set appropriately.

Errors

As defined in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

setstate_r

Name

`setstate_r` — reentrantly change the state array used by random number generator functions

Synopsis

```
#include <stdlib.h>
int setstate_r(char * statebuf, struct random_data * buf);
```

Description

The interface `setstate_r()` shall function in the same way as the interface `setstate()`, except that `setstate_r()` shall use the data in *statebuf* instead of the global random number generator state.

setutent

Name

`setutent` — access user accounting database entries

Synopsis

```
#include <utmp.h>
void setutent(void);
```

Description

The `setutent()` function shall reset the user accounting database such that the next call to `getutent()` shall return the first record in the database. It is recommended to call it before any of the other functions that operate on the user accounting databases (e.g. `getutent()`)

Return Value

None.

sigandset

Name

`sigandset` — build a new signal set by combining the two input sets using logical AND

Synopsis

```
#include <signal.h>
int sigandset(sigset_t * set, const sigset_t * left, const sigset_t
* right);
```

Description

The `sigandset()` function shall combine the two signal sets referenced by *left* and *right*, using a logical AND operation, and shall place the result in the location referenced by *set*, The resulting signal set shall contain only signals that are in both the set referenced by *left* and the set referenced by *right*.

Applications shall call `sigemptyset()` or `sigfillset()` at least once for each object of type sigset_t to initialize it. If an uninitialized or NULL object is passed to `sigandset()`, the results are undefined.

Return Value

`sigandset()` returns 0. There are no defined error returns.

See Also

`sigorset()`

sigisemptyset

Name

sigisemptyset — check for empty signal set

Synopsis

```
#include <signal.h>
int sigisemptyset(const sigset_t * set);
```

Description

The `sigisemptyset()` function shall check for empty signal set referenced by *set*.

Applications shall call `sigemptyset()` or `sigfillset()` at least once for each object of type sigset_t to initialize it. If an uninitialized or NULL object is passed to `sigisemptyset()`, the results are undefined.

Return Value

The `sigisemptyset()` function shall return a positive non-zero value if the signal set referenced by *set* is empty, or zero if this set is empty. There are no defined error returns.

sigorset

Name

sigorset — build a new signal set by combining the two input sets using logical OR

Synopsis

```
#include <signal.h>
int sigorset(sigset_t * set, const sigset_t * left, const sigset_t * right);
```

Description

The `sigorset()` function shall combine the two signal sets referenced by *left* and *right*, using a logical OR operation, and shall place the result in the location referenced by *set*, The resulting signal set shall contain only signals that are in either the set referenced by *left* or the set referenced by *right*.

Applications shall call `sigemptyset()` or `sigfillset()` at least once for each object of type sigset_t to initialize it. If an uninitialized or NULL object is passed to `sigorset()`, the results are undefined.

Return Value

`sigorset()` returns 0. There are no defined error returns.

See Also

`sigandset()`

sigpause

Name

`sigpause` — remove a signal from the signal mask and suspend the thread (deprecated)

Synopsis

```
#include <signal.h>
int sigpause(int sig);
```

Description

The `sigpause()` function is deprecated from the LSB and is expected to disappear from a future version of the LSB. Conforming applications should use `sigsuspend()` instead.

In the source standard, `sigpause()` is implemented as a macro causing it to behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), and is equivalent to the function `__xpg_sigpause()`. If the macro is undefined, `sigpause()` from the binary standard is used, with differences as described here:

The `sigpause()` function shall block those signals indicated by *sig* and suspend execution of the thread until a signal is delivered. When a signal is delivered, the original signal mask shall be restored.

See Also

`__xpg_sigpause()`

sigreturn

Name

`sigreturn` — return from signal handler and cleanup stack frame

Synopsis

```
int sigreturn(struct sigcontext * scp);
```

Description

The `sigreturn()` function is used by the system to cleanup after a signal handler has returned. This function is not in the source standard; it is only in the binary standard.

Return Value

`sigreturn()` never returns.

srand48_r

Name

srand48_r — reentrantly generate pseudorandom numbers in a uniform distribution

Synopsis

```
#include <stdlib.h>
int srand48_r(long int seedval, struct drand48_data * buffer);
```

Description

The interface srand48_r() shall function in the same way as the interface srand48(), except that srand48_r() shall use the data in *buffer* instead of the global random number generator state.

srandom_r

Name

srandom_r — reentrantly set the seed for a new sequence of pseudorandom numbers

Synopsis

```
#include <stdlib.h>
int srandom_r(unsigned int seed, struct random_data * buffer);
```

Description

The interface srandom_r() shall function in the same way as the interface srandom(), except that srandom_r() shall use the data in *buffer* instead of the global random number generator state.

sscanf

Name

sscanf — convert formatted input

Description

The scanf() family of functions shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except as noted below.

Differences

The %s, %S and %[conversion specifiers shall accept an option length modifier a, which shall cause a memory buffer to be allocated to hold the string converted. In such a case, the argument corresponding to the conversion specifier should be a reference to a pointer value that will receive a pointer to the allocated buffer. If there is insufficient memory to allocate a buffer, the function may set errno to ENOMEM and a conversion error results.

> **Note:** This directly conflicts with the ISO C (1999) usage of %a as a conversion specifier for hexadecimal float values. While this conversion specifier should be supported, a format specifier such as "%aseconds" will have a different meaning on an LSB conforming system.

statfs

Name

statfs — (deprecated)

Synopsis

```
#include <sys/statfs.h>
int statfs(const char *path, struct statfs *buf);
```

Description

The statfs() function returns information about a mounted file system. The file system is identified by *path*, a path name of a file within the mounted filesystem. The results are placed in the structure pointed to by

Fields that are undefined for a particular file system shall be set to 0.

> **Note:** Application developers should use the statvfs() function to obtain general file system information. Applications should only use the statfs() function if they must determine the file system type, which need not be provided by statvfs().

Return Value

On success, the statfs() function shall return 0 and set the fields of the structure idenfitied by *buf* accordingly. On error, the statfs() function shall return -1 and set errno accordingly.

Errors

ENOTDIR

A component of the path prefix of *path* is not a directory.

ENAMETOOLONG

path is too long.

ENOENT

The file referred to by *path* does not exist.

EACCES

Search permission is denied for a component of the path prefix of *path*.

ELOOP

Too many symbolic links were encountered in translating *path*.

EFAULT

buf or *path* points to an invalid address.

EIO

An I/O error occurred while reading from or writing to the file system.

ENOMEM

Insufficient kernel memory was available.

ENOSYS

The filesystem `path` is on does not support `statfs()`.

statfs64

Name

`statfs64` — (deprecated)

Synopsis

```
#include <sys/statfs.h>
int statfs64(const char * path, struct statfs64 *buf);
```

Description

The `statfs64()` function returns information about a mounted file system. The file system is identified by `path`, a path name of a file within the mounted filesystem. The results are placed in the structure pointed to by `buf`.

`statfs64()` is a large-file version of the `statfs()` function.

Fields that are undefined for a particular file system shall be set to `0`.

> **Note:** Application developers should use the `statvfs64()` function to obtain general file system information. Applications should only use the `statfs64()` function if they must determine the file system type, which need not be provided by `statvfs64()`.

Return Value

On success, the `statfs64()` function shall return 0 and set the fields of the structure idenfitied by `buf` accordingly. On error, the `statfs64()` function shall return -1 and set `errno` accordingly.

Errors

See `fstatfs()`.

stime

Name

`stime` — set time

Synopsis

```
#define _SVID_SOURCE
```

```
#include <time.h>
int stime(const time_t * t);
```

Description

If the process has appropriate privilege, the stime() function shall set the system's idea of the time and date. Time, referenced by t, is measured in seconds from the epoch (defined in POSIX 1003.1-2001 (ISO/IEC 9945-2003) as 00:00:00 UTC January 1, 1970).

Return Value

On success, stime() shall return 0. Otherwise, stime() shall return -1 and errno shall be set to indicate the error.

Errors

EPERM

   The process does not have appropriate privilege.

EINVAL

   t is a null pointer.

stpcpy

Name

stpcpy — copy a string returning a pointer to its end

Synopsis

```
#include <string.h>
char * stpcpy(char * restrict dest, const char * restrict src);
```

Description

The stpcpy() function shall copy the string pointed to by *src* (including the terminating null character) to the array pointed to by *dest*. The strings may not overlap, and the destination string *dest* shall be large enough to receive the copy.

Return Value

stpcpy() returns a pointer to the end of the string *dest* (that is, the address of the terminating null character) rather than the beginning.

Example

This program uses stpcpy() to concatenate foo and bar to produce foobar, which it then prints.

```
#include <string.h>

int
main (void)
{
  char buffer[256];
  char *to = buffer;
  to = stpcpy (to, "foo");
  to = stpcpy (to, "bar");
  printf ("%s\n", buffer);
```

```
    }
```

stpncpy

Name

`stpncpy` — copy a fixed-size string, returning a pointer to its end

Synopsis

```
#include <string.h>
char * stpncpy(char * restrict dest, const char * restrict src,
size_t n);
```

Description

The `stpncpy()` function shall copy at most *n* characters from the string pointed to by *src*, including the terminating null character, to the array pointed to by *dest*. Exactly *n* characters are written at *dest*. If the length `strlen()(src)` is smaller than *n*, the remaining characters in *dest* are filled with '\0' characters. If the length `strlen(src)` is greater than or equal to *n*, *dest* will not be null terminated.

The strings may not overlap.

The programmer shall ensure that there is room for at least *n* characters at *dest*.

Return Value

The `stpncpy()` function shall return a pointer to the terminating NULL in *dest*, or, if *dest* is not NULL-terminated, *dest* + *n*.

strcasestr

Name

`strcasestr` — locate a substring ignoring case

Synopsis

```
#include <string.h>
char * strcasestr(const char * s1, const char * s2);
```

Description

The `strcasestr()` shall behave as `strstr()`, except that it shall ignore the case of both strings. The `strcasestr()` function shall be locale aware; that is `strcasestr()` shall behave as if both strings had been converted to lower case in the current locale before the comparison is performed.

Return Value

Upon successful completion, `strcasestr()` shall return a pointer to the located string or a null pointer if the string is not found. If *s2* points to a string with zero length, the function shall return *s1*.

strerror_r

Name

strerror_r — return string describing error number

Synopsis

```
#include <string.h>
char * strerror_r(int errnum, char * buf, size_t buflen);
```

Description

In the source standard, `strerror_r()` is implemented as a macro causing it to behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), and is equivalent to the function `__xpg_strerror_r()`. If the macro is undefined, `strerror_r()` from the binary standard is used, with differences as described here.

The `strerror_r()` function shall return a pointer to the string corresponding to the error number *errnum*. The returned pointer may point within the buffer *buf* (at most *buflen* bytes).

Return Value

On success, `strerror_r()` shall return a pointer to the generated message string (determined by the setting of the LC_MESSAGES category in the current locale). Otherwise, `strerror_r()` shall return the string corresponding to "Unknown error".

See Also

`__xpg_strerror_r()`

strndup

Name

strndup — return a malloc'd copy of at most the specified number of bytes of a string

Synopsis

```
#include <string.h>
char * strndup(const char * string, size_t n);
```

Description

The strndup() function shall return a malloc()'d copy of at most *n* bytes of *string*. The resultant string shall be terminated even if no NULL terminator appears before *string+n*.

Return Value

On success, strndup() shall return a pointer to a newly allocated block of memory containing a copy of at most *n* bytes of *string*. Otherwise, strndup() shall return NULL and set errno to indicate the error.

Errors

ENOMEM

Insufficient memory available.

strnlen

Name

strnlen — determine the length of a fixed-size string

Synopsis

```
#include <string.h>
size_t strnlen(const char * s, size_t maxlen);
```

Description

The strnlen() function shall compute the number of bytes in the array to which *s* points, stopping at *maxlen* bytes. A null byte and any bytes following it are not counted.

Return Value

The strnlen() function shall return the length of *s* if that is less than *maxlen*, or *maxlen* if there is no null byte in the first *maxlen* bytes.

Errors

No errors are defined.

strptime

Name

strptime — parse a time string

Description

The strptime() shall behave as specified in the *POSIX 1003.1-2001 (ISO/IEC 9945-2003)* with differences as listed below.

Number of leading zeroes may be limited

The *POSIX 1003.1-2001 (ISO/IEC 9945-2003)* specifies fields for which "leading zeros are permitted but not required"; however, applications shall not expect to be able to supply more leading zeroes for these fields than would be implied by the range of the field. Implementations may choose to either match an input with excess leading zeroes, or treat this as a non-matching input. For example, %j has a range of 001 to 366, so 0, 00, 000, 001, and 045 are acceptable inputs, but inputs such as 0000, 0366 and the like are not.

Rationale

glibc developers consider it appropriate behavior to forbid excess leading zeroes. When trying to parse a given input against several format strings, forbidding excess leading zeroes could be helpful. For example, if one matches 0011-12-26 against %m-%d-%Y and then against %Y-%m-%d, it seems useful for the first match to fail, as it would be perverse to parse that date as November 12, year 26. The second pattern parses it as December 26, year 11.

The *POSIX 1003.1-2001 (ISO/IEC 9945-2003)* is not explicit that an unlimited number of leading zeroes are required, although it may imply this. The LSB explicitly allows implementations to have either behavior. Future versions of this standard may require implementations to forbid excess leading zeroes.

An Interpretation Request is currently pending against POSIX 1003.1-2001 (ISO/IEC 9945-2003) for this matter.

strsep

Name

strsep — extract token from string

Synopsis

```
#include <string.h>
char * strsep(char * * stringp, const char * delim);
```

Description

The strsep() function shall find the first token in the string referenced by the pointer *stringp*, using the characters in *delim* as delimiters.

If *stringp* is NULL, strsep() shall return NULL and do nothing else.

If *stringp* is non-NULL, strsep() shall find the first token in the string referenced by *stringp*, where tokens are delimited by characters in the string *delim*. This token shall be terminated with a \0 character by overwriting the delimiter, and *stringp* shall be updated to point past the token. In case no delimiter was found, the token is taken to be the entire string referenced by *stringp*, and the location referenced by *stringp* is made NULL.

Return Value

strsep() shall return a pointer to the beginning of the token.

Notes

The strsep() function was introduced as a replacement for strtok(), since the latter cannot handle empty fields. However, strtok() conforms to ISO C (1999) and to POSIX 1003.1-2001 (ISO/IEC 9945-2003) and hence is more portable.

See Also

strtok(), strtok_r().

strsignal

Name

strsignal — return string describing signal

Synopsis

```
#define _GNU_SOURCE
```

```
#include <string.h>
char * strsignal(int sig);
```

Description

The `strsignal()` function shall return a pointer to a string describing the signal number *sig*. The string can only be used until the next call to `strsignal()`.

Return Value

If *sig* is a valid signal number, `strsignal()` shall return a pointer to the appropriate description string. If *sig* is not a valid signal number, `strsignal()` shall return a pointer to an error string. The contents of either type of string are unspecified.

Although the function is not declared as returning a pointer to a constant character string, applications shall not modify the returned string.

strtoq

Name

`strtoq` — convert string value to a long or quad_t integer

Synopsis

```
#include <sys/types.h>
#include <stdlib.h>
#include <limits.h>
long long strtoq(const char * nptr, char * * endptr, int base);
```

Description

`strtoq()` converts the string *nptr* to a quadt value. The conversion is done according to the given base, which shall be between `2` and `36` inclusive, or be the special value `0`.

nptr may begin with an arbitrary amount of white space (as determined by `isspace()`), followed by a single optional + or - sign character. If *base* is `0` or `16`, the string may then include a 0x prefix, and the number will be read in base 16; otherwise, a `0` base is taken as 10 (decimal), unless the next character is `0`, in which case it is taken as 8 (octal).

The remainder of the string is converted to a long value in the obvious manner, stopping at the first character which is not a valid digit in the given base. (In bases above 10, the letter `A` in either upper or lower case represents 10, `B` represents 11, and so forth, with `Z` representing 35.)

Return Value

`strtoq()` returns the result of the conversion, unless the value would underflow or overflow. If an underflow occurs, `strtoq()` returns `QUAD_MIN`. If an overflow occurs, `strtoq()` returns `QUAD_MAX`. In both cases, the global variable `errno` is set to ERANGE.

Errors

ERANGE

> The given string was out of range; the value converted has been clamped.

strtouq

Name

strtouq — convert a string to an unsigned long long

Synopsis

```
#include <sys/types.h>
#include <stdlib.h>
#include <limits.h>
unsigned long long strtouq(const char * nptr, char * * endptr, int
base);
```

Description

strtouq() converts the string *nptr* to an unsigned long long value. The conversion is done according to the given base, which shall be between 2 and 36 inclusive, or be the special value 0.

nptr may begin with an arbitrary amount of white space (as determined by isspace()), followed by a single optional + or - sign character. If *base* is 0 or 16, the string may then include a 0x prefix, and the number will be read in base 16; otherwise, a 0 base is taken as 10 (decimal), unless the next character is 0, in which case it is taken as 8 (octal).

The remainder of the string is converted to an unsigned long value in the obvious manner, stopping at the end of the string or at the first character that does not produce a valid digit in the given base. (In bases above 10, the letter A in either upper or lower case represents 10, B represents 11, and so forth, with Z representing 35.)

Return Value

On success, strtouq() returns either the result of the conversion or, if there was a leading minus sign, the negation of the result of the conversion, unless the original (non-negated) value would overflow. In the case of an overflow the function returns UQUAD_MAX and the global variable errno is set to ERANGE.

Errors

ERANGE

The given string was out of range; the value converted has been clamped.

svc_register

Name

`svc_register` — register Remote Procedure Call interface

Synopsis

```
#include <rpc/rpc.h>
bool_t  svc_register(SVCXPRT  *  xprt,  rpcprog_t  prognum,  rpcvers_t
versnum, __dispatch_fn_t dispatch, rpcprot_t protocol);
```

Description

The `svc_register()` function shall associate the program identified by *prognum* at version *versnum* with the service dispatch procedure, *dispatch*. If *protocol* is zero, the service is not registered with the `portmap` service. If *protocol* is non-zero, then a mapping of the triple [*prognum*, *versnum*, *protocol*] to xprt->xp_port is established with the local `portmap` service. The procedure *dispatch* has the following form:

```
int dispatch(struct svc_req * request, SVCXPRT * xprt);
```

Return Value

`svc_register()` returns 1 if it succeeds, and zero otherwise.

svc_run

Name

`svc_run` — waits for RPC requests to arrive and calls service procedure

Synopsis

```
#include <rpc/svc.h>
void svc_run(void);
```

Description

The `svc_run()` function shall wait for RPC requests to arrive, read and unpack each request, and dispatch it to the appropriate registered handler. Under normal conditions, `svc_run()` shall not return; it shall only return if serious errors occur that prevent further processing.

svc_sendreply

Name

`svc_sendreply` — called by RPC service's dispatch routine

Synopsis

`bool_t svc_sendreply(SVCXPRT *`*xprt*`, xdrproc_t `*outproc*`, caddr_t `*out*`);`

Description

Called by an RPC service's dispatch routine to send the results of a remote procedure call. The parameter *xprt* is the request's associated transport handle; *outproc* is the XDR routine which is used to encode the results; and *out* is the address of the results. This routine returns one if it succeeds, zero otherwise.

svctcp_create

Name

`svctcp_create` — create a TCP/IP-based RPC service transport

Synopsis

```
#include <rpc/rpc.h>
SVCXPRT * svctcp_create(int    sock,    u_int   send_buf_size,   u_int
recv_buf_size);
```

Description

`svctcp_create()` creates a TCP/IP-based RPC service transport, to which it returns a pointer. The transport is associated with the socket *sock*, which may be `RPC_ANYSOCK`, in which case a new socket is created. If the socket is not bound to a local TCP port, then this routine binds it to an arbitrary port. Upon completion, `xprt->xp_sock` is the transport's socket descriptor, and `xprt->xp_port` is the transport's port number. Since TCP-based RPC uses buffered I/O, users may specify the size of buffers; values of zero choose suitable defaults.

Return Value

`svctcp_create()` returns NULL if it fails, or a pointer to the RPC service transport otherwise.

svcudp_create

Name

svcudp_create — create a UDP-based RPC service transport

Synopsis

```
SVCXPRT *
svcudp_create(int sock);
```

Description

The `svcudp_create()` function shall create a UDP/IP-based RPC service transport, and return a pointer to its descriptor. The transport is associated with the socket *sock*, which may be `RPC_ANYSOCK`, in which case a new socket shall be created. If the socket is not bound to a local UDP port, then `svcudp_create()` shall bind it to an arbitrary port.

If `svcudp_create()` returns successfully, then the *xp_sock* field in the result shall be the transport's socket descriptor, and the *xp_port* field shall be the transport's port number.

Return Value

Upon successful completion, `svcudp_create()` shall return a pointer to a RPC service transport; otherwise, a null pointer shall be returned.

swscanf

Name

swscanf — convert formatted input

Description

The `scanf()` family of functions shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except as noted below.

Differences

The `%s`, `%S` and `%[` conversion specifiers shall accept an option length modifier `a`, which shall cause a memory buffer to be allocated to hold the string converted. In such a case, the argument corresponding to the conversion specifier should be a reference to a pointer value that will receive a pointer to the allocated buffer. If there is insufficient memory to allocate a buffer, the function may set `errno` to ENOMEM and a conversion error results.

> **Note:** This directly conflicts with the ISO C (1999) usage of `%a` as a conversion specifier for hexadecimal float values. While this conversion specifier should be supported, a format specifier such as `"%aseconds"` will have a different meaning on an LSB conforming system.

sysconf

Name

sysconf — Get configuration information at runtime

Synopsis

```
#include <unistd.h>
long sysconf(int name);
```

DESCRIPTION

sysconf() is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

Extra Variables

These additional values extend the list in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

- *_SC_PHYS_PAGES*

    The number of pages of physical memory.

- *_SC_AVPHYS_PAGES*

    The number of currently available pages of physical memory.

- *_SC_NPROCESSORS_CONF*

    The number of processors configured.

- *_SC_NPROCESSORS_ONLN*

    The number of processors currently online (available).

Extra Versions

While this specification only requires conformance with POSIX 1003.1-2001 (ISO/IEC 9945-2003), implementations are not constrained from moving on and claiming conformance with a susequent edition, POSIX 1003.1-2008 (ISO/IEC 9945-2009). Thus for run-time checks using sysconf(), the wording is amended to allow return values of 0, -1, 200112L or 200809L where formerly 200809L was not listed as allowed.

sysinfo

Name

sysinfo — return system information

Synopsis

```
#include <sys/sysinfo.h>
int sysinfo(struct sysinfo *info);
```

Description

sysinfo() provides a way to obtain certain system statistics. Statistics are written into a sysinfo structure pointed to by *info*. Elements which take a size are sized in units indicated by the value of the *mem_unit* member of *info*. The other members have traditional meanings as indicated in Data Definitions, but are not formally part of this specification.

Return Value

Returns zero on success. On error, -1 is returned and errno is set to indicate the error.

Errors

EFAULT

> The *info* parameter does not point to a valid sysinfo structure.

system

Name

system — execute a shell command

Synopsis

```
#include <stdlib.h>
int system(const char * string);
```

Description

The system() function shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

Notes

The fact that system() ignores interrupts is often not what a program wants. POSIX 1003.1-2001 (ISO/IEC 9945-2003) describes some of the consequences; an additional consequence is that a program calling system() from a loop cannot be reliably interrupted. Many programs will want to use the exec() family of functions instead.

Do not use system() from a program with suid or sgid privileges, because unexpected values for some environment variables might be used to subvert system integrity. Use the exec() family of functions instead, but not execlp() or execvp(). system() will not, in fact, work properly from programs with suid or sgid privileges on systems on which /bin/sh is **bash** version 2, since **bash** 2 drops privileges on startup. (Debian uses a modified **bash** which does not do this when invoked as **sh**.)

The check for the availability of /bin/sh is not actually performed; it is always assumed to be available. ISO C (1999) specifies the check, but POSIX 1003.1-2001 (ISO/IEC 9945-2003) specifies that the return shall always be nonzero, since a system without the shell is not conforming, and it is this that is implemented.

It is possible for the shell command to return 127, so that code is not a sure indication that the execve() call failed; check the global variable errno to make sure.

textdomain

Name

`textdomain` — set the current default message domain

Synopsis

```
#include <libintl.h>
char * textdomain(const char * domainname);
```

Description

The `textdomain()` function shall set the current default message domain to *domainname*. Subsequent calls to `gettext()` and `ngettext()` use the default message domain.

If *domainname* is NULL, the default message domain shall not be altered.

If *domainname* is "", `textdomain()` shall reset the default domain to the system default of "messages".

Return

On success, `textdomain()` shall return the currently selected domain. Otherwise, a null pointer shall be returned, and `errno` is set to indicate the error.

Errors

`ENOMEM`

> Insufficent memory available.

unlink

Name

`unlink` — remove a directory entry

Synopsis

```
int unlink(const char * path);
```

Description

`unlink()` is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

See also Section 18.1, Additional behaviors: unlink/link on directory.

May return EISDIR on directories

If *path* specifies a directory, the implementation may return EISDIR instead of EPERM as specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003).

> **Rationale:** The Linux kernel has deliberately chosen EISDIR for this case and does not expect to change.

uselocale

Name

uselocale — set locale for thread

Synopsis

```
#include <locale.h>
locale_t uselocale(locale_t newloc);
```

Description

The `uselocale()` function shall set the locale for the calling thread to the locale specified by *newloc*.

If *newloc* is the value `LC_GLOBAL_LOCALE`, the thread's locale shall be set to the process current global locale, as set by `setlocale()`. If *newloc* is `NULL`, the thread's locale is not altered.

Return Value

The `uselocale()` function shall return the previous locale, or `LC_GLOBAL_LOCALE` if the thread local locale has not been previously set.

Errors

None defined.

See Also

`setlocale()`, `freelocale()`, `duplocale()`, `newlocale()`

utmpname

Name

utmpname — set user accounting database

Synopsis

```
#include <utmp.h>
int utmpname(const char * dbname);
```

Description

The `utmpname()` function shall cause the user accounting database used by the `getutent()`, `getutent_r()`, `getutxent()`, `getutxid()`, `getutxline()`, and `pututxline()` functions to be that named by *dbname*, instead of the system default database. See Section 16.3 for further information.

> **Note:** The LSB does not specify the format of the user accounting database, nor the names of the file or files that may contain it.

Return Value

None.

Errors

None defined.

vasprintf

Name

`vasprintf` — write formatted output to a dynamically allocated string

Synopsis

```
#include <stdarg.h>
#include <stdio.h>
int vasprintf(char * * restrict ptr, const char * restrict format,
va_list arg);
```

Description

The `vasprintf()` function shall write formatted output to a dynamically allocated string, and store the address of that string in the location referenced by *ptr*. It shall behave as `asprintf()`, except that instead of being called with a variable number of arguments, it is called with an argument list as defined by `<stdarg.h>`.

Return Value

Refer to `fprintf()`.

Errors

Refer to `fprintf()`.

vdprintf

Name

`vdprintf` — write formatted output to a file descriptor

Synopsis

```
#include <stdio.h>
int vdprintf(int fd, const char * restrict format, va_list arg);
```

Description

The `vdprintf()` function shall behave as `vfprintf()`, except that `vdprintf()` shall write output to the file associated with the file descriptor specified by the *fd* argument, rather than place output on a stream (as defined by POSIX 1003.1-2001 (ISO/IEC 9945-2003)).

Return Value

Refer to `fprintf()`.

Errors

Refer to `fprintf()`.

verrx

Name

verrx — display formatted error message and exit

Synopsis

```
#include <stdarg.h>
#include <err.h>
void verrx(int eval, const char * fmt, va_list args);
```

Description

The verrx() shall behave as errx() except that instead of being called with a variable number of arguments, it is called with an argument list as defined by <stdarg.h>.

verrx() does not return, but exits with the value of *eval*.

Return Value

None.

Errors

None.

vfscanf

Name

vfscanf — convert formatted input

Description

The scanf() family of functions shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except as noted below.

Differences

The %s, %S and %[conversion specifiers shall accept an option length modifier a, which shall cause a memory buffer to be allocated to hold the string converted. In such a case, the argument corresponding to the conversion specifier should be a reference to a pointer value that will receive a pointer to the allocated buffer. If there is insufficient memory to allocate a buffer, the function may set errno to ENOMEM and a conversion error results.

> **Note:** This directly conflicts with the ISO C (1999) usage of %a as a conversion specifier for hexadecimal float values. While this conversion specifier should be supported, a format specifier such as "%aseconds" will have a different meaning on an LSB conforming system.

vfwscanf

Name

`vfwscanf` — convert formatted input

Description

The `scanf()` family of functions shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except as noted below.

Differences

The `%s`, `%S` and `%[` conversion specifiers shall accept an option length modifier `a`, which shall cause a memory buffer to be allocated to hold the string converted. In such a case, the argument corresponding to the conversion specifier should be a reference to a pointer value that will receive a pointer to the allocated buffer. If there is insufficient memory to allocate a buffer, the function may set `errno` to ENOMEM and a conversion error results.

> **Note:** This directly conflicts with the ISO C (1999) usage of `%a` as a conversion specifier for hexadecimal float values. While this conversion specifier should be supported, a format specifier such as `"%aseconds"` will have a different meaning on an LSB conforming system.

vscanf

Name

`vscanf` — convert formatted input

Description

The `scanf()` family of functions shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except as noted below.

Differences

The `%s`, `%S` and `%[` conversion specifiers shall accept an option length modifier `a`, which shall cause a memory buffer to be allocated to hold the string converted. In such a case, the argument corresponding to the conversion specifier should be a reference to a pointer value that will receive a pointer to the allocated buffer. If there is insufficient memory to allocate a buffer, the function may set `errno` to ENOMEM and a conversion error results.

> **Note:** This directly conflicts with the ISO C (1999) usage of `%a` as a conversion specifier for hexadecimal float values. While this conversion specifier should be supported, a format specifier such as `"%aseconds"` will have a different meaning on an LSB conforming system.

vsscanf

Name

vsscanf — convert formatted input

Description

The scanf() family of functions shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except as noted below.

Differences

The %s, %S and %[conversion specifiers shall accept an option length modifier a, which shall cause a memory buffer to be allocated to hold the string converted. In such a case, the argument corresponding to the conversion specifier should be a reference to a pointer value that will receive a pointer to the allocated buffer. If there is insufficient memory to allocate a buffer, the function may set errno to ENOMEM and a conversion error results.

> **Note:** This directly conflicts with the ISO C (1999) usage of %a as a conversion specifier for hexadecimal float values. While this conversion specifier should be supported, a format specifier such as "%aseconds" will have a different meaning on an LSB conforming system.

vswscanf

Name

vswscanf — convert formatted input

Description

The scanf() family of functions shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except as noted below.

Differences

The %s, %S and %[conversion specifiers shall accept an option length modifier a, which shall cause a memory buffer to be allocated to hold the string converted. In such a case, the argument corresponding to the conversion specifier should be a reference to a pointer value that will receive a pointer to the allocated buffer. If there is insufficient memory to allocate a buffer, the function may set errno to ENOMEM and a conversion error results.

> **Note:** This directly conflicts with the ISO C (1999) usage of %a as a conversion specifier for hexadecimal float values. While this conversion specifier should be supported, a format specifier such as "%aseconds" will have a different meaning on an LSB conforming system.

vsyslog

Name

vsyslog — log to system log

Synopsis

```
#include <stdarg.h>
```

```
#include <syslog.h>
void vsyslog(int priority, char * message, va_list arglist);
```

Description

The `vsyslog()` function is identical to `syslog()` as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that *arglist* (as defined by `stdarg.h`) replaces the variable number of arguments.

vwscanf

Name

`vwscanf` — convert formatted input

Description

The `scanf()` family of functions shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except as noted below.

Differences

The `%s`, `%S` and `%[` conversion specifiers shall accept an option length modifier `a`, which shall cause a memory buffer to be allocated to hold the string converted. In such a case, the argument corresponding to the conversion specifier should be a reference to a pointer value that will receive a pointer to the allocated buffer. If there is insufficient memory to allocate a buffer, the function may set `errno` to ENOMEM and a conversion error results.

> **Note:** This directly conflicts with the ISO C (1999) usage of `%a` as a conversion specifier for hexadecimal float values. While this conversion specifier should be supported, a format specifier such as `"%aseconds"` will have a different meaning on an LSB conforming system.

wait4

Name

`wait4` — wait for process termination, BSD style

Synopsis

```
#include <sys/types.h>
#include <sys/resource.h>
```

```
#include <sys/wait.h>
pid_t wait4(pid_t pid, int * status, int options, struct rusage *
rusage);
```

Description

`wait4()` suspends execution of the current process until a child (as specified by *pid*) has exited, or until a signal is delivered whose action is to terminate the current process or to call a signal handling function. If a child (as requested by *pid*) has already exited by the time of the call (a so-called "zombie" process), the function returns immediately. Any system resources used by the child are freed.

The value of *pid* can be one of:

< -1

> wait for any child process whose process group ID is equal to the absolute value of *pid*.

-1

> wait for any child process; this is equivalent to calling `wait3()`.

0

> wait for any child process whose process group ID is equal to that of the calling process.

> 0

> wait for the child whose process ID is equal to the value of *pid*.

The value of options is a bitwise or of zero or more of the following constants:

WNOHANG

> return immediately if no child is there to be waited for.

WUNTRACED

> return for children that are stopped, and whose status has not been reported.

If status is not NULL, `wait4()` stores status information in the location *status*. This status can be evaluated with the following macros:

> **Note:** These macros take the `status` value (an `int`) as an argument -- not a pointer to the value!

WIFEXITED(status)

> is nonzero if the child exited normally.

WEXITSTATUS(status)

> evaluates to the least significant eight bits of the return code of the child that terminated, which may have been set as the argument to a call to `exit()` or as the argument for a return statement in the main program. This macro can only be evaluated if `WIFEXITED()` returned nonzero.

WIFSIGNALED(status)

> returns true if the child process exited because of a signal that was not caught.

WTERMSIG(status)

> returns the number of the signal that caused the child process to terminate. This macro can only be evaluated if `WIFSIGNALED()` returned nonzero.

WIFSTOPPED(status)

> returns true if the child process that caused the return is currently stopped; this is only possible if the call was done using `WUNTRACED()`.

WSTOPSIG(status)

> returns the number of the signal that caused the child to stop. This macro can only be evaluated if `WIFSTOPPED()` returned nonzero.

If *rusage* is not NULL, the struct `rusage` (as defined in `sys/resource.h`) that it points to will be filled with accounting information. See `getrusage()` for details.

Return Value

On success, the process ID of the child that exited is returned. On error, -1 is returned (in particular, when no unwaited-for child processes of the specified kind exist), or 0 if `WNOHANG()` was used and no child was available yet. In the latter two cases, the global variable `errno` is set appropriately.

Errors

ECHILD

> No unwaited-for child process as specified does exist.

ERESTARTSYS

> A `WNOHANG()` was not set and an unblocked signal or a `SIGCHILD` was caught. This error is returned by the system call. The library interface is not allowed to return ERESTARTSYS, but will return EINTR.

warn

Name

warn — formatted error messages

Synopsis

```
#include <err.h>
void warn(const char * fmt, ...);
```

Description

The `warn()` function shall display a formatted error message on the standard error stream. The output shall consist of the last component of the program name, a colon character, and a space character. If *fmt* is non-NULL, it shall be used as a format string for the `printf()` family of functions, and the formatted message, a colon character, and a space are written to `stderr`. Finally, the error message string affiliated with the current value of the global variable `errno` shall be written to `stderr`, followed by a newline character.

Return Value

None.

Errors

None.

warnx

Name

warnx — formatted error messages

Synopsis

```
#include <err.h>
void warnx(const char * fmt, ...);
```

Description

The `warnx()` function shall display a formatted error message on the standard error stream. The last component of the program name, a colon character, and a space shall be output. If *fmt* is non-NULL, it shall be used as the format string for the `printf()` family of functions, and the formatted error message, a colon character, and a space shall be output. The output shall be followed by a newline character.

Return Value

None.

Errors

None.

wcpcpy

Name

wcpcpy — copy a wide character string, returning a pointer to its end

Synopsis

```
#include <wchar.h>
wchar_t * wcpcpy(wchar_t * dest, const wchar_t * src);
```

Description

`wcpcpy()` is the wide-character equivalent of `stpcpy()`. It copies the wide character string *src*, including the terminating null wide character code, to the array *dest*.

The strings may not overlap.

The programmer shall ensure that there is room for at least `wcslen()(src)+1` wide characters at *dest*.

Return Value

`wcpcpy()` returns a pointer to the end of the wide-character string *dest*, that is, a pointer to the terminating null wide character code.

wcpncpy

Name

wcpncpy — copy a fixed-size string of wide characters, returning a pointer to its end

Synopsis

```
#include <wchar.h>
wchar_t * wcpncpy(wchar_t * dest, const wchar_t * src, size_t n);
```

Description

`wcpncpy()` is the wide-character equivalent of `stpncpy()`. It copies at most *n* wide characters from the wide-character string *src*, including the terminating null wide character code, to the array *dest*. Exactly *n* wide characters are written at *dest*. If the length `wcslen()(src)` is smaller than *n*, the remaining wide characters in the array *dest* are filled with null wide character codes. If the length `wcslen()(src)` is greater than or equal to *n*, the string *dest* will not be terminated with a null wide character code.

The strings may not overlap.

The programmer shall ensure that there is room for at least *n* wide characters at *dest*.

Return Value

`wcpncpy()` returns a pointer to the wide character one past the last non-null wide character written.

wcscasecmp

Name

wcscasecmp — compare two wide-character strings, ignoring case

Synopsis

```
#include <wchar.h>
int wcscasecmp(const wchar_t * s1, const wchar_t * s2);
```

Description

wcscasecmp() is the wide-character equivalent of strcasecmp(). It compares the wide-character string *s1* and the wide-character string *s2*, ignoring case differences (towupper, towlower).

Return Value

The wcscasecmp() function shall return 0 if the wide-character strings *s1* and *s2* are equal except for case distinctions. It shall return a positive integer if *s1* is greater than *s2*, ignoring case. It shall return a negative integer if *s1* is less than *s2*, ignoring case.

Notes

The behavior of wcscasecmp() depends upon the LC_CTYPE category of the current locale.

wcsdup

Name

wcsdup — duplicate a wide-character string

Synopsis

```
#include <wchar.h>
wchar_t * wcsdup(const wchar_t * s);
```

Description

The wcsdup() function is the wide-character equivalent of strdup(). The wcsdup() function shall return a pointer to a new wide character string, which is a duplicate of the wide character string pointed to by *s*. The returned pointer can be passed to free(). A null pointer is returned if the new string cannot be created.

Return Value

The wcsdup() function returns a pointer to a new wide-character string on success. Otherwise, it shall return NULL and set errno to indicate the error.

Errors

ENOMEM

Insufficient memory available.

wcsncasecmp

Name

wcsncasecmp — compare two fixed-size wide-character strings, ignoring case

Synopsis

```
#include <wchar.h>
int wcsncasecmp(const wchar_t * s1, const wchar_t * s2, size_t n);
```

Description

`wcsncasecmp()` is the wide-character equivalent of `strncasecmp()`. It compares the wide-character string *s1* and the wide-character string *s2*, but at most *n* wide characters from each string, ignoring case differences (towupper, towlower).

Return Value

`wcscasecmp()` returns 0 if the wide-character strings *s1* and *s2*, truncated to at most length *n*, are equal except for case distinctions. It returns a positive integer if truncated *s1* is greater than truncated *s2*, ignoring case. It returns a negative integer if truncated *s1* is smaller than truncated *s2*, ignoring case.

Notes

The behavior of `wcsncasecmp()` depends upon the `LC_CTYPE` category of the current locale.

wcsnlen

Name

wcsnlen — determine the length of a fixed-size wide-character string

Synopsis

```
#include <wchar.h>
size_t wcsnlen(const wchar_t * s, size_t maxlen);
```

Description

`wcsnlen()` is the wide-character equivalent of `strnlen()`. It returns the number of wide-characters in the string *s*, not including the terminating null wide character code, but at most *maxlen*. In doing this, `wcsnlen()` looks only at the first *maxlen* wide-characters at *s* and never beyond *s* + *maxlen*.

Return Value

`wcsnlen()` returns `wcslen()`*(s)* if that is less than *maxlen*, or *maxlen* if there is no null wide character code among the first *maxlen* wide characters pointed to by *s*.

wcsnrtombs

Name

wcsnrtombs — convert a wide character string to a multi-byte string

Synopsis

```
#include <wchar.h>
size_t wcsnrtombs(char * dest, const wchar_t * * src, size_t nwc,
size_t len, mbstate_t * ps);
```

Description

`wcsnrtombs()` is like `wcsrtombs()`, except that the number of wide characters to be converted, starting at `src`, is limited to `nwc`.

If `dest` is not a NULL pointer, `wcsnrtombs()` converts at most `nwc` wide characters from the wide-character string `src` to a multibyte string starting at `dest`. At most `len` bytes are written to `dest`. The shift state `ps` is updated.

The conversion is effectively performed by repeatedly calling:

```
wcrtomb(dest, *src, ps)
```

as long as this call succeeds, and then incrementing `dest` by the number of bytes written and `src` by `1`.

The conversion can stop for three reasons:

- A wide character has been encountered that cannot be represented as a multibyte sequence (according to the current locale). In this case `src` is left pointing to the invalid wide character, (size_t)(-1) is returned, and `errno` is set to EILSEQ.

- `nws` wide characters have been converted without encountering a null wide character code, or the length limit forces a stop. In this case, `src` is left pointing to the next wide character to be converted, and the number bytes written to `dest` is returned.

- The wide-character string has been completely converted, including the terminating null wide character code (which has the side effect of bringing back `ps` to the initial state). In this case, `src` is set to `NULL`, and the number of bytes written to `dest`, excluding the terminating null wide character code, is returned.

If `dest` is `NULL`, `len` is ignored, and the conversion proceeds as above, except that the converted bytes are not written out to memory, and that no destination length limit exists.

In both of the above cases, if `ps` is a `NULL` pointer, a static anonymous state only known to `wcsnrtombs()` is used instead.

The programmer shall ensure that there is room for at least `len` bytes at `dest`.

Return Value

`wcsnrtombs()` returns the number of bytes that make up the converted part of multibyte sequence, not including the terminating null wide character code. If a wide character was encountered which could not be converted, (size_t)(-1) is returned, and the global variable `errno` set to EILSEQ.

Notes

The behavior of `wcsnrtombs()` depends on the `LC_CTYPE` category of the current locale.

Passing NULL as *ps* is not multi-thread safe.

wcstoq

Name

`wcstoq` — convert wide string to long long int representation

Synopsis

```
#include <wchar.h>
long long int wcstoq(const wchar_t * restrict nptr, wchar_t ** restrict endptr, int base);
```

Description

The `wcstoq()` function shall convert the initial portion of the wide string *nptr* to `long long int` representation. It is identical to `wcstoll()`.

Return Value

Refer to `wcstoll()`.

Errors

Refer to `wcstoll()`.

wcstouq

Name

`wcstouq` — convert wide string to unsigned long long int representation

Synopsis

```
#include <wchar.h>
unsigned long long wcstouq(const wchar_t * restrict nptr, wchar_t ** restrict endptr, int base);
```

Description

The `wcstouq()` function shall convert the initial portion of the wide string *nptr* to `unsigned long long int` representation. It is identical to `wcstoull()`.

Return Value

Refer to `wcstoull()`.

Errors

Refer to `wcstoull()`.

wscanf

Name

wscanf — convert formatted input

Description

The scanf() family of functions shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except as noted below.

Differences

The %s, %S and %[conversion specifiers shall accept an option length modifier a, which shall cause a memory buffer to be allocated to hold the string converted. In such a case, the argument corresponding to the conversion specifier should be a reference to a pointer value that will receive a pointer to the allocated buffer. If there is insufficient memory to allocate a buffer, the function may set errno to ENOMEM and a conversion error results.

> **Note:** This directly conflicts with the ISO C (1999) usage of %a as a conversion specifier for hexadecimal float values. While this conversion specifier should be supported, a format specifier such as "%aseconds" will have a different meaning on an LSB conforming system.

xdr_u_int

Name

xdr_u_int — library routines for external data representation

Synopsis

```
int xdr_u_int(XDR * xdrs, unsigned int * up);
```

Description

xdr_u_int() is a filter primitive that translates between C unsigned integers and their external representations.

Return Value

On success, 1 is returned. On error, 0 is returned.

xdrstdio_create

Name

`xdrstdio_create` — library routines for external data representation

Synopsis

```
#include <rpc/xdr.h>
void xdrstdio_create(XDR * xdrs, FILE * file, enum xdr_op op);
```

Description

The `xdrstdio_create()` function shall initialize the XDR stream object referred to by `xdrs`. The XDR stream data shall be written to, or read from, the standard I/O stream associated with `file`. If the operation `op` is `XDR_ENCODE`, encoded data shall be written to `file`. If `op` is `XDR_DECODE`, encoded data shall be read from `file`. If `op` is `XDR_FREE`, the XDR stream object may be used to deallocate storage allocated by a previous `XDR_DECODE`.

The associated destroy function shall flush the `file` I/O stream, but not close it.

Return Value

None.

12.6 Interfaces for libm

Table 12-38 defines the library name and shared object name for the libm library

Table 12-38 libm Definition

Library:	libm
SONAME:	See archLSB.

The behavior of the interfaces in this library is specified by the following specifications:

 [LSB] This Specification
 [SUSv3] POSIX 1003.1-2001 (ISO/IEC 9945-2003)

12.6.1 Math

12.6.1.1 Interfaces for Math

An LSB conforming implementation shall provide the generic functions for Math specified in Table 12-39, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-39 libm - Math Function Interfaces

__finite [LSB]	__finitef [LSB]	__finitel [LSB]	__fpclassify [LSB]
__fpclassifyf [LSB]	__signbit [LSB]	__signbitf [LSB]	acos [SUSv3]
acosf [SUSv3]	acosh [SUSv3]	acoshf [SUSv3]	acoshl [SUSv3]
acosl [SUSv3]	asin [SUSv3]	asinf [SUSv3]	asinh [SUSv3]

asinhf [SUSv3]	asinhl [SUSv3]	asinl [SUSv3]	atan [SUSv3]
atan2 [SUSv3]	atan2f [SUSv3]	atan2l [SUSv3]	atanf [SUSv3]
atanh [SUSv3]	atanhf [SUSv3]	atanhl [SUSv3]	atanl [SUSv3]
cabs [SUSv3]	cabsf [SUSv3]	cabsl [SUSv3]	cacos [SUSv3]
cacosf [SUSv3]	cacosh [SUSv3]	cacoshf [SUSv3]	cacoshl [SUSv3]
cacosl [SUSv3]	carg [SUSv3]	cargf [SUSv3]	cargl [SUSv3]
casin [SUSv3]	casinf [SUSv3]	casinh [SUSv3]	casinhf [SUSv3]
casinhl [SUSv3]	casinl [SUSv3]	catan [SUSv3]	catanf [SUSv3]
catanh [SUSv3]	catanhf [SUSv3]	catanhl [SUSv3]	catanl [SUSv3]
cbrt [SUSv3]	cbrtf [SUSv3]	cbrtl [SUSv3]	ccos [SUSv3]
ccosf [SUSv3]	ccosh [SUSv3]	ccoshf [SUSv3]	ccoshl [SUSv3]
ccosl [SUSv3]	ceil [SUSv3]	ceilf [SUSv3]	ceill [SUSv3]
cexp [SUSv3]	cexpf [SUSv3]	cexpl [SUSv3]	cimag [SUSv3]
cimagf [SUSv3]	cimagl [SUSv3]	clog [SUSv3]	clog10 [LSB]
clog10f [LSB]	clog10l [LSB]	clogf [SUSv3]	clogl [SUSv3]
conj [SUSv3]	conjf [SUSv3]	conjl [SUSv3]	copysign [SUSv3]
copysignf [SUSv3]	copysignl [SUSv3]	cos [SUSv3]	cosf [SUSv3]
cosh [SUSv3]	coshf [SUSv3]	coshl [SUSv3]	cosl [SUSv3]
cpow [SUSv3]	cpowf [SUSv3]	cpowl [SUSv3]	cproj [SUSv3]
cprojf [SUSv3]	cprojl [SUSv3]	creal [SUSv3]	crealf [SUSv3]
creall [SUSv3]	csin [SUSv3]	csinf [SUSv3]	csinh [SUSv3]
csinhf [SUSv3]	csinhl [SUSv3]	csinl [SUSv3]	csqrt [SUSv3]
csqrtf [SUSv3]	csqrtl [SUSv3]	ctan [SUSv3]	ctanf [SUSv3]
ctanh [SUSv3]	ctanhf [SUSv3]	ctanhl [SUSv3]	ctanl [SUSv3]
drem [LSB]	dremf [LSB]	dreml [LSB]	erf [SUSv3]
erfc [SUSv3]	erfcf [SUSv3]	erfcl [SUSv3]	erff [SUSv3]
erfl [SUSv3]	exp [SUSv3]	exp10 [LSB]	exp10f [LSB]
exp10l [LSB]	exp2 [SUSv3]	exp2f [SUSv3]	expf [SUSv3]
expl [SUSv3]	expm1 [SUSv3]	expm1f [SUSv3]	expm1l [SUSv3]
fabs [SUSv3]	fabsf [SUSv3]	fabsl [SUSv3]	fdim [SUSv3]
fdimf [SUSv3]	fdiml [SUSv3]	feclearexcept [SUSv3]	fedisableexcept [LSB]
feenableexcept [LSB]	fegetenv [SUSv3]	fegetexcept [LSB]	fegetexceptflag [SUSv3]

fegetround [SUSv3]	feholdexcept [SUSv3]	feraiseexcept [SUSv3]	fesetenv [SUSv3]
fesetexceptflag [SUSv3]	fesetround [SUSv3]	fetestexcept [SUSv3]	feupdateenv [SUSv3]
finite [LSB]	finitef [LSB]	finitel [LSB]	floor [SUSv3]
floorf [SUSv3]	floorl [SUSv3]	fma [SUSv3]	fmaf [SUSv3]
fmal [SUSv3]	fmax [SUSv3]	fmaxf [SUSv3]	fmaxl [SUSv3]
fmin [SUSv3]	fminf [SUSv3]	fminl [SUSv3]	fmod [SUSv3]
fmodf [SUSv3]	fmodl [SUSv3]	frexp [SUSv3]	frexpf [SUSv3]
frexpl [SUSv3]	gamma [LSB]	gammaf [LSB]	gammal [LSB]
hypot [SUSv3]	hypotf [SUSv3]	hypotl [SUSv3]	ilogb [SUSv3]
ilogbf [SUSv3]	ilogbl [SUSv3]	j0 [SUSv3]	j0f [LSB]
j0l [LSB]	j1 [SUSv3]	j1f [LSB]	j1l [LSB]
jn [SUSv3]	jnf [LSB]	jnl [LSB]	ldexp [SUSv3]
ldexpf [SUSv3]	ldexpl [SUSv3]	lgamma [SUSv3]	lgamma_r [LSB]
lgammaf [SUSv3]	lgammaf_r [LSB]	lgammal [SUSv3]	lgammal_r [LSB]
llrint [SUSv3]	llrintf [SUSv3]	llrintl [SUSv3]	llround [SUSv3]
llroundf [SUSv3]	llroundl [SUSv3]	log [SUSv3]	log10 [SUSv3]
log10f [SUSv3]	log10l [SUSv3]	log1p [SUSv3]	log1pf [SUSv3]
log1pl [SUSv3]	log2 [SUSv3]	log2f [SUSv3]	log2l [SUSv3]
logb [SUSv3]	logbf [SUSv3]	logbl [SUSv3]	logf [SUSv3]
logl [SUSv3]	lrint [SUSv3]	lrintf [SUSv3]	lrintl [SUSv3]
lround [SUSv3]	lroundf [SUSv3]	lroundl [SUSv3]	matherr [LSB]
modf [SUSv3]	modff [SUSv3]	modfl [SUSv3]	nan [SUSv3]
nanf [SUSv3]	nanl [SUSv3]	nearbyint [SUSv3]	nearbyintf [SUSv3]
nearbyintl [SUSv3]	nextafter [SUSv3]	nextafterf [SUSv3]	nextafterl [SUSv3]
nexttoward [SUSv3]	nexttowardf [SUSv3]	nexttowardl [SUSv3]	pow [SUSv3]
pow10 [LSB]	pow10f [LSB]	pow10l [LSB]	powf [SUSv3]
powl [SUSv3]	remainder [SUSv3]	remainderf [SUSv3]	remainderl [SUSv3]
remquo [SUSv3]	remquof [SUSv3]	remquol [SUSv3]	rint [SUSv3]
rintf [SUSv3]	rintl [SUSv3]	round [SUSv3]	roundf [SUSv3]
roundl [SUSv3]	scalb [SUSv3]	scalbf [LSB]	scalbl [LSB]
scalbln [SUSv3]	scalblnf [SUSv3]	scalblnl [SUSv3]	scalbn [SUSv3]

scalbnf [SUSv3]	scalbnl [SUSv3]	significand [LSB]	significandf [LSB]
significandl [LSB]	sin [SUSv3]	sincos [LSB]	sincosf [LSB]
sincosl [LSB]	sinf [SUSv3]	sinh [SUSv3]	sinhf [SUSv3]
sinhl [SUSv3]	sinl [SUSv3]	sqrt [SUSv3]	sqrtf [SUSv3]
sqrtl [SUSv3]	tan [SUSv3]	tanf [SUSv3]	tanh [SUSv3]
tanhf [SUSv3]	tanhl [SUSv3]	tanl [SUSv3]	tgamma [SUSv3]
tgammaf [SUSv3]	tgammal [SUSv3]	trunc [SUSv3]	truncf [SUSv3]
truncl [SUSv3]	y0 [SUSv3]	y0f [LSB]	y0l [LSB]
y1 [SUSv3]	y1f [LSB]	y1l [LSB]	yn [SUSv3]
ynf [LSB]	ynl [LSB]		

An LSB conforming implementation shall provide the generic deprecated functions for Math specified in Table 12-40, with the full mandatory functionality as described in the referenced underlying specification.

> **Note:** These interfaces are deprecated, and applications should avoid using them. These interfaces may be withdrawn in future releases of this specification.

Table 12-40 libm - Math Deprecated Function Interfaces

drem [LSB]	dremf [LSB]	dreml [LSB]	finite [LSB]
finitef [LSB]	finitel [LSB]	gamma [LSB]	gammaf [LSB]
gammal [LSB]	matherr [LSB]		

An LSB conforming implementation shall provide the generic data interfaces for Math specified in Table 12-41, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-41 libm - Math Data Interfaces

signgam [SUSv3]			

12.7 Data Definitions for libm

This section defines global identifiers and their values that are associated with interfaces contained in libm. These definitions are organized into groups that correspond to system headers. This convention is used as a convenience for the reader, and does not imply the existence of these headers, or their content. Where an interface is defined as requiring a particular system header file all of the data definitions for that system header file presented here shall be in effect.

This section gives data definitions to promote binary application portability, not to repeat source interface definitions available elsewhere. System providers and application developers should use this ABI to supplement - not to replace - source interface definition specifications.

This specification uses the ISO C (1999) C Language as the reference programming language, and data definitions are specified in ISO C format. The C language is used here as a convenient notation. Using a C language description of these data objects does not preclude their use by other programming languages.

12.7.1 complex.h

```
#define complex _Complex

extern double cabs(double complex);
extern float cabsf(float complex);
extern long double cabsl(long double complex);
extern double complex cacos(double complex);
extern float complex cacosf(float complex);
extern double complex cacosh(double complex);
extern float complex cacoshf(float complex);
extern long double complex cacoshl(long double complex);
extern long double complex cacosl(long double complex);
extern double carg(double complex);
extern float cargf(float complex);
extern long double cargl(long double complex);
extern double complex casin(double complex);
extern float complex casinf(float complex);
extern double complex casinh(double complex);
extern float complex casinhf(float complex);
extern long double complex casinhl(long double complex);
extern long double complex casinl(long double complex);
extern double complex catan(double complex);
extern float complex catanf(float complex);
extern double complex catanh(double complex);
extern float complex catanhf(float complex);
extern long double complex catanhl(long double complex);
extern long double complex catanl(long double complex);
extern double complex ccos(double complex);
extern float complex ccosf(float complex);
extern double complex ccosh(double complex);
extern float complex ccoshf(float complex);
extern long double complex ccoshl(long double complex);
extern long double complex ccosl(long double complex);
extern double complex cexp(double complex);
extern float complex cexpf(float complex);
extern long double complex cexpl(long double complex);
extern double cimag(double complex);
extern float cimagf(float complex);
extern long double cimagl(long double complex);
extern double complex clog(double complex);
extern double complex clog10(double complex);
extern float complex clog10f(float complex);
extern long double complex clog10l(long double complex);
extern float complex clogf(float complex);
extern long double complex clogl(long double complex);
extern double complex conj(double complex);
extern float complex conjf(float complex);
extern long double complex conjl(long double complex);
extern double complex cpow(double complex, double complex);
extern float complex cpowf(float complex, float complex);
extern long double complex cpowl(long double complex, long double
complex);
extern double complex cproj(double complex);
extern float complex cprojf(float complex);
extern long double complex cprojl(long double complex);
extern double creal(double complex);
extern float crealf(float complex);
```

```
extern long double creall(long double complex);
extern double complex csin(double complex);
extern float complex csinf(float complex);
extern double complex csinh(double complex);
extern float complex csinhf(float complex);
extern long double complex csinhl(long double complex);
extern long double complex csinl(long double complex);
extern double complex csqrt(double complex);
extern float complex csqrtf(float complex);
extern long double complex csqrtl(long double complex);
extern double complex ctan(double complex);
extern float complex ctanf(float complex);
extern double complex ctanh(double complex);
extern float complex ctanhf(float complex);
extern long double complex ctanhl(long double complex);
extern long double complex ctanl(long double complex);
```

12.7.2 fenv.h

```
extern int feclearexcept(int __excepts);
extern int fedisableexcept(int __excepts);
extern int feenableexcept(int __excepts);
extern int fegetenv(fenv_t * __envp);
extern int fegetexcept(void);
extern int fegetexceptflag(fexcept_t * __flagp, int __excepts);
extern int fegetround(void);
extern int feholdexcept(fenv_t * __envp);
extern int feraiseexcept(int __excepts);
extern int fesetenv(const fenv_t * __envp);
extern int fesetexceptflag(const fexcept_t * __flagp, int
__excepts);
extern int fesetround(int __rounding_direction);
extern int fetestexcept(int __excepts);
extern int feupdateenv(const fenv_t * __envp);
```

12.7.3 math.h

```
#define DOMAIN  1
#define SING    2

#define FP_NAN  0
#define FP_INFINITE     1
#define FP_ZERO 2
#define FP_SUBNORMAL    3
#define FP_NORMAL       4

#define isnormal(x)     (fpclassify (x) == FP_NORMAL)   /* Return
nonzero value if X is neither zero, subnormal, Inf, n */

#define HUGE_VAL        0x1.0p2047
#define HUGE_VALF       0x1.0p255f

#define NAN     ((float)0x7fc00000UL)
#define M_1_PI  0.31830988618379067154
#define M_LOG10E        0.43429448190325182765
#define M_2_PI  0.63661977236758134308
#define M_LN2   0.69314718055994530942
#define M_SQRT1_2       0.70710678118654752440
#define M_PI_4  0.78539816339744830962
#define M_2_SQRTPI      1.12837916709551257390
#define M_SQRT2 1.41421356237309504880
#define M_LOG2E 1.44269504088896340740
#define M_PI_2  1.57079632679489661923
#define M_LN10  2.30258509299404568402
```

```
#define M_E     2.7182818284590452354
#define M_PI    3.14159265358979323846
#define INFINITY          HUGE_VALF

#define MATH_ERRNO        1          /* errno set by math functions.
*/
#define MATH_ERREXCEPT    2              /* Exceptions raised by math
functions. */

#define isunordered(u, v)        \
        (__extension__({ __typeof__(u) __u = (u); __typeof__(v)
__v = (v);fpclassify (__u) == FP_NAN || fpclassify (__v) ==
FP_NAN; })) /* Return nonzero value if arguments are unordered.
*/
#define islessgreater(x, y)      \
        (__extension__({ __typeof__(x) __x = (x); __typeof__(y)
__y = (y);!isunordered (__x, __y) && (__x < __y || __y < __x);
}))      /* Return nonzero value if either X is less than Y or Y
is less */
#define isless(x,y)     \
        (__extension__({ __typeof__(x) __x = (x); __typeof__(y)
__y = (y);!isunordered (__x, __y) && __x < __y; }))     /* Return
nonzero value if X is less than Y. */
#define islessequal(x, y)       \
        (__extension__({ __typeof__(x) __x = (x); __typeof__(y)
__y = (y);!isunordered (__x, __y) && __x <= __y; }))    /* Return
nonzero value if X is less than or equal to Y. */
#define isgreater(x,y)  \
        (__extension__({ __typeof__(x) __x = (x); __typeof__(y)
__y = (y);!isunordered (__x, __y) && __x > __y; }))     /* Return
nonzero value if X is greater than Y. */
#define isgreaterequal(x,y)      \
        (__extension__({ __typeof__(x) __x = (x); __typeof__(y)
__y = (y);!isunordered (__x, __y) && __x >= __y; }))    /* Return
nonzero value if X is greater than or equal to Y. */


extern int __finite(double);
extern int __finitef(float);
extern int __finitel(long double);
extern int __fpclassify(double);
extern int __fpclassifyf(float);
extern int __isinf(double);
extern int __isinff(float);
extern int __isinfl(long double);
extern int __isnan(double);
extern int __isnanf(float);
extern int __isnanl(long double);
extern int __signbit(double);
extern int __signbitf(float);
extern double acos(double);
extern float acosf(float);
extern double acosh(double);
extern float acoshf(float);
extern long double acoshl(long double);
extern long double acosl(long double);
extern double asin(double);
extern float asinf(float);
extern double asinh(double);
extern float asinhf(float);
extern long double asinhl(long double);
extern long double asinl(long double);
extern double atan(double);
extern double atan2(double, double);
extern float atan2f(float, float);
extern long double atan2l(long double, long double);
extern float atanf(float);
```

```
extern double atanh(double);
extern float atanhf(float);
extern long double atanhl(long double);
extern long double atanl(long double);
extern double cbrt(double);
extern float cbrtf(float);
extern long double cbrtl(long double);
extern double ceil(double);
extern float ceilf(float);
extern long double ceill(long double);
extern double copysign(double, double);
extern float copysignf(float, float);
extern long double copysignl(long double, long double);
extern double cos(double);
extern float cosf(float);
extern double cosh(double);
extern float coshf(float);
extern long double coshl(long double);
extern long double cosl(long double);
extern double drem(double, double);
extern float dremf(float, float);
extern long double dreml(long double, long double);
extern double erf(double);
extern double erfc(double);
extern float erfcf(float);
extern long double erfcl(long double);
extern float erff(float);
extern long double erfl(long double);
extern double exp(double);
extern double exp10(double);
extern float exp10f(float);
extern long double exp10l(long double);
extern double exp2(double);
extern float exp2f(float);
extern float expf(float);
extern long double expl(long double);
extern double expm1(double);
extern float expm1f(float);
extern long double expm1l(long double);
extern double fabs(double);
extern float fabsf(float);
extern long double fabsl(long double);
extern double fdim(double, double);
extern float fdimf(float, float);
extern long double fdiml(long double, long double);
extern int finite(double);
extern int finitef(float);
extern int finitel(long double);
extern double floor(double);
extern float floorf(float);
extern long double floorl(long double);
extern double fma(double, double, double);
extern float fmaf(float, float, float);
extern long double fmal(long double, long double, long double);
extern double fmax(double, double);
extern float fmaxf(float, float);
extern long double fmaxl(long double, long double);
extern double fmin(double, double);
extern float fminf(float, float);
extern long double fminl(long double, long double);
extern double fmod(double, double);
extern float fmodf(float, float);
extern long double fmodl(long double, long double);
extern double frexp(double, int *);
extern float frexpf(float, int *);
extern long double frexpl(long double, int *);
```

```
extern double gamma(double);
extern float gammaf(float);
extern long double gammal(long double);
extern double hypot(double, double);
extern float hypotf(float, float);
extern long double hypotl(long double, long double);
extern int ilogb(double);
extern int ilogbf(float);
extern int ilogbl(long double);
extern double j0(double);
extern float j0f(float);
extern long double j0l(long double);
extern double j1(double);
extern float j1f(float);
extern long double j1l(long double);
extern double jn(int, double);
extern float jnf(int, float);
extern long double jnl(int, long double);
extern double ldexp(double, int);
extern float ldexpf(float, int);
extern long double ldexpl(long double, int);
extern double lgamma(double);
extern double lgamma_r(double, int *);
extern float lgammaf(float);
extern float lgammaf_r(float, int *);
extern long double lgammal(long double);
extern long double lgammal_r(long double, int *);
extern long long int llrint(double);
extern long long int llrintf(float);
extern long long int llrintl(long double);
extern long long int llround(double);
extern long long int llroundf(float);
extern long long int llroundl(long double);
extern double log(double);
extern double log10(double);
extern float log10f(float);
extern long double log10l(long double);
extern double log1p(double);
extern float log1pf(float);
extern long double log1pl(long double);
extern double log2(double);
extern float log2f(float);
extern long double log2l(long double);
extern double logb(double);
extern float logbf(float);
extern long double logbl(long double);
extern float logf(float);
extern long double logl(long double);
extern long int lrint(double);
extern long int lrintf(float);
extern long int lrintl(long double);
extern long int lround(double);
extern long int lroundf(float);
extern long int lroundl(long double);
extern double modf(double, double *);
extern float modff(float, float *);
extern long double modfl(long double, long double *);
extern double nan(const char *);
extern float nanf(const char *);
extern long double nanl(const char *);
extern double nearbyint(double);
extern float nearbyintf(float);
extern long double nearbyintl(long double);
extern double nextafter(double, double);
extern float nextafterf(float, float);
extern long double nextafterl(long double, long double);
```

```
extern double nexttoward(double, long double);
extern float nexttowardf(float, long double);
extern long double nexttowardl(long double, long double);
extern double pow(double, double);
extern double pow10(double);
extern float pow10f(float);
extern long double pow10l(long double);
extern float powf(float, float);
extern long double powl(long double, long double);
extern double remainder(double, double);
extern float remainderf(float, float);
extern long double remainderl(long double, long double);
extern double remquo(double, double, int *);
extern float remquof(float, float, int *);
extern long double remquol(long double, long double, int *);
extern double rint(double);
extern float rintf(float);
extern long double rintl(long double);
extern double round(double);
extern float roundf(float);
extern long double roundl(long double);
extern double scalb(double, double);
extern float scalbf(float, float);
extern long double scalbl(long double, long double);
extern double scalbln(double, long int);
extern float scalblnf(float, long int);
extern long double scalblnl(long double, long int);
extern double scalbn(double, int);
extern float scalbnf(float, int);
extern long double scalbnl(long double, int);
extern int signgam;
extern double significand(double);
extern float significandf(float);
extern long double significandl(long double);
extern double sin(double);
extern void sincos(double, double *, double *);
extern void sincosf(float, float *, float *);
extern void sincosl(long double, long double *, long double *);
extern float sinf(float);
extern double sinh(double);
extern float sinhf(float);
extern long double sinhl(long double);
extern long double sinl(long double);
extern double sqrt(double);
extern float sqrtf(float);
extern long double sqrtl(long double);
extern double tan(double);
extern float tanf(float);
extern double tanh(double);
extern float tanhf(float);
extern long double tanhl(long double);
extern long double tanl(long double);
extern double tgamma(double);
extern float tgammaf(float);
extern long double tgammal(long double);
extern double trunc(double);
extern float truncf(float);
extern long double truncl(long double);
extern double y0(double);
extern float y0f(float);
extern long double y0l(long double);
extern double y1(double);
extern float y1f(float);
extern long double y1l(long double);
extern double yn(int, double);
extern float ynf(int, float);
```

```
extern long double ynl(int, long double);
```

12.8 Interface Definitions for libm

The interfaces defined on the following pages are included in libm and are defined by this specification. Unless otherwise noted, these interfaces shall be included in the source standard.

Other interfaces listed in Section 12.6 shall behave as described in the referenced base document.

__finite

Name

`__finite` — test for infinity

Synopsis

```
#include <math.h>
int __finite(double arg);
```

Description

`__finite()` has the same specification as `isfinite()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that the argument type for `__finite()` is known to be double.

`__finite()` is not in the source standard; it is only in the binary standard.

__finitef

Name

`__finitef` — test for infinity

Synopsis

```
#include <math.h>
int __finitef(float arg);
```

Description

`__finitef()` has the same specification as `isfinite()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003) except that the argument type for `__finitef()` is known to be float.

`__finitef()` is not in the source standard; it is only in the binary standard.

__finitel

Name

`__finitel` — test for infinity

Synopsis

```
#include <math.h>
int __finitel(long double arg);
```

Description

`__finitel()` has the same specification as `isfinite()` in the POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that the argument type for `__finitel()` is known to be long double.

`__finitel()` is not in the source standard; it is only in the binary standard.

__fpclassify

Name

`__fpclassify` — Classify real floating type

Synopsis

```
int __fpclassify(double arg);
```

Description

`__fpclassify()` has the same specification as `fpclassify()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that the argument type for `__fpclassify()` is known to be double.

`__fpclassify()` is not in the source standard; it is only in the binary standard.

__fpclassifyf

Name

`__fpclassifyf` — Classify real floating type

Synopsis

```
int __fpclassifyf(float arg);
```

Description

`__fpclassifyf()` has the same specification as `fpclassify()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that the argument type for `__fpclassifyf()` is known to be float.

`__fpclassifyf()` is not in the source standard; it is only in the binary standard.

__signbit

Name

`__signbit` — test sign of floating point value

Synopsis

```
#include <math.h>
int __signbit(double arg);
```

Description

`__signbit()` has the same specification as `signbit()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that the argument type for `__signbit()` is known to be double.

`__signbit()` is not in the source standard; it is only in the binary standard.

__signbitf

Name

`__signbitf` — test sign of floating point value

Synopsis

```
#include <math.h>
int __signbitf(float arg);
```

Description

`__signbitf()` has the same specification as `signbit()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that the argument type for `__signbitf()` is known to be float.

`__signbitf()` is not in the source standard; it is only in the binary standard.

clog10

Name

`clog10` — Logarithm of a Complex Number

Synopsis

```
#include <complex.h>
double complex clog10(double complex z);
```

Description

The `clog10()` function shall compute the base 10 logarithm of the complex number *z*.

Return Value

The `clog10()` function shall return the base 10 logarithm.

clog10f

Name

`clog10f` — Logarithm of a Complex Number

Synopsis

```
#include <complex.h>
float complex clog10f(float complex z);
```

Description

The `clog10f()` function shall compute the base 10 logarithm of the complex number *z*.

Return Value

The `clog10f()` function shall return the base 10 logarithm.

clog10l

Name

`clog10l` — Logarithm of a Complex Number

Synopsis

```
#include <complex.h>
long double complex clog10l(long double complex z);
```

Description

The `clog10l()` function shall compute the base 10 logarithm of the complex number *z*.

Return Value

The `clog10l()` function shall return the base 10 logarithm.

drem

Name

`drem` — Floating Point Remainder (DEPRECATED)

Synopsis

```
#include <math.h>
double drem(double x, double y);
```

Description

The `drem()` function shall return the floating point remainder, x REM y as required by IEC 60559/IEEE 754 Floating Point in the same way as `remainder()`.

> **Note:** This function is included only for backwards compatibility; applications should use `remainder()` instead.

Returns

See `remainder()`.

See Also

`remainder()`, `dremf()`, `dreml()`

dremf

Name

`dremf` — Floating Point Remainder (DEPRECATED)

Synopsis

```
#include <math.h>
double dremf(double x, double y);
```

Description

The `dremf()` function shall return the floating point remainder, x REM y as required by IEC 60559/IEEE 754 Floating Point in the same way as `remainderf()`.

> **Note:** This function is included only for backwards compatibility; applications should use `remainderf()` instead.

Returns

See `remainderf()`.

See Also

`remainderf()`, `drem()`, `dreml()`

dreml

Name

`dreml` — Floating Point Remainder (DEPRECATED)

Synopsis

```
#include <math.h>
double dreml(double x, double y);
```

Description

The `dreml()` function shall return the floating point remainder, x REM y as required by IEC 60559/IEEE 754 Floating Point in the same way as `remainderl()`.

> **Note:** This function is included only for backwards compatibility; applications should use `remainderl()` instead.

Returns

See `remainderl()`.

See Also

`remainderl()`, `drem()`, `dremf()`

exp10

Name

`exp10` — Base-10 power function

Synopsis

```
#include <math.h>
double exp10(double x);
```

Description

The `exp10()` function shall return 10^x.

> **Note:** This function is identical to `pow10()`.

Returns

Upon successful completion, `exp10()` shall return 10 rised to the power of x.

If the correct value would cause overflow, a range error shall occur and `exp10()` shall return ±HUGE_VAL, with the same sign as the correct value of the function.

See Also

`pow10()`, `exp10f()`, `exp10l()`

exp10f

Name

`exp10f` — Base-10 power function

Synopsis

```
#include <math.h>
float exp10f(float x);
```

Description

The `exp10f()` function shall return 10ˣ.

> **Note:** This function is identical to `pow10f()`.

Returns

Upon successful completion, `exp10f()` shall return 10 rised to the power of x.

If the correct value would cause overflow, a range error shall occur and `exp10f()` shall return ±HUGE_VALF, with the same sign as the correct value of the function.

See Also

`pow10f()`, `exp10()`, `exp10l()`

exp10l

Name

`exp10l` — Base-10 power function

Synopsis

```
#include <math.h>
long double exp10l(long double x);
```

Description

The `exp10l()` function shall return 10ˣ.

> **Note:** This function is identical to `pow10l()`.

Returns

Upon successful completion, `exp10l()` shall return 10 rised to the power of x.

If the correct value would cause overflow, a range error shall occur and `exp10l()` shall return ±HUGE_VALL, with the same sign as the correct value of the function.

See Also

`pow10l()`, `exp10()`, `exp10f()`

fedisableexcept

Name

`fedisableexcept` — disable floating point exceptions

Synopsis

```
#include <fenv.h>
int fedisableexcept(int excepts);
```

Description

The `fedisableexcept()` function disables traps for each of the exceptions represented by the mask `excepts`.

Return Value

The `fedisableexcept()` function returns the previous set of enabled exceptions on success. On error, -1 is returned.

Errors

No errors are defined, but the function will fail if not supported on the architecture.

feenableexcept

Name

`feenableexcept` — enable floating point exceptions

Synopsis

```
#include <fenv.h>
int feenableexcept(int excepts);
```

Description

The `feenableexcept()` function enables traps for each of the exceptions represented by the mask `excepts`.

Return Value

The `feenableexcept()` function returns the previous set of enabled exceptions on success. On error, -1 is returned.

Errors

No errors are defined, but the function will fail if not supported on the architecture.

fegetexcept

Name

`fegetexcept` — query floating point exception handling state

Synopsis

```
#include <fenv.h>
int fegetexcept
```

Description

The `fegetexcept()` function returns the set of all currently enabled exceptions.

Return Value

The `fegetexcept()` function returns the set of all currently enabled exceptions.

Errors

No errors are defined, but the function will fail if not supported on the architecture.

finite

Name

`finite` — test for infinity (DEPRECATED)

Synopsis

```
#define _SVID_SOURCE
#include <math.h>
int finite(double arg);
```

Description

The `finite()` function shall test whether its argument is neither `INFINITY` nor not a number (NaN).

Returns

On success, `finite()` shall return 1. Otherwise the function shall return 0.

> **Note:** The ISO C (1999) standard defines the function `isfinite()`, which is more general purpose. The `finite()` function is deprecated, and applications should use `isfinite()` instead. A future revision of this standard may remove this function.

See Also

`isfinite()`, `finitef()`, `finitel()`

finitef

Name

`finitef` — test for infinity (DEPRECATED)

Synopsis

```
#define _SVID_SOURCE
```

```
#include <math.h>
int finitef(float arg);
```

Description

The `finitef()` function shall test whether its argument is neither `INFINITY` nor not a number (NaN).

Returns

On success, `finitef()` shall return 1. Otherwise the function shall return 0.

> **Note:** The ISO C (1999) standard defines the function `isfinite()`, which is more general purpose. The `finitef()` function is deprecated, and applications should use `isfinite()` instead. A future revision of this standard may remove this function.

See Also

`isfinite()`, `finite()`, `finitel()`

finitel

Name

`finitel` — test for infinity (DEPRECATED)

Synopsis

```
#define _SVID_SOURCE
#include <math.h>
int finitel(long double arg);
```

Description

The `finitel()` function shall test whether its argument is neither `INFINITY` nor not a number (NaN).

Returns

On success, `finitel()` shall return 1. Otherwise the function shall return 0.

> **Note:** The ISO C (1999) standard defines the function `isfinite()`, which is more general purpose. The `finitel()` function is deprecated, and applications should use `isfinite()` instead. A future revision of this standard may remove this function.

See Also

`isfinite()`, `finite()`, `finitef()`

gamma

Name

gamma — log gamma function (DEPRECATED)

Synopsis

```
#include <math.h>
double gammaf(double x);
```

Description

The gamma() function is identical to lgamma() in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

> **Note:** The name gamma() for this function is deprecated and should not be used.

Returns

See lgamma().

See Also

lgamma(),lgammaf(),lgammal(),gammaf(),gammal()

gammaf

Name

gammaf — log gamma function (DEPRECATED)

Synopsis

```
#include <math.h>
float gammaf(float x);
```

Description

The gammaf() function is identical to lgammaf() in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

> **Note:** The name gammaf() for this function is deprecated and should not be used.

Returns

See lgammaf().

See Also

lgamma(),lgammaf(),lgammal(),gamma(),gammal()

gammal

Name

`gammal` — log gamma function (DEPRECATED)

Synopsis

```
#include <math.h>
long double gammal(long double x);
```

Description

The `gammal()` function is identical to `lgammal()` in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

> **Note:** The name `gammal()` for this function is deprecated and should not be used.

Returns

See `lgammal()`.

See Also

`lgamma()`, `lgammaf()`, `lgammal()`, `gamma()`, `gammaf()`

j0f

Name

`j0f` — Bessel functions

Synopsis

```
#include <math.h>
float j0f(float x);
```

Description

The `j0f()` function is identical to `j0()`, except that the argument *x* and the return value is a float.

Returns

See `j0()`.

See Also

`j0()`, `j0l()`, `j1()`, `j1f()`, `j1l()`, `jn()`, `jnf()`, `jnl()`, `y0()`, `y0f()`, `y0l()`, `y1()`, `y1f()`, `y1l()`, `yn()`, `ynf()`, `ynl()`

j0l

Name

`j0l` — Bessel functions

Synopsis

```
#include <math.h>
long double j0l(long double x);
```

Description

The `j0l()` function is identical to `j0()`, except that the argument *x* and the return value is a long double.

Returns

See `j0()`.

See Also

`j0()`, `j0f()`, `j1()`, `j1f()`, `j1l()`, `jn()`, `jnf()`, `jnl()`, `y0()`, `y0f()`, `y0l()`, `y1()`, `y1f()`, `y1l()`, `yn()`, `ynf()`, `ynl()`

j1f

Name

`j1f` — Bessel functions

Synopsis

```
#include <math.h>
float j1f(float x);
```

Description

The `j1f()` function is identical to `j1()`, except that the argument *x* and the return value is a float.

Returns

See `j1()`.

See Also

`j0()`, `j0f()`, `j0l()`, `j1()`, `j1l()`, `jn()`, `jnf()`, `jnl()`, `y0()`, `y0f()`, `y0l()`, `y1()`, `y1f()`, `y1l()`, `yn()`, `ynf()`, `ynl()`

j1l

Name

j1l — Bessel functions

Synopsis

```
#include <math.h>
long double j1l(long double x);
```

Description

The `j1l()` function is identical to `j1()`, except that the argument *x* and the return value is a long double.

Returns

See `j0()`.

See Also

`j0()`, `j0f()`, `j0l()`, `j1()`, `j1f()`, `jn()`, `jnf()`, `jnl()`, `y0()`, `y0f()`, `y0l()`, `y1()`, `y1f()`, `y1l()`, `yn()`, `ynf()`, `ynl()`

jnf

Name

jnf — Bessel functions

Synopsis

```
#include <math.h>
float jnf(float x);
```

Description

The `jnf()` function is identical to `jn()`, except that the argument *x* and the return value is a float.

Returns

See `jn()`.

See Also

`j0()`, `j0f()`, `j0l()`, `j1()`, `j1f()`, `j1l()`, `jn()`, `jnl()`, `y0()`, `y0f()`, `y0l()`, `y1()`, `y1f()`, `y1l()`, `yn()`, `ynf()`, `ynl()`

jnl

Name

`jnl` — Bessel functions

Synopsis

```
#include <math.h>
long double jnl(long double x);
```

Description

The `jnl()` function is identical to `jn()`, except that the argument `x` and the return value is a long double.

Returns

See `jn()`.

See Also

`j0()`, `j0f()`, `j0l()`, `j1()`, `j1f()`, `j1l()`, `jn()`, `jnf()`, `y0()`, `y0f()`, `y0l()`, `y1()`, `y1f()`, `y1l()`, `yn()`, `ynf()`, `ynl()`

lgamma_r

Name

`lgamma_r` — log gamma functions

Synopsis

```
#include <math.h>
double lgamma_r(double x, int * signp);
```

Description

The `lgamma_r()` function shall compute the natural logarithm of the absolute value of the Gamma function, as `lgamma()`. However, instead of setting the external integer `signgam` to the sign of the Gamma function, `lgamma_r()` shall set the integer referenced by `signp` to the sign.

Returns

See `lgamma()` and `signgam`.

See Also

`lgamma()`, `lgammaf_r()`, `lgammal_r()`, `signgam`

lgammaf_r

Name

`lgammaf_r` — log gamma functions

Synopsis

```
#include <math.h>
float lgammaf_r(float x, int * signp);
```

Description

The `lgammaf_r()` function shall compute the natural logarithm of the absolute value of the Gamma function, as `lgammaf()`. However, instead of setting the external integer `signgam` to the sign of the Gamma function, `lgammaf_r()` shall set the integer referenced by *signp* to the sign.

Returns

See `lgammaf()` and `signgam`.

See Also

`lgamma()`, `lgamma_r()`, `lgammal_r()`, `signgam`

lgammal_r

Name

`lgammal_r` — log gamma functions

Synopsis

```
#include <math.h>
double lgammal_r(double x, int * signp);
```

Description

The `lgammal_r()` function shall compute the natural logarithm of the absolute value of the Gamma function, as `lgammal()`. However, instead of setting the external integer `signgam` to the sign of the Gamma function, `lgammal_r()` shall set the integer referenced by *signp* to the sign.

Returns

See `lgammal()` and `signgam`.

See Also

`lgamma()`, `lgamma_r()`, `lgammaf_r()`, `signgam`

matherr

Name

`matherr` — math library exception handling

Synopsis

```
#include <math.h>
int matherr(struct exception *__exc);
```

Description

The System V Interface Definition (SVID) Issue 3 specifies that various math functions should invoke a function called `matherr()` if a math exception is detected. This function is called before the math function returns; after `matherr()` returns, the system then returns to the math function, which in turn returns to the caller.

`matherr()` is obsolete; indeed it was withdrawn in the System V Interface Definition (SVID) Issue 4, and is required only by this specification for historical compatibility, and will be removed in a future version. The floating point environment function group including `fesetenv()` should be used instead.

`matherr()` is not in the source standard; it is only in the binary standard.

See Also

`fesetenv()`, `fegetenv()`, `feupdateenv()`.

pow10

Name

`pow10` — Base-10 power function

Synopsis

```
#include <math.h>
double pow10(double x);
```

Description

The `pow10()` function shall return 10^x.

> **Note:** This function is identical to `exp10()`.

Returns

Upon successful completion, `pow10()` shall return 10 rised to the power of `x`.

If the correct value would cause overflow, a range error shall occur and `pow10()` shall return ±HUGE_VAL, with the same sign as the correct value of the function.

See Also

`exp10()`, `pow10f()`, `pow10l()`

pow10f

Name

`pow10f` — Base-10 power function

Synopsis

```
#include <math.h>
float pow10f(float x);
```

Description

The `pow10f()` function shall return 10^x.

> **Note:** This function is identical to `exp10f()`.

Returns

Upon successful completion, `pow10f()` shall return 10 rised to the power of `x`.

If the correct value would cause overflow, a range error shall occur and `pow10f()` shall return ±HUGE_VALF, with the same sign as the correct value of the function.

See Also

`exp10f()`, `pow10()`, `pow10l()`

pow10l

Name

`pow10l` — Base-10 power function

Synopsis

```
#include <math.h>
long double pow10l(long double x);
```

Description

The `pow10l()` function shall return 10^x.

> **Note:** This function is identical to `exp10l()`.

Returns

Upon successful completion, `pow10l()` shall return 10 rised to the power of `x`.

If the correct value would cause overflow, a range error shall occur and `pow10l()` shall return ±HUGE_VALL, with the same sign as the correct value of the function.

See Also

`exp10l()`, `pow10()`, `pow10f()`

scalbf

Name

`scalbf` — load exponent of radix-independent floating point number

Synopsis

```
#include <math.h>
float scalbf(float x, double exp);
```

Description

The `scalbf()` function is identical to `scalb()`, except that the argument *x* and the return value is of type float.

Returns

See `scalb()`.

scalbl

Name

`scalbl` — load exponent of radix-independent floating point number

Synopsis

```
#include <math.h>
long double scalbl(long double x, double exp);
```

Description

The `scalbl()` function is identical to `scalb()`, except that the argument *x* and the return value is of type long double.

Returns

See `scalb()`.

significand

Name

significand — floating point mantissa

Synopsis

```
#include <math.h>
double significand(double x);
```

Description

The significand() function shall return the mantissa of x, sig such that $x \equiv$ sig $\times 2^n$ scaled such that $1 \leq$ sig < 2.

> **Note:** This function is intended for testing conformance to IEC 60559/IEEE 754 Floating Point, and its use is not otherwise recommended.
>
> This function is equivalent to scalb(x, (double)-ilogb(x)).

Returns

Upon successful completion, significand() shall return the mantissa of x in the range $1 \leq$ sig < 2.

If x is 0, ±HUGE_VAL, or NaN, the result is undefined.

See Also

significandf(), significandl()

significandf

Name

significandf — floating point mantissa

Synopsis

```
#include <math.h>
float significandf(float x);
```

Description

The significandf() function shall return the mantissa of x, sig such that $x \equiv$ sig $\times 2^n$ scaled such that $1 \leq$ sig < 2.

> **Note:** This function is intended for testing conformance to IEC 60559/IEEE 754 Floating Point, and its use is not otherwise recommended.
>
> This function is equivalent to scalb(x, (double)-ilogb(x)).

Returns

Upon successful completion, significandf() shall return the mantissa of x in the range $1 \leq$ sig < 2.

If x is 0, ±HUGE_VALF, or NaN, the result is undefined.

See Also

significand(), significandl()

significandl

Name

significandl — floating point mantissa

Synopsis

```
#include <math.h>
long double significandl(long double x);
```

Description

The significandl() function shall return the mantissa of x, sig such that $x \equiv$ sig $\times 2^n$ scaled such that $1 \le$ sig < 2.

> **Note:** This function is intended for testing conformance to IEC 60559/IEEE 754 Floating Point, and its use is not otherwise recommended.
>
> This function is equivalent to scalb(x, (double)-ilogb(x)).

Returns

Upon successful completion, significandl() shall return the mantissa of x in the range $1 \le$ sig < 2.

If x is 0, ±HUGE_VALL, or NaN, the result is undefined.

See Also

significand(), significandf()

sincos

Name

sincos — trigonometric functions

Synopsis

```
#define _GNU_SOURCE
#include <math.h>
void sincos(double x, double * sin, double * cos);
```

Description

The sincos() function shall calculate both the sine and cosine of x. The sine shall be stored in the location referenced by *sin*, and the cosine in the location referenced by *cosine*.

Returns

None. See sin() and cos() for possible error conditions.

See Also

cos(), sin(), sincosf(), sincosl()

sincosf

Name

sincosf — trigonometric functions

Synopsis

```
#define _GNU_SOURCE
#include <math.h>
void sincosf(float x, float * sin, float * cos);
```

Description

The `sincosf()` function shall calculate both the sine and cosine of *x*. The sine shall be stored in the location referenced by *sin*, and the cosine in the location referenced by *cosine*.

Returns

None. See `sin()` and `cos()` for possible error conditions.

See Also

`cos()`, `sin()`, `sincos()`, `sincosl()`

sincosl

Name

sincosl — trigonometric functions

Synopsis

```
#define _GNU_SOURCE
#include <math.h>
void sincosl(long double x, long double * sin, long double * cos);
```

Description

The `sincosl()` function shall calculate both the sine and cosine of *x*. The sine shall be stored in the location referenced by *sin*, and the cosine in the location referenced by *cosine*.

Returns

None. See `sin()` and `cos()` for possible error conditions.

See Also

`cos()`, `sin()`, `sincos()`, `sincosl()`

y0f

Name

`y0f` — Bessel functions

Synopsis

```
#include <math.h>
float y0f(float x);
```

Description

The `y0f()` function is identical to `y0()`, except that the argument x and the return value is a float.

Returns

See `y0()`.

See Also

`j0()`, `j0f()`, `j0l()`, `j1()`, `j1f()`, `j1l()`, `jn()`, `jnf()`, `jnl()`, `y0()`, `y0l()`, `y1()`, `y1f()`, `y1l()`, `yn()`, `ynf()`, `ynl()`

y0l

Name

`y0l` — Bessel functions

Synopsis

```
#include <math.h>
long double y0l(long double x);
```

Description

The `y0l()` function is identical to `y0()`, except that the argument x and the return value is a long double.

Returns

See `y0()`.

See Also

`j0()`, `j0f()`, `j0l()`, `j1()`, `j1f()`, `j1l()`, `jn()`, `jnf()`, `jnl()`, `y0()`, `y0f()`, `y1()`, `y1f()`, `y1l()`, `yn()`, `ynf()`, `ynl()`

y1f

Name

`y1f` — Bessel functions

Synopsis

```
#include <math.h>
float y1f(float x);
```

Description

The `y1f()` function is identical to `y1()`, except that the argument `x` and the return value is a float.

Returns

See `y1()`.

See Also

`j0()`, `j0f()`, `j0l()`, `j1()`, `j1f()`, `j1l()`, `jn()`, `jnf()`, `jnl()`, `y0()`, `y0f()`, `y0l()`, `y1()`, `y1l()`, `yn()`, `ynf()`, `ynl()`

y1l

Name

`y1l` — Bessel functions

Synopsis

```
#include <math.h>
long double y1l(long double x);
```

Description

The `y1l()` function is identical to `y1()`, except that the argument `x` and the return value is a long double.

Returns

See `j0()`.

See Also

`j0()`, `j0f()`, `j0l()`, `j1()`, `j1f()`, `j1l()`, `jn()`, `jnf()`, `jnl()`, `y0()`, `y0f()`, `y0l()`, `y1()`, `y1f()`, `yn()`, `ynf()`, `ynl()`

ynf

Name

`ynf` — Bessel functions

Synopsis

```
#include <math.h>
float ynf(float x);
```

Description

The `ynf()` function is identical to `yn()`, except that the argument `x` and the return value is a float.

Returns

See `yn()`.

See Also

`j0()`, `j0f()`, `j0l()`, `j1()`, `j1f()`, `j1l()`, `jn()`, `jnf()`, `jnl()`, `y0()`, `y0f()`, `y0l()`, `y1()`, `y1f()`, `y1l()`, `yn()`, `ynl()`

ynl

Name

`ynl` — Bessel functions

Synopsis

```
#include <math.h>
long double ynl(long double x);
```

Description

The `ynl()` function is identical to `yn()`, except that the argument `x` and the return value is a long double.

Returns

See `yn()`.

See Also

`j0()`, `j0f()`, `j0l()`, `j1()`, `j1f()`, `j1l()`, `jn()`, `jnf()`, `jnl()`, `y0()`, `y0f()`, `y0l()`, `y1()`, `y1f()`, `y1l()`, `yn()`, `ynf()`

12.9 Interfaces for libpthread

Table 12-42 defines the library name and shared object name for the libpthread library

Table 12-42 libpthread Definition

Library:	libpthread
SONAME:	libpthread.so.0

The behavior of the interfaces in this library is specified by the following specifications:

[LFS] Large File Support
[LSB] This Specification
[SUSv3] POSIX 1003.1-2001 (ISO/IEC 9945-2003)
[SUSv4] POSIX 1003.1-2008 (ISO/IEC 9945-2009)

12.9.1 Realtime Threads

12.9.1.1 Interfaces for Realtime Threads

An LSB conforming implementation shall provide the generic functions for Realtime Threads specified in Table 12-43, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-43 libpthread - Realtime Threads Function Interfaces

pthread_attr_getinheritsched [SUSv3]	pthread_attr_getschedpolicy [SUSv3]	pthread_attr_getscope [SUSv3]	pthread_attr_setinheritsched [SUSv3]
pthread_attr_setschedpolicy [SUSv3]	pthread_attr_setscope [SUSv3]	pthread_getschedparam [SUSv3]	pthread_mutex_getprioceiling(GLIBC_2.4) [SUSv4]
pthread_mutex_setprioceiling(GLIBC_2.4) [SUSv4]	pthread_mutexattr_getprioceiling(GLIBC_2.4) [SUSv4]	pthread_mutexattr_getprotocol(GLIBC_2.4) [SUSv4]	pthread_mutexattr_setprioceiling(GLIBC_2.4) [SUSv4]
pthread_mutexattr_setprotocol(GLIBC_2.4) [SUSv4]	pthread_setschedparam [SUSv3]	pthread_setschedprio(GLIBC_2.3.4) [SUSv3]	

12.9.2 Advanced Realtime Threads

12.9.2.1 Interfaces for Advanced Realtime Threads

An LSB conforming implementation shall provide the generic functions for Advanced Realtime Threads specified in Table 12-44, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-44 libpthread - Advanced Realtime Threads Function Interfaces

pthread_barrier_destroy [SUSv3]	pthread_barrier_init [SUSv3]	pthread_barrier_wait [SUSv3]	pthread_barrierattr_destroy [SUSv3]
pthread_barrierattr_getpshared(GLIBC_2.3.3) [SUSv3]	pthread_barrierattr_init [SUSv3]	pthread_barrierattr_setpshared [SUSv3]	pthread_getcpuclockid [SUSv3]
pthread_spin_destroy [SUSv3]	pthread_spin_init [SUSv3]	pthread_spin_lock [SUSv3]	pthread_spin_trylock [SUSv3]
pthread_spin_un			

lock [SUSv3]			

12.9.3 Posix Threads

12.9.3.1 Interfaces for Posix Threads

An LSB conforming implementation shall provide the generic functions for Posix Threads specified in Table 12-45, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-45 libpthread - Posix Threads Function Interfaces

_pthread_cleanup_pop [LSB]	_pthread_cleanup_push [LSB]	pthread_attr_destroy [SUSv3]	pthread_attr_get detachstate [SUSv3]
pthread_attr_get guardsize [SUSv3]	pthread_attr_get schedparam [SUSv3]	pthread_attr_get stack [SUSv3]	pthread_attr_get stackaddr [SUSv3]
pthread_attr_get stacksize [SUSv3]	pthread_attr_init [SUSv3]	pthread_attr_set detachstate [SUSv3]	pthread_attr_set guardsize [SUSv3]
pthread_attr_setschedparam [SUSv3]	pthread_attr_setstack [SUSv3]	pthread_attr_setstackaddr [SUSv3]	pthread_attr_setstacksize [SUSv3]
pthread_cancel [SUSv3]	pthread_cond_broadcast [SUSv3]	pthread_cond_destroy [SUSv3]	pthread_cond_init [SUSv3]
pthread_cond_signal [SUSv3]	pthread_cond_timedwait [SUSv3]	pthread_cond_wait [SUSv3]	pthread_condattr_destroy [SUSv3]
pthread_condattr_getpshared [SUSv3]	pthread_condattr_init [SUSv3]	pthread_condattr_setpshared [SUSv3]	pthread_create [SUSv3]
pthread_detach [SUSv3]	pthread_equal [SUSv3]	pthread_exit [SUSv3]	pthread_getconcurrency [SUSv3]
pthread_getspecific [SUSv3]	pthread_join [SUSv3]	pthread_key_create [SUSv3]	pthread_key_delete [SUSv3]
pthread_kill [SUSv3]	pthread_mutex_destroy [SUSv3]	pthread_mutex_init [SUSv3]	pthread_mutex_lock [SUSv3]
pthread_mutex_timedlock [SUSv3]	pthread_mutex_trylock [SUSv3]	pthread_mutex_unlock [SUSv3]	pthread_mutexattr_destroy [SUSv3]
pthread_mutexattr_getpshared [SUSv3]	pthread_mutexattr_gettype [SUSv3]	pthread_mutexattr_init [SUSv3]	pthread_mutexattr_setpshared [SUSv3]
pthread_mutexattr_settype [SUSv3]	pthread_once [SUSv3]	pthread_rwlock_destroy [SUSv3]	pthread_rwlock_init [SUSv3]
pthread_rwlock_	pthread_rwlock_timedrdlock	pthread_rwlock_timedwrlock	pthread_rwlock_tryrdlock

rdlock [SUSv3]	[SUSv3]	[SUSv3]	[SUSv3]
pthread_rwlock_trywrlock [SUSv3]	pthread_rwlock_unlock [SUSv3]	pthread_rwlock_wrlock [SUSv3]	pthread_rwlockattr_destroy [SUSv3]
pthread_rwlockattr_getpshared [SUSv3]	pthread_rwlockattr_init [SUSv3]	pthread_rwlockattr_setpshared [SUSv3]	pthread_self [SUSv3]
pthread_setcancelstate [SUSv3]	pthread_setcanceltype [SUSv3]	pthread_setconcurrency [SUSv3]	pthread_setspecific [SUSv3]
pthread_sigmask [SUSv3]	pthread_testcancel [SUSv3]	sem_close [SUSv3]	sem_destroy [SUSv3]
sem_getvalue [SUSv3]	sem_init [SUSv3]	sem_open [SUSv3]	sem_post [SUSv3]
sem_timedwait [SUSv3]	sem_trywait [SUSv3]	sem_unlink [SUSv3]	sem_wait [SUSv3]

An LSB conforming implementation shall provide the generic deprecated functions for Posix Threads specified in Table 12-46, with the full mandatory functionality as described in the referenced underlying specification.

> **Note:** These interfaces are deprecated, and applications should avoid using them. These interfaces may be withdrawn in future releases of this specification.

Table 12-46 libpthread - Posix Threads Deprecated Function Interfaces

pthread_attr_get stackaddr [SUSv3]	pthread_attr_setstackaddr [SUSv3]		

12.9.4 Thread aware versions of libc interfaces

12.9.4.1 Interfaces for Thread aware versions of libc interfaces

An LSB conforming implementation shall provide the generic functions for Thread aware versions of libc interfaces specified in Table 12-47, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-47 libpthread - Thread aware versions of libc interfaces Function Interfaces

lseek64 [LFS]	open64 [LFS]	pread [SUSv3]	pread64 [LSB]
pwrite [SUSv3]	pwrite64 [LSB]		

12.9.5 GNU Extensions for libpthread

12.9.5.1 Interfaces for GNU Extensions for libpthread

An LSB conforming implementation shall provide the generic functions for GNU Extensions for libpthread specified in Table 12-48, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-48 libpthread - GNU Extensions for libpthread Function Interfaces

pthread_getattr_np [LSB]	pthread_mutex_consistent_np [LSB]	pthread_mutexattr_getrobust_np [LSB]	pthread_mutexattr_setrobust_np [LSB]
pthread_rwlockattr_getkind_np [LSB]	pthread_rwlockattr_setkind_np [LSB]		

12.10 Data Definitions for libpthread

This section defines global identifiers and their values that are associated with interfaces contained in libpthread. These definitions are organized into groups that correspond to system headers. This convention is used as a convenience for the reader, and does not imply the existence of these headers, or their content. Where an interface is defined as requiring a particular system header file all of the data definitions for that system header file presented here shall be in effect.

This section gives data definitions to promote binary application portability, not to repeat source interface definitions available elsewhere. System providers and application developers should use this ABI to supplement - not to replace - source interface definition specifications.

This specification uses the ISO C (1999) C Language as the reference programming language, and data definitions are specified in ISO C format. The C language is used here as a convenient notation. Using a C language description of these data objects does not preclude their use by other programming languages.

12.10.1 pthread.h

```
#define PTHREAD_MUTEX_DEFAULT   0
#define PTHREAD_MUTEX_NORMAL    0
#define PTHREAD_SCOPE_SYSTEM    0
#define PTHREAD_MUTEX_RECURSIVE 1
#define PTHREAD_SCOPE_PROCESS   1
#define PTHREAD_MUTEX_ERRORCHECK        2
#define PTHREAD_RWLOCK_DEFAULT_NP       2
#define __SIZEOF_PTHREAD_BARRIERATTR_T  4
#define __SIZEOF_PTHREAD_CONDATTR_T     4
#define __SIZEOF_PTHREAD_MUTEXATTR_T    4
#define __SIZEOF_PTHREAD_COND_T 48
#define __SIZEOF_PTHREAD_RWLOCKATTR_T   8
#define pthread_cleanup_push(routine,arg)       \
        {struct _pthread_cleanup_buffer _buffer;\
        _pthread_cleanup_push(&_buffer,(routine),(arg));
#define                          pthread_cleanup_pop(execute)
_pthread_cleanup_pop(&_buffer,(execute));}
#define PTHREAD_COND_INITIALIZER        { { 0, 0, 0, 0, 0, (void
*) 0, 0, 0 } }

struct _pthread_cleanup_buffer {
    void (*__routine) (void *);
    void *__arg;
    int __canceltype;
    struct _pthread_cleanup_buffer *__prev;
};
typedef unsigned int pthread_key_t;
typedef int pthread_once_t;
typedef volatile int pthread_spinlock_t;
```

```
typedef union {
    char __size[__SIZEOF_PTHREAD_BARRIERATTR_T];
    int __align;
} pthread_barrierattr_t;
enum {
    PTHREAD_PRIO_NONE,
    PTHREAD_PRIO_INHERIT,
    PTHREAD_PRIO_PROTECT
};
enum {
    PTHREAD_MUTEX_STALLED_NP = 0,
    PTHREAD_MUTEX_ROBUST_NP = 1
};

typedef unsigned long int pthread_t;

typedef union {
    struct __pthread_mutex_s __data;
    char __size[__SIZEOF_PTHREAD_MUTEX_T];
    long int __align;
} pthread_mutex_t;
typedef union {
    char __size[__SIZEOF_PTHREAD_MUTEXATTR_T];
    int __align;
} pthread_mutexattr_t;

typedef union {
    char __size[__SIZEOF_PTHREAD_ATTR_T];
    long int __align;
} pthread_attr_t;

typedef union {
    struct {
        int __lock;
        unsigned int __futex;
        unsigned long long int __total_seq;
        unsigned long long int __wakeup_seq;
        unsigned long long int __woken_seq;
        void *__mutex;
        unsigned int __nwaiters;
        unsigned int __broadcast_seq;
    } __data;
    char __size[__SIZEOF_PTHREAD_COND_T];
    long long int __align;
} pthread_cond_t;
typedef union {
    char __size[__SIZEOF_PTHREAD_CONDATTR_T];
    int __align;
} pthread_condattr_t;

typedef union {
    char __size[__SIZEOF_PTHREAD_RWLOCKATTR_T];
    long int __align;
} pthread_rwlockattr_t;

#define PTHREAD_CREATE_JOINABLE 0
#define PTHREAD_INHERIT_SCHED   0
#define PTHREAD_ONCE_INIT       0
#define PTHREAD_PROCESS_PRIVATE 0
#define PTHREAD_CREATE_DETACHED 1
#define PTHREAD_EXPLICIT_SCHED  1
#define PTHREAD_PROCESS_SHARED  1

#define PTHREAD_CANCELED        ((void*)-1)
#define PTHREAD_CANCEL_DEFERRED 0
#define PTHREAD_CANCEL_ENABLE   0
```

```
#define PTHREAD_CANCEL_ASYNCHRONOUS    1
#define PTHREAD_CANCEL_DISABLE  1

extern int __register_atfork(void (*)(void), void (*)(void),
                             void (*)(void), void *);
extern void _pthread_cleanup_pop(struct _pthread_cleanup_buffer
*, int);
extern void _pthread_cleanup_push(struct _pthread_cleanup_buffer
*,
                                  void (*)(void *), void *);
extern int pthread_atfork(void (*__prepare) (void),
                        void (*__parent) (void), void
(*__child) (void));
extern int pthread_attr_destroy(pthread_attr_t * __attr);
extern int pthread_attr_getdetachstate(const pthread_attr_t *
__attr,
                                       int *__detachstate);
extern int pthread_attr_getguardsize(const pthread_attr_t *
__attr,
                                     size_t * __guardsize);
extern int pthread_attr_getinheritsched(const pthread_attr_t *
__attr,
                                        int *__inherit);
extern int pthread_attr_getschedparam(const pthread_attr_t *
__attr,
                                      struct sched_param
*__param);
extern int pthread_attr_getschedpolicy(const pthread_attr_t *
__attr,
                                       int *__policy);
extern int pthread_attr_getscope(const pthread_attr_t * __attr,
                               int *__scope);
extern int pthread_attr_getstack(const pthread_attr_t * __attr,
                               void **__stackaddr, size_t *
__stacksize);
extern int pthread_attr_getstackaddr(const pthread_attr_t *
__attr,
                                     void **__stackaddr);
extern int pthread_attr_getstacksize(const pthread_attr_t *
__attr,
                                     size_t * __stacksize);
extern int pthread_attr_init(pthread_attr_t * __attr);
extern int pthread_attr_setdetachstate(pthread_attr_t * __attr,
                                       int __detachstate);
extern int pthread_attr_setguardsize(pthread_attr_t * __attr,
                                     size_t __guardsize);
extern int pthread_attr_setinheritsched(pthread_attr_t * __attr,
                                        int __inherit);
extern int pthread_attr_setschedparam(pthread_attr_t * __attr,
                                      const struct sched_param
*__param);
extern int pthread_attr_setschedpolicy(pthread_attr_t * __attr,
                                       int __policy);
extern int pthread_attr_setscope(pthread_attr_t * __attr, int
__scope);
extern int pthread_attr_setstack(pthread_attr_t * __attr,
                                 void *__stackaddr, size_t
__stacksize);
extern int pthread_attr_setstackaddr(pthread_attr_t * __attr,
                                     void *__stackaddr);
extern int pthread_attr_setstacksize(pthread_attr_t * __attr,
                                     size_t __stacksize);
extern int pthread_barrier_destroy(pthread_barrier_t *
__barrier);
extern int pthread_barrier_init(pthread_barrier_t * __barrier,
```

```
                                        const     pthread_barrierattr_t    *
__attr,
                              unsigned int __count);
extern int pthread_barrier_wait(pthread_barrier_t * __barrier);
extern  int  pthread_barrierattr_destroy(pthread_barrierattr_t  *
__attr);
extern          int          pthread_barrierattr_getpshared(const
pthread_barrierattr_t *
                                __attr,              int
*__pshared);
extern   int   pthread_barrierattr_init(pthread_barrierattr_t   *
__attr);
extern int pthread_barrierattr_setpshared(pthread_barrierattr_t *
__attr,
                                int __pshared);
extern int pthread_cancel(pthread_t __th);
extern int pthread_cond_broadcast(pthread_cond_t * __cond);
extern int pthread_cond_destroy(pthread_cond_t * __cond);
extern int pthread_cond_init(pthread_cond_t * __cond,
                      const      pthread_condattr_t      *
__cond_attr);
extern int pthread_cond_signal(pthread_cond_t * __cond);
extern int pthread_cond_timedwait(pthread_cond_t * __cond,
                            pthread_mutex_t * __mutex,
                            const    struct    timespec
*__abstime);
extern int pthread_cond_wait(pthread_cond_t * __cond,
                      pthread_mutex_t * __mutex);
extern int pthread_condattr_destroy(pthread_condattr_t * __attr);
extern int pthread_condattr_getpshared(const pthread_condattr_t *
__attr,
                                int *__pshared);
extern int pthread_condattr_init(pthread_condattr_t * __attr);
extern   int   pthread_condattr_setpshared(pthread_condattr_t   *
__attr,
                                int __pshared);
extern int pthread_create(pthread_t * __newthread,
                      const pthread_attr_t * __attr,
                      void *(*__start_routine) (void *), void
*__arg);
extern int pthread_detach(pthread_t __th);
extern   int   pthread_equal(pthread_t   __thread1,   pthread_t
__thread2);
extern void pthread_exit(void *__retval);
extern int pthread_getattr_np(pthread_t thread, pthread_attr_t *
attr);
extern int pthread_getconcurrency(void);
extern int pthread_getcpuclockid(pthread_t __thread_id,
                            clockid_t * __clock_id);
extern  int  pthread_getschedparam(pthread_t  __target_thread, int
*__policy,
                            struct sched_param *__param);
extern void *pthread_getspecific(pthread_key_t __key);
extern int pthread_join(pthread_t __th, void **__thread_return);
extern int pthread_key_create(pthread_key_t * __key,
                      void (*__destr_function) (void *));
extern int pthread_key_delete(pthread_key_t __key);
extern   int   pthread_mutex_consistent_np(pthread_mutex_t   *
__mutex);
extern int pthread_mutex_destroy(pthread_mutex_t * __mutex);
extern  int  pthread_mutex_getprioceiling(const  pthread_mutex_t  *
__mutex,
                                int *__prioceiling);
extern int pthread_mutex_init(pthread_mutex_t * __mutex,
                      const      pthread_mutexattr_t      *
__mutexattr);
```

```
extern int pthread_mutex_lock(pthread_mutex_t * __mutex);
extern    int    pthread_mutex_setprioceiling(pthread_mutex_t    *
__mutex,
                                    int __prioceiling,
                                    int *__old_ceiling);
extern int pthread_mutex_timedlock(pthread_mutex_t * __mutex,
                                const    struct    timespec
*__abstime);
extern int pthread_mutex_trylock(pthread_mutex_t * __mutex);
extern int pthread_mutex_unlock(pthread_mutex_t * __mutex);
extern    int    pthread_mutexattr_destroy(pthread_mutexattr_t    *
__attr);
extern        int        pthread_mutexattr_getprioceiling(const
pthread_mutexattr_t *
                                    __attr,           int
*__prioceiling);
extern          int          pthread_mutexattr_getprotocol(const
pthread_mutexattr_t *
                                    __attr,           int
*__protocol);
extern int pthread_mutexattr_getpshared(const pthread_mutexattr_t
* __attr,
                                    int *__pshared);
extern          int          pthread_mutexattr_getrobust_np(const
pthread_mutexattr_t *
                                    __attr,           int
*__robustness);
extern int pthread_mutexattr_gettype(const pthread_mutexattr_t *
__attr,
                                    int *__kind);
extern int pthread_mutexattr_init(pthread_mutexattr_t * __attr);
extern int pthread_mutexattr_setprioceiling(pthread_mutexattr_t *
__attr,
                                    int __prioceiling);
extern  int  pthread_mutexattr_setprotocol(pthread_mutexattr_t  *
__attr,
                                    int __protocol);
extern  int  pthread_mutexattr_setpshared(pthread_mutexattr_t  *
__attr,
                                    int __pshared);
extern  int  pthread_mutexattr_setrobust_np(pthread_mutexattr_t  *
__attr,
                                    int __robustness);
extern    int    pthread_mutexattr_settype(pthread_mutexattr_t    *
__attr,
                                    int __kind);
extern int pthread_once(pthread_once_t * __once_control,
                    void (*__init_routine) (void));
extern int pthread_rwlock_destroy(pthread_rwlock_t * __rwlock);
extern int pthread_rwlock_init(pthread_rwlock_t * __rwlock,
                            const    pthread_rwlockattr_t    *
__attr);
extern int pthread_rwlock_rdlock(pthread_rwlock_t * __rwlock);
extern    int    pthread_rwlock_timedrdlock(pthread_rwlock_t    *
__rwlock,
                                    const    struct    timespec
*__abstime);
extern    int    pthread_rwlock_timedwrlock(pthread_rwlock_t    *
__rwlock,
                                    const    struct    timespec
*__abstime);
extern int pthread_rwlock_tryrdlock(pthread_rwlock_t * __rwlock);
extern int pthread_rwlock_trywrlock(pthread_rwlock_t * __rwlock);
extern int pthread_rwlock_unlock(pthread_rwlock_t * __rwlock);
extern int pthread_rwlock_wrlock(pthread_rwlock_t * __rwlock);
```

```
extern   int   pthread_rwlockattr_destroy(pthread_rwlockattr_t   *
__attr);
extern           int           pthread_rwlockattr_getkind_np(const
pthread_rwlockattr_t *
                                       __attr, int *__pref);
extern           int           pthread_rwlockattr_getpshared(const
pthread_rwlockattr_t *
                                       __attr, int *__pshared);
extern   int   pthread_rwlockattr_init(pthread_rwlockattr_t   *
__attr);
extern  int  pthread_rwlockattr_setkind_np(pthread_rwlockattr_t  *
__attr,
                                       int __pref);
extern  int  pthread_rwlockattr_setpshared(pthread_rwlockattr_t  *
__attr,
                                       int __pshared);
extern pthread_t pthread_self(void);
extern int pthread_setcancelstate(int __state, int *__oldstate);
extern int pthread_setcanceltype(int __type, int *__oldtype);
extern int pthread_setconcurrency(int __level);
extern int pthread_setschedparam(pthread_t  __target_thread, int
__policy,
                                 const    struct    sched_param
*__param);
extern  int  pthread_setschedprio(pthread_t  __target_thread, int
__prio);
extern  int  pthread_setspecific(pthread_key_t  __key, const  void
*__pointer);
extern int pthread_spin_destroy(pthread_spinlock_t * __lock);
extern  int  pthread_spin_init(pthread_spinlock_t  *  __lock,  int
__pshared);
extern int pthread_spin_lock(pthread_spinlock_t * __lock);
extern int pthread_spin_trylock(pthread_spinlock_t * __lock);
extern int pthread_spin_unlock(pthread_spinlock_t * __lock);
extern void pthread_testcancel(void);
```

12.10.2 semaphore.h

```
typedef union {
    char __size[__SIZEOF_SEM_T];
    long int __align;
} sem_t;

#define SEM_FAILED      ((sem_t*)0)

#define SEM_VALUE_MAX   ((int)((~0u)>>1))

extern int sem_close(sem_t * __sem);
extern int sem_destroy(sem_t * __sem);
extern int sem_getvalue(sem_t * __sem, int *__sval);
extern int sem_init(sem_t  *  __sem, int __pshared, unsigned  int
__value);
extern sem_t *sem_open(const char *__name, int __oflag, ...);
extern int sem_post(sem_t * __sem);
extern  int  sem_timedwait(sem_t  *  __sem, const  struct  timespec
*__abstime);
extern int sem_trywait(sem_t * __sem);
extern int sem_unlink(const char *__name);
extern int sem_wait(sem_t * __sem);
```

12.11 Interface Definitions for libpthread

The interfaces defined on the following pages are included in libpthread and are defined by this specification. Unless otherwise noted, these interfaces shall be included in the source standard.

Other interfaces listed in Section 12.9 shall behave as described in the referenced base document.

_pthread_cleanup_pop

Name

`_pthread_cleanup_pop` — establish cancellation handlers

Synopsis

```
#include <pthread.h>
void _pthread_cleanup_pop(struct _pthread_cleanup_buffer *, int);
```

Description

The `_pthread_cleanup_pop()` function provides an implementation of the `pthread_cleanup_pop()` macro described in *POSIX 1003.1-2001 (ISO/IEC 9945-2003)*.

The `_pthread_cleanup_pop()` function is not in the source standard; it is only in the binary standard.

_pthread_cleanup_push

Name

`_pthread_cleanup_push` — establish cancellation handlers

Synopsis

```
#include <pthread.h>
void _pthread_cleanup_push(struct _pthread_cleanup_buffer *, void
(*) (void *), void *);
```

Description

The `_pthread_cleanup_push()` function provides an implementation of the `pthread_cleanup_push()` macro described in *POSIX 1003.1-2001 (ISO/IEC 9945-2003)*.

The `_pthread_cleanup_push()` function is not in the source standard; it is only in the binary standard.

pthread_getattr_np

Name

pthread_getattr_np — get thread attributes

Synopsis

```
#include <pthread.h>
int pthread_getattr_np(pthread_t thread, pthread_attr_t *attr);
```

Description

pthread_getattr_np() fills in the thread attribute object *attr* with attribute values describing the running thread *thread*. This is useful to detect runtime changes from the values specified in the thread attributes object used to create the thread with pthread_create(). The following differences may be noted:

- The detach state, since a joinable thread may have detached itself after creation. Use pthread_attr_getdetachstate() to extract from *attr*.

- The stack size, which the implementation may align to a suitable boundary. Use pthread_attr_getstack() to extract from *attr*.

- The guard size, which the implementation may round upwards to a multiple of the page size, or ignore (i.e., treat as 0), if the application is allocating its own stack. Use pthread_attr_getguardsize() to extract from *attr*.

If the stack address attribute was not set in the thread attributes object used to create the thread, then the thread attributes object returned by pthread_getattr_np() will show the actual stack address the implementation selected for the thread. Use pthread_attr_getstack() to extract from *attr*.

The thread attributes object *attr* should be destroyed using pthread_attr_destroy() when it is no longer needed.

Return Value

On success, pthread_getattr_np() returns 0; on error, it returns a non-zero error number.

Errors

ENOMEM

   Insufficient memory to complete the operation.

In addition, if *thread* refers to the main thread, then pthread_getattr_np() may also fail due to errors from various underlying calls: fopen(), if the pseudo-file containing the memory region map cannot be opened; getrlimit() if the RLIMIT_STACK resource limit it not supported.

Notes

This function is a GNU extension.

See Also

pthread_attr_destroy(), pthread_attr_getdetachstate(), pthread_attr_getguardsize(), pthread_attr_getstack(), pthread_create().

pthread_mutex_consistent_np

Name

`pthread_mutex_consistent_np` — mark state protected by robust mutex as consistent

Synopsis

```
#include <pthread.h>
int pthread_mutex_consistent_np(pthread_mutex_t * __mutex);
```

Description

`pthread_mutex_consistent_np()` shall behave as described for `pthread_mutex_consistent()` in POSIX 1003.1-2008 (ISO/IEC 9945-2009).

pthread_mutexattr_getrobust_np, pthread_mutexattr_setrobust_np

Name

`pthread_mutexattr_getrobust_np`, `pthread_mutexattr_setrobust_np` — get and set the mutex robust attribute

Synopsis

```
#include <pthread.h>
int   pthread_mutexattr_getrobust_np(const   pthread_mutexattr_t   *
__attr, int * __robustness);
int   pthread_mutexattr_setrobust_np(const   pthread_mutexattr_t   *
__attr, int __robustness);
```

Description

`pthread_mutexattr_setrobust_np()` shall behave as described for `pthread_mutexattr_setrobust()` in POSIX 1003.1-2008 (ISO/IEC 9945-2009).

`pthread_mutexattr_getrobust_np()` shall behave as described for `pthread_mutexattr_getrobust()` in POSIX 1003.1-2008 (ISO/IEC 9945-2009).

Two additional valid values are defined for *__robustness*: `PTHREAD_MUTEX_STALLED_NP`, which is identical to `PTHREAD_MUTEX_STALLED` and `PTHREAD_MUTEX_ROBUST_NP`, which is identical to `PTHREAD_MUTEX_ROBUST`.

pthread_rwlockattr_getkind_np, pthread_rwlockattr_setkind_np

Name

pthread_rwlockattr_getkind_np,
pthread_rwlockattr_setkind_np — get/set the read-write lock kind of
the thread read-write lock attribute object

Synopsis

```
#include <pthread.h>
int pthread_rwlockattr_getkind_np(const pthread_rwlockattr_t * attr,
int * pref);
int pthread_rwlockattr_setkind_np(pthread_rwlockattr_t * attr, int *
pref);
```

Description

The `pthread_rwlockattr_setkind_np()` function sets the kind of read-write
lock of the thread read-write lock attribute object referred to by attr to the value
specified with pref. The argument pref may be set to
`PTHREAD_RWLOCK_PREFER_READER_NP`,
`PTHREAD_RWLOCK_PREFER_WRITER_NONRECURSIVE_NP`,   or
`PTHREAD_RWLOCK_PREFER_WRITER_NP`.   The   default   lock   setting   is
`PTHREAD_RWLOCK_PREFER_READER_NP`. A thread may hold multiple read locks,
i.e. read locks are recursive. According to The Single Unix Specification, the
behavior is unspecified when a reader tries to place a lock, and there is no write
lock but writers are waiting. Giving preference to the reader, as is set by default
with the `PTHREAD_RWLOCK_PREFER_READER_NP` value implies that the reader
will receive the requested lock, even if a writer is waiting. As long as there are
readers   the   writer   will   be   starved.   Setting   the   kind   to
`PTHREAD_RWLOCK_PREFER_WRITER_NONRECURSIVE_NP`, avoids writer starvation
as long as any read locking is not done in a recursive fashion. The
`pthread_rwlockattr_getkind_np()` function returns the value of the read-
write lock attribute of the thread read-write lock attribute object referred to by
attr in the pointer *pref*.

Return Value

`pthread_rwlockattr_setkind_np()` function returns 0 on success; on error, it
returns   a   non-zero   error   number.   `pthread_rwlockattr_setkind_np()`
function always returns 0.

Errors

EINVAL

> *pref* is set to an unsupported value.

Notes

Setting the value read-write lock kind to `PTHREAD_RWLOCK_PREFER_WRITER_NP`,
results   in   the   same   behavior   as   setting   the   value   to
`PTHREAD_RWLOCK_PREFER_READER_NP`. As long as a reader thread holds the lock
the thread holding a write lock will be starved. Setting the kind value to
`PTHREAD_RWLOCK_PREFER_WRITER_NONRECURSIVE_NP`, allows the writer to run.
However, the writer may not be recursive as is implied by the name.

12.12 Interfaces for libgcc_s

Table 12-49 defines the library name and shared object name for the libgcc_s library

Table 12-49 libgcc_s Definition

Library:	libgcc_s
SONAME:	libgcc_s.so.1

The behavior of the interfaces in this library is specified by the following specifications:

 [LSB] This Specification

12.12.1 Unwind Library

12.12.1.1 Interfaces for Unwind Library

An LSB conforming implementation shall provide the generic functions for Unwind Library specified in Table 12-50, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-50 libgcc_s - Unwind Library Function Interfaces

_Unwind_Backtrace [LSB]	_Unwind_Delete Exception [LSB]	_Unwind_FindE nclosingFunction [LSB]	_Unwind_Forced Unwind [LSB]
_Unwind_GetCF A [LSB]	_Unwind_GetGR [LSB]	_Unwind_GetIP [LSB]	_Unwind_GetIPI nfo(GCC_4.2.0) [LSB]
_Unwind_GetLa nguageSpecificD ata [LSB]	_Unwind_GetRe gionStart [LSB]	_Unwind_RaiseE xception [LSB]	_Unwind_Resum e [LSB]
_Unwind_Resum e_or_Rethrow [LSB]	_Unwind_SetGR [LSB]	_Unwind_SetIP [LSB]	

12.13 Data Definitions for libgcc_s

This section defines global identifiers and their values that are associated with interfaces contained in libgcc_s. These definitions are organized into groups that correspond to system headers. This convention is used as a convenience for the reader, and does not imply the existence of these headers, or their content. Where an interface is defined as requiring a particular system header file all of the data definitions for that system header file presented here shall be in effect.

This section gives data definitions to promote binary application portability, not to repeat source interface definitions available elsewhere. System providers and application developers should use this ABI to supplement - not to replace - source interface definition specifications.

This specification uses the ISO C (1999) C Language as the reference programming language, and data definitions are specified in ISO C format. The C language is used here as a convenient notation. Using a C language

description of these data objects does not preclude their use by other programming languages.

12.13.1 unwind.h

```
struct _Unwind_Context;
struct _Unwind_Exception;

typedef     unsigned     int     _Unwind_Ptr     __attribute__
((__mode__(__pointer__)));
typedef     unsigned     int     _Unwind_Word     __attribute__
((__mode__(__word__)));
typedef unsigned int _Unwind_Exception_Class
    __attribute__ ((__mode__(__DI__)));

typedef enum {
    _URC_NO_REASON = 0,
    _URC_FOREIGN_EXCEPTION_CAUGHT = 1,
    _URC_FATAL_PHASE2_ERROR = 2,
    _URC_FATAL_PHASE1_ERROR = 3,
    _URC_NORMAL_STOP = 4,
    _URC_END_OF_STACK = 5,
    _URC_HANDLER_FOUND = 6,
    _URC_INSTALL_CONTEXT = 7,
    _URC_CONTINUE_UNWIND = 8
} _Unwind_Reason_Code;

typedef         void         (*_Unwind_Exception_Cleanup_Fn)
(_Unwind_Reason_Code,
                                               struct
_Unwind_Exception *);

struct _Unwind_Exception {
    _Unwind_Exception_Class exception_class;
    _Unwind_Exception_Cleanup_Fn exception_cleanup;
    _Unwind_Word private_1;
    _Unwind_Word private_2;
} __attribute__ ((__aligned__));

#define _UA_SEARCH_PHASE       1
#define _UA_END_OF_STACK       16
#define _UA_CLEANUP_PHASE      2
#define _UA_HANDLER_FRAME      4
#define _UA_FORCE_UNWIND       8

typedef int _Unwind_Action;

typedef _Unwind_Reason_Code(*_Unwind_Stop_Fn) (int version,
                                               _Unwind_Action
actions,

_Unwind_Exception_Class
                                               exceptionClass,
                                               struct
_Unwind_Exception *
                                               exceptionObject,
                                               struct
_Unwind_Context *
                                               context,
                                               void
*stop_parameter);

typedef     _Unwind_Reason_Code(*_Unwind_Trace_Fn)     (struct
_Unwind_Context *,
```

```
                                                      void *);
extern   _Unwind_Reason_Code   _Unwind_Backtrace(_Unwind_Trace_Fn,
void *);
extern void _Unwind_DeleteException(struct _Unwind_Exception *);
extern void *_Unwind_FindEnclosingFunction(void *);
extern       _Unwind_Reason_Code      _Unwind_ForcedUnwind(struct
_Unwind_Exception *,
                                                    _Unwind_Stop_Fn,
void *);
extern _Unwind_Word _Unwind_GetCFA(struct _Unwind_Context *);
extern _Unwind_Word _Unwind_GetGR(struct _Unwind_Context *, int);
extern _Unwind_Ptr _Unwind_GetIP(struct _Unwind_Context *);
extern _Unwind_Ptr _Unwind_GetIPInfo(struct  _Unwind_Context  *,
int *);
extern         void         *_Unwind_GetLanguageSpecificData(struct
_Unwind_Context *);
extern _Unwind_Ptr _Unwind_GetRegionStart(struct  _Unwind_Context
*);
extern        _Unwind_Reason_Code      _Unwind_RaiseException(struct
_Unwind_Exception
                                                    *);
extern void _Unwind_Resume(struct _Unwind_Exception *);
extern _Unwind_Reason_Code _Unwind_Resume_or_Rethrow(struct

_Unwind_Exception *);
extern   void   _Unwind_SetGR(struct   _Unwind_Context   *,   int,
u_int64_t);
extern void _Unwind_SetIP(struct _Unwind_Context *, _Unwind_Ptr);
```

12.14 Interface Definitions for libgcc_s

The interfaces defined on the following pages are included in libgcc_s and are defined by this specification. Unless otherwise noted, these interfaces shall be included in the source standard.

Other interfaces listed in Section 12.12 shall behave as described in the referenced base document.

_Unwind_Backtrace

Name

_Unwind_Backtrace — private C++ error handling method

Synopsis

```
_Unwind_Reason_Code _Unwind_Backtrace(_Unwind_Trace_Fn trace, void *
trace_argument);
```

Description

_Unwind_Backtrace() performs a stack backtrace using unwind data. The trace callback is called for every stack frame in the call chain. No cleanup actions are performed.

_Unwind_DeleteException

Name

_Unwind_DeleteException — private C++ error handling method

Synopsis

```
void _Unwind_DeleteException(struct _Unwind_Exception * object);
```

Description

_Unwind_DeleteException() deletes the given exception *object*. If a given runtime resumes normal execution after catching a foreign exception, it will not know how to delete that exception. Such an exception shall be deleted by calling _Unwind_DeleteException(). This is a convenience function that calls the function pointed to by the *exception_cleanup* field of the exception header.

_Unwind_FindEnclosingFunction

Name

_Unwind_FindEnclosingFunction — private C++ error handling method

Synopsis

```
void * _Unwind_FindEnclosingFunction(void * ip);
```

Description

_Unwind_FindEnclosingFunction() Find the start address of the procedure containing the specified *ip* or NULL if it cannot be found (for example, because the function has no unwind info).

Note that there is not necessarily a one-to-one correspondence between source level functions and procedures. Some functions do not have unwind-info and others are split into multiple procedures.

_Unwind_ForcedUnwind

Name

_Unwind_ForcedUnwind — private C++ error handling method

Synopsis

```
#include <unwind.h>
_Unwind_Reason_Code _Unwind_ForcedUnwind(struct _Unwind_Exception *
object, _Unwind_Stop_Fn stop, void * stop_parameter);
```

Description

Forced unwinding is a single-phase process. `stop` and `stop_parameter` control the termination of the unwind process instead of the usual personality routine query. Stop function `stop` is called for each unwind frame, with the parameteres described for the usual personality routine below, plus an additional `stop_parameter`.

Return Value

When `stop` identifies the destination frame, it transfers control to the user code as appropriate without returning, normally after calling `_Unwind_DeleteException()`. If not, then it should return an `_Unwind_Reason_Code` value.

If `stop` returns any reason code other than `_URC_NO_REASON`, then the stack state is indeterminate from the point of view of the caller of `_Unwind_ForcedUnwind()`. Rather than attempt to return, therefore, the unwind library should use the `exception_cleanup` entry in `object`, and then call `abort()`.

_URC_NO_REASON

> This is not the destination from. The unwind runtime will call frame's personality routine with the `_UA_FORCE_UNWIND` and `_UA_CLEANUP_PHASE` flag set in *actions*, and then unwind to the next frame and call the `stop()` function again.

_URC_END_OF_STACK

> In order to allow `_Unwind_ForcedUnwind()` to perform special processing when it reaches the end of the stack, the unwind runtime will call it after the last frame is rejected, with a `NULL` stack pointer in the context, and the `STOP()` FUNCTION SHALL CATCH THIS CONDITION. iT MAY return this code if it cannot handle end-of-stack.

_URC_FATAL_PHASE2_ERROR

> The `stop()` function may return this code for other fatal conditions like stack corruption.

_Unwind_GetCFA

Name

_Unwind_GetCFA — private C++ error handling method

Synopsis

`_Unwind_Word _Unwind_GetCFA(struct _Unwind_Context * context);`

Description

`_Unwind_GetCFA()` shall retrieve the value of the Canonical Frame Address (CFA) of the given `context`.

_Unwind_GetGR

Name

_Unwind_GetGR — private C++ error handling method

Synopsis

`_Unwind_Word _Unwind_GetGR(struct _Unwind_Context * context, int index);`

Description

`_Unwind_GetGR()` returns data at `index` found in `context`. The register is identified by its index: `0` to `31` are for the fixed registers, and `32` to `127` are for the stacked registers.

During the two phases of unwinding, only GR1 has a guaranteed value, which is the global pointer of the frame referenced by the unwind `context`. If the register has its NAT bit set, the behavior is unspecified.

_Unwind_GetIP

Name

_Unwind_GetIP — private C++ error handling method

Synopsis

`_Unwind_Ptr _Unwind_GetIP(struct _Unwind_Context * context);`

Description

`_Unwind_GetIP()` returns the instruction pointer value for the routine identified by the unwind `context`.

_Unwind_GetIPInfo

Name

`_Unwind_GetIPInfo` — private C++ error handling method

Synopsis

`_Unwind_Ptr _Unwind_GetIPInfo(struct _Unwind_Context * context, int * ip_before_insn);`

Description

`_Unwind_GetIPInfo()` returns the instruction pointer value for the routine identified by the unwind `context` and sets `ip_before_insn` flag indicating whether that IP is before or after first not yet fully executed instruction.

_Unwind_GetLanguageSpecificData

Name

`_Unwind_GetLanguageSpecificData` — private C++ error handling method

Synopsis

```
#include <unwind.h>
_Unwind_Ptr _Unwind_GetLanguageSpecificData(struct _Unwind_Context * context);
```

Description

`_Unwind_GetLanguageSpecificData()` returns the address of the language specific data area for the current stack frame described by `context`.

_Unwind_GetRegionStart

Name

`_Unwind_GetRegionStart` — private C++ error handling method

Synopsis

`_Unwind_Ptr    _Unwind_GetRegionStart(struct    _Unwind_Context    * context);`

Description

`_Unwind_GetRegionStart()` routine returns the address (i.e., `0`) of the beginning of the procedure or code fragment described by the current unwind descriptor block.

_Unwind_RaiseException

Name

`_Unwind_RaiseException` — private C++ error handling method

Synopsis

`_Unwind_Reason_Code _Unwind_RaiseException(struct _Unwind_Exception * object);`

Description

`_Unwind_RaiseException()` raises an exception, passing along the given exception *object*, which should have its *exception_class* and *exception_cleanup* fields set. The exception object has been allocated by the language-specific runtime, and has a language-specific format, exception that it shall contain an `_Unwind_Exception`.

Return Value

`_Unwind_RaiseException()` does not return unless an error condition is found. If an error condition occurs, an `_Unwind_Reason_Code` is returnd:

_URC_END_OF_STACK

> The unwinder encountered the end of the stack during phase one without finding a handler. The unwind runtime will not have modified the stack. The C++ runtime will normally call `uncaught_exception()` in this case.

_URC_FATAL_PHASE1_ERROR

> The unwinder encountered an unexpected error during phase one, because of something like stack corruption. The unwind runtime will not have modified the stack. The C++ runtime will normally call `terminate()` in this case.

_URC_FATAL_PHASE2_ERROR

> The unwinder encountered an unexpected error during phase two. This is usually a *throw*, which will call `terminate()`.

_Unwind_Resume

Name

`_Unwind_Resume` — private C++ error handling method

Synopsis

`void _Unwind_Resume(struct _Unwind_Exception * object);`

Description

`_Unwind_Resume()` resumes propagation of an existing exception *object*. A call to this routine is inserted as the end of a landing pad that performs cleanup, but does not resume normal execution. It causes unwinding to proceed further.

_Unwind_Resume_or_Rethrow

Name

`_Unwind_Resume_or_Rethrow` — private C++ error handling method

Synopsis

```
_Unwind_Reason_Code                    _Unwind_Resume_or_Rethrow(struct
_Unwind_Exception * exception_object);
```

Description

If the unwind was initiated due to a forced unwind,
`_Unwind_Resume_or_Rethrow()` shall resume that operation, else it shall re-
raise the exception.

_Unwind_SetGR

Name

`_Unwind_SetGR` — private C++ error handling method

Synopsis

```
void _Unwind_SetGR(struct _Unwind_Context * context, int index, uint
value);
```

Description

`_Unwind_SetGR()` sets the *value* of the register *index*ed for the routine
identified by the unwind *context*.

_Unwind_SetIP

Name

`_Unwind_SetIP` — private C++ error handling method

Synopsis

```
#include <unwind.h>
void _Unwind_SetIP(struct _Unwind_Context * context, _Unwind_Ptr
value);
```

Description

`_Unwind_SetIP()` sets the instruction pointer for the routine identified by the
unwind *context* to *value*.

12.15 Interfaces for libdl

Table 12-51 defines the library name and shared object name for the libdl library

Table 12-51 libdl Definition

Library:	libdl
SONAME:	libdl.so.2

The behavior of the interfaces in this library is specified by the following specifications:

[LSB] This Specification
[SUSv3] POSIX 1003.1-2001 (ISO/IEC 9945-2003)

12.15.1 Dynamic Loader

12.15.1.1 Interfaces for Dynamic Loader

An LSB conforming implementation shall provide the generic functions for Dynamic Loader specified in Table 12-52, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-52 libdl - Dynamic Loader Function Interfaces

dladdr [LSB]	dlclose [SUSv3]	dlerror [SUSv3]	dlopen [LSB]
dlsym [LSB]	dlvsym [LSB]		

12.16 Data Definitions for libdl

This section defines global identifiers and their values that are associated with interfaces contained in libdl. These definitions are organized into groups that correspond to system headers. This convention is used as a convenience for the reader, and does not imply the existence of these headers, or their content. Where an interface is defined as requiring a particular system header file all of the data definitions for that system header file presented here shall be in effect.

This section gives data definitions to promote binary application portability, not to repeat source interface definitions available elsewhere. System providers and application developers should use this ABI to supplement - not to replace - source interface definition specifications.

This specification uses the ISO C (1999) C Language as the reference programming language, and data definitions are specified in ISO C format. The C language is used here as a convenient notation. Using a C language description of these data objects does not preclude their use by other programming languages.

12.16.1 dlfcn.h

```
#define RTLD_NEXT       ((void *) -1l)
#define RTLD_DEFAULT    ((void *) 0)
#define RTLD_LOCAL      0
#define RTLD_LAZY       0x00001
#define RTLD_NOW        0x00002
#define RTLD_GLOBAL     0x00100

typedef struct {
    char *dli_fname;
    void *dli_fbase;
    char *dli_sname;
    void *dli_saddr;
} Dl_info;
extern int dladdr(const void *__address, Dl_info * __info);
extern int dlclose(void *__handle);
extern char *dlerror(void);
extern void *dlopen(const char *__file, int __mode);
extern void *dlsym(void *__handle, const char *__name);
```

```
extern void *dlvsym(void *handle, const char *name, const char
*version);
```

12.17 Interface Definitions for libdl

The interfaces defined on the following pages are included in libdl and are defined by this specification. Unless otherwise noted, these interfaces shall be included in the source standard.

Other interfaces listed in Section 12.15 shall behave as described in the referenced base document.

dladdr

Name

dladdr — find the shared object containing a given address

Synopsis

```
#include <dlfcn.h>

typedef struct {
            const char  *dli_fname;
            void        *dli_fbase;
            const char  *dli_sname;
            void        *dli_saddr;
```

```
} Dl_info;

int dladdr(const void * addr, Dl_info * dlip);
```

Description

The `dladdr()` function shall query the dynamic linker for information about the shared object containing the address *addr*. The information shall be returned in the user supplied data structure referenced by *dlip*.

The structure shall contain at least the following members:

dli_fname

> The pathname of the shared object containing the address

dli_fbase

> The base address at which the shared object is mapped into the address space of the calling process.

dli_sname

> The name of the nearest runtime symbol with value less than or equal to *addr*. Where possible, the symbol name shall be returned as it would appear in C source code.
>
> If no symbol with a suitable value is found, both this field and *dli_saddr* shall be set to NULL.

dli_saddr

> The address of the symbol returned in *dli_sname*. This address has type "pointer to *type*", where *type* is the type of the symbol *dli_sname*.
>
> **Example:** If the symbol in *dli_sname* is a function, then the type of *dli_saddr* is of type "pointer to function".

The behavior of `dladdr()` is only specified in dynamically linked programs.

Return Value

On success, `dladdr()` shall return non-zero, and the structure referenced by *dlip* shall be filled in as described. Otherwise, `dladdr()` shall return zero, and the cause of the error can be fetched with `dlerror()`.

Errors

See `dlerror()`.

Environment

LD_LIBRARY_PATH

> directory search-path for object files

dlopen

Name

`dlopen` — open dynamic object

Synopsis

```
#include <dlfcn.h>

void * dlopen(const char * filename, int flag);
```

Description

The `dlopen()` function shall behave as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with additional behaviors listed below.

If the file argument does not contain a slash character, then the system shall look for a library of that name in at least the following directories, and use the first one which is found:

• The directories specified by the `DT_RPATH` dynamic entry.

• The directories specified in the `LD_LIBRARY_PATH` environment variable (which is a colon separated list of pathnames). This step shall be skipped for setuid and setgid executables.

• A set of directories sufficient to contain the libraries specified in this standard.

> **Note:** Traditionally, `/lib` and `/usr/lib`. This case would also cover cases in which the system used the mechanism of `/etc/ld.so.conf` and `/etc/ld.so.cache` to provide access.

> Example: An application which is not linked against libm may choose to dlopen libm.

dlsym

Name

`dlsym` — obtain the address of a symbol from a dlopen object

Description

`dlsym()` is as specified in the POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

RTLD_NEXT, RTLD_DEFAULT Required

The values `RTLD_NEXT` and `RTLD_DEFAULT`, described as reserved for future use in POSIX 1003.1-2001 (ISO/IEC 9945-2003), are required, with behavior as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

dlvsym

Name

`dlvsym` — obtain the address of a symbol from a dlopen object

Synopsis

```
#include <dlfcn.h>
void * dlvsym(void * handle, char * name, char * version);
```

Description

`dlvsym()` does the same as dlsym() but takes a version string as an additional argument.

12.18 Interfaces for librt

Table 12-53 defines the library name and shared object name for the librt library

Table 12-53 librt Definition

Library:	librt
SONAME:	librt.so.1

The behavior of the interfaces in this library is specified by the following specifications:

 [SUSv3] POSIX 1003.1-2001 (ISO/IEC 9945-2003)

12.18.1 Shared Memory Objects

12.18.1.1 Interfaces for Shared Memory Objects

An LSB conforming implementation shall provide the generic functions for Shared Memory Objects specified in Table 12-54, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-54 librt - Shared Memory Objects Function Interfaces

shm_open [SUSv3]	shm_unlink [SUSv3]		

12.18.2 Clock

12.18.2.1 Interfaces for Clock

An LSB conforming implementation shall provide the generic functions for Clock specified in Table 12-55, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-55 librt - Clock Function Interfaces

clock_getcpuclockid [SUSv3]	clock_getres [SUSv3]	clock_gettime [SUSv3]	clock_nanosleep [SUSv3]
clock_settime [SUSv3]			

12.18.3 Timers

12.18.3.1 Interfaces for Timers

An LSB conforming implementation shall provide the generic functions for Timers specified in Table 12-56, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-56 librt - Timers Function Interfaces

timer_create [SUSv3]	timer_delete [SUSv3]	timer_getoverru n [SUSv3]	timer_gettime [SUSv3]
timer_settime [SUSv3]			

12.18.4 Message Queues

12.18.4.1 Interfaces for Message Queues

An LSB conforming implementation shall provide the generic functions for Message Queues specified in Table 12-57, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-57 librt - Message Queues Function Interfaces

mq_close(GLIBC _2.3.4) [SUSv3]	mq_getattr(GLIB C_2.3.4) [SUSv3]	mq_notify(GLIB C_2.3.4) [SUSv3]	mq_open(GLIBC _2.3.4) [SUSv3]
mq_receive(GLIB C_2.3.4) [SUSv3]	mq_send(GLIBC _2.3.4) [SUSv3]	mq_setattr(GLIB C_2.3.4) [SUSv3]	mq_timedreceive (GLIBC_2.3.4) [SUSv3]
mq_timedsend(G LIBC_2.3.4) [SUSv3]	mq_unlink(GLIB C_2.3.4) [SUSv3]		

12.19 Data Definitions for librt

This section defines global identifiers and their values that are associated with interfaces contained in librt. These definitions are organized into groups that correspond to system headers. This convention is used as a convenience for the reader, and does not imply the existence of these headers, or their content. Where an interface is defined as requiring a particular system header file all of the data definitions for that system header file presented here shall be in effect.

This section gives data definitions to promote binary application portability, not to repeat source interface definitions available elsewhere. System providers and application developers should use this ABI to supplement - not to replace - source interface definition specifications.

This specification uses the ISO C (1999) C Language as the reference programming language, and data definitions are specified in ISO C format. The C language is used here as a convenient notation. Using a C language description of these data objects does not preclude their use by other programming languages.

12.19.1 mqueue.h

```
typedef int mqd_t;
struct mq_attr {
    long int mq_flags;
    long int mq_maxmsg;
    long int mq_msgsize;
    long int mq_curmsgs;
    long int __pad[4];
};
extern int mq_close(mqd_t __mqdes);
extern int mq_getattr(mqd_t __mqdes, struct mq_attr *__mqstat);
extern  int  mq_notify(mqd_t  __mqdes,  const  struct  sigevent
*__notification);
extern mqd_t mq_open(const char *__name, int __oflag, ...);
extern ssize_t mq_receive(mqd_t __mqdes, char *__msg_ptr, size_t
__msg_len,
                          unsigned int *__msg_prio);
extern int mq_send(mqd_t __mqdes, const char *__msg_ptr, size_t
__msg_len,
                   unsigned int __msg_prio);
extern  int  mq_setattr(mqd_t  __mqdes,  const  struct  mq_attr
*__mqstat,
                  struct mq_attr *__omqstat);
extern ssize_t mq_timedreceive(mqd_t __mqdes, char *__msg_ptr,
                               size_t  __msg_len,  unsigned  int
*__msg_prio,
                               const        struct      timespec
*__abs_timeout);
extern int mq_timedsend(mqd_t __mqdes, const char *__msg_ptr,
                     size_t    __msg_len,    unsigned    int
__msg_prio,
                     const struct timespec *__abs_timeout);
extern int mq_unlink(const char *__name);
```

12.20 Interfaces for libcrypt

Table 12-58 defines the library name and shared object name for the libcrypt library

Table 12-58 libcrypt Definition

Library:	libcrypt
SONAME:	libcrypt.so.1

The behavior of the interfaces in this library is specified by the following specifications:

 [SUSv3] POSIX 1003.1-2001 (ISO/IEC 9945-2003)

12.20.1 Encryption

12.20.1.1 Interfaces for Encryption

An LSB conforming implementation shall provide the generic functions for Encryption specified in Table 12-59, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-59 libcrypt - Encryption Function Interfaces

crypt [SUSv3]	encrypt [SUSv3]	setkey [SUSv3]	

12.21 Interfaces for libpam

Table 12-60 defines the library name and shared object name for the libpam library

Table 12-60 libpam Definition

Library:	libpam
SONAME:	libpam.so.0

The Pluggable Authentication Module (PAM) interfaces allow applications to request authentication via a system administrator defined mechanism, known as a *service*.

A single service name, `other`, shall always be present. The behavior of this service shall be determined by the system administrator. Additional service names may also exist.

> **Note:** Future versions of this specification might define additional service names.

The behavior of the interfaces in this library is specified by the following specifications:

[LSB] This Specification

12.21.1 Pluggable Authentication API

12.21.1.1 Interfaces for Pluggable Authentication API

An LSB conforming implementation shall provide the generic functions for Pluggable Authentication API specified in Table 12-61, with the full mandatory functionality as described in the referenced underlying specification.

Table 12-61 libpam - Pluggable Authentication API Function Interfaces

pam_acct_mgmt(LIBPAM_1.0) [LSB]	pam_authenticate(LIBPAM_1.0) [LSB]	pam_chauthtok(LIBPAM_1.0) [LSB]	pam_close_session(LIBPAM_1.0) [LSB]
pam_end(LIBPAM_1.0) [LSB]	pam_fail_delay(LIBPAM_1.0) [LSB]	pam_get_item(LIBPAM_1.0) [LSB]	pam_getenv(LIBPAM_1.0) [LSB]
pam_getenvlist(LIBPAM_1.0) [LSB]	pam_open_session(LIBPAM_1.0) [LSB]	pam_putenv(LIBPAM_1.0) [LSB]	pam_set_item(LIBPAM_1.0) [LSB]
pam_setcred(LIBPAM_1.0) [LSB]	pam_start(LIBPAM_1.0) [LSB]	pam_strerror(LIBPAM_1.0) [LSB]	

12.22 Data Definitions for libpam

This section defines global identifiers and their values that are associated with interfaces contained in libpam. These definitions are organized into groups that correspond to system headers. This convention is used as a convenience for the reader, and does not imply the existence of these headers, or their content. Where an interface is defined as requiring a particular system header file all of the data definitions for that system header file presented here shall be in effect.

This section gives data definitions to promote binary application portability, not to repeat source interface definitions available elsewhere. System providers and application developers should use this ABI to supplement - not to replace - source interface definition specifications.

This specification uses the ISO C (1999) C Language as the reference programming language, and data definitions are specified in ISO C format. The C language is used here as a convenient notation. Using a C language description of these data objects does not preclude their use by other programming languages.

12.22.1 security/pam_appl.h

```
typedef struct pam_handle pam_handle_t;
struct pam_message {
    int msg_style;
    const char *msg;
};
struct pam_response {
    char *resp;
    int resp_retcode;                    /* currently un-used, zero
expected */
};

struct pam_conv {
    int (*conv) (int num_msg, const struct pam_message * *msg,
                struct pam_response * *resp, void *appdata_ptr);
    void *appdata_ptr;
};

#define PAM_PROMPT_ECHO_OFF     1
#define PAM_PROMPT_ECHO_ON      2
#define PAM_ERROR_MSG   3
#define PAM_TEXT_INFO   4

#define PAM_SERVICE     1        /* The service name */
#define PAM_USER        2        /* The user name */
#define PAM_TTY 3                /* The tty name */
#define PAM_RHOST       4        /* The remote host name */
#define PAM_CONV        5        /* The pam_conv structure */
#define PAM_RUSER       8        /* The remote user name */
#define PAM_USER_PROMPT 9           /* the prompt for getting a
username */

#define PAM_SUCCESS     0        /* Successful function return */
#define PAM_OPEN_ERR    1        /* dlopen() failure */
#define PAM_USER_UNKNOWN        10       /* User not known to the
underlying authenticaiton module */
#define PAM_MAXTRIES    11       /* An authentication service has
maintained a retry count which */
#define PAM_NEW_AUTHTOK_REQD    12       /* New authentication
token required */
#define PAM_ACCT_EXPIRED        13       /* User account has
expired */
#define PAM_SESSION_ERR 14       /* Can not make/remove an entry
for  the specified session */
#define PAM_CRED_UNAVAIL        15       /* Underlying
authentication service can not retrieve user cred */
#define PAM_CRED_EXPIRED        16       /* User credentials
expired */
#define PAM_CRED_ERR    17       /* Failure  setting  user
credentials */
#define PAM_CONV_ERR    19       /* Conversation error */
```

```
#define PAM_SYMBOL_ERR  2        /* Symbol not found */
#define  PAM_AUTHTOK_ERR  20            /* Authentication  token
manipulation error */
#define  PAM_AUTHTOK_RECOVER_ERR  21           /* Authentication
information cannot be recovered */
#define  PAM_AUTHTOK_LOCK_BUSY   22       /* Authentication token
lock busy */
#define PAM_AUTHTOK_DISABLE_AGING      23       /* Authentication
token aging disabled */
#define PAM_TRY_AGAIN   24       /* Preliminary check by password
service */
#define PAM_ABORT       26       /* Critical error (?module fail
now request) */
#define PAM_AUTHTOK_EXPIRED     27       /* user's authentication
token has expired */
#define  PAM_BAD_ITEM      29             /*  Bad  item  passed  to
pam_*_item() */
#define PAM_SERVICE_ERR 3       /* Error in service module */
#define PAM_SYSTEM_ERR  4       /* System error */
#define PAM_BUF_ERR     5       /* Memory buffer error */
#define PAM_PERM_DENIED 6       /* Permission denied */
#define PAM_AUTH_ERR    7       /* Authentication failure */
#define  PAM_CRED_INSUFFICIENT    8           /*  Can  not  access
authentication data due to insufficient crede */
#define  PAM_AUTHINFO_UNAVAIL       9            /*  Underlying
authentication service can not retrieve authentic */

#define PAM_DISALLOW_NULL_AUTHTOK      0x0001U
#define PAM_ESTABLISH_CRED      0x0002U /* Set user credentials
for an authentication service */
#define  PAM_DELETE_CRED  0x0004U  /*  Delete  user  credentials
associated with an authentication se */
#define  PAM_REINITIALIZE_CRED    0x0008U  /*  Reinitialize  user
credentials */
#define PAM_REFRESH_CRED        0x0010U /* Extend lifetime of
user credentials */
#define  PAM_CHANGE_EXPIRED_AUTHTOK         0x0020U  /*  Extend
lifetime of user credentials */
#define PAM_SILENT      0x8000U /* Authentication service should
not generate any messages */

extern int pam_acct_mgmt(pam_handle_t *, int);
extern int pam_authenticate(pam_handle_t *, int);
extern int pam_chauthtok(pam_handle_t *, int);
extern int pam_close_session(pam_handle_t *, int);
extern int pam_end(pam_handle_t *, int);
extern int pam_fail_delay(pam_handle_t *, unsigned int);
extern  int pam_get_item(const  pam_handle_t *,  int,  const void
**);
extern const char *pam_getenv(pam_handle_t *, const char *);
extern char **pam_getenvlist(pam_handle_t *);
extern int pam_open_session(pam_handle_t *, int);
extern int pam_putenv(pam_handle_t *, const char *);
extern int pam_set_item(pam_handle_t *, int, const void *);
extern int pam_setcred(pam_handle_t *, int);
extern int pam_start(const char *, const char *, const struct
pam_conv *,
                pam_handle_t * *);
extern const char *pam_strerror(pam_handle_t *, int);
```

12.23 Interface Definitions for libpam

The interfaces defined on the following pages are included in libpam and are defined by this specification. Unless otherwise noted, these interfaces shall be included in the source standard.

Other interfaces listed in Section 12.21 shall behave as described in the referenced base document.

pam_acct_mgmt

Name

`pam_acct_mgmt` — establish the status of a user's account

Synopsis

```
#include <security/pam_appl.h>
int pam_acct_mgmt(pam_handle_t * pamh, int flags);
```

Description

`pam_acct_mgmt()` establishes the account's usability and the user's accessibility to the system. It is typically called after the user has been authenticated.

flags may be specified as any valid flag (namely, one of those applicable to the *flags* argument of `pam_authenticate()`). Additionally, the value of *flags* may be logically or'd with PAM_SILENT.

Return Value

PAM_SUCCESS

Success.

PAM_NEW_AUTHTOK_REQD

User is valid, but user's authentication token has expired. The correct response to this return-value is to require that the user satisfy the `pam_chauthtok()` function before obtaining service. It may not be possible for an application to do this. In such a case, the user should be denied access until the account password is updated.

PAM_ACCT_EXPIRED

User is no longer permitted access to the system.

PAM_AUTH_ERR

Authentication error.

PAM_PERM_DENIED

User is not permitted to gain access at this time.

PAM_USER_UNKNOWN

User is not known to a module's account management component.

Note: Errors may be translated to text with `pam_strerror()`.

pam_authenticate

Name

`pam_authenticate` — authenticate the user

Synopsis

```
#include <security/pam_appl.h>
int pam_authenticate(pam_handle_t * pamh, int flags);
```

Description

`pam_authenticate()` serves as an interface to the authentication mechanisms of the loaded modules.

`flags` is an optional parameter that may be specified by the following value:

PAM_DISALLOW_NULL_AUTHTOK

> Instruct the authentication modules to return `PAM_AUTH_ERR` if the user does not have a registered authorization token.

Additionally, the value of `flags` may be logically or'd with `PAM_SILENT`.

The process may need to be privileged in order to successfully call this function.

Return Value

PAM_SUCCESS

> Success.

PAM_AUTH_ERR

> User was not authenticated or process did not have sufficient privileges to perform authentication.

PAM_CRED_INSUFFICIENT

> Application does not have sufficient credentials to authenticate the user.

PAM_AUTHINFO_UNAVAIL

> Modules were not able to access the authentication information. This might be due to a network or hardware failure, etc.

PAM_USER_UNKNOWN

> Supplied username is not known to the authentication service.

PAM_MAXTRIES

> One or more authentication modules has reached its limit of tries authenticating the user. Do not try again.

PAM_ABORT

> One or more authentication modules failed to load.

> **Note:** Errors may be translated to text with `pam_strerror()`.

pam_chauthtok

Name

pam_chauthtok — change the authentication token for a given user

Synopsis

```
#include <security/pam_appl.h>
int pam_chauthtok(pam_handle_t * pamh, const int flags);
```

Description

pam_chauthtok() is used to change the authentication token for a given user as indicated by the state associated with the handle *pamh*.

flags is an optional parameter that may be specified by the following value:

PAM_CHANGE_EXPIRED_AUTHTOK

   User's authentication token should only be changed if it has expired.

Additionally, the value of *flags* may be logically or'd with PAM_SILENT.

RETURN VALUE

PAM_SUCCESS

   Success.

PAM_AUTHTOK_ERR

   A module was unable to obtain the new authentication token.

PAM_AUTHTOK_RECOVER_ERR

   A module was unable to obtain the old authentication token.

PAM_AUTHTOK_LOCK_BUSY

   One or more modules were unable to change the authentication token since it is currently locked.

PAM_AUTHTOK_DISABLE_AGING

   Authentication token aging has been disabled for at least one of the modules.

PAM_PERM_DENIED

   Permission denied.

PAM_TRY_AGAIN

   Not all modules were in a position to update the authentication token(s). In such a case, none of the user's authentication tokens are updated.

PAM_USER_UNKNOWN

   User is not known to the authentication token changing service.

   Note: Errors may be translated to text with pam_strerror().

pam_close_session

Name

`pam_close_session` — indicate that an authenticated session has ended

Synopsis

```
#include <security/pam_appl.h>
int pam_close_session(pam_handle_t * pamh, int flags);
```

Description

`pam_close_session()` is used to indicate that an authenticated session has ended. It is used to inform the module that the user is exiting a session. It should be possible for the PAM library to open a session and close the same session from different applications.

`flags` may have the value `PAM_SILENT` to indicate that no output should be generated as a result of this function call.

Return Value

PAM_SUCCESS

> Success.

PAM_SESSION_ERR

> One of the required loaded modules was unable to close a session for the user.

> **Note:** Errors may be translated to text with `pam_strerror()`.

pam_end

Name

`pam_end` — terminate the use of the PAM library

Synopsis

```
#include <security/pam_appl.h>
int pam_end(pam_handle_t * pamh, int pam_status);
```

Description

`pam_end()` terminates use of the PAM library. On success, the contents of `*pamh` are no longer valid, and all memory associated with it is invalid.

Normally, `pam_status` is passed the value `PAM_SUCCESS`, but in the event of an unsuccessful service application, the appropriate PAM error return value should be used.

Return Value

PAM_SUCCESS

> Success.

> **Note:** Errors may be translated to text with `pam_strerror()`.

pam_fail_delay

Name

`pam_fail_delay` — specify delay time to use on authentication error

Synopsis

```
#include <security/pam_appl.h>
int pam_fail_delay(pam_handle_t * pamh, unsigned int micro_sec);
```

Description

`pam_fail_delay()` specifies the minimum delay for the PAM library to use when an authentication error occurs. The actual delay can vary by as much at 25%. If this function is called multiple times, the longest time specified by any of the call will be used.

The delay is invoked if an authentication error occurs during the `pam_authenticate()` or `pam_chauthtok()` function calls.

Independent of the success of `pam_authenticate()` or `pam_chauthtok()`, the delay time is reset to its default value of 0 when the PAM library returns control to the application from these two functions.

Return Value

PAM_SUCCESS

Success.

> **Note:** Errors may be translated to text with `pam_strerror()`.

pam_get_item

Name

`pam_get_item` — obtain the value of the indicated item.

Synopsis

```
#include <security/pam_appl.h>
int pam_get_item(const pam_handle_t * pamh, int item_type, const void
* * item);
```

Description

`pam_get_item()` obtains the value of the indicated `item_type`. The possible values of `item_type` are the same as listed for `pam_set_item()`.

On success, `item` contains a pointer to the value of the corresponding item. Note that this is a pointer to the actual data and should not be `free()`'d or over-written.

Return Value

PAM_SUCCESS

Success.

PAM_PERM_DENIED

Application passed a `NULL` pointer for `item`.

PAM_BAD_ITEM

Application attempted to get an undefined item.

Note: Errors may be translated to text with `pam_strerror()`.

pam_getenv

Name

`pam_getenv` — get a PAM environment variable

Synopsis

```
#include <security/pam_appl.h>
const char * pam_getenv(const pam_handle_t * pamh, const char *
name);
```

Description

The `pam_getenv()` function shall search the environment associated with the PAM handle `pamh` for the environment variable `name`. If the specified environment variable cannot be found, a null pointer shall be returned. The application shall ensure that it does not modify the string pointed to by the `pam_getenv()` function.

Return Value

On success, `pam_getenv()` returns a pointer to a string of the form name=value.

pam_getenvlist

Name

`pam_getenvlist` — returns a pointer to the complete PAM environment.

Synopsis

```
#include <security/pam_appl.h>
char * const * pam_getenvlist(pam_handle_t * pamh);
```

Description

`pam_getenvlist()` returns a pointer to the complete PAM environment. This pointer points to an array of pointers to `NUL`-terminated strings and must be terminated by a `NULL` pointer. Each string has the form "name=value".

The PAM library module allocates memory for the returned value and the associated strings. The calling application is responsible for freeing this memory.

Return Value

`pam_getenvlist()` returns an array of string pointers containing the PAM environment. On error, `NULL` is returned.

pam_open_session

Name

`pam_open_session` — indicate session has started

Synopsis

```
#include <security/pam_appl.h>
int pam_open_session(pam_handle_t * pamh, int flags);
```

Description

The `pam_open_session()` function is used to indicate that an authenticated session has begun, after the user has been identified (see `pam_authenticate()`) and, if necessary, granted credentials (see `pam_setcred()`). It is used to inform the module that the user is currently in a session. It should be possible for the PAM library to open a session and close the same session from different applications.

flags may have the value `PAM_SILENT` to indicate that no output be generated as a result of this function call.

Return Value

PAM_SUCCESS

Success.

PAM_SESSION_ERR

One of the loaded modules was unable to open a session for the user.

Note: Errors may be translated to text with `pam_strerror()`.

pam_putenv

Name

`pam_putenv` — Add, replace or delete a PAM environment variable

Synopsis

```
#include <security/pam_appl.h>
int pam_putenv(const pam_handle_t * pamh, const char * name_value);
```

Description

The `pam_putenv()` function shall modify the environment list associated with *pamh*. If *name_value* contains an `'='` character, the characters to the left of the first `'='` character represent the *name*, and the remaining characters after the `'='` represent the *value*.

If the *name* environment variable exists in the environment associated with *pamh*, it shall be modified to have the value *value*. Otherwise, the *name* shall be added to the environment associated with *pamh* with the value *value*.

If there is no `'='` character in *name_value*, the variable in the environment associated with *pamh* named *name_value* shall be deleted.

Return Value

On success, the `pam_putenv()` function shall return PAM_SUCCESS. Otherwise the return value indicates the error:

PAM_PERM_DENIED

The *name_value* argument is a null pointer.

PAM_BAD_ITEM

The PAM environment varable named *name_value* does not exist and therefore cannot be deleted.

PAM_ABORT

The PAM handle identifed by *pamh* is corrupt.

PAM_BUF_ERR

Memory buffer error.

pam_set_item

Name

pam_set_item — (re)set the value of an item.

Synopsis

```
#include <security/pam_appl.h>
int pam_set_item(pam_handle_t * pamh, int item_type, const void *
item);
```

Description

pam_set_item() (re)sets the value of one of the following item_types:

PAM_SERVICE

> service name

PAM_USER

> user name

PAM_TTY

> terminal name

> The value for a device file should include the /dev/ prefix. The value for graphical, X-based, applications should be the $DISPLAY variable.

PAM_RHOST

> remote host name

PAM_CONV

> conversation structure

PAM_RUSER

> remote user name

PAM_USER_PROMPT

> string to be used when prompting for a user's name

> The default value for this string is Please enter username: .

For all *item_types* other than PAM_CONV, *item* is a pointer to a NULL-terminated character string. In the case of PAM_CONV, *item* points to an initialized pam_conv structure.

Return Value

PAM_SUCCESS

> Success.

PAM_PERM_DENIED

> An attempt was made to replace the conversation structure with a NULL value.

PAM_BUF_ERR

Function ran out of memory making a copy of the item.

PAM_BAD_ITEM

Application attempted to set an undefined item.

Note: Errors may be translated to text with `pam_strerror()`.

pam_setcred

Name

`pam_setcred` — set the module-specific credentials of the user

Synopsis

```
#include <security/pam_appl.h>
extern int pam_setcred(pam_handle_t * pamh, int flags);
```

Description

`pam_setcred()` sets the module-specific credentials of the user. It is usually called after the user has been authenticated, after the account management function has been called and after a session has been opened for the user.

flags maybe specified from among the following values:

PAM_ESTABLISH_CRED

> set credentials for the authentication service

PAM_DELETE_CRED

> delete credentials associated with the authentication service

PAM_REINITIALIZE_CRED

> reinitialize the user credentials

PAM_REFRESH_CRED

> extend lifetime of the user credentials

Additionally, the value of *flags* may be logically or'd with PAM_SILENT.

Return Value

PAM_SUCCESS

> Success.

PAM_CRED_UNAVAIL

> Module cannot retrieve the user's credentials.

PAM_CRED_EXPIRED

> User's credentials have expired.

PAM_USER_UNKNOWN

> User is not known to an authentication module.

PAM_CRED_ERR

> Module was unable to set the credentials of the user.

> **Note:** Errors may be translated to text with `pam_strerror()`.

pam_start

Name

`pam_start` — initialize the PAM library

Synopsis

```
#include <security/pam_appl.h>
int pam_start(const char *  service_name, const  char  *  user, const
struct pam_conv *  pam_conversation, pam_handle_t * *  pamh);
```

Description

`pam_start()` is used to initialize the PAM library. It must be called prior to any other usage of the PAM library. On success, `*pamh` becomes a handle that provides continuity for successive calls to the PAM library. `pam_start()` expects arguments as follows: the `service_name` of the program, the `username` of the individual to be authenticated, a pointer to an application-supplied `pam_conv` structure, and a pointer to a `pam_handle_t` pointer.

An application must provide the *conversation function* used for direct communication between a loaded module and the application. The application also typically provides a means for the module to prompt the user for a password, etc.

The structure, pam_conv, is defined to be,

```
struct pam_conv {
          int (*conv) (int num_msg,
                       const struct pam_message * *msg,
                       struct pam_response * *resp,
                       void *appdata_ptr);
          void *appdata_ptr;
```

```
};
```

It is initialized by the application before it is passed to the library. The contents of this structure are attached to the *pamh* handle. The point of this argument is to provide a mechanism for any loaded module to interact directly with the application program; this is why it is called a conversation structure.

When a module calls the referenced conv() function, *appdata_ptr* is set to the second element of this structure.

The other arguments of a call to conv() concern the information exchanged by module and application. *num_msg* holds the length of the array of pointers passed via *msg*. On success, the pointer *resp* points to an array of *num_msg* pam_response structures, holding the application-supplied text. Note that *resp* is a struct pam_response array and not an array of pointers.

Return Value

PAM_SUCCESS

Success.

PAM_BUF_ERR

Memory allocation error.

PAM_ABORT

Internal failure.

ERRORS

May be translated to text with pam_strerror().

pam_strerror

Name

pam_strerror — returns a string describing the PAM error

Synopsis

```
#include <security/pam_appl.h>
const char * pam_strerror(pam_handle_t * pamh, int errnum);
```

Description

pam_strerror() returns a string describing the PAM error associated with *errnum*.

Return Value

On success, this function returns a description of the indicated error. The application should not free or modify this string. Otherwise, a string indicating that the error is unknown shall be returned. It is unspecified whether or not the string returned is translated according to the setting of LC_MESSAGES.

IV Utility Libraries

13 Utility Libraries

13.1 Introduction

An LSB-conforming implementation shall also support the following utility libraries which are built on top of the interfaces provided by the base libraries. These libraries implement common functionality, and hide additional system dependent information such as file formats and device names.

• libz

• libcurses

• libutil

The structure of the definitions for these libraries follows the same model as used for Base Libraries.

13.2 Interfaces for libz

Table 13-1 defines the library name and shared object name for the libz library

Table 13-1 libz Definition

Library:	libz
SONAME:	libz.so.1

The behavior of the interfaces in this library is specified by the following specifications:

 [LSB] This Specification

13.2.1 Compression Library

13.2.1.1 Interfaces for Compression Library

An LSB conforming implementation shall provide the generic functions for Compression Library specified in Table 13-2, with the full mandatory functionality as described in the referenced underlying specification.

Table 13-2 libz - Compression Library Function Interfaces

adler32 [LSB]	compress [LSB]	compress2 [LSB]	compressBound [LSB]
crc32 [LSB]	deflate [LSB]	deflateBound [LSB]	deflateCopy [LSB]
deflateEnd [LSB]	deflateInit2_ [LSB]	deflateInit_ [LSB]	deflateParams [LSB]
deflateReset [LSB]	deflateSetDiction ary [LSB]	get_crc_table [LSB]	gzclose [LSB]
gzdopen [LSB]	gzeof [LSB]	gzerror [LSB]	gzflush [LSB]
gzgetc [LSB]	gzgets [LSB]	gzopen [LSB]	gzprintf [LSB]
gzputc [LSB]	gzputs [LSB]	gzread [LSB]	gzrewind [LSB]
gzseek [LSB]	gzsetparams	gztell [LSB]	gzwrite [LSB]

	[LSB]		
inflate [LSB]	inflateEnd [LSB]	inflateInit2_ [LSB]	inflateInit_ [LSB]
inflateReset [LSB]	inflateSetDiction ary [LSB]	inflateSync [LSB]	inflateSyncPoint [LSB]
uncompress [LSB]	zError [LSB]	zlibVersion [LSB]	

13.3 Data Definitions for libz

This section defines global identifiers and their values that are associated with interfaces contained in libz. These definitions are organized into groups that correspond to system headers. This convention is used as a convenience for the reader, and does not imply the existence of these headers, or their content. Where an interface is defined as requiring a particular system header file all of the data definitions for that system header file presented here shall be in effect.

This section gives data definitions to promote binary application portability, not to repeat source interface definitions available elsewhere. System providers and application developers should use this ABI to supplement - not to replace - source interface definition specifications.

This specification uses the ISO C (1999) C Language as the reference programming language, and data definitions are specified in ISO C format. The C language is used here as a convenient notation. Using a C language description of these data objects does not preclude their use by other programming languages.

13.3.1 zconf.h

```
#define ZEXPORT
#define ZEXPORTVA
#define OF(args)        args
#define ZEXTERN extern
```

13.3.2 zlib.h

```
#define Z_NULL  0
#define ZLIB_VERSION    "1.2.2"
#define MAX_WBITS       15      /* 32K LZ77 window */
#define MAX_MEM_LEVEL   9        /* Maximum value for memLevel in
deflateInit2 */
#define
deflateInit2(strm,level,method,windowBits,memLevel,strategy)   \

deflateInit2_((strm),(level),(method),(windowBits),(memLevel),(st
rategy),ZLIB_VERSION,sizeof(z_stream))
#define deflateInit(strm,level) \
        deflateInit_((strm),  (level),           ZLIB_VERSION,
sizeof(z_stream))
#define inflateInit2(strm,windowBits)   \
        inflateInit2_((strm),    (windowBits),    ZLIB_VERSION,
sizeof(z_stream))
#define inflateInit(strm)       \
        inflateInit_((strm),                     ZLIB_VERSION,
sizeof(z_stream))
```

```
typedef char charf;
typedef int intf;

typedef void *voidpf;
typedef unsigned int uInt;
typedef unsigned long int uLong;
typedef uLong uLongf;
typedef void *voidp;
typedef unsigned char Byte;
typedef off_t z_off_t;
typedef void *const voidpc;

typedef  voidpf(*alloc_func) (voidpf opaque, uInt items, uInt
size);
typedef void (*free_func) (voidpf opaque, voidpf address);
struct internal_state {
    int dummy;
};
typedef Byte Bytef;
typedef uInt uIntf;

typedef struct z_stream_s {
    Bytef *next_in;              /* next input byte */
    uInt avail_in;               /* number of bytes available at
next_in */
    uLong total_in;              /* total nb of input bytes read
so far */
    Bytef *next_out;             /* next output byte should be put
there */
    uInt avail_out;              /* remaining free space at
next_out */
    uLong total_out;             /* total nb of bytes output so
far */
    char *msg;                   /* last error message, NULL if no
error */
    struct internal_state *state;            /* not visible by
applications */
    alloc_func zalloc;           /* used to allocate the internal
state */
    free_func zfree;             /* used to free the internal
state */
    voidpf opaque;               /* private data object passed to
zalloc and zfree */
    int data_type;               /* best guess about the data
type: ascii or binary */
    uLong adler;                 /* adler32 value of the
uncompressed data */
    uLong reserved;              /* reserved for future use */
} z_stream;

typedef z_stream *z_streamp;
typedef voidp gzFile;

#define Z_NO_FLUSH      0
#define Z_PARTIAL_FLUSH 1
#define Z_SYNC_FLUSH    2
#define Z_FULL_FLUSH    3
#define Z_FINISH        4
#define Z_BLOCK 5

#define Z_ERRNO (-1)
#define Z_STREAM_ERROR  (-2)
#define Z_DATA_ERROR    (-3)
#define Z_MEM_ERROR     (-4)
#define Z_BUF_ERROR     (-5)
#define Z_VERSION_ERROR (-6)
```

```
#define Z_OK    0
#define Z_STREAM_END    1
#define Z_NEED_DICT    2

#define Z_DEFAULT_COMPRESSION    (-1)
#define Z_NO_COMPRESSION    0
#define Z_BEST_SPEED    1
#define Z_BEST_COMPRESSION    9

#define Z_DEFAULT_STRATEGY    0
#define Z_FILTERED    1
#define Z_HUFFMAN_ONLY  2

#define Z_BINARY    0
#define Z_ASCII 1
#define Z_UNKNOWN    2

#define Z_DEFLATED    8

extern uLong adler32(uLong adler, const Bytef * buf, uInt len);
extern int compress(Bytef * dest, uLongf * destLen, const Bytef *
source,
                    uLong sourceLen);
extern int compress2(Bytef * dest, uLongf * destLen, const Bytef
* source,
                    uLong sourceLen, int level);
extern uLong compressBound(uLong sourceLen);
extern uLong crc32(uLong crc, const Bytef * buf, uInt len);
extern int deflate(z_streamp strm, int flush);
extern uLong deflateBound(z_streamp strm, uLong sourceLen);
extern int deflateCopy(z_streamp dest, z_streamp source);
extern int deflateEnd(z_streamp strm);
extern int deflateInit2_(z_streamp strm, int level, int method,
                        int    windowBits,    int    memLevel,    int
strategy,
                        const char *version, int stream_size);
extern  int  deflateInit_(z_streamp  strm,  int  level,  const  char
*version,
                        int stream_size);
extern    int    deflateParams(z_streamp    strm,    int    level,    int
strategy);
extern int deflateReset(z_streamp strm);
extern  int  deflateSetDictionary(z_streamp  strm,  const  Bytef  *
dictionary,
                                uInt dictLength);
extern const uLongf *get_crc_table(void);
extern int gzclose(gzFile file);
extern gzFile gzdopen(int fd, const char *mode);
extern int gzeof(gzFile file);
extern const char *gzerror(gzFile file, int *errnum);
extern int gzflush(gzFile file, int flush);
extern int gzgetc(gzFile file);
extern char *gzgets(gzFile file, char *buf, int len);
extern gzFile gzopen(const char *path, const char *mode);
extern int gzprintf(gzFile file, const char *format, ...);
extern int gzputc(gzFile file, int c);
extern int gzputs(gzFile file, const char *s);
extern int gzread(gzFile file, voidp buf, unsigned int len);
extern int gzrewind(gzFile file);
extern z_off_t gzseek(gzFile file, z_off_t offset, int whence);
extern int gzsetparams(gzFile file, int level, int strategy);
extern z_off_t gztell(gzFile file);
extern int gzwrite(gzFile file, voidpc buf, unsigned int len);
extern int inflate(z_streamp strm, int flush);
extern int inflateEnd(z_streamp strm);
extern int inflateInit2_(z_streamp strm, int windowBits,
```

```
                            const char *version, int stream_size);
extern int inflateInit_(z_streamp strm, const char *version,
                        int stream_size);
extern int inflateReset(z_streamp strm);
extern int inflateSetDictionary(z_streamp strm, const Bytef *
dictionary,
                                uInt dictLength);
extern int inflateSync(z_streamp strm);
extern int inflateSyncPoint(z_streamp z);
extern int uncompress(Bytef * dest, uLongf * destLen, const Bytef
* source,
                      uLong sourceLen);
extern const char *zError(int);
extern const char *zlibVersion(void);
```

13.4 Interface Definitions for libz

The interfaces defined on the following pages are included in libz and are defined by this specification. Unless otherwise noted, these interfaces shall be included in the source standard.

Other interfaces listed in Section 13.2 shall behave as described in the referenced base document.

adler32

Name

`adler32` — compute Adler 32 Checksum

Synopsis

```
#include <zlib.h>
uLong adler32(uLong adler, const Bytef * buf, uInt len);
```

Description

The `adler32()` function shall compute a running Adler-32 checksum (as described in RFC 1950: ZLIB Compressed Data Format Specication). On entry, *adler* is the previous value for the checksum, and *buf* shall point to an array of *len* bytes of data to be added to this checksum. The `adler32()` function shall return the new checksum.

If *buf* is `NULL` (or `Z_NULL`), `adler32()` shall return the initial checksum.

Return Value

The `adler32()` function shall return the new checksum value.

Errors

None defined.

Application Usage (informative)

The following code fragment demonstrates typical usage of the `adler32()` function:

```
    uLong adler = adler32(0L, Z_NULL, 0);

    while (read_buffer(buffer, length) != EOF) {
      adler = adler32(adler, buffer, length);
    }
```

```
                    if (adler != original_adler) error();
```

compress

Name

compress — compress data

Synopsis

```
#include <zlib.h>
int compress(Bytef * dest, uLongf * destLen, const Bytef * source,
uLong sourceLen);
```

Description

The compress() function shall attempt to compress *sourceLen* bytes of data in the buffer *source*, placing the result in the buffer *dest*.

On entry, *destLen* should point to a value describing the size of the *dest* buffer. The application should ensure that this value be at least (sourceLen × 1.001) + 12. On successful exit, the variable referenced by *destLen* shall be updated to hold the length of compressed data in *dest*.

The compress() function is equivalent to compress2() with a *level* of Z_DEFAULT_COMPRESSION.

Return Value

On success, compress() shall return Z_OK. Otherwise, compress() shall return a value to indicate the error.

Errors

On error, compress() shall return a value as described below:

Z_BUF_ERROR

   The buffer *dest* was not large enough to hold the compressed data.

Z_MEM_ERROR

   Insufficient memory.

compress2

Name

`compress2` — compress data at a specified level

Synopsis

```
#include <zlib.h>
int compress2(Bytef * dest, uLongf * destLen, const Bytef * source,
uLong sourceLen, int level);
```

Description

The `compress2()` function shall attempt to compress *sourceLen* bytes of data in the buffer *source*, placing the result in the buffer *dest*, at the level described by *level*. The *level* supplied shall be a value between `0` and `9`, or the value `Z_DEFAULT_COMPRESSION`. A *level* of `1` requests the highest speed, while a *level* of `9` requests the highest compression. A *level* of `0` indicates that no compression should be used, and the output shall be the same as the input.

On entry, *destLen* should point to a value describing the size of the *dest* buffer. The application should ensure that this value be at least (`sourceLen` × `1.001`) `+ 12`. On successful exit, the variable referenced by *destLen* shall be updated to hold the length of compressed data in *dest*.

The `compress()` function is equivalent to `compress2()` with a *level* of `Z_DEFAULT_COMPRESSION`.

Return Value

On success, `compress2()` shall return Z_OK. Otherwise, `compress2()` shall return a value to indicate the error.

Errors

On error, `compress2()` shall return a value as described below:

Z_BUF_ERROR

   The buffer *dest* was not large enough to hold the compressed data.

Z_MEM_ERROR

   Insufficient memory.

Z_STREAM_ERROR

   The *level* was not `Z_DEFAULT_COMPRESSION`, or was not between 0 and 9.

compressBound

Name

compressBound — compute compressed data size

Synopsis

```
#include <zlib.h>
int compressBound(uLong sourceLen);
```

Description

The `compressBound()` function shall estimate the size of buffer required to compress *sourceLen* bytes of data using the `compress()` or `compress2()` functions. If successful, the value returned shall be an upper bound for the size of buffer required to compress *sourceLen* bytes of data, using the parameters stored in *stream*, in a single call to `compress()` or `compress2()`.

Return Value

The `compressBound()` shall return a value representing the upper bound of an array to allocate to hold the compressed data in a single call to `compress()` or `compress2()`. This function may return a conservative value that may be larger than *sourceLen*.

Errors

None defined.

crc32

Name

`crc32` — compute CRC-32 Checksum

Synopsis

```
#include <zlib.h>
uLong crc32(uLong crc, const Bytef * buf, uInt len);
```

Description

The `crc32()` function shall compute a running Cyclic Redundancy Check checksum, as defined in ITU-T V.42. On entry, `crc` is the previous value for the checksum, and `buf` shall point to an array of `len` bytes of data to be added to this checksum. The `crc32()` function shall return the new checksum.

If `buf` is `NULL` (or `Z_NULL`), `crc32()` shall return the initial checksum.

Return Value

The `crc32()` function shall return the new checksum value.

Errors

None defined.

Application Usage (informative)

The following code fragment demonstrates typical usage of the `crc32()` function:

```
    uLong crc = crc32(0L, Z_NULL, 0);

    while (read_buffer(buffer, length) != EOF) {
      crc = crc32(crc, buffer, length);
    }
    if (crc != original_crc) error();
```

deflate

Name

`deflate` — compress data

Synopsis

```
#include <zlib.h>
int deflate(z_streamp stream, int flush);
```

Description

The `deflate()` function shall attempt to compress data until either the input buffer is empty or the output buffer is full. The *stream* references a z_stream structure. Before the first call to `deflate()`, this structure should have been initialized by a call to `deflateInit2_()`.

> **Note:** `deflateInit2_()` is only in the binary standard; source level applications should initialize *stream* via a call to `deflateInit()` or `deflateInit2()`.

In addition, the *stream* input and output buffers should have been initialized as follows:

next_in

should point to the data to be compressed.

avail_in

should contain the number of bytes of data in the buffer referenced by *next_in*.

next_out

should point to a buffer where compressed data may be placed.

avail_out

should contain the size in bytes of the buffer referenced by *next_out*

The `deflate()` function shall perform one or both of the following actions:

1. Compress input data from *next_in* and update *next_in*, *avail_in* and *total_in* to reflect the data that has been compressed.

2. Fill the output buffer referenced by *next_out*, and update *next_out*, *avail_out* and *total_out* to reflect the compressed data that has been placed there. If *flush* is not `Z_NO_FLUSH`, and *avail_out* indicates that there is still space in output buffer, this action shall always occur (see below for further details).

The `deflate()` function shall return when either *avail_in* reaches zero (indicating that all the input data has been compressed), or *avail_out* reaches zero (indicating that the output buffer is full).

On success, the `deflate()` function shall set the *adler* field of the *stream* to the `adler32()` checksum of all the input data compressed so far (represented by *total_in*).

If the `deflate()` function shall attempt to determine the type of input data, and set field *data_type* in *stream* to `Z_ASCII` if the majority of the data bytes fall within the ASCII (ISO 646) printable character range. Otherwise, it shall set *data_type* to `Z_BINARY`. This data type is informational only, and does not affect the compression algorithm.

> **Note:** Future versions of the LSB may remove this requirement, since it is based on an outdated character set that does not support Internationalization, and does not affect the algorithm. It is included for information only at this release. Applications should not depend on this field.

Flush Operation

The parameter *flush* determines when compressed bits are added to the output buffer in *next_out*. If *flush* is `Z_NO_FLUSH`, `deflate()` may return with some data pending output, and not yet added to the output buffer.

If *flush* is `Z_SYNC_FLUSH`, `deflate()` shall flush all pending output to *next_out* and align the output to a byte boundary. A synchronization point is generated in the output.

If *flush* is `Z_FULL_FLUSH`, all output shall be flushed, as for `Z_SYNC_FLUSH`, and the compression state shall be reset. A synchronization point is generated in the output.

> **Rationale:** `Z_SYNC_FLUSH` is intended to ensure that the compressed data contains all the data compressed so far, and allows a decompressor to reconstruct all of the input data. `Z_FULL_FLUSH` allows decompression to restart from this point if the previous compressed data has been lost or damaged. Flushing is likely to degrade the performance of the compression system, and should only be used where necessary.

If *flush* is set to `Z_FINISH`, all pending input shall be processed and `deflate()` shall return with Z_STREAM_END if there is sufficient space in the output buffer at *next_out*, as indicated by *avail_out*. If `deflate()` is called with *flush* set to `Z_FINISH` and there is insufficient space to store the compressed data, and no other error has occurred during compression, `deflate()` shall return Z_OK, and the application should call `deflate()` again with *flush* unchanged, and having updated *next_out* and *avail_out*.

If all the compression is to be done in a single step, `deflate()` may be called with *flush* set to `Z_FINISH` immediately after the stream has been initialized if *avail_out* is set to at least the value returned by `deflateBound()`.

Return Value

On success, `deflate()` shall return Z_OK, unless *flush* was set to `Z_FINISH` and there was sufficient space in the output buffer to compress all of the input data. In this case, `deflate()` shall return Z_STREAM_END. On error, `deflate()` shall return a value to indicate the error.

> **Note:** If `deflate()` returns Z_OK and has set *avail_out* to zero, the function should be called again with the same value for *flush*, and with updated *next_out* and *avail_out* until `deflate()` returns with Z_OK (or Z_STREAM_END if *flush* is set to `Z_FINISH`) and a non-zero *avail_out*.

Errors

On error, `deflate()` shall return a value as described below, and set the *msg* field of *stream* to point to a string describing the error:

Z_BUF_ERROR

> No progress is possible; either *avail_in* or *avail_out* was zero.

Z_MEM_ERROR

> Insufficient memory.

Z_STREAM_ERROR

> The state (as represented in *stream*) is inconsistent, or *stream* was NULL.

deflateBound

Name

deflateBound — compute compressed data size

Synopsis

```
#include <zlib.h>
int deflateBound(z_streamp stream, uLong sourceLen);
```

Description

The deflateBound() function shall estimate the size of buffer required to compress *sourceLen* bytes of data. If successful, the value returned shall be an upper bound for the size of buffer required to compress *sourceLen* bytes of data, using the parameters stored in *stream*, in a single call to deflate() with flush set to Z_FINISH.

On entry, *stream* should have been initialized via a call to deflateInit_() or deflateInit2_().

Return Value

The deflateBound() shall return a value representing the upper bound of an array to allocate to hold the compressed data in a single call to deflate(). If the *stream* is not correctly initialized, or is NULL, then deflateBound() may return a conservative value that may be larger than *sourceLen*.

Errors

None defined.

deflateCopy

Name

deflateCopy — copy compression stream

Synopsis

```
#include <zlib.h>
int deflateCopy(z_streamp dest, z_streamp source);
```

Description

The `deflateCopy()` function shall copy the compression state information in *source* to the uninitialized `z_stream` structure referenced by *dest*.

On successful return, *dest* will be an exact copy of the stream referenced by *source*. The input and output buffer pointers in *next_in* and *next_out* will reference the same data.

Return Value

On success, `deflateCopy()` shall return Z_OK. Otherwise it shall return a value less than zero to indicate the error.

Errors

On error, `deflateCopy()` shall return a value as described below:

Z_STREAM_ERROR

> The state in *source* is inconsistent, or either *source* or *dest* was NULL.

Z_MEM_ERROR

> Insufficient memory available.

Application Usage (informative)

This function can be useful when several compression strategies will be tried, for example when there are several ways of pre-processing the input data with a filter. The streams that will be discarded should then be freed by calling `deflateEnd()`. Note that `deflateCopy()` duplicates the internal compression state which can be quite large, so this strategy may be slow and can consume lots of memory.

deflateEnd

Name

`deflateEnd` — free compression stream state

Synopsis

```
#include <zlib.h>
int deflateEnd(z_streamp stream);
```

Description

The `deflateEnd()` function shall free all allocated state information referenced by *stream*. All pending output is discarded, and unprocessed input is ignored.

Return Value

On success, `deflateEnd()` shall return Z_OK, or Z_DATA_ERROR if there was pending output discarded or input unprocessed. Otherwise it shall return Z_STREAM_ERROR to indicate the error.

Errors

On error, `deflateEnd()` shall return Z_STREAM_ERROR. The following conditions shall be treated as an error:

• The state in *stream* is inconsistent or inappropriate.

• *stream* is NULL.

deflateInit2_

Name

deflateInit2_ — initialize compression system

Synopsis

```
#include <zlib.h>
 int deflateInit2_ (z_streamp strm, int level, int method, int
windowBits, int memLevel, int strategy, char * version, int
stream_size);
```

Description

The deflateInit2_() function shall initialize the compression system. On entry, *strm* shall refer to a user supplied z_stream object (a z_stream_s structure). The following fields shall be set on entry:

zalloc

> a pointer to an alloc_func function, used to allocate state information. If this is NULL, a default allocation function will be used.

zfree

> a pointer to a free_func function, used to free memory allocated by the *zalloc* function. If this is NULL a default free function will be used.

opaque

> If *alloc_func* is not NULL, *opaque* is a user supplied pointer to data that will be passed to the *alloc_func* and *free_func* functions.

If the *version* requested is not compatible with the version implemented, or if the size of the z_stream_s structure provided in *stream_size* does not match the size in the library implementation, deflateInit2_() shall fail, and return Z_VERSION_ERROR.

The *level* supplied shall be a value between 0 and 9, or the value Z_DEFAULT_COMPRESSION. A *level* of 1 requests the highest speed, while a *level* of 9 requests the highest compression. A *level* of 0 indicates that no compression should be used, and the output shall be the same as the input.

The *method* selects the compression algorithm to use. LSB conforming implementation shall support the Z_DEFLATED method, and may support other implementation defined methods.

The *windowBits* parameter shall be a base 2 logarithm of the window size to use, and shall be a value between 8 and 15. A smaller value will use less memory, but will result in a poorer compression ratio, while a higher value will give better compression but utilize more memory.

The *memLevel* parameter specifies how much memory to use for the internal state. The value of *memLevel* shall be between 1 and MAX_MEM_LEVEL. Smaller values use less memory but are slower, while higher values use more memory to gain compression speed.

The *strategy* parameter selects the compression strategy to use:

Z_DEFAULT_STRATEGY

use the system default compression strategy. `Z_DEFAULT_STRATEGY` is particularly appropriate for text data.

`Z_FILTERED`

use a compression strategy tuned for data consisting largely of small values with a fairly random distribution. `Z_FILTERED` uses more Huffman encoding and less string matching than `Z_DEFAULT_STRATEGY`.

`Z_HUFFMAN_ONLY`

force Huffman encoding only, with no string match.

The `deflateInit2_()` function is not in the source standard; it is only in the binary standard. Source applications should use the `deflateInit2()` macro.

Return Value

On success, the `deflateInit2_()` function shall return `Z_OK`. Otherwise, `deflateInit2_()` shall return a value as described below to indicate the error.

Errors

On error, `deflateInit2_()` shall return one of the following error indicators:

`Z_STREAM_ERROR`

Invalid parameter.

`Z_MEM_ERROR`

Insufficient memory available.

`Z_VERSION_ERROR`

The version requested is not compatible with the library version, or the z_stream size differs from that used by the library.

In addition, the *msg* field of the *strm* may be set to an error message.

deflateInit_

Name

deflateInit_ — initialize compression system

Synopsis

```
#include <zlib.h>
int deflateInit_(z_streamp stream, int level, const char * version,
int stream_size);
```

Description

The deflateInit_() function shall initialize the compression system. On entry, *stream* shall refer to a user supplied z_stream object (a z_stream_s structure). The following fields shall be set on entry:

zalloc

> a pointer to an alloc_func function, used to allocate state information. If this is NULL, a default allocation function will be used.

zfree

> a pointer to a free_func function, used to free memory allocated by the *zalloc* function. If this is NULL a default free function will be used.

opaque

> If *alloc_func* is not NULL, *opaque* is a user supplied pointer to data that will be passed to the *alloc_func* and *free_func* functions.

If the *version* requested is not compatible with the version implemented, or if the size of the z_stream_s structure provided in *stream_size* does not match the size in the library implementation, deflateInit_() shall fail, and return Z_VERSION_ERROR.

The *level* supplied shall be a value between 0 and 9, or the value Z_DEFAULT_COMPRESSION. A *level* of 1 requests the highest speed, while a *level* of 9 requests the highest compression. A *level* of 0 indicates that no compression should be used, and the output shall be the same as the input.

The deflateInit_() function is not in the source standard; it is only in the binary standard. Source applications should use the deflateInit() macro.

The deflateInit_() function is equivalent to

```
 deflateInit2_(stream,        level,        Z_DEFLATED,        MAX_WBITS,
MAX_MEM_LEVEL,
```

```
                            Z_DEFAULT_STRATEGY,                 version,
stream_size);
```

Return Value

On success, the `deflateInit_()` function shall return `Z_OK`. Otherwise, `deflateInit_()` shall return a value as described below to indicate the error.

Errors

On error, `deflateInit_()` shall return one of the following error indicators:

`Z_STREAM_ERROR`

Invalid parameter.

`Z_MEM_ERROR`

Insufficient memory available.

`Z_VERSION_ERROR`

The version requested is not compatible with the library version, or the z_stream size differs from that used by the library.

In addition, the *msg* field of the *stream* may be set to an error message.

deflateParams

Name

`deflateParams` — set compression parameters

Synopsis

```
#include <zlib.h>
int deflateParams(z_streamp stream, int level, int strategy);
```

Description

The `deflateParams()` function shall dynamically alter the compression parameters for the compression stream object `stream`. On entry, `stream` shall refer to a user supplied z_stream object (a z_stream_s structure), already initialized via a call to `deflateInit_()` or `deflateInit2_()`.

The `level` supplied shall be a value between `0` and `9`, or the value `Z_DEFAULT_COMPRESSION`. A `level` of `1` requests the highest speed, while a `level` of `9` requests the highest compression. A `level` of `0` indicates that no compression should be used, and the output shall be the same as the input. If the compression level is altered by `deflateParams()`, and some data has already been compressed with this `stream` (i.e. `total_in` is not zero), and the new `level` requires a different underlying compression method, then `stream` shall be flushed by a call to `deflate()`.

The `strategy` parameter selects the compression strategy to use:

`Z_DEFAULT_STRATEGY`

> use the system default compression strategy. `Z_DEFAULT_STRATEGY` is particularly appropriate for text data.

`Z_FILTERED`

> use a compression strategy tuned for data consisting largely of small values with a fairly random distribution. `Z_FILTERED` uses more Huffman encoding and less string matching than `Z_DEFAULT_STRATEGY`.

`Z_HUFFMAN_ONLY`

> force Huffman encoding only, with no string match.

Return Value

On success, the `deflateParams()` function shall return `Z_OK`. Otherwise, `deflateParams()` shall return a value as described below to indicate the error.

Errors

On error, `deflateParams()` shall return one of the following error indicators:

`Z_STREAM_ERROR`

> Invalid parameter.

`Z_MEM_ERROR`

> Insufficient memory available.

`Z_BUF_ERROR`

> Insufficient space in `stream` to flush the current output.

In addition, the *msg* field of the *strm* may be set to an error message.

Application Usage (Informative)

Applications should ensure that the *stream* is flushed, e.g. by a call to **deflate(stream, Z_SYNC_FLUSH)** before calling deflateParams(), or ensure that there is sufficient space in *next_out* (as identified by *avail_out*) to ensure that all pending output and all uncompressed input can be flushed in a single call to deflate().

> **Rationale:** Although the deflateParams() function should flush pending output and compress all pending input, the result is unspecified if there is insufficient space in the output buffer. Applications should only call deflateParams() when the *stream* is effectively empty (flushed).

> The deflateParams() can be used to switch between compression and straight copy of the input data, or to switch to a different kind of input data requiring a different strategy.

deflateReset

Name

deflateReset — reset compression stream state

Synopsis

```
#include <zlib.h>
int deflateReset(z_streamp stream);
```

Description

The deflateReset() function shall reset all state associated with *stream*. All pending output shall be discarded, and the counts of processed bytes (*total_in* and *total_out*) shall be reset to zero.

Return Value

On success, deflateReset() shall return Z_OK. Otherwise it shall return Z_STREAM_ERROR to indicate the error.

Errors

On error, deflateReset() shall return Z_STREAM_ERROR. The following conditions shall be treated as an error:

• The state in *stream* is inconsistent or inappropriate.

• *stream* is NULL.

deflateSetDictionary

Name

`deflateSetDictionary` — initialize compression dictionary

Synopsis

```
#include <zlib.h>
int deflateSetDictionary(z_streamp stream, const Bytef * dictionary,
uInt dictlen);
```

Description

The `deflateSetDictionary()` function shall initialize the compression dictionary associated with *stream* using the *dictlen* bytes referenced by *dictionary*.

The implementation may silently use a subset of the provided dictionary if the dictionary cannot fit in the current window associated with *stream* (see `deflateInit2_()`). The application should ensure that the dictionary is sorted such that the most commonly used strings occur at the end of the dictionary.

If the dictionary is successfully set, the Adler32 checksum of the entire provided dictionary shall be stored in the *adler* member of *stream*. This value may be used by the decompression system to select the correct dictionary. The compression and decompression systems must use the same dictionary.

stream shall reference an initialized compression stream, with *total_in* zero (i.e. no data has been compressed since the stream was initialized).

Return Value

On success, `deflateSetDictionary()` shall return Z_OK. Otherwise it shall return Z_STREAM_ERROR to indicate an error.

Errors

On error, `deflateSetDictionary()` shall return a value as described below:

`Z_STREAM_ERROR`

> The state in *stream* is inconsistent, or *stream* was `NULL`.

Application Usage (informative)

The application should provide a dictionary consisting of strings {{{ed note: do we really mean "strings"? Null terminated?}}} that are likely to be encountered in the data to be compressed. The application should ensure that the dictionary is sorted such that the most commonly used strings occur at the end of the dictionary.

The use of a dictionary is optional; however if the data to be compressed is relatively short and has a predictable structure, the use of a dictionary can substantially improve the compression ratio.

get_crc_table

Name

`get_crc_table` — generate a table for crc calculations

Synopsis

```
#include <zlib.h>
const uLongf * get_crc_table(void);
```

Description

Generate tables for a byte-wise 32-bit CRC calculation based on the polynomial:
$x^{32}+x^{26}+x^{23}+x^{22}+x^{16}+x^{12}+x^{11}+x^{10}+x^8+x^7+x^5+x^4+x^2+x+1$

In a multi-threaded application, `get_crc_table()` should be called by one thread to initialize the tables before any other thread calls any `libz` function.

Return Value

The `get_crc_table()` function shall return a pointer to the first of a set of tables used internally to calculate CRC-32 values (see `crc32()`).

Errors

None defined.

gzclose

Name

`gzclose` — close a compressed file stream

Synopsis

```
#include <zlib.h>
 int gzclose (gzFile file );
```

Description

The `gzclose()` function shall close the compressed file stream *file*. If *file* was open for writing, `gzclose()` shall first flush any pending output. Any state information allocated shall be freed.

Return Value

On success, `gzclose()` shall return Z_OK. Otherwise, `gzclose()` shall return an error value as described below.

Errors

On error, `gzclose()` may set the global variable `errno` to indicate the error. The `gzclose()` shall return a value other than `Z_OK` on error.

Z_STREAM_ERROR

file was NULL (or `Z_NULL`), or did not refer to an open compressed file stream.

Z_ERRNO

An error occurred in the underlying base libraries, and the application should check `errno` for further information.

Z_BUF_ERROR

no compression progress is possible during buffer flush (see `deflate()`).

gzdopen

Name

`gzdopen` — open a compressed file

Synopsis

```
#include <zlib.h>
 gzFile gzdopen ( int fd, const char *mode );
```

Description

The `gzdopen()` function shall attempt to associate the open file referenced by `fd` with a gzFile object. The `mode` argument is based on that of `fopen()`, but the `mode` parameter may also contain the following characters:

digit

> set the compression level to *digit*. A low value (e.g. 1) means high speed, while a high value (e.g. 9) means high compression. A compression level of 0 (zero) means no compression. See `deflateInit2_()` for further details.

[fhR]

> set the compression strategy to *[fhR]*. The letter `f` corresponds to filtered data, the letter `h` corresponds to Huffman only compression, and the letter `R` corresponds to Run Length Encoding. See `deflateInit2_()` for further details.

If `fd` refers to an uncompressed file, and `mode` refers to a read mode, `gzdopen()` shall attempt to open the file and return a gzFile object suitable for reading directly from the file without any decompression.

If `mode` is `NULL`, or if `mode` does not contain one of `r`, `w`, or `a`, `gzdopen()` shall return `Z_NULL`, and need not set any other error condition.

Example

```
gzdopen(fileno(stdin), "r");
```

Attempt to associate the standard input with a gzFile object.

Return Value

On success, `gzdopen()` shall return a gzFile object. On failure, `gzdopen()` shall return `Z_NULL` and may set `errno` accordingly.

> **Note:** At version 1.2.2, `zlib` does not set `errno` for several error conditions. Applications may not be able to determine the cause of an error.

Errors

On error, `gzdopen()` may set the global variable `errno` to indicate the error.

gzeof

Name

gzeof — check for end-of-file on a compressed file stream

Synopsis

```
#include <zlib.h>
 int gzeof (gzFile file );
```

Description

The gzeof() function shall test the compressed file stream *file* for end of file.

Return Value

If *file* was open for reading and end of file has been reached, gzeof() shall return 1. Otherwise, gzeof() shall return 0.

Errors

None defined.

gzerror

Name

gzerror — decode an error on a compressed file stream

Synopsis

```
#include <zlib.h>
 const char * gzerror (gzFile file, int * errnum);
```

Description

The gzerror() function shall return a string describing the last error to have occurred associated with the open compressed file stream referred to by *file*. It shall also set the location referenced by *errnum* to an integer value that further identifies the error.

Return Value

The gzerror() function shall return a string that describes the last error associated with the given *file* compressed file stream. This string shall have the format "%s: %s", with the name of the file, followed by a colon, a space, and the description of the error. If the compressed file stream was opened by a call to gzdopen(), the format of the filename is unspecified.

> **Rationale:** Although in all current implementations of libz file descriptors are named "<fd:%d>", the code suggests that this is for debugging purposes only, and may change in a future release.

It is unspecified if the string returned is determined by the setting of the LC_MESSAGES category in the current locale.

Errors

None defined.

gzflush

Name

`gzflush` — flush a compressed file stream

Synopsis

```
#include <zlib.h>
int gzflush(gzFile file, int flush);
```

Description

The `gzflush()` function shall flush pending output to the compressed file stream identified by `file`, which must be open for writing.

Flush Operation

The parameter `flush` determines which compressed bits are added to the output file. If `flush` is `Z_NO_FLUSH`, `gzflush()` may return with some data pending output, and not yet written to the file.

If `flush` is `Z_SYNC_FLUSH`, `gzflush()` shall flush all pending output to `file` and align the output to a byte boundary. There may still be data pending compression that is not flushed.

If `flush` is `Z_FULL_FLUSH`, all output shall be flushed, as for `Z_SYNC_FLUSH`, and the compression state shall be reset. There may still be data pending compression that is not flushed.

> **Rationale:** `Z_SYNC_FLUSH` is intended to ensure that the compressed data contains all the data compressed so far, and allows a decompressor to reconstruct all of the input data. `Z_FULL_FLUSH` allows decompression to restart from this point if the previous compressed data has been lost or damaged. Flushing is likely to degrade the performance of the compression system, and should only be used where necessary.

If `flush` is set to `Z_FINISH`, all pending uncompressed data shall be compressed and all output shall be flushed.

Return Value

On success, `gzflush()` shall return the value Z_OK. Otherwise `gzflush()` shall return a value to indicate the error, and may set the error number associated with the compressed file stream `file`.

> **Note:** If `flush` is set to `Z_FINISH` and the flush operation is successful, `gzflush()` will return Z_OK, but the compressed file stream error value may be set to `Z_STREAM_END`.

Errors

On error, `gzflush()` shall return an error value, and may set the error number associated with the stream identified by `file` to indicate the error. Applications may use `gzerror()` to access this error value.

`Z_ERRNO`

> An underlying base library function has indicated an error. The global variable `errno` may be examined for further information.

`Z_STREAM_ERROR`

The stream is invalid, is not open for writing, or is in an invalid state.

Z_BUF_ERROR

no compression progress is possible (see deflate()).

Z_MEM_ERROR

Insufficient memory available to compress.

gzgetc

Name

gzgetc — read a character from a compressed file

Synopsis

```
#include <zlib.h>
 int gzgetc (gzFile file);
```

Description

The gzgetc() function shall read the next single character from the compressed file stream referenced by *file*, which shall have been opened in a read mode (see gzopen() and gzdopen()).

Return Value

On success, gzgetc() shall return the uncompressed character read, otherwise, on end of file or error, gzgetc() shall return -1.

Errors

On end of file or error, gzgetc() shall return -1. Further information can be found by calling gzerror() with a pointer to the compressed file stream.

gzgets

Name

`gzgets` — read a string from a compressed file

Synopsis

```
#include <zlib.h>
 char * gzgets (gzFile file, char * buf, int len);
```

Description

The `gzgets()` function shall attempt to read data from the compressed file stream *file*, uncompressing it into *buf* until either *len-1* bytes have been inserted into *buf*, or until a newline character has been uncompressed into *buf*. A null byte shall be appended to the uncompressed data. The *file* shall have been opened in for reading (see `gzopen()` and `gzdopen()`).

Return Value

On success, `gzgets()` shall return a pointer to *buf*. Otherwise, `gzgets()` shall return Z_NULL. Applications may examine the cause using `gzerror()`.

Errors

On error, `gzgets()` shall return Z_NULL. The following conditions shall always be treated as an error:

file is NULL, or does not refer to a file open for reading;
buf is NULL;
len is less than or equal to zero.

gzopen

Name

`gzopen` — open a compressed file

Synopsis

```
#include <zlib.h>
 gzFile gzopen (const char *path , const char *mode );
```

Description

The `gzopen()` function shall open the compressed file named by *path*. The *mode* argument is based on that of `fopen()`, but the *mode* parameter may also contain the following characters:

digit

> set the compression level to *digit*. A low value (e.g. 1) means high speed, while a high value (e.g. 9) means high compression. A compression level of 0 (zero) means no compression. See `deflateInit2_()` for further details.

[fhR]

> set the compression strategy to *[fhR]*. The letter `f` corresponds to filtered data, the letter `h` corresponds to Huffman only compression, and the letter `R` corresponds to Run Length Encoding. See `deflateInit2_()` for further details.

If *path* refers to an uncompressed file, and *mode* refers to a read mode, `gzopen()` shall attempt to open the file and return a gzFile object suitable for reading directly from the file without any decompression.

If *path* or *mode* is `NULL`, or if *mode* does not contain one of `r`, `w`, or `a`, `gzopen()` shall return `Z_NULL`, and need not set any other error condition.

The gzFile object is also referred to as a compressed file stream.

Example

```
gzopen("file.gz", "w6h");
```

Attempt to create a new compressed file, `file.gz`, at compression level 6 using Huffman only compression.

Return Value

On success, `gzopen()` shall return a gzFile object (also known as a *compressed file stream*). On failure, `gzopen()` shall return `Z_NULL` and may set `errno` accordingly.

> **Note:** At version 1.2.2, `zlib` does not set `errno` for several error conditions. Applications may not be able to determine the cause of an error.

Errors

On error, `gzopen()` may set the global variable `errno` to indicate the error.

gzprintf

Name

`gzprintf` — format data and compress

Synopsis

```
#include <zlib.h>
 int gzprintf (gzFile file, const char * fmt, ...);
```

Description

The `gzprintf()` function shall format data as for `fprintf()`, and write the resulting string to the compressed file stream `file`.

Return Value

The `gzprintf()` function shall return the number of uncompressed bytes actually written, or a value less than or equal to `0` in the event of an error.

Errors

If `file` is `NULL`, or refers to a compressed file stream that has not been opened for writing, `gzprintf()` shall return `Z_STREAM_ERROR`. Otherwise, errors are as for `gzwrite()`.

gzputc

Name

`gzputc` — write character to a compressed file

Synopsis

```
#include <zlib.h>
 int gzputc (gzFile file, int c);
```

Description

The `gzputc()` function shall write the single character `c`, converted from integer to unsigned character, to the compressed file referenced by `file`, which shall have been opened in a write mode (see `gzopen()` and `gzdopen()`).

Return Value

On success, `gzputc()` shall return the value written, otherwise `gzputc()` shall return -1.

Errors

On error, `gzputc()` shall return -1.

gzputs

Name

gzputs — string write to a compressed file

Synopsis

```
#include <zlib.h>
 int gzputs (gzFile file, const char * s);
```

Description

The gzputs() function shall write the null terminated string *s* to the compressed file referenced by *file*, which shall have been opened in a write mode (see gzopen() and gzdopen()). The terminating null character shall not be written. The gzputs() function shall return the number of uncompressed bytes actually written.

Return Value

On success, gzputs() shall return the number of uncompressed bytes actually written to *file*. On error gzputs() shall return a value less than or equal to 0. Applications may examine the cause using gzerror().

Errors

On error, gzputs() shall set the error number associated with the stream identified by *file* to indicate the error. Applications should use gzerror() to access this error value. If *file* is NULL, gzputs() shall return Z_STREAM_ERR.

Z_ERRNO

An underlying base library function has indicated an error. The global variable errno may be examined for further information.

Z_STREAM_ERROR

The stream is invalid, is not open for writing, or is in an invalid state.

Z_BUF_ERROR

no compression progress is possible (see deflate()).

Z_MEM_ERROR

Insufficient memory available to compress.

gzread

Name

`gzread` — read from a compressed file

Synopsis

```
#include <zlib.h>
 int gzread (gzFile file, voidp buf, unsigned int len);
```

Description

The `gzread()` function shall read data from the compressed file referenced by `file`, which shall have been opened in a read mode (see `gzopen()` and `gzdopen()`). The `gzread()` function shall read data from `file`, and uncompress it into `buf`. At most, `len` bytes of uncompressed data shall be copied to `buf`. If the file is not compressed, `gzread()` shall simply copy data from `file` to `buf` without alteration.

Return Value

On success, `gzread()` shall return the number of bytes decompressed into `buf`. If `gzread()` returns `0`, either the end-of-file has been reached or an underlying read error has occurred. Applications should use `gzerror()` or `gzeof()` to determine which occurred. On other errors, `gzread()` shall return a value less than `0` and applications may examine the cause using `gzerror()`.

Errors

On error, `gzread()` shall set the error number associated with the stream identified by `file` to indicate the error. Applications should use `gzerror()` to access this error value.

`Z_ERRNO`

> An underlying base library function has indicated an error. The global variable `errno` may be examined for further information.

`Z_STREAM_END`

> End of file has been reached on input.

`Z_DATA_ERROR`

> A CRC error occurred when reading data; the file is corrupt.

`Z_STREAM_ERROR`

> The stream is invalid, or is in an invalid state.

`Z_NEED_DICT`

> A dictionary is needed (see `inflateSetDictionary()`).

`Z_MEM_ERROR`

> Insufficient memory available to decompress.

gzrewind

Name

gzrewind — reset the file-position indicator on a compressed file stream

Synopsis

```
#include <zlib.h>
int gzrewind(gzFile file);
```

Description

The `gzrewind()` function shall set the starting position for the next read on compressed file stream `file` to the beginning of file. `file` must be open for reading.

`gzrewind()` is equivalent to

```
(int)gzseek(file, 0L, SEEK_SET)
```

.

Return Value

On success, `gzrewind()` shall return 0. On error, `gzrewind()` shall return -1, and may set the error value for `file` accordingly.

Errors

On error, `gzrewind()` shall return -1, indicating that `file` is NULL, or does not represent an open compressed file stream, or represents a compressed file stream that is open for writing and is not currently at the beginning of file.

gzseek

Name

`gzseek` — reposition a file-position indicator in a compressed file stream

Synopsis

```
#include <zlib.h>
z_off_t gzseek(gzFile file, z_off_t offset, int whence);
```

Description

The `gzseek()` function shall set the file-position indicator for the compressed file stream `file`. The file-position indicator controls where the next read or write operation on the compressed file stream shall take place. The `offset` indicates a byte offset in the uncompressed data. The `whence` parameter may be one of:

`SEEK_SET`

　　the offset is relative to the start of the uncompressed data.

`SEEK_CUR`

　　the offset is relative to the current positition in the uncompressed data.

　　Note: The value `SEEK_END` need not be supported.

If the `file` is open for writing, the new offset must be greater than or equal to the current offset. In this case, `gzseek()` shall compress a sequence of null bytes to fill the gap from the previous offset to the new offset.

Return Value

On success, `gzseek()` shall return the resulting offset in the file expressed as a byte position in the *uncompressed* data stream. On error, `gzseek()` shall return -1, and may set the error value for `file` accordingly.

Errors

On error, `gzseek()` shall return -1. The following conditions shall always result in an error:

- `file` is `NULL`
- `file` does not represent an open compressed file stream.
- `file` refers to a compressed file stream that is open for writing, and the newly computed offset is less than the current offset.
- The newly computed offset is less than zero.
- `whence` is not one of the supported values.

Application Usage (informative)

If `file` is open for reading, the implementation may still need to uncompress all of the data up to the new offset. As a result, `gzseek()` may be extremely slow in some circumstances.

gzsetparams

Name

gzsetparams — dynamically set compression parameters

Synopsis

```
#include <zlib.h>
 int gzsetparams (gzFile file, int level, int strategy);
```

Description

The gzsetparams() function shall set the compression level and compression strategy on the compressed file stream referenced by *file*. The compressed file stream shall have been opened in a write mode. The *level* and *strategy* are as defined in deflateInit2.. If there is any data pending writing, it shall be flushed before the parameters are updated.

Return Value

On success, the gzsetparams() function shall return Z_OK.

Errors

On error, gzsetparams() shall return one of the following error indications:

Z_STREAM_ERROR

   Invalid parameter, or *file* not open for writing.

Z_BUF_ERROR

   An internal inconsistency was detected while flushing the previous buffer.

gztell

Name

gztell — find position on a compressed file stream

Synopsis

```
#include <zlib.h>
 z_off_t gztell (gzFile file );
```

Description

The gztell() function shall return the starting position for the next read or write operation on compressed file stream *file*. This position represents the number of bytes from the beginning of file in the uncompressed data.

gztell() is equivalent to

```
gzseek(file, 0L, SEEK_CUR)
```

.

Return Value

gztell() shall return the current offset in the file expressed as a byte position in the *uncompressed* data stream. On error, gztell() shall return -1, and may set the error value for *file* accordingly.

Errors

On error, gztell() shall return -1, indicating that *file* is NULL, or does not represent an open compressed file stream.

gzwrite

Name

gzwrite — write to a compressed file

Synopsis

```
#include <zlib.h>
 int gzwrite (gzFile file, voidpc buf, unsigned int len);
```

Description

The gzwrite() function shall write data to the compressed file referenced by *file*, which shall have been opened in a write mode (see gzopen() and gzdopen()). On entry, *buf* shall point to a buffer containing *len* bytes of uncompressed data. The gzwrite() function shall compress this data and write it to *file*. The gzwrite() function shall return the number of uncompressed bytes actually written.

Return Value

On success, gzwrite() shall return the number of uncompressed bytes actually written to *file*. On error gzwrite() shall return a value less than or equal to 0. Applications may examine the cause using gzerror().

Errors

On error, gzwrite() shall set the error number associated with the stream identified by *file* to indicate the error. Applications should use gzerror() to access this error value.

Z_ERRNO

An underlying base library function has indicated an error. The global variable errno may be examined for further information.

Z_STREAM_ERROR

The stream is invalid, is not open for writing, or is in an invalid state.

Z_BUF_ERROR

no compression progress is possible (see deflate()).

Z_MEM_ERROR

Insufficient memory available to compress.

inflate

Name

`inflate` — decompress data

Synopsis

```
#include <zlib.h>
int inflate(z_streamp stream, int flush);
```

Description

The `inflate()` function shall attempt to decompress data until either the input buffer is empty or the output buffer is full. The `stream` references a z_stream structure. Before the first call to `inflate()`, this structure should have been initialized by a call to `inflateInit2_()`.

> **Note:** `inflateInit2_()` is only in the binary standard; source level applications should initialize `stream` via a call to `inflateInit()` or `inflateInit2()`.

In addition, the `stream` input and output buffers should have been initialized as follows:

`next_in`

> should point to the data to be decompressed.

`avail_in`

> should contain the number of bytes of data in the buffer referenced by `next_in`.

`next_out`

> should point to a buffer where decompressed data may be placed.

`avail_out`

> should contain the size in bytes of the buffer referenced by `next_out`

The `inflate()` function shall perform one or both of the following actions:

1. Decompress input data from `next_in` and update `next_in`, `avail_in` and `total_in` to reflect the data that has been decompressed.

2. Fill the output buffer referenced by `next_out`, and update `next_out`, `avail_out`, and `total_out` to reflect the decompressed data that has been placed there. If `flush` is not `Z_NO_FLUSH`, and `avail_out` indicates that there is still space in output buffer, this action shall always occur (see below for further details).

The `inflate()` function shall return when either `avail_in` reaches zero (indicating that all the input data has been compressed), or `avail_out` reaches zero (indicating that the output buffer is full).

Flush Operation

The parameter `flush` determines when uncompressed bytes are added to the output buffer in `next_out`. If `flush` is `Z_NO_FLUSH`, `inflate()` may return with some data pending output, and not yet added to the output buffer.

If `flush` is `Z_SYNC_FLUSH`, `inflate()` shall flush all pending output to `next_out`, and update `next_out` and `avail_out` accordingly.

If *flush* is set to `Z_BLOCK`, `inflate()` shall stop adding data to the output buffer if and when the next compressed block boundary is reached (see RFC 1951: DEFLATE Compressed Data Format Specification).

If *flush* is set to `Z_FINISH`, all of the compressed input shall be decompressed and added to the output. If there is insufficient output space (i.e. the compressed input data uncompresses to more than *avail_out* bytes), then `inflate()` shall fail and return Z_BUF_ERROR.

Return Value

On success, `inflate()` shall return Z_OK if decompression progress has been made, or Z_STREAM_END if all of the input data has been decompressed and there was sufficient space in the output buffer to store the uncompressed result. On error, `inflate()` shall return a value to indicate the error.

> **Note:** If `inflate()` returns Z_OK and has set *avail_out* to zero, the function should be called again with the same value for *flush*, and with updated *next_out* and *avail_out* until `inflate()` returns with either Z_OK or Z_STREAM_END and a non-zero *avail_out*.

On success, `inflate()` shall set the *adler* to the Adler-32 checksum of the output produced so far (i.e. *total_out* bytes).

Errors

On error, `inflate()` shall return a value as described below, and may set the *msg* field of *stream* to point to a string describing the error:

`Z_BUF_ERROR`

   No progress is possible; either *avail_in* or *avail_out* was zero.

`Z_MEM_ERROR`

   Insufficient memory.

`Z_STREAM_ERROR`

   The state (as represented in *stream*) is inconsistent, or *stream* was NULL.

`Z_NEED_DICT`

   A preset dictionary is required. The *adler* field shall be set to the Adler-32 checksum of the dictionary chosen by the compressor.

inflateEnd

Name

inflateEnd — free decompression stream state

Synopsis

```
#include <zlib.h>
int inflateEnd(z_streamp stream);
```

Description

The inflateEnd() function shall free all allocated state information referenced by stream. All pending output is discarded, and unprocessed input is ignored.

Return Value

On success, inflateEnd() shall return Z_OK. Otherwise it shall return Z_STREAM_ERROR to indicate the error.

Errors

On error, inflateEnd() shall return Z_STREAM_ERROR. The following conditions shall be treated as an error:

• The state in stream is inconsistent.

• stream is NULL.

• The zfree function pointer is NULL.

inflateInit2_

Name

inflateInit2_ — initialize decompression system

Synopsis

```
#include <zlib.h>
 int inflateInit2_ (z_streamp strm, int windowBits, char * version,
int stream_size);
```

Description

The inflateInit2_() function shall initialize the decompression system. On entry, *strm* shall refer to a user supplied z_stream object (a z_stream_s structure). The following fields shall be set on entry:

zalloc

> a pointer to an alloc_func function, used to allocate state information. If this is NULL, a default allocation function will be used.

zfree

> a pointer to a free_func function, used to free memory allocated by the *zalloc* function. If this is NULL a default free function will be used.

opaque

> If *alloc_func* is not NULL, *opaque* is a user supplied pointer to data that will be passed to the *alloc_func* and *free_func* functions.

If the *version* requested is not compatible with the version implemented, or if the size of the z_stream_s structure provided in *stream_size* does not match the size in the library implementation, inflateInit2_() shall fail, and return Z_VERSION_ERROR.

The *windowBits* parameter shall be a base 2 logarithm of the maximum window size to use, and shall be a value between 8 and 15. If the input data was compressed with a larger window size, subsequent attempts to decompress this data will fail with Z_DATA_ERROR, rather than try to allocate a larger window.

The inflateInit2_() function is not in the source standard; it is only in the binary standard. Source applications should use the inflateInit2() macro.

Return Value

On success, the inflateInit2_() function shall return Z_OK. Otherwise, inflateInit2_() shall return a value as described below to indicate the error.

Errors

On error, inflateInit2_() shall return one of the following error indicators:

Z_STREAM_ERROR

> Invalid parameter.

Z_MEM_ERROR

> Insufficient memory available.

Z_VERSION_ERROR

The version requested is not compatible with the library version, or the z_stream size differs from that used by the library.

In addition, the *msg* field of the *strm* may be set to an error message.

inflateInit_

Name

`inflateInit_` — initialize decompression system

Synopsis

```
#include <zlib.h>
int inflateInit_(z_streamp stream, const char * version, int
stream_size);
```

Description

The `inflateInit_()` function shall initialize the decompression system. On entry, *stream* shall refer to a user supplied z_stream object (a z_stream_s structure). The following fields shall be set on entry:

zalloc

> a pointer to an alloc_func function, used to allocate state information. If this is NULL, a default allocation function will be used.

zfree

> a pointer to a free_func function, used to free memory allocated by the *zalloc* function. If this is NULL a default free function will be used.

opaque

> If *alloc_func* is not NULL, *opaque* is a user supplied pointer to data that will be passed to the *alloc_func* and *free_func* functions.

If the *version* requested is not compatible with the version implemented, or if the size of the z_stream_s structure provided in *stream_size* does not match the size in the library implementation, `inflateInit_()` shall fail, and return `Z_VERSION_ERROR`.

The `inflateInit_()` function is not in the source standard; it is only in the binary standard. Source applications should use the `inflateInit()` macro.

The `inflateInit_()` shall be equivalent to

```
inflateInit2_(strm, MAX_WBITS, version, stream_size);
```

Return Value

On success, the `inflateInit_()` function shall return `Z_OK`. Otherwise, `inflateInit_()` shall return a value as described below to indicate the error.

Errors

On error, `inflateInit_()` shall return one of the following error indicators:

`Z_STREAM_ERROR`

> Invalid parameter.

`Z_MEM_ERROR`

> Insufficient memory available.

`Z_VERSION_ERROR`

The version requested is not compatible with the library version, or the z_stream size differs from that used by the library.

In addition, the `msg` field of the `strm` may be set to an error message.

inflateReset

Name

`inflateReset` — reset decompression stream state

Synopsis

```
#include <zlib.h>
int inflateReset(z_streamp stream);
```

Description

The `inflateReset()` function shall reset all state associated with `stream`. All pending output shall be discarded, and the counts of processed bytes (`total_in` and `total_out`) shall be reset to zero.

Return Value

On success, `inflateReset()` shall return Z_OK. Otherwise it shall return Z_STREAM_ERROR to indicate the error.

Errors

On error, `inflateReset()` shall return Z_STREAM_ERROR. The following conditions shall be treated as an error:

• The state in `stream` is inconsistent or inappropriate.

• `stream` is NULL.

inflateSetDictionary

Name

`inflateSetDictionary` — initialize decompression dictionary

Synopsis

```
#include <zlib.h>
int inflateSetDictionary(z_streamp stream, const Bytef * dictionary,
uInt dictlen);
```

Description

The `inflateSetDictionary()` function shall initialize the decompression dictionary associated with *stream* using the *dictlen* bytes referenced by *dictionary*.

The `inflateSetDictionary()` function should be called immediately after a call to `inflate()` has failed with return value Z_NEED_DICT. The *dictionary* must have the same Adler-32 checksum as the dictionary used for the compression (see `deflateSetDictionary()`).

stream shall reference an initialized decompression stream, with *total_in* zero (i.e. no data has been decompressed since the stream was initialized).

Return Value

On success, `inflateSetDictionary()` shall return Z_OK. Otherwise it shall return a value as indicated below.

Errors

On error, `inflateSetDictionary()` shall return a value as described below:

Z_STREAM_ERROR

   The state in *stream* is inconsistent, or *stream* was `NULL`.

Z_DATA_ERROR

   The Adler-32 checksum of the supplied dictionary does not match that used for the compression.

Application Usage (informative)

The application should provide a dictionary consisting of strings {{{ed note: do we really mean "strings"? Null terminated?}}} that are likely to be encountered in the data to be compressed. The application should ensure that the dictionary is sorted such that the most commonly used strings occur at the end of the dictionary.

The use of a dictionary is optional; however if the data to be compressed is relatively short and has a predictable structure, the use of a dictionary can substantially improve the compression ratio.

inflateSync

Name

`inflateSync` — advance compression stream to next sync point

Synopsis

```
#include <zlib.h>
int inflateSync(z_streamp stream);
```

Description

The `inflateSync()` function shall advance through the compressed data in *stream*, skipping any invalid compressed data, until the next full flush point is reached, or all input is exhausted. See the description for `deflate()` with flush level `Z_FULL_FLUSH`. No output is placed in *next_out*.

Return Value

On success, `inflateSync()` shall return Z_OK, and update the *next_in*, *avail_in*, and *total_in* fields of *stream* to reflect the number of bytes of compressed data that have been skipped. Otherwise, `inflateSync()` shall return a value as described below to indicate the error.

Errors

On error, `inflateSync()` shall return a value as described below:

`Z_STREAM_ERROR`

  The state (as represented in *stream*) is inconsistent, or *stream* was NULL.

`Z_BUF_ERROR`

  There is no data available to skip over.

`Z_DATA_ERROR`

  No sync point was found.

inflateSyncPoint

Name

`inflateSyncPoint` — test for synchronization point

Synopsis

```
#include <zlib.h>
int inflateSyncPoint(z_streamp stream);
```

Description

The `inflateSyncPoint()` function shall return a non-zero value if the compressed data stream referenced by *stream* is at a synchronization point.

Return Value

If the compressed data in *stream* is at a synchronization point (see `deflate()` with a flush level of `Z_SYNC_FLUSH` or `Z_FULL_FLUSH`), `inflateSyncPoint()` shall return a non-zero value, other than `Z_STREAM_ERROR`. Otherwise, if the *stream* is valid, `inflateSyncPoint()` shall return 0. If *stream* is invalid, or in an invalid state, `inflateSyncPoint()` shall return Z_STREAM_ERROR to indicate the error.

Errors

On error, `inflateSyncPoint()` shall return a value as described below:

`Z_STREAM_ERROR`

   The state (as represented in *stream*) is inconsistent, or *stream* was `NULL`.

uncompress

Name

uncompress — uncompress data

Synopsis

```
#include <zlib.h>
int uncompress(Bytef * dest, uLongf * destLen, const Bytef * source,
uLong sourceLen);
```

Description

The `uncompress()` function shall attempt to uncompress *sourceLen* bytes of data in the buffer *source*, placing the result in the buffer *dest*.

On entry, *destLen* should point to a value describing the size of the *dest* buffer. The application should ensure that this value is large enough to hold the entire uncompressed data.

> **Note:** The LSB does not describe any mechanism by which a compressor can communicate the size required to the uncompressor.

On successful exit, the variable referenced by *destLen* shall be updated to hold the length of uncompressed data in *dest*.

Return Value

On success, `uncompress()` shall return Z_OK. Otherwise, `uncompress()` shall return a value to indicate the error.

Errors

On error, `uncompress()` shall return a value as described below:

`Z_BUF_ERROR`

The buffer *dest* was not large enough to hold the uncompressed data.

`Z_MEM_ERROR`

Insufficient memory.

`Z_DATA_ERROR`

The compressed data (referenced by *source*) was corrupted.

zError

Name

`zError` — translate error number to string

Synopsis

```
#include <zlib.h>
const char * zError(int err);
```

Description

The `zError()` function shall return the string identifying the error associated with `err`. This allows for conversion from error code to string for functions such as `compress()` and `uncompress()`, that do not always set the string version of an error.

Return Value

The `zError()` function shall return a the string identifying the error associated with `err`, or NULL if `err` is not a valid error code.

It is unspecified if the string returned is determined by the setting of the `LC_MESSAGES` category in the current locale.

Errors

None defined.

zlibVersion

Name

`zlibVersion` — discover library version at run time

Synopsis

```
#include <zlib.h>
 const char * zlibVersion (void);
```

Description

The `zlibVersion()` function shall return the string identifying the interface version at the time the library was built.

Applications should compare the value returned from `zlibVersion()` with the macro constant `ZLIB_VERSION` for compatibility.

Return Value

The `zlibVersion()` function shall return a the string identifying the version of the library currently implemented.

Errors

None defined.

13.5 Interfaces for libncurses

Table 13-3 defines the library name and shared object name for the libncurses library

Table 13-3 libncurses Definition

Library:	libncurses
SONAME:	libncurses.so.5

The parameters or return types of the following interfaces have had the const qualifier added as shown here, as compared to the specification in X/Open Curses.

```
extern const char *keyname (int);
extern SCREEN *newterm (const char *, FILE *, FILE *);
extern const char *unctrl (chtype);

extern int mvprintw (int, int, const char *, ...);
extern int mvwprintw (WINDOW *, int, int, const char *, ...);
extern int printw (const char *, ...);
extern int vwprintw (WINDOW *, const char *, va_list);
extern int vw_printw (WINDOW *, const char *, va_list);
extern int wprintw (WINDOW *, const char *, ...);

extern int mvscanw (int, int, const char *, ...);
extern int mvwscanw (WINDOW *, int, int, const char *, ...);
extern int scanw (const char *, ...);
extern int vwscanw (WINDOW *, const char *, va_list);
extern int vw_scanw (WINDOW *, const char *, va_list);
extern int wscanw (WINDOW *, const char *, ...);
```

The behavior of the interfaces in this library is specified by the following specifications:

[LSB] This Specification
[SUS-CURSES] X/Open Curses

13.5.1 Curses

13.5.1.1 Interfaces for Curses

An LSB conforming implementation shall provide the generic functions for Curses specified in Table 13-4, with the full mandatory functionality as described in the referenced underlying specification.

Table 13-4 libncurses - Curses Function Interfaces

addch [SUS-CURSES]	addchnstr [SUS-CURSES]	addchstr [SUS-CURSES]	addnstr [SUS-CURSES]
addstr [SUS-CURSES]	attr_get [SUS-CURSES]	attr_off [SUS-CURSES]	attr_on [SUS-CURSES]
attr_set [SUS-CURSES]	attroff [SUS-CURSES]	attron [SUS-CURSES]	attrset [SUS-CURSES]
baudrate [SUS-CURSES]	beep [SUS-CURSES]	bkgd [SUS-CURSES]	bkgdset [SUS-CURSES]
border [SUS-CURSES]	box [SUS-CURSES]	can_change_color [SUS-CURSES]	cbreak [SUS-CURSES]
chgat [SUS-CURSES]	clear [SUS-CURSES]	clearok [SUS-CURSES]	clrtobot [SUS-CURSES]
clrtoeol [SUS-	color_content	color_set [SUS-	copywin [SUS-

CURSES]	[SUS-CURSES]	CURSES]	CURSES]
curs_set [SUS-CURSES]	def_prog_mode [SUS-CURSES]	def_shell_mode [SUS-CURSES]	del_curterm [SUS-CURSES]
delay_output [SUS-CURSES]	delch [SUS-CURSES]	deleteln [SUS-CURSES]	delscreen [SUS-CURSES]
delwin [SUS-CURSES]	derwin [SUS-CURSES]	doupdate [SUS-CURSES]	dupwin [SUS-CURSES]
echo [SUS-CURSES]	echochar [SUS-CURSES]	endwin [SUS-CURSES]	erase [SUS-CURSES]
erasechar [SUS-CURSES]	filter [SUS-CURSES]	flash [SUS-CURSES]	flushinp [SUS-CURSES]
getbkgd [SUS-CURSES]	getch [SUS-CURSES]	getnstr [SUS-CURSES]	getstr [SUS-CURSES]
getwin [SUS-CURSES]	halfdelay [SUS-CURSES]	has_colors [SUS-CURSES]	has_ic [SUS-CURSES]
has_il [SUS-CURSES]	hline [SUS-CURSES]	idcok [SUS-CURSES]	idlok [SUS-CURSES]
immedok [SUS-CURSES]	inch [SUS-CURSES]	inchnstr [LSB]	inchstr [LSB]
init_color [SUS-CURSES]	init_pair [SUS-CURSES]	initscr [SUS-CURSES]	innstr [SUS-CURSES]
insch [SUS-CURSES]	insdelln [SUS-CURSES]	insertln [SUS-CURSES]	insnstr [SUS-CURSES]
insstr [SUS-CURSES]	instr [LSB]	intrflush [SUS-CURSES]	is_linetouched [SUS-CURSES]
is_wintouched [SUS-CURSES]	isendwin [SUS-CURSES]	keyname [SUS-CURSES]	keypad [SUS-CURSES]
killchar [SUS-CURSES]	leaveok [SUS-CURSES]	longname [SUS-CURSES]	meta [SUS-CURSES]
move [SUS-CURSES]	mvaddch [SUS-CURSES]	mvaddchnstr [SUS-CURSES]	mvaddchstr [SUS-CURSES]
mvaddnstr [SUS-CURSES]	mvaddstr [SUS-CURSES]	mvchgat [SUS-CURSES]	mvcur [LSB]
mvdelch [SUS-CURSES]	mvderwin [SUS-CURSES]	mvgetch [SUS-CURSES]	mvgetnstr [SUS-CURSES]
mvgetstr [SUS-CURSES]	mvhline [SUS-CURSES]	mvinch [SUS-CURSES]	mvinchnstr [LSB]
mvinchstr [LSB]	mvinnstr [SUS-CURSES]	mvinsch [SUS-CURSES]	mvinsnstr [SUS-CURSES]
mvinsstr [SUS-CURSES]	mvinstr [LSB]	mvprintw [SUS-CURSES]	mvscanw [LSB]
mvvline [SUS-	mvwaddch [SUS-	mvwaddchnstr	mvwaddchstr

CURSES]	CURSES]	[SUS-CURSES]	[SUS-CURSES]
mvwaddnstr [SUS-CURSES]	mvwaddstr [SUS-CURSES]	mvwchgat [SUS-CURSES]	mvwdelch [SUS-CURSES]
mvwgetch [SUS-CURSES]	mvwgetnstr [SUS-CURSES]	mvwgetstr [SUS-CURSES]	mvwhline [SUS-CURSES]
mvwin [SUS-CURSES]	mvwinch [SUS-CURSES]	mvwinchnstr [LSB]	mvwinchstr [LSB]
mvwinnstr [SUS-CURSES]	mvwinsch [SUS-CURSES]	mvwinsnstr [SUS-CURSES]	mvwinsstr [SUS-CURSES]
mvwinstr [LSB]	mvwprintw [SUS-CURSES]	mvwscanw [LSB]	mvwvline [SUS-CURSES]
napms [SUS-CURSES]	newpad [SUS-CURSES]	newterm [SUS-CURSES]	newwin [SUS-CURSES]
nl [SUS-CURSES]	nocbreak [SUS-CURSES]	nodelay [SUS-CURSES]	noecho [SUS-CURSES]
nonl [SUS-CURSES]	noqiflush [SUS-CURSES]	noraw [SUS-CURSES]	notimeout [SUS-CURSES]
overlay [SUS-CURSES]	overwrite [SUS-CURSES]	pair_content [SUS-CURSES]	pechochar [SUS-CURSES]
pnoutrefresh [SUS-CURSES]	prefresh [SUS-CURSES]	printw [SUS-CURSES]	putp [SUS-CURSES]
putwin [SUS-CURSES]	qiflush [SUS-CURSES]	raw [SUS-CURSES]	redrawwin [SUS-CURSES]
refresh [SUS-CURSES]	reset_prog_mode [SUS-CURSES]	reset_shell_mode [SUS-CURSES]	resetty [SUS-CURSES]
restartterm [SUS-CURSES]	ripoffline [LSB]	savetty [SUS-CURSES]	scanw [LSB]
scr_dump [SUS-CURSES]	scr_init [SUS-CURSES]	scr_restore [SUS-CURSES]	scr_set [SUS-CURSES]
scrl [SUS-CURSES]	scroll [SUS-CURSES]	scrollok [SUS-CURSES]	set_curterm [SUS-CURSES]
set_term [SUS-CURSES]	setscrreg [SUS-CURSES]	setupterm [SUS-CURSES]	slk_attr_set [SUS-CURSES]
slk_attroff [SUS-CURSES]	slk_attron [SUS-CURSES]	slk_attrset [SUS-CURSES]	slk_clear [SUS-CURSES]
slk_color [SUS-CURSES]	slk_init [SUS-CURSES]	slk_label [SUS-CURSES]	slk_noutrefresh [SUS-CURSES]
slk_refresh [SUS-CURSES]	slk_restore [SUS-CURSES]	slk_set [SUS-CURSES]	slk_touch [SUS-CURSES]
standend [SUS-CURSES]	standout [SUS-CURSES]	start_color [SUS-CURSES]	subpad [SUS-CURSES]
subwin [SUS-	syncok [SUS-	termattrs [SUS-	termname [SUS-

CURSES]	CURSES]	CURSES]	CURSES]
tgetent [SUS-CURSES]	tgetflag [SUS-CURSES]	tgetnum [SUS-CURSES]	tgetstr [SUS-CURSES]
tgoto [SUS-CURSES]	tigetflag [SUS-CURSES]	tigetnum [SUS-CURSES]	tigetstr [SUS-CURSES]
timeout [SUS-CURSES]	touchline [SUS-CURSES]	touchwin [SUS-CURSES]	tparm [SUS-CURSES]
tputs [SUS-CURSES]	typeahead [SUS-CURSES]	unctrl [SUS-CURSES]	ungetch [SUS-CURSES]
untouchwin [SUS-CURSES]	use_env [SUS-CURSES]	vidattr [SUS-CURSES]	vidputs [SUS-CURSES]
vline [SUS-CURSES]	vw_printw [SUS-CURSES]	vw_scanw [LSB]	vwprintw [SUS-CURSES]
vwscanw [LSB]	waddch [SUS-CURSES]	waddchnstr [SUS-CURSES]	waddchstr [SUS-CURSES]
waddnstr [SUS-CURSES]	waddstr [SUS-CURSES]	wattr_get [SUS-CURSES]	wattr_off [SUS-CURSES]
wattr_on [SUS-CURSES]	wattr_set [SUS-CURSES]	wattroff [SUS-CURSES]	wattron [SUS-CURSES]
wattrset [SUS-CURSES]	wbkgd [SUS-CURSES]	wbkgdset [SUS-CURSES]	wborder [SUS-CURSES]
wchgat [SUS-CURSES]	wclear [SUS-CURSES]	wclrtobot [SUS-CURSES]	wclrtoeol [SUS-CURSES]
wcolor_set [SUS-CURSES]	wcursyncup [SUS-CURSES]	wdelch [SUS-CURSES]	wdeleteln [SUS-CURSES]
wechochar [SUS-CURSES]	werase [SUS-CURSES]	wgetch [SUS-CURSES]	wgetnstr [SUS-CURSES]
wgetstr [SUS-CURSES]	whline [SUS-CURSES]	winch [SUS-CURSES]	winchnstr [LSB]
winchstr [LSB]	winnstr [SUS-CURSES]	winsch [SUS-CURSES]	winsdelln [SUS-CURSES]
winsertln [SUS-CURSES]	winsnstr [SUS-CURSES]	winsstr [SUS-CURSES]	winstr [LSB]
wmove [SUS-CURSES]	wnoutrefresh [SUS-CURSES]	wprintw [SUS-CURSES]	wredrawln [SUS-CURSES]
wrefresh [SUS-CURSES]	wscanw [LSB]	wscrl [SUS-CURSES]	wsetscrreg [SUS-CURSES]
wstandend [SUS-CURSES]	wstandout [SUS-CURSES]	wsyncdown [SUS-CURSES]	wsyncup [SUS-CURSES]
wtimeout [SUS-CURSES]	wtouchln [SUS-CURSES]	wvline [SUS-CURSES]	

An LSB conforming implementation shall provide the generic deprecated functions for Curses specified in Table 13-5, with the full mandatory functionality as described in the referenced underlying specification.

> **Note:** These interfaces are deprecated, and applications should avoid using them. These interfaces may be withdrawn in future releases of this specification.

Table 13-5 libncurses - Curses Deprecated Function Interfaces

tgetent [SUS-CURSES]	tgetflag [SUS-CURSES]	tgetnum [SUS-CURSES]	tgetstr [SUS-CURSES]
tgoto [SUS-CURSES]			

An LSB conforming implementation shall provide the generic data interfaces for Curses specified in Table 13-6, with the full mandatory functionality as described in the referenced underlying specification.

Table 13-6 libncurses - Curses Data Interfaces

COLORS [SUS-CURSES]	COLOR_PAIRS [SUS-CURSES]	COLS [SUS-CURSES]	LINES [SUS-CURSES]
acs_map [SUS-CURSES]	cur_term [SUS-CURSES]	curscr [SUS-CURSES]	stdscr [SUS-CURSES]

13.6 Data Definitions for libncurses

This section defines global identifiers and their values that are associated with interfaces contained in libncurses. These definitions are organized into groups that correspond to system headers. This convention is used as a convenience for the reader, and does not imply the existence of these headers, or their content. Where an interface is defined as requiring a particular system header file all of the data definitions for that system header file presented here shall be in effect.

This section gives data definitions to promote binary application portability, not to repeat source interface definitions available elsewhere. System providers and application developers should use this ABI to supplement - not to replace - source interface definition specifications.

This specification uses the ISO C (1999) C Language as the reference programming language, and data definitions are specified in ISO C format. The C language is used here as a convenient notation. Using a C language description of these data objects does not preclude their use by other programming languages.

13.6.1 curses.h

```
#define ERR      (-1)
#define OK       (0)
#define ACS_RARROW      (acs_map['+'])
#define ACS_LARROW      (acs_map[','])
#define ACS_UARROW      (acs_map['-'])
#define ACS_DARROW      (acs_map['.'])
#define ACS_BLOCK       (acs_map['0'])
#define ACS_CKBOARD     (acs_map['a'])
#define ACS_DEGREE      (acs_map['f'])
#define ACS_PLMINUS     (acs_map['g'])
```

```
#define ACS_BOARD       (acs_map['h'])
#define ACS_LANTERN     (acs_map['i'])
#define ACS_LRCORNER    (acs_map['j'])
#define ACS_URCORNER    (acs_map['k'])
#define ACS_ULCORNER    (acs_map['l'])
#define ACS_LLCORNER    (acs_map['m'])
#define ACS_PLUS        (acs_map['n'])
#define ACS_S1  (acs_map['o'])
#define ACS_HLINE       (acs_map['q'])
#define ACS_S9  (acs_map['s'])
#define ACS_LTEE        (acs_map['t'])
#define ACS_RTEE        (acs_map['u'])
#define ACS_BTEE        (acs_map['v'])
#define ACS_TTEE        (acs_map['w'])
#define ACS_VLINE       (acs_map['x'])
#define ACS_DIAMOND     (acs_map['`'])
#define ACS_BULLET      (acs_map['~'])
#define getmaxyx(win,y,x)       \
        (y=(win)?((win)->_maxy+1):ERR,x=(win)?((win)-
>_maxx+1):ERR)
#define getbegyx(win,y,x)       \
        (y=(win)?(win)->_begy:ERR,x=(win)?(win)->_begx:ERR)
#define getyx(win,y,x)  \
        (y=(win)?(win)->_cury:ERR,x=(win)?(win)->_curx:ERR)
#define getparyx(win,y,x)       \
        (y=(win)?(win)->_pary:ERR,x=(win)?(win)->_parx:ERR)

#define __NCURSES_H     1
#define NCURSES_EXPORT(type)    type
#define NCURSES_EXPORT_VAR(type)        type

#define WA_ALTCHARSET   A_ALTCHARSET
#define WA_ATTRIBUTES   A_ATTRIBUTES
#define WA_BLINK        A_BLINK
#define WA_BOLD A_BOLD
#define WA_DIM  A_DIM
#define WA_HORIZONTAL   A_HORIZONTAL
#define WA_INVIS        A_INVIS
#define WA_LEFT A_LEFT
#define WA_LOW  A_LOW
#define WA_NORMAL       A_NORMAL
#define WA_PROTECT      A_PROTECT
#define WA_REVERSE      A_REVERSE
#define WA_RIGHT        A_RIGHT
#define WA_STANDOUT     A_STANDOUT
#define WA_TOP  A_TOP
#define WA_UNDERLINE    A_UNDERLINE
#define WA_VERTICAL     A_VERTICAL
#define A_REVERSE       NCURSES_BITS(1UL,10)

#define COLOR_BLACK     0
#define COLOR_RED       1
#define COLOR_GREEN     2
#define COLOR_YELLOW    3
#define COLOR_BLUE      4
#define COLOR_MAGENTA   5
#define COLOR_CYAN      6
#define COLOR_WHITE     7

#define _SUBWIN 0x01
#define _ENDLINE        0x02
#define _FULLWIN        0x04
#define _SCROLLWIN      0x08
#define _ISPAD  0x10
#define _HASMOVED       0x20
```

```
        typedef unsigned char bool;

        typedef unsigned long int chtype;
        typedef struct screen SCREEN;
        typedef struct _win_st WINDOW;
        typedef chtype attr_t;
        typedef struct {
            attr_t attr;
            wchar_t chars[5];
        } cchar_t;
        struct pdat {
            short _pad_y;
            short _pad_x;
            short _pad_top;
            short _pad_left;
            short _pad_bottom;
            short _pad_right;
        };

        struct _win_st {
            short _cury;                /* current cursor position */
            short _curx;
            short _maxy;                    /* maximums of x and y, NOT
        window size */
            short _maxx;
            short _begy;                 /* screen coords of upper-left-
        hand corner */
            short _begx;
            short _flags;              /* window state flags */
            attr_t _attrs;                /* current attribute for non-
        space character */
            chtype _bkgd;                       /* current background
        char/attribute pair */
            bool _notimeout;           /* no time out on function-key
        entry? */
            bool _clear;                   /* consider all data in the
        window invalid? */
            bool _leaveok;               /* OK to not reset cursor on
        exit? */
            bool _scroll;              /* OK to scroll this window? */
            bool _idlok;                 /* OK to use insert/delete line?
        */
            bool _idcok;                 /* OK to use insert/delete char?
        */
            bool _immed;                 /* window in immed mode? (not yet
        used) */
            bool _sync;                /* window in sync mode? */
            bool _use_keypad;              /* process function keys into
        KEY_ symbols? */
            int _delay;                /* 0 = nodelay, <0 = blocking, >0
        = delay */
            struct ldat *_line;        /* the actual line data */
            short _regtop;              /* top line of scrolling region
        */
            short _regbottom;             /* bottom line of scrolling
        region */
            int _parx;                 /* x coordinate of this window in
        parent */
            int _pary;                 /* y coordinate of this window in
        parent */
            WINDOW *_parent;            /* pointer to parent if a sub-
        window */
            struct pdat _pad;
            short _yoffset;             /* real begy is _begy + _yoffset
        */
```

```
    cchar_t _bkgrnd;                               /* current background
char/attribute pair */
};

#define KEY_F(n)          (KEY_F0+(n))
#define KEY_CODE_YES      0400
#define KEY_BREAK         0401
#define KEY_MIN 0401
#define KEY_DOWN          0402
#define KEY_UP  0403
#define KEY_LEFT          0404
#define KEY_RIGHT         0405
#define KEY_HOME          0406
#define KEY_BACKSPACE     0407
#define KEY_F0  0410
#define KEY_DL  0510
#define KEY_IL  0511
#define KEY_DC  0512
#define KEY_IC  0513
#define KEY_EIC 0514
#define KEY_CLEAR         0515
#define KEY_EOS 0516
#define KEY_EOL 0517
#define KEY_SF  0520
#define KEY_SR  0521
#define KEY_NPAGE         0522
#define KEY_PPAGE         0523
#define KEY_STAB          0524
#define KEY_CTAB          0525
#define KEY_CATAB         0526
#define KEY_ENTER         0527
#define KEY_SRESET        0530
#define KEY_RESET         0531
#define KEY_PRINT         0532
#define KEY_LL  0533
#define KEY_A1  0534
#define KEY_A3  0535
#define KEY_B2  0536
#define KEY_C1  0537
#define KEY_C3  0540
#define KEY_BTAB          0541
#define KEY_BEG 0542
#define KEY_CANCEL        0543
#define KEY_CLOSE         0544
#define KEY_COMMAND       0545
#define KEY_COPY          0546
#define KEY_CREATE        0547
#define KEY_END 0550
#define KEY_EXIT          0551
#define KEY_FIND          0552
#define KEY_HELP          0553
#define KEY_MARK          0554
#define KEY_MESSAGE       0555
#define KEY_MOVE          0556
#define KEY_NEXT          0557
#define KEY_OPEN          0560
#define KEY_OPTIONS       0561
#define KEY_PREVIOUS      0562
#define KEY_REDO          0563
#define KEY_REFERENCE     0564
#define KEY_REFRESH       0565
#define KEY_REPLACE       0566
#define KEY_RESTART       0567
#define KEY_RESUME        0570
#define KEY_SAVE          0571
#define KEY_SBEG          0572
```

```
#define KEY_SCANCEL    0573
#define KEY_SCOMMAND   0574
#define KEY_SCOPY      0575
#define KEY_SCREATE    0576
#define KEY_SDC 0577
#define KEY_SDL 0600
#define KEY_SELECT     0601
#define KEY_SEND       0602
#define KEY_SEOL       0603
#define KEY_SEXIT      0604
#define KEY_SFIND      0605
#define KEY_SHELP      0606
#define KEY_SHOME      0607
#define KEY_SIC 0610
#define KEY_SLEFT      0611
#define KEY_SMESSAGE   0612
#define KEY_SMOVE      0613
#define KEY_SNEXT      0614
#define KEY_SOPTIONS   0615
#define KEY_SPREVIOUS  0616
#define KEY_SPRINT     0617
#define KEY_SREDO      0620
#define KEY_SREPLACE   0621
#define KEY_SRIGHT     0622
#define KEY_SRSUME     0623
#define KEY_SSAVE      0624
#define KEY_SSUSPEND   0625
#define KEY_SUNDO      0626
#define KEY_SUSPEND    0627
#define KEY_UNDO       0630
#define KEY_MOUSE      0631
#define KEY_RESIZE     0632
#define KEY_MAX 0777

#define PAIR_NUMBER(a)  (((a)&A_COLOR)>>8)
#define NCURSES_BITS(mask,shift)         ((mask)<<((shift)+8))
#define A_CHARTEXT      (NCURSES_BITS(1UL,0)-1UL)
#define A_NORMAL        0L
#define NCURSES_ATTR_SHIFT      8
#define A_COLOR NCURSES_BITS(((1UL)<<8)-1UL,0)
#define A_BLINK NCURSES_BITS(1UL,11)
#define A_DIM   NCURSES_BITS(1UL,12)
#define A_BOLD  NCURSES_BITS(1UL,13)
#define A_ALTCHARSET    NCURSES_BITS(1UL,14)
#define A_INVIS NCURSES_BITS(1UL,15)
#define A_PROTECT       NCURSES_BITS(1UL,16)
#define A_HORIZONTAL    NCURSES_BITS(1UL,17)
#define A_LEFT  NCURSES_BITS(1UL,18)
#define A_LOW   NCURSES_BITS(1UL,19)
#define A_RIGHT NCURSES_BITS(1UL,20)
#define A_TOP   NCURSES_BITS(1UL,21)
#define A_VERTICAL      NCURSES_BITS(1UL,22)
#define A_STANDOUT      NCURSES_BITS(1UL,8)
#define A_UNDERLINE     NCURSES_BITS(1UL,9)
#define COLOR_PAIR(n)   NCURSES_BITS(n,0)
#define A_ATTRIBUTES    NCURSES_BITS(~(1UL-1UL),0)

extern int COLORS;
extern int COLOR_PAIRS;
extern int COLS;
extern int LINES;
extern chtype acs_map[];
extern int addch(const chtype);
extern int addchnstr(const chtype *, int);
extern int addchstr(const chtype *);
extern int addnstr(const char *, int);
```

```
extern int addstr(const char *);
extern int attr_get(attr_t *, short *, void *);
extern int attr_off(attr_t, void *);
extern int attr_on(attr_t, void *);
extern int attr_set(attr_t, short, void *);
extern int attroff(int);
extern int attron(int);
extern int attrset(int);
extern int baudrate(void);
extern int beep(void);
extern int bkgd(chtype);
extern void bkgdset(chtype);
extern int border(chtype, chtype, chtype, chtype, chtype, chtype,
chtype,
                   chtype);
extern int box(WINDOW *, chtype, chtype);
extern bool can_change_color(void);
extern int cbreak(void);
extern int chgat(int, attr_t, short, const void *);
extern int clear(void);
extern int clearok(WINDOW *, bool);
extern int clrtobot(void);
extern int clrtoeol(void);
extern int color_content(short, short *, short *, short *);
extern int color_set(short, void *);
extern int copywin(const WINDOW *, WINDOW *, int, int, int, int,
int, int,
                   int);
extern int curs_set(int);
extern WINDOW *curscr;
extern int def_prog_mode(void);
extern int def_shell_mode(void);
extern int delay_output(int);
extern int delch(void);
extern int deleteln(void);
extern void delscreen(SCREEN *);
extern int delwin(WINDOW *);
extern WINDOW *derwin(WINDOW *, int, int, int, int);
extern int doupdate(void);
extern WINDOW *dupwin(WINDOW *);
extern int echo(void);
extern int echochar(const chtype);
extern int endwin(void);
extern int erase(void);
extern char erasechar(void);
extern void filter(void);
extern int flash(void);
extern int flushinp(void);
extern chtype getbkgd(WINDOW *);
extern int getch(void);
extern int getnstr(char *, int);
extern int getstr(char *);
extern WINDOW *getwin(FILE *);
extern int halfdelay(int);
extern bool has_colors(void);
extern bool has_ic(void);
extern bool has_il(void);
extern int hline(chtype, int);
extern void idcok(WINDOW *, bool);
extern int idlok(WINDOW *, bool);
extern void immedok(WINDOW *, bool);
extern chtype inch(void);
extern int inchnstr(chtype *, int);
extern int inchstr(chtype *);
extern int init_color(short, short, short, short);
extern int init_pair(short, short, short);
```

```
extern WINDOW *initscr(void);
extern int innstr(char *, int);
extern int insch(chtype);
extern int insdelln(int);
extern int insertln(void);
extern int insnstr(const char *, int);
extern int insstr(const char *);
extern int instr(char *);
extern int intrflush(WINDOW *, bool);
extern bool is_linetouched(WINDOW *, int);
extern bool is_wintouched(WINDOW *);
extern bool isendwin(void);
extern const char *keyname(int);
extern int keypad(WINDOW *, bool);
extern char killchar(void);
extern int leaveok(WINDOW *, bool);
extern char *longname(void);
extern int meta(WINDOW *, bool);
extern int move(int, int);
extern int mvaddch(int, int, const chtype);
extern int mvaddchnstr(int, int, const chtype *, int);
extern int mvaddchstr(int, int, const chtype *);
extern int mvaddnstr(int, int, const char *, int);
extern int mvaddstr(int, int, const char *);
extern int mvchgat(int, int, int, attr_t, short, const void *);
extern int mvcur(int, int, int, int);
extern int mvdelch(int, int);
extern int mvderwin(WINDOW *, int, int);
extern int mvgetch(int, int);
extern int mvgetnstr(int, int, char *, int);
extern int mvgetstr(int, int, char *);
extern int mvhline(int, int, chtype, int);
extern chtype mvinch(int, int);
extern int mvinchnstr(int, int, chtype *, int);
extern int mvinchstr(int, int, chtype *);
extern int mvinnstr(int, int, char *, int);
extern int mvinsch(int, int, chtype);
extern int mvinsnstr(int, int, const char *, int);
extern int mvinsstr(int, int, const char *);
extern int mvinstr(int, int, char *);
extern int mvprintw(int, int, const char *, ...);
extern int mvscanw(int, int, const char *, ...);
extern int mvvline(int, int, chtype, int);
extern int mvwaddch(WINDOW *, int, int, const chtype);
extern int mvwaddchnstr(WINDOW *, int, int, const chtype *, int);
extern int mvwaddchstr(WINDOW *, int, int, const chtype *);
extern int mvwaddnstr(WINDOW *, int, int, const char *, int);
extern int mvwaddstr(WINDOW *, int, int, const char *);
extern int mvwchgat(WINDOW *, int, int, int, attr_t, short, const
void *);
extern int mvwdelch(WINDOW *, int, int);
extern int mvwgetch(WINDOW *, int, int);
extern int mvwgetnstr(WINDOW *, int, int, char *, int);
extern int mvwgetstr(WINDOW *, int, int, char *);
extern int mvwhline(WINDOW *, int, int, chtype, int);
extern int mvwin(WINDOW *, int, int);
extern chtype mvwinch(WINDOW *, int, int);
extern int mvwinchnstr(WINDOW *, int, int, chtype *, int);
extern int mvwinchstr(WINDOW *, int, int, chtype *);
extern int mvwinnstr(WINDOW *, int, int, char *, int);
extern int mvwinsch(WINDOW *, int, int, chtype);
extern int mvwinsnstr(WINDOW *, int, int, const char *, int);
extern int mvwinsstr(WINDOW *, int, int, const char *);
extern int mvwinstr(WINDOW *, int, int, char *);
extern int mvwprintw(WINDOW *, int, int, const char *, ...);
extern int mvwscanw(WINDOW *, int, int, const char *, ...);
```

```
extern int mvwvline(WINDOW *, int, int, chtype, int);
extern int napms(int);
extern WINDOW *newpad(int, int);
extern SCREEN *newterm(const char *, FILE *, FILE *);
extern WINDOW *newwin(int, int, int, int);
extern int nl(void);
extern int nocbreak(void);
extern int nodelay(WINDOW *, bool);
extern int noecho(void);
extern int nonl(void);
extern void noqiflush(void);
extern int noraw(void);
extern int notimeout(WINDOW *, bool);
extern int overlay(const WINDOW *, WINDOW *);
extern int overwrite(const WINDOW *, WINDOW *);
extern int pair_content(short, short *, short *);
extern int pechochar(WINDOW *, chtype);
extern int pnoutrefresh(WINDOW *, int, int, int, int, int, int);
extern int prefresh(WINDOW *, int, int, int, int, int, int);
extern int printw(const char *, ...);
extern int putwin(WINDOW *, FILE *);
extern void qiflush(void);
extern int raw(void);
extern int redrawwin(WINDOW *);
extern int refresh(void);
extern int reset_prog_mode(void);
extern int reset_shell_mode(void);
extern int resetty(void);
extern int ripoffline(int, int (*)(WINDOW *, int));
extern int savetty(void);
extern int scanw(const char *, ...);
extern int scr_dump(const char *);
extern int scr_init(const char *);
extern int scr_restore(const char *);
extern int scr_set(const char *);
extern int scrl(int);
extern int scroll(WINDOW *);
extern int scrollok(WINDOW *, bool);
extern SCREEN *set_term(SCREEN *);
extern int setscrreg(int, int);
extern int slk_attr_set(const attr_t, short, void *);
extern int slk_attroff(const chtype);
extern int slk_attron(const chtype);
extern int slk_attrset(const chtype);
extern int slk_clear(void);
extern int slk_color(short);
extern int slk_init(int);
extern char *slk_label(int);
extern int slk_noutrefresh(void);
extern int slk_refresh(void);
extern int slk_restore(void);
extern int slk_set(int, const char *, int);
extern int slk_touch(void);
extern int standend(void);
extern int standout(void);
extern int start_color(void);
extern WINDOW *stdscr;
extern WINDOW *subpad(WINDOW *, int, int, int, int);
extern WINDOW *subwin(WINDOW *, int, int, int, int);
extern int syncok(WINDOW *, bool);
extern chtype termattrs(void);
extern char *termname(void);
extern void timeout(int);
extern int touchline(WINDOW *, int, int);
extern int touchwin(WINDOW *);
extern int typeahead(int);
```

```
extern const char *unctrl(chtype);
extern int ungetch(int);
extern int untouchwin(WINDOW *);
extern void use_env(bool);
extern int vidattr(chtype);
extern int vidputs(chtype, int (*)(int));
extern int vline(chtype, int);
extern int vw_printw(WINDOW *, const char *, va_list);
extern int vw_scanw(WINDOW *, const char *, va_list);
extern int vwprintw(WINDOW *, const char *, va_list);
extern int vwscanw(WINDOW *, const char *, va_list);
extern int waddch(WINDOW *, const chtype);
extern int waddchnstr(WINDOW *, const chtype *, int);
extern int waddchstr(WINDOW *, const chtype *);
extern int waddnstr(WINDOW *, const char *, int);
extern int waddstr(WINDOW *, const char *);
extern int wattr_get(WINDOW *, attr_t *, short *, void *);
extern int wattr_off(WINDOW *, attr_t, void *);
extern int wattr_on(WINDOW *, attr_t, void *);
extern int wattr_set(WINDOW *, attr_t, short, void *);
extern int wattroff(WINDOW *, int);
extern int wattron(WINDOW *, int);
extern int wattrset(WINDOW *, int);
extern int wbkgd(WINDOW *, chtype);
extern void wbkgdset(WINDOW *, chtype);
extern  int  wborder(WINDOW  *,  chtype,  chtype,  chtype,  chtype,
chtype,
                 chtype, chtype, chtype);
extern int wchgat(WINDOW *, int, attr_t, short, const void *);
extern int wclear(WINDOW *);
extern int wclrtobot(WINDOW *);
extern int wclrtoeol(WINDOW *);
extern int wcolor_set(WINDOW *, short, void *);
extern void wcursyncup(WINDOW *);
extern int wdelch(WINDOW *);
extern int wdeleteln(WINDOW *);
extern int wechochar(WINDOW *, const chtype);
extern int werase(WINDOW *);
extern int wgetch(WINDOW *);
extern int wgetnstr(WINDOW *, char *, int);
extern int wgetstr(WINDOW *, char *);
extern int whline(WINDOW *, chtype, int);
extern chtype winch(WINDOW *);
extern int winchnstr(WINDOW *, chtype *, int);
extern int winchstr(WINDOW *, chtype *);
extern int winnstr(WINDOW *, char *, int);
extern int winsch(WINDOW *, chtype);
extern int winsdelln(WINDOW *, int);
extern int winsertln(WINDOW *);
extern int winsnstr(WINDOW *, const char *, int);
extern int winsstr(WINDOW *, const char *);
extern int winstr(WINDOW *, char *);
extern int wmove(WINDOW *, int, int);
extern int wnoutrefresh(WINDOW *);
extern int wprintw(WINDOW *, const char *, ...);
extern int wredrawln(WINDOW *, int, int);
extern int wrefresh(WINDOW *);
extern int wscanw(WINDOW *, const char *, ...);
extern int wscrl(WINDOW *, int);
extern int wsetscrreg(WINDOW *, int, int);
extern int wstandend(WINDOW *);
extern int wstandout(WINDOW *);
extern void wsyncdown(WINDOW *);
extern void wsyncup(WINDOW *);
extern void wtimeout(WINDOW *, int);
extern int wtouchln(WINDOW *, int, int, int);
```

```
extern int wvline(WINDOW *, chtype, int);
```

13.6.2 term.h

```
extern TERMINAL *cur_term;
extern int del_curterm(TERMINAL *);
extern int putp(const char *);
extern int restartterm(char *, int, int *);
extern TERMINAL *set_curterm(TERMINAL *);
extern int setupterm(char *, int, int *);
extern int tgetent(char *, const char *);
extern int tgetflag(char *);
extern int tgetnum(char *);
extern char *tgetstr(char *, char **);
extern char *tgoto(const char *, int, int);
extern int tigetflag(const char *);
extern int tigetnum(const char *);
extern char *tigetstr(const char *);
extern char *tparm(const char *, ...);
extern int tputs(const char *, int, int (*)(int));
```

13.7 Interface Definitions for libncurses

The interfaces defined on the following pages are included in libncurses and are defined by this specification. Unless otherwise noted, these interfaces shall be included in the source standard.

Other interfaces listed in Section 13.5 shall behave as described in the referenced base document.

inchnstr

Name

inchnstr — obtain a string of characters and their attributes from a curses window

Synopsis

```
#include <curses.h>
int inchnstr(chtype * chstr, int n);
```

Description

The interface inchnstr() shall behave as specified in X/Open Curses, except that inchnstr() shall return the number of characters that were read.

inchstr

Name

`inchstr` — obtain a string of characters and their attributes from a curses window

Synopsis

```
#include <curses.h>
int inchstr(chtype * chstr);
```

Description

The interface `inchstr()` shall behave as specified in X/Open Curses, except that `inchstr()` shall return the number of characters that were read.

instr

Name

`instr` — obtain a string of characters from a curses window

Synopsis

```
#include <curses.h>
int instr(char * str);
```

Description

The interface `instr()` shall behave as specified in X/Open Curses, except that `instr()` shall return the number of characters that were read.

mvcur

Name

`mvcur` — send cursor movement commands to terminal

Synopsis

```
#include <curses.h>
int mvcur(int oldrow, int oldcol, int newrow, int newcol);
```

Description

The interface `mvcur()` shall behave as described in X/Open Curses, except that if (*newrow*, *newcol*) is not a valid address for the terminal in use, the results of the `mvcur()` function are unspecified.

mvinchnstr

Name

mvinchnstr — obtain a string of characters and their attributes from a curses window

Synopsis

```
#include <curses.h>
int mvinchnstr(int y, int x, chtype * chstr, int n);
```

Description

The interface mvinchnstr() shall behave as specified in X/Open Curses, except that mvinchnstr() shall return the number of characters that were read.

mvinchstr

Name

mvinchstr — obtain a string of characters and their attributes from a curses window

Synopsis

```
#include <curses.h>
int mvinchstr(int y, int x, chtype * chstr);
```

Description

The interface mvinchstr() shall behave as specified in X/Open Curses, except that mvinchstr() shall return the number of characters that were read.

mvinstr

Name

mvinstr — obtain a string of characters from a curses window

Synopsis

```
#include <curses.h>
int mvinstr(int y, int x, char * str);
```

Description

The interface mvinstr() shall behave as specified in X/Open Curses, except that mvinstr() shall return the number of characters that were read.

mvscanw

Name

mvscanw — convert formatted input from a curses window

Synopsis

```
#include <curses.h>
int mvscanw(int y, int x, const char *fmt, ...);
```

Description

The scanw family of functions shall behave as described in X/Open Curses, except as noted below.

Differences

This function returns ERR on failure. On success it returns the number of successfully matched and assigned input items. This differs from X/Open Curses, which indicates this function returns OK on success.

mvwinchnstr

Name

mvwinchnstr — obtain a string of characters and their attributes from a curses window

Synopsis

```
#include <curses.h>
int mvwinchnstr(WINDOW * win, int y, int x, chtype * chstr, int n);
```

Description

The interface mvwinchnstr() shall behave as specified in X/Open Curses, except that mvwinchnstr() shall return the number of characters that were read.

mvwinchstr

Name

mvwinchstr — obtain a string of characters and their attributes from a curses window

Synopsis

```
#include <curses.h>
int mvwinchstr(WINDOW * win, int y, int x, chtype * chstr);
```

Description

The interface mvwinchstr() shall behave as specified in X/Open Curses, except that mvwinchstr() shall return the number of characters that were read.

mvwinstr

Name

`mvwinstr` — obtain a string of characters from a curses window

Synopsis

```
#include <curses.h>
int mvwinstr(WINDOW * win, int y, int x, char * str);
```

Description

The interface `mvwinstr()` shall behave as specified in X/Open Curses, except that `mvwinstr()` shall return the number of characters that were read.

mvwscanw

Name

`mvwscanw` — convert formatted input from a curses window

Synopsis

```
#include <curses.h>
int mvwscanw(WINDOW *win, int y, int x, const char *fmt, ...);
```

Description

The scanw family of functions shall behave as described in X/Open Curses, except as noted below.

Differences

This function returns `ERR` on failure. On success it returns the number of successfully matched and assigned input items. This differs from X/Open Curses, which indicates this function returns `OK` on success.

ripoffline

Name

`ripoffline` — obtain a string of characters and their attributes from a curses window

Synopsis

```
#include <curses.h>
int ripoffline(int line, int (*init) (WINDOW *, int));
```

Description

The interface `ripoffline()` shall behave as specified in X/Open Curses, except that `ripoffline()` shall return `-1` if the number of lines that were ripped off exceeds five.

scanw

Name

`scanw` — convert formatted input from a curses window

Synopsis

```
#include <curses.h>
int scanw(const char *fmt, ...);
```

Description

The scanw family of functions shall behave as described in X/Open Curses, except as noted below.

Differences

This function returns `ERR` on failure. On success it returns the number of successfully matched and assigned input items. This differs from X/Open Curses, which indicates this function returns `OK` on success.

vw_scanw

Name

`vw_scanw` — convert formatted input from a curses window

Synopsis

```
#include <curses.h>
int vw_scanw(WINDOW *win, const char *fmt, va_list vararglist);
```

Description

The scanw family of functions shall behave as described in X/Open Curses, except as noted below.

Differences

This function returns `ERR` on failure. On success it returns the number of successfully matched and assigned input items. This differs from X/Open Curses, which indicates this function returns `OK` on success.

vwscanw

Name

vwscanw — convert formatted input from a curses window

Synopsis

```
#include <curses.h>
int vw_scanw(WINDOW *win, const char *fmt, va_list vararglist);
```

Description

The scanw family of functions shall behave as described in X/Open Curses, except as noted below.

Differences

This function returns ERR on failure. On success it returns the number of successfully matched and assigned input items. This differs from X/Open Curses, which indicates this function returns OK on success.

winchnstr

Name

winchnstr — obtain a string of characters and their attributes from a curses window

Synopsis

```
#include <curses.h>
int winchnstr(WINDOW * win, chtype * chstr, int n);
```

Description

The interface winchnstr() shall behave as specified in X/Open Curses, except that winchnstr() shall return the number of characters that were read.

winchstr

Name

winchstr — obtain a string of characters and their attributes from a curses window

Synopsis

```
#include <curses.h>
int winchstr(WINDOW * win, chtype * chstr);
```

Description

The interface winchstr() shall behave as specified in X/Open Curses, except that winchstr() shall return the number of characters that were read.

winstr

Name

winstr — obtain a string of characters from a curses window

Synopsis

```
#include <curses.h>
int winstr(WINDOW * win, char * str);
```

Description

The interface `winstr()` shall behave as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that `winstr()` shall return the number of characters that were read.

wscanw

Name

wscanw — convert formatted input from a curses window

Synopsis

```
#include <curses.h>
int wscanw(WINDOW *win, const char *fmt, ...);
```

Description

The scanw family of functions shall behave as described in X/Open Curses, except as noted below.

Differences

This function returns `ERR` on failure. On success it returns the number of successfully matched and assigned input items. This differs from X/Open Curses, which indicates this function returns `OK` on success.

13.8 Interfaces for libutil

Table 13-7 defines the library name and shared object name for the libutil library

Table 13-7 libutil Definition

Library:	libutil
SONAME:	libutil.so.1

The behavior of the interfaces in this library is specified by the following specifications:

 [LSB] This Specification

13.8.1 Utility Functions

13.8.1.1 Interfaces for Utility Functions

An LSB conforming implementation shall provide the generic functions for Utility Functions specified in Table 13-8, with the full mandatory functionality as described in the referenced underlying specification.

Table 13-8 libutil - Utility Functions Function Interfaces

forkpty [LSB]	login [LSB]	login_tty [LSB]	logout [LSB]
logwtmp [LSB]	openpty [LSB]		

13.9 Interface Definitions for libutil

The interfaces defined on the following pages are included in libutil and are defined by this specification. Unless otherwise noted, these interfaces shall be included in the source standard.

Other interfaces listed in Section 13.8 shall behave as described in the referenced base document.

forkpty

Name

`forkpty` — Create a new process attached to an available pseudo-terminal

Synopsis

```
#include <pty.h>
int forkpty(int * amaster, char * name, const struct termios * termp,
const struct winsize * winp);
```

Description

The `forkpty()` function shall find and open a pseudo-terminal device pair in the same manner as the `openpty()` function. If a pseudo-terminal is available, `forkpty()` shall create a new process in the same manner as the `fork()` function, and prepares the new process for login in the same manner as `login_tty()`.

If *termp* is not null, it shall refer to a `termios` structure that shall be used to initialize the characteristics of the slave device. If *winp* is not null, it shall refer to a `winsize` structure used to initialize the window size of the slave device.

Return Value

On success, the parent process shall return the process id of the child, and the child shall return 0. On error, no new process shall be created, -1 shall be returned, and `errno` shall be set appropriately. On success, the parent process shall receive the file descriptor of the master side of the pseudo-terminal in the location referenced by *amaster*, and, if *name* is not NULL, the filename of the slave device in *name*.

Errors

EAGAIN

Unable to create a new process.

ENOENT

There are no available pseudo-terminals.

ENOMEM

Insufficient memory was available.

login

Name

`login` — login utility function

Synopsis

```
#include <utmp.h>
void login (struct utmp * ut );
```

Description

The `login()` function shall update the user accounting databases. The *ut* parameter shall reference a `utmp` structure for all fields except the following:

1. The *ut_type* field shall be set to `USER_PROCESS`.

2. The *ut_pid* field shall be set to the process identifier for the current process.

3. The *ut_line* field shall be set to the name of the controlling terminal device. The name shall be found by examining the device associated with the standard input, output and error streams in sequence, until one associated with a terminal device is found. If none of these streams refers to a terminal device, the *ut_line* field shall be set to `"???"`. If the terminal device is in the `/dev` directory hierarchy, the *ut_line* field shall not contain the leading `"/dev/"`, otherwise it shall be set to the final component of the pathname of the device. If the user accounting database imposes a limit on the size of the *ut_line* field, it shall truncate the name, but any such limit shall not be smaller than `UT_LINESIZE` (including a terminating null character).

Return Value

None

Errors

None

login_tty

Name

`login_tty` — Prepare a terminal for login

Synopsis

```
#include <utmp.h>
int login_tty (int fdr);
```

Description

The `login_tty()` function shall prepare the terminal device referenced by the file descriptor `fdr`. This function shall create a new session, make the terminal the controlling terminal for the current process, and set the standard input, output, and error streams of the current process to the terminal. If `fdr` is not the standard input, output or error stream, then `login_tty()` shall close `fdr`.

Return Value

On success, `login_tty()` shall return zero; otherwise -1 is returned, and errno shall be set appropriately.

Errors

ENOTTY

> `fdr` does not refer to a terminal device.

logout

Name

`logout` — logout utility function

Synopsis

```
#include <utmp.h>
int logout (const char * line );
```

Description

Given the device `line`, the `logout()` function shall search the user accounting database which is read by `getutent()` for an entry with the corresponding line, and with the type of `USER_PROCESS`. If a corresponding entry is located, it shall be updated as follows:

1. The `ut_name` field shall be set to zeroes (`UT_NAMESIZE` NUL bytes).

2. The `ut_host` field shall be set to zeroes (`UT_HOSTSIZE` NUL bytes).

3. The `ut_tv` shall be set to the current time of day.

4. The `ut_type` field shall be set to `DEAD_PROCESS`.

Return Value

On success, the `logout()` function shall return non-zero. Zero is returned if there was no entry to remove, or if the utmp file could not be opened or updated.

logwtmp

Name

logwtmp — append an entry to the wtmp file

Synopsis

```
#include <utmp.h>
void logwtmp (const char * line , const char * name , const char *
host );
```

Description

If the process has permission to update the user accounting databases, the logwtmp() function shall append a record to the user accounting database that records all logins and logouts. The record to be appended shall be constructed as follows:

1. The ut_line field shall be initialized from *line*. If the user accounting database imposes a limit on the size of the *ut_line* field, it shall truncate the value, but any such limit shall not be smaller than UT_LINESIZE (including a terminating null character).

2. The ut_name field shall be initialized from *name*. If the user accounting database imposes a limit on the size of the *ut_name* field, it shall truncate the value, but any such limit shall not be smaller than UT_NAMESIZE (including a terminating null character).

3. The ut_host field shall be initialized from *host*. If the user accounting database imposes a limit on the size of the *ut_host* field, it shall truncate the value, but any such limit shall not be smaller than UT_HOSTSIZE (including a terminating null character).

4. If the *name* parameter does not refer to an empty string (i.e. ""), the ut_type field shall be set to USER_PROCESS; otherwise the ut_type field shall be set to DEAD_PROCESS.

5. The ut_id field shall be set to the process identifier for the current process.

6. The ut_tv field shall be set to the current time of day.

    Note: If a process does not have write access to the the user accounting database, the logwtmp() function will not update it. Since the function does not return any value, an application has no way of knowing whether it succeeded or failed.

Return Value

None.

openpty

Name

openpty — find and open an available pseudo-terminal

Synopsis

```
#include <pty.h>
int openpty(int *amaster, int *aslave, char *name, const struct
termios *termp, const struct winsize *winp);
```

Description

The openpty() function shall find an available pseudo-terminal and return file descriptors for the master and slave devices in the locations referenced by *amaster* and *aslave* respectively. If *name* is not NULL, the filename of the slave shall be placed in the user supplied buffer referenced by *name*. If *termp* is not NULL, it shall point to a termios structure used to initialize the terminal parameters of the slave pseudo-terminal device. If *winp* is not NULL, it shall point to a winsize structure used to initialize the window size parameters of the slave pseudo-terminal device.

Return Value

On success, zero is returned. On error, -1 is returned, and errno is set appropriately.

Errors

ENOENT

There are no available pseudo-terminals.

V Network Security Services

14 Libraries

14.1 Interfaces for libnspr4

Table 14-1 defines the library name and shared object name for the libnspr4 library

Table 14-1 libnspr4 Definition

Library:	libnspr4
SONAME:	libnspr4.so

The behavior of the interfaces in this library is specified by the following specifications:

 [NSPR] NSPR Reference

14.1.1 Netscape Portable Runtime

14.1.1.1 Interfaces for Netscape Portable Runtime

An LSB conforming implementation shall provide the generic functions for Netscape Portable Runtime specified in Table 14-2, with the full mandatory functionality as described in the referenced underlying specification.

Table 14-2 libnspr4 - Netscape Portable Runtime Function Interfaces

PR_Accept [NSPR]	PR_Bind [NSPR]	PR_Cleanup [NSPR]
PR_Close [NSPR]	PR_Connect [NSPR]	PR_CreateIOLayerStub [NSPR]
PR_EnumerateAddrInfo [NSPR]	PR_FreeAddrInfo [NSPR]	PR_GetAddrInfoByName [NSPR]
PR_GetDefaultIOMethods [NSPR]	PR_GetError [NSPR]	PR_GetLayersIdentity [NSPR]
PR_GetSocketOption [NSPR]	PR_GetUniqueIdentity [NSPR]	PR_ImportTCPSocket [NSPR]
PR_Interrupt [NSPR]	PR_Listen [NSPR]	PR_MillisecondsToInterval [NSPR]
PR_NetAddrToString [NSPR]	PR_Now [NSPR]	PR_OpenTCPSocket [NSPR]
PR_OpenUDPSocket [NSPR]	PR_Poll [NSPR]	PR_PopIOLayer [NSPR]
PR_PushIOLayer [NSPR]	PR_Read [NSPR]	PR_Recv [NSPR]
PR_RecvFrom [NSPR]	PR_SecondsToInterval [NSPR]	PR_Send [NSPR]
PR_SendTo [NSPR]	PR_SetError [NSPR]	PR_SetSocketOption [NSPR]
PR_Shutdown [NSPR]	PR_StringToNetAddr	PR_Write [NSPR]

	[NSPR]	

14.2 Data Definitions for libnspr4

This section defines global identifiers and their values that are associated with interfaces contained in libnspr4. These definitions are organized into groups that correspond to system headers. This convention is used as a convenience for the reader, and does not imply the existence of these headers, or their content. Where an interface is defined as requiring a particular system header file all of the data definitions for that system header file presented here shall be in effect.

This section gives data definitions to promote binary application portability, not to repeat source interface definitions available elsewhere. System providers and application developers should use this ABI to supplement - not to replace - source interface definition specifications.

This specification uses the ISO C (1999) C Language as the reference programming language, and data definitions are specified in ISO C format. The C language is used here as a convenient notation. Using a C language description of these data objects does not preclude their use by other programming languages.

14.2.1 nspr4/nspr.h

```
#define nspr_h___
```

14.2.2 nspr4/plarena.h

```
#define plarena_h___

typedef struct PLArenaPool {
    struct PLArena first;
    struct PLArena *current;
    PRUint32 arenasize;
    PRUword mask;
} PLArenaPool;
struct PLArena {
    struct PLArena *next;
    PRUword base;
    PRUword limit;
    PRUword avail;
};
```

14.2.3 nspr4/plhash.h

```
#define plhash_h___

typedef PRUint32 PLHashNumber;
typedef PRIntn(*PLHashComparator) (const void *, const void *);
typedef struct PLHashAllocOps {
    void *(*allocTable) (void *, PRSize);
    void (*freeTable) (void *, void *);
    struct PLHashEntry *(*allocEntry) (void *, const void *);
    void (*freeEntry) (void *, struct PLHashEntry *, PRUintn);
} PLHashAllocOps;
typedef PLHashNumber(*PLHashFunction) (const void *);
struct PLHashEntry {
    struct PLHashEntry *next;
    PLHashNumber keyHash;
```

```
    const void *key;
    void *value;
};
struct PLHashTable {
    struct PLHashEntry **buckets;
    PRUint32 nentries;
    PRUint32 shift;
    PLHashFunction keyHash;
    PLHashComparator keyCompare;
    PLHashComparator valueCompare;
    const PLHashAllocOps *allocOps;
    void *allocPriv;
};
```

14.2.4 nspr4/prclist.h

```
#define prclist_h___

typedef struct PRCListStr {
    PRCList *next;
    PRCList *prev;
} PRCList;
```

14.2.5 nspr4/prerror.h

```
#define prerror_h___

typedef PRInt32 PRErrorCode;
extern PRErrorCode PR_GetError(void);
extern void PR_SetError(PRErrorCode errorCode, PRInt32 oserr);
```

14.2.6 nspr4/prinit.h

```
#define prinit_h___

extern PRStatus PR_Cleanup(void);
```

14.2.7 nspr4/prinrval.h

```
#define prinrval_h

typedef PRUint32 PRIntervalTime;
extern PRIntervalTime PR_MillisecondsToInterval(PRUint32 milli);
extern PRIntervalTime PR_SecondsToInterval(PRUint32 seconds);
```

14.2.8 nspr4/prio.h

```
#define prio_h___

typedef enum PRDescType {
    PR_DESC_FILE = 1,
    PR_DESC_SOCKET_TCP = 2,
    PR_DESC_SOCKET_UDP = 3,
    PR_DESC_LAYERED = 4,
    PR_DESC_PIPE = 5
} PRDescType;
typedef struct PRIPv6Addr {
    union {
        PRUint8 _S6_u8[15];
        PRUint16 _S6_u16[7];
```

```
        PRUint32 _S6_u32[3];
        PRUint64 _S6_u64[1];
    } _S6_un;
} PRIPv6Addr;
typedef enum PRTransmitFileFlags {
    PR_TRANSMITFILE_KEEP_OPEN,
    PR_TRANSMITFILE_CLOSE_SOCKET = 1
} PRTransmitFileFlags;
typedef struct PRLinger {
    PRBool polarity;
    PRIntervalTime linger;
} PRLinger;
typedef struct PRFilePrivate PRFilePrivate;
typedef struct PRFileDesc {
    const struct PRIOMethods *methods;
    PRFilePrivate *secret;
    PRFileDesc *lower;
    PRFileDesc *higher;
    void (*dtor) (PRFileDesc *);
    PRDescIdentity identity;
} PRFileDesc;
typedef union PRNetAddr {
    struct {
        PRUint16 family;
        char data[14];
    } raw;
    struct {
        PRUint16 family;
        PRUint16 port;
        PRUint32 ip;
        char pad[7];
    } inet;
    struct {
        PRUint16 family;
        PRUint16 port;
        PRUint32 flowinfo;
        PRIPv6Addr ip;
        PRUint32 scope_id;
    } ipv6;
    struct {
        PRUint16 family;
        char path[103];
    } local;
} PRNetAddr;
typedef struct PRMcastRequest {
    union PRNetAddr mcaddr;
    union PRNetAddr ifaddr;
} PRMcastRequest;
typedef struct PRIOVec {
    char *iov_base;
    int iov_len;
} PRIOVec;
typedef struct PRSocketOptionData {
    PRSockOption option;
    union {
        PRUintn ip_ttl;
        PRUintn mcast_ttl;
        PRUintn tos;
        PRBool non_blocking;
        PRBool reuse_addr;
        PRBool keep_alive;
        PRBool mcast_loopback;
        PRBool no_delay;
        PRBool broadcast;
        PRSize max_segment;
        PRSize recv_buffer_size;
```

```
            PRSize send_buffer_size;
            PRLinger linger;
            PRMcastRequest add_member;
            PRMcastRequest drop_member;
            union PRNetAddr mcast_if;
        } value;
    } PRSocketOptionData;
    typedef PRStatus(*PRFsyncFN) (PRFileDesc *);
    typedef PRStatus(*PRListenFN) (PRFileDesc *, PRIntn);
    typedef enum PRSeekWhence {
        PR_SEEK_SET,
        PR_SEEK_CUR = 1,
        PR_SEEK_END = 2
    } PRSeekWhence;
    typedef PRInt32(*PRAcceptreadFN) (PRFileDesc *, PRFileDesc * *,
                                      PRNetAddr * *, void *, PRInt32,
                                      PRIntervalTime);
    typedef PRStatus(*PRCloseFN) (PRFileDesc *);
    typedef PRInt32(*PRTransmitfileFN) (PRFileDesc *, PRFileDesc *,
                                        const void *, PRInt32,
                                        PRTransmitFileFlags,
    PRIntervalTime);
    typedef enum PRSockOption {
        PR_SockOpt_Nonblocking,
        PR_SockOpt_Linger = 1,
        PR_SockOpt_Reuseaddr = 2,
        PR_SockOpt_Keepalive = 3,
        PR_SockOpt_RecvBufferSize = 4,
        PR_SockOpt_SendBufferSize = 5,
        PR_SockOpt_IpTimeToLive = 6,
        PR_SockOpt_IpTypeOfService = 7,
        PR_SockOpt_AddMember = 8,
        PR_SockOpt_DropMember = 9,
        PR_SockOpt_McastInterface = 10,
        PR_SockOpt_McastTimeToLive = 11,
        PR_SockOpt_McastLoopback = 12,
        PR_SockOpt_NoDelay = 13,
        PR_SockOpt_MaxSegment = 14,
        PR_SockOpt_Broadcast = 15,
        PR_SockOpt_Last = 16
    } PRSockOption;
    typedef PRFileDesc *(*PRAcceptFN) (PRFileDesc *, PRNetAddr *,
                                       PRIntervalTime);
    typedef PRStatus(*PRConnectcontinueFN) (PRFileDesc *, PRInt16);
    typedef PRInt32(*PRReadFN) (PRFileDesc *, void *, PRInt32);
    typedef struct PRFileInfo64 {
        PRFileType type;
        PROffset64 size;
        PRTime creationTime;
        PRTime modifyTime;
    } PRFileInfo64;
    typedef PRStatus(*PRGetsocketoptionFN) (PRFileDesc *,
                                            PRSocketOptionData *);
    typedef  PRInt32(*PRSendtoFN)  (PRFileDesc  *,  const  void  *,
    PRInt32, PRIntn,
                                    const PRNetAddr *, PRIntervalTime);
    typedef PRStatus(*PRGetsocknameFN) (PRFileDesc *, PRNetAddr *);
    typedef PRInt32(*PRSendFN) (PRFileDesc *, const void *, PRInt32,
    PRIntn,
                                PRIntervalTime);
    typedef  PROffset32(*PRSeekFN)  (PRFileDesc  *,  PROffset32,
    PRSeekWhence);
    typedef PRInt64(*PRAvailable64FN) (PRFileDesc *);
    typedef PRInt32(*PRAvailableFN) (PRFileDesc *);
    typedef struct PRFileInfo {
        PRFileType type;
```

```
    PROffset32 size;
    PRTime creationTime;
    PRTime modifyTime;
} PRFileInfo;
typedef  PROffset64(*PRSeek64FN)  (PRFileDesc  *,  PROffset64,
PRSeekWhence);
typedef PRStatus(*PRSetsocketoptionFN) (PRFileDesc *,
                                         const    PRSocketOptionData
*);
typedef  PRInt32(*PRRecvFN) (PRFileDesc  *,  void  *,  PRInt32,
PRIntn,
                                PRIntervalTime);
typedef struct PRSendFileData {
    PRFileDesc *fd;
    PRUint32 file_offset;
    PRSize file_nbytes;
    const void *header;
    PRInt32 hlen;
    const void *trailer;
    PRInt32 tlen;
} PRSendFileData;
typedef PRIntn PRDescIdentity;
typedef PRStatus(*PRConnectFN) (PRFileDesc *, const PRNetAddr *,
                                PRIntervalTime);
typedef PRInt32(*PRSendfileFN) (PRFileDesc *, PRSendFileData *,
                                PRTransmitFileFlags,
PRIntervalTime);
typedef  PRInt32(*PRRecvfromFN) (PRFileDesc  *,  void  *,  PRInt32,
PRIntn,
                                PRNetAddr *, PRIntervalTime);
typedef struct PRPollDesc {
    PRFileDesc *fd;
    PRInt16 in_flags;
    PRInt16 out_flags;
} PRPollDesc;
typedef  PRInt32(*PRWriteFN)  (PRFileDesc  *,  const   void   *,
PRInt32);
typedef PRStatus(*PRFileInfo64FN) (PRFileDesc *, PRFileInfo64 *);
typedef PRStatus(*PRShutdownFN) (PRFileDesc *, PRIntn);
typedef PRIntn(*PRReservedFN) (PRFileDesc *);
typedef PRStatus(*PRFileInfoFN) (PRFileDesc *, PRFileInfo *);
typedef  PRInt32(*PRWritevFN)  (PRFileDesc  *,  const  PRIOVec  *,
PRInt32,
                                PRIntervalTime);
typedef enum PRFileType {
    PR_FILE_FILE = 1,
    PR_FILE_DIRECTORY = 2,
    PR_FILE_OTHER = 3
} PRFileType;
typedef PRStatus(*PRBindFN) (PRFileDesc *, const PRNetAddr *);
typedef PRInt16(*PRPollFN) (PRFileDesc *, PRInt16, PRInt16 *);
struct PRIOMethods {
    PRDescType file_type;
    PRCloseFN close;
    PRReadFN read;
    PRWriteFN write;
    PRAvailableFN available;
    PRAvailable64FN available64;
    PRFsyncFN fsync;
    PRSeekFN seek;
    PRSeek64FN seek64;
    PRFileInfoFN fileInfo;
    PRFileInfo64FN fileInfo64;
    PRWritevFN writev;
    PRConnectFN connect;
    PRAcceptFN accept;
```

```
        PRBindFN bind;
        PRListenFN listen;
        PRShutdownFN shutdown;
        PRRecvFN recv;
        PRSendFN send;
        PRRecvfromFN recvfrom;
        PRSendtoFN sendto;
        PRPollFN poll;
        PRAcceptreadFN acceptread;
        PRTransmitfileFN transmitfile;
        PRGetsocknameFN getsockname;
        PRGetpeernameFN getpeername;
        PRReservedFN reserved_fn_6;
        PRReservedFN reserved_fn_5;
        PRGetsocketoptionFN getsocketoption;
        PRSetsocketoptionFN setsocketoption;
        PRSendfileFN sendfile;
        PRConnectcontinueFN connectcontinue;
        PRReservedFN reserved_fn_3;
        PRReservedFN reserved_fn_2;
        PRReservedFN reserved_fn_1;
        PRReservedFN reserved_fn_0;
    };
    typedef PRStatus(*PRGetpeernameFN) (PRFileDesc *, PRNetAddr *);
    typedef enum PRShutdownHow {
        PR_SHUTDOWN_RCV,
        PR_SHUTDOWN_SEND = 1,
        PR_SHUTDOWN_BOTH = 2
    } PRShutdownHow;
    extern PRFileDesc *PR_Accept(PRFileDesc * fd, PRNetAddr * addr,
                                PRIntervalTime timeout);
    extern PRStatus PR_Bind(PRFileDesc * fd, const PRNetAddr * addr);
    extern PRStatus PR_Close(PRFileDesc * fd);
    extern  PRStatus  PR_Connect(PRFileDesc *  fd, const  PRNetAddr  *
    addr,
                                PRIntervalTime timeout);
    extern PRFileDesc *PR_CreateIOLayerStub(PRDescIdentity ident,
                                            const    struct    PRIOMethods
        *methods);
    extern const struct PRIOMethods *PR_GetDefaultIOMethods(void);
    extern PRDescIdentity PR_GetLayersIdentity(PRFileDesc * fd);
    extern PRStatus PR_GetSocketOption(PRFileDesc * fd,
                                    PRSocketOptionData * data);
    extern     PRDescIdentity     PR_GetUniqueIdentity(const     char
    *layer_name);
    extern PRStatus PR_Listen(PRFileDesc * fd, PRIntn backlog);
    extern PRFileDesc *PR_OpenTCPSocket(PRIntn af);
    extern PRFileDesc *PR_OpenUDPSocket(PRIntn af);
    extern PRInt32 PR_Poll(PRPollDesc * pds, PRIntn npds,
                        PRIntervalTime timeout);
    extern    PRFileDesc    *PR_PopIOLayer(PRFileDesc   *    fd_stack,
    PRDescIdentity id);
    extern     PRStatus     PR_PushIOLayer(PRFileDesc     *     fd_stack,
    PRDescIdentity id,
                                    PRFileDesc * layer);
    extern  PRInt32  PR_Read(PRFileDesc  *  fd,  void *buf,  PRInt32
    amount);
    extern  PRInt32  PR_Recv(PRFileDesc  *  fd,  void *buf,  PRInt32
    amount,
                            PRIntn flags, PRIntervalTime timeout);
    extern PRInt32 PR_RecvFrom(PRFileDesc * fd, void *buf, PRInt32
    amount,
                                PRIntn flags, PRNetAddr * addr,
                                PRIntervalTime timeout);
    extern PRInt32 PR_Send(PRFileDesc * fd, const void *buf, PRInt32
    amount,
```

```
                              PRIntn flags, PRIntervalTime timeout);
extern  PRInt32  PR_SendTo(PRFileDesc  *  fd,  const  void  *buf,
PRInt32 amount,
                         PRIntn flags, const PRNetAddr * addr,
                         PRIntervalTime timeout);
extern PRStatus PR_SetSocketOption(PRFileDesc * fd,
                                  const    PRSocketOptionData   *
data);
extern PRStatus PR_Shutdown(PRFileDesc * fd, PRShutdownHow how);
extern PRInt32 PR_Write(PRFileDesc * fd, const void *buf, PRInt32
amount);
```

14.2.9 nspr4/private/pprio.h

```
#define pprio_h___

typedef PRInt32 PROsfd;
extern PRFileDesc *PR_ImportTCPSocket(PROsfd osfd);
```

14.2.10 nspr4/prlock.h

```
#define prlock_h___

typedef struct PRLock PRLock;
```

14.2.11 nspr4/prmon.h

```
#define prmon_h___

typedef struct PRMonitor PRMonitor;
```

14.2.12 nspr4/prnetdb.h

```
#define prnetdb_h___

typedef struct PRHostEnt {
    char *h_name;
    char **h_aliases;
    PRInt32 h_addrtype;
    PRInt32 h_length;
    char **h_addr_list;
} PRHostEnt;
typedef struct PRAddrInfo PRAddrInfo;
extern void *PR_EnumerateAddrInfo(void *enumPtr,
                                 const PRAddrInfo * addrInfo,
                                 PRUint16  port,  PRNetAddr  *
result);
extern void PR_FreeAddrInfo(PRAddrInfo * addrInfo);
extern  PRAddrInfo  *PR_GetAddrInfoByName(const  char  *hostname,
PRUint16 af,
                                         PRIntn flags);
extern PRStatus PR_NetAddrToString(const PRNetAddr * addr, char
*string,
                                  PRUint32 size);
extern PRStatus PR_StringToNetAddr(const char *string, PRNetAddr
* addr);
```

14.2.13 nspr4/prthread.h

```
#define prthread_h___
```

```
typedef struct PRThread PRThread;
extern PRStatus PR_Interrupt(PRThread * thread);
```

14.2.14 nspr4/prtime.h

```
#define prtime_h___

typedef PRInt64 PRTime;
extern PRTime PR_Now(void);
```

14.2.15 nspr4/prtypes.h

```
#define prtypes_h___

typedef int PRInt32;
typedef unsigned long int PRUword;
typedef int PRIntn;
typedef unsigned long int PRUint64;
typedef unsigned char PRUint8;
typedef short int PRInt16;
typedef long int PRInt64;
typedef PRIntn PRBool;
typedef unsigned short PRUint16;
typedef unsigned int PRUint32;
typedef size_t PRSize;
typedef unsigned int PRUintn;
typedef PRInt64 PROffset64;
typedef PRInt32 PROffset32;
typedef enum {
    PR_FAILURE = -1,
    PR_SUCCESS
} PRStatus;
```

14.3 Interfaces for libnss3

Table 14-3 defines the library name and shared object name for the libnss3 library

Table 14-3 libnss3 Definition

Library:	libnss3
SONAME:	libnss3.so

The behavior of the interfaces in this library is specified by the following speci-fications:

 [NSS SSL] Mozilla's NSS SSL Reference

14.3.1 NSS Utility

14.3.1.1 Interfaces for NSS Utility

An LSB conforming implementation shall provide the generic functions for NSS Utility specified in Table 14-4, with the full mandatory functionality as described in the referenced underlying specification.

Table 14-4 libnss3 - NSS Utility Function Interfaces

CERT_CheckCertValid	CERT_DestroyCertificat	CERT_DupCertificate(

Times(NSS_3.2) [NSS SSL]	e(NSS_3.2) [NSS SSL]	NSS_3.2) [NSS SSL]
CERT_FreeNicknames(NSS_3.2) [NSS SSL]	CERT_GetCertNicknam es(NSS_3.2) [NSS SSL]	CERT_GetDefaultCertD B(NSS_3.2) [NSS SSL]
CERT_VerifyCertName (NSS_3.2) [NSS SSL]	CERT_VerifyCertNow(NSS_3.2) [NSS SSL]	NSS_Init(NSS_3.2) [NSS SSL]
NSS_InitReadWrite(NS S_3.2) [NSS SSL]	NSS_NoDB_Init(NSS_3. 2) [NSS SSL]	NSS_Shutdown(NSS_3. 2) [NSS SSL]
PK11_FindCertFromNic kname(NSS_3.2) [NSS SSL]	PK11_FindKeyByAnyC ert(NSS_3.2) [NSS SSL]	PK11_GetSlotName(NS S_3.2) [NSS SSL]
PK11_GetTokenName(NSS_3.2) [NSS SSL]	PK11_IsHW(NSS_3.2) [NSS SSL]	PK11_IsPresent(NSS_3. 2) [NSS SSL]
PK11_IsReadOnly(NSS _3.2) [NSS SSL]	PK11_SetPasswordFunc (NSS_3.2) [NSS SSL]	SECKEY_DestroyPrivat eKey(NSS_3.2) [NSS SSL]

14.4 Data Definitions for libnss3

This section defines global identifiers and their values that are associated with interfaces contained in libnss3. These definitions are organized into groups that correspond to system headers. This convention is used as a convenience for the reader, and does not imply the existence of these headers, or their content. Where an interface is defined as requiring a particular system header file all of the data definitions for that system header file presented here shall be in effect.

This section gives data definitions to promote binary application portability, not to repeat source interface definitions available elsewhere. System providers and application developers should use this ABI to supplement - not to replace - source interface definition specifications.

This specification uses the ISO C (1999) C Language as the reference programming language, and data definitions are specified in ISO C format. The C language is used here as a convenient notation. Using a C language description of these data objects does not preclude their use by other programming languages.

14.4.1 nss3/blapit.h

```
#define _BLAPIT_H_
#define PQG_PBITS_TO_INDEX(bits)          \
   (((bits) < 512 || (bits) > 1024 || (bits) % 64) ? -1 : \
 (int)((bits)-512)/64)
#define PQG_INDEX_TO_PBITS(j)    \
   (((unsigned)(j) > 8) ? -1 : (512 + 64 * (j)))
#define NSS_AES 0
#define NSS_DES 0
#define NSS_RC2 0
#define NSS_RC5 0
#define NSS_AES_CBC     1
#define NSS_DES_CBC     1
#define NSS_RC2_CBC     1
#define NSS_RC5_CBC     1
#define DSA_MAX_P_BITS  1024
```

```
#define DH_MIN_P_BITS   128
#define RSA_MIN_MODULUS_BITS     128
#define AES_BLOCK_SIZE 16
#define DSA_Q_BITS      160
#define NSS_DES_EDE3    2
#define DSA_SUBPRIME_LEN        20
#define NSS_FREEBL_DEFAULT_CHUNKSIZE    2048
#define DH_MAX_P_BITS   2236
#define NSS_DES_EDE3_CBC        3
#define DSA_SIGNATURE_LEN       40
#define DSA_MIN_P_BITS 512
#define AES_KEY_WRAP_BLOCK_SIZE 8
#define AES_KEY_WRAP_IV_BYTES   8
#define DES_KEY_LENGTH 8

typedef struct PQGParamsStr {
    PLArenaPool *arena;
    SECItem prime;
    SECItem subPrime;
    SECItem base;
} PQGParams;
typedef struct PQGVerifyStr {
    PLArenaPool *arena;
    unsigned int counter;
    SECItem seed;
    SECItem h;
} PQGVerify;
```

14.4.2 nss3/cert.h

```
#define _CERT_H_

extern                                          SECCertTimeValidity
CERT_CheckCertValidTimes(CERTCertificate * cert,
                                                    PRTime t,
                                                    PRBool
allowOverride);
extern void CERT_DestroyCertificate(CERTCertificate * cert);
extern CERTCertificate *CERT_DupCertificate(CERTCertificate * c);
extern void CERT_FreeNicknames(CERTCertNicknames * nicknames);
extern  CERTCertNicknames  *CERT_GetCertNicknames(CERTCertDBHandle
* handle,
                                                    int    what,   void
*wincx);
extern CERTCertDBHandle *CERT_GetDefaultCertDB(void);
extern SECStatus CERT_VerifyCertName(CERTCertificate * cert,
                                    const char *hostname);
extern SECStatus CERT_VerifyCertNow(CERTCertDBHandle * handle,
                                    CERTCertificate * cert,
                                    PRBool checkSig,
                                    SECCertUsage  certUsage,  void
*wincx);
```

14.4.3 nss3/certt.h

```
#define _CERTT_H_
#define NS_CERT_TYPE_CA  \
        ( NS_CERT_TYPE_SSL_CA | NS_CERT_TYPE_EMAIL_CA | \
        NS_CERT_TYPE_OBJECT_SIGNING_CA                          |
EXT_KEY_USAGE_STATUS_RESPONDER )
#define NS_CERT_TYPE_APP          \
        ( NS_CERT_TYPE_SSL_CLIENT | NS_CERT_TYPE_SSL_SERVER | \
        NS_CERT_TYPE_EMAIL | NS_CERT_TYPE_OBJECT_SIGNING )
#define SEC_GET_TRUST_FLAGS(trust,type)  \
```

```
        (((type)==trustSSL)?((trust)->sslFlags): \
        (((type)==trustEmail)?((trust)->emailFlags): \
        (((type)==trustObjectSigning)?((trust)-
>objectSigningFlags):0)))
#define KU_ALL   \
        (KU_DIGITAL_SIGNATURE      |      KU_NON_REPUDIATION      |
KU_KEY_ENCIPHERMENT | \
        KU_DATA_ENCIPHERMENT      |      KU_KEY_AGREEMENT      |
KU_KEY_CERT_SIGN | \
        KU_CRL_SIGN)
#define CERT_LIST_END(n,l)          (((void *)n) == ((void *)&l-
>list))
#define  CERT_LIST_NEXT(n)                  ((CERTCertListNode *)n-
>links.next)
#define   CERT_LIST_HEAD(l)                        ((CERTCertListNode
*)PR_LIST_HEAD(&l->list))
#define certificateUsageSSLClient      (0x0001)
#define certificateUsageSSLServer      (0x0002)
#define certificateUsageSSLServerWithStepUp    (0x0004)
#define certificateUsageSSLCA    (0x0008)
#define certificateUsageEmailSigner    (0x0010)
#define certificateUsageEmailRecipient (0x0020)
#define certificateUsageObjectSigner   (0x0040)
#define certificateUsageUserCertImport (0x0080)
#define NS_CERT_TYPE_OBJECT_SIGNING_CA (0x01)
#define certificateUsageVerifyCA       (0x0100)
#define KU_CRL_SIGN     (0x02)
#define NS_CERT_TYPE_EMAIL_CA    (0x02)
#define RF_CERTIFICATE_HOLD      (0x02)
#define certificateUsageProtectedObjectSigner   (0x0200)
#define KU_KEY_CERT_SIGN         (0x04)
#define NS_CERT_TYPE_SSL_CA      (0x04)
#define RF_CESSATION_OF_OPERATION      (0x04)
#define certificateUsageStatusResponder (0x0400)
#define KU_KEY_AGREEMENT         (0x08)
#define NS_CERT_TYPE_RESERVED    (0x08)
#define RF_SUPERSEDED    (0x08)
#define certificateUsageAnyCA    (0x0800)
#define KU_DATA_ENCIPHERMENT     (0x10)
#define NS_CERT_TYPE_OBJECT_SIGNING    (0x10)
#define RF_AFFILIATION_CHANGED   (0x10)
#define KU_KEY_ENCIPHERMENT      (0x20)
#define NS_CERT_TYPE_EMAIL       (0x20)
#define RF_CA_COMPROMISE         (0x20)
#define KU_NON_REPUDIATION       (0x40)
#define NS_CERT_TYPE_SSL_SERVER (0x40)
#define RF_KEY_COMPROMISE        (0x40)
#define EXT_KEY_USAGE_STATUS_RESPONDER  (0x4000)
#define KU_KEY_AGREEMENT_OR_ENCIPHERMENT        (0x4000)
#define KU_DIGITAL_SIGNATURE     (0x80)
#define NS_CERT_TYPE_SSL_CLIENT (0x80)
#define RF_UNUSED       (0x80)
#define EXT_KEY_USAGE_TIME_STAMP       (0x8000)
#define KU_NS_GOVT_APPROVED     (0x8000)
#define CERT_UNLIMITED_PATH_CONSTRAINT -2
#define SEC_CERTIFICATE_REQUEST_VERSION 0
#define SEC_CERTIFICATE_VERSION_1        0
#define SEC_CRL_VERSION_1       0
#define SEC_CERTIFICATE_VERSION_2       1
#define SEC_CERT_CLASS_CA       1
#define SEC_CERT_NICKNAMES_ALL  1
#define SEC_CRL_VERSION_2       1
#define SEC_CERTIFICATE_VERSION_3       2
#define SEC_CERT_CLASS_SERVER   2
#define SEC_CERT_NICKNAMES_USER 2
#define CERT_MAX_CERT_CHAIN     20
```

```
#define SEC_CERT_CLASS_USER      3
#define SEC_CERT_NICKNAMES_SERVER        3
#define SEC_CERT_CLASS_EMAIL     4
#define SEC_CERT_NICKNAMES_CA    4
#define certificateUsageHighest certificateUsageAnyCA
#define CERT_LIST_EMPTY(l)       CERT_LIST_END(CERT_LIST_HEAD(l),
l)


typedef struct CERTAVAStr {
    SECItem type;
    SECItem value;
} CERTAVA;
typedef struct CERTAttributeStr {
    SECItem attrType;
    SECItem **attrValue;
} CERTAttribute;
typedef struct CERTAuthInfoAccessStr {
    SECItem method;
    SECItem derLocation;
    CERTGeneralName *location;
} CERTAuthInfoAccess;
typedef struct CERTAuthKeyIDStr {
    SECItem keyID;
    CERTGeneralName *authCertIssuer;
    SECItem authCertSerialNumber;
    SECItem **DERAuthCertIssuer;
} CERTAuthKeyID;
typedef struct CERTBasicConstraintsStr {
    PRBool isCA;
    int pathLenConstraint;
} CERTBasicConstraints;
typedef struct NSSTrustDomainStr CERTCertDBHandle;
typedef struct CERTCertExtensionStr {
    SECItem id;
    SECItem critical;
    SECItem value;
} CERTCertExtension;
typedef struct CERTCertListStr {
    PRCList list;
    PLArenaPool *arena;
} CERTCertList;
typedef struct CERTCertListNodeStr {
    PRCList links;
    CERTCertificate *cert;
    void *appData;
} CERTCertListNode;
typedef struct CERTCertNicknamesStr {
    PLArenaPool *arena;
    void *head;
    int numnicknames;
    char **nicknames;
    int what;
    int totallen;
} CERTCertNicknames;
typedef struct CERTCertTrustStr {
    unsigned int sslFlags;
    unsigned int emailFlags;
    unsigned int objectSigningFlags;
} CERTCertTrust;
typedef struct CERTSignedDataStr {
    SECItem data;
    SECAlgorithmID signatureAlgorithm;
    SECItem signature;
} CERTSignedData;
typedef struct CERTCertificateListStr {
    SECItem *certs;
```

```
        int len;
        PLArenaPool *arena;
} CERTCertificateList;
typedef struct CERTNameStr {
        PLArenaPool *arena;
        CERTRDN **rdns;
} CERTName;
typedef struct CERTCrlStr {
        PLArenaPool *arena;
        SECItem version;
        SECAlgorithmID signatureAlg;
        SECItem derName;
        CERTName name;
        SECItem lastUpdate;
        SECItem nextUpdate;
        CERTCrlEntry **entries;
        CERTCertExtension **extensions;
} CERTCrl;
typedef struct CERTCrlDistributionPointsStr {
        CRLDistributionPoint **distPoints;
} CERTCrlDistributionPoints;
typedef struct CERTCrlEntryStr {
        SECItem serialNumber;
        SECItem revocationDate;
        CERTCertExtension **extensions;
} CERTCrlEntry;
typedef struct CERTCrlHeadNodeStr {
        PLArenaPool *arena;
        CERTCertDBHandle *dbhandle;
        CERTCrlNode *first;
        CERTCrlNode *last;
} CERTCrlHeadNode;
typedef struct CERTCrlNodeStr {
        CERTCrlNode *next;
        int type;
        CERTSignedCrl *crl;
} CERTCrlNode;
typedef struct CERTDistNamesStr {
        PLArenaPool *arena;
        int nnames;
        SECItem *names;
        void *head;
} CERTDistNames;
typedef struct OtherNameStr {
        SECItem name;
        SECItem oid;
} OtherName;
typedef struct CERTGeneralNameListStr {
        PLArenaPool *arena;
        CERTGeneralName *name;
        int refCount;
        int len;
        PRLock *lock;
} CERTGeneralNameList;
typedef struct CERTIssuerAndSNStr {
        SECItem derIssuer;
        CERTName issuer;
        SECItem serialNumber;
} CERTIssuerAndSN;
typedef struct CERTSubjectPublicKeyInfoStr {
        PLArenaPool *arena;
        SECAlgorithmID algorithm;
        SECItem subjectPublicKey;
} CERTSubjectPublicKeyInfo;
typedef struct CERTGeneralNameStr {
        CERTGeneralNameType type;
```

```
            union {
                CERTName directoryName;
                OtherName OthName;
                SECItem other;
            } name;
            SECItem derDirectoryName;
            PRCList l;
    } CERTGeneralName;
    typedef struct CERTNameConstraintsStr {
            CERTNameConstraint *permited;
            CERTNameConstraint *excluded;
            SECItem **DERPermited;
            SECItem **DERExcluded;
    } CERTNameConstraints;
    typedef struct CERTOKDomainNameStr {
            CERTOKDomainName *next;
            char name[1];
    } CERTOKDomainName;
    typedef struct CERTPrivKeyUsagePeriodStr {
            SECItem notBefore;
            SECItem notAfter;
            PLArenaPool *arena;
    } CERTPrivKeyUsagePeriod;
    typedef struct CERTRDNStr {
            CERTAVA **avas;
    } CERTRDN;
    typedef struct CERTSignedCrlStr {
            PLArenaPool *arena;
            CERTCrl crl;
            void *reserved1;
            PRBool reserved2;
            PRBool isperm;
            PRBool istemp;
            int referenceCount;
            CERTCertDBHandle *dbhandle;
            CERTSignedData signatureWrap;
            char *url;
            SECItem *derCrl;
            PK11SlotInfo *slot;
            CK_OBJECT_HANDLE pkcs11ID;
            void *opaque;
    } CERTSignedCrl;
    typedef struct CERTValidityStr {
            PLArenaPool *arena;
            SECItem notBefore;
            SECItem notAfter;
    } CERTValidity;
    typedef struct CERTStatusConfigStr {
            CERTStatusChecker statusChecker;
            CERTStatusDestroy statusDestroy;
            void *statusContext;
    } CERTStatusConfig;
    typedef struct CERTSubjectListStr {
            PLArenaPool *arena;
            int ncerts;
            char *emailAddr;
            CERTSubjectNode *head;
            CERTSubjectNode *tail;
            void *entry;
    } CERTSubjectList;
    typedef struct CERTSubjectNodeStr {
            struct CERTSubjectNodeStr *next;
            struct CERTSubjectNodeStr *prev;
            SECItem certKey;
            SECItem keyID;
    } CERTSubjectNode;
```

```
typedef struct CERTCertificateRequestStr {
    PLArenaPool *arena;
    SECItem version;
    CERTName subject;
    CERTSubjectPublicKeyInfo subjectPublicKeyInfo;
    CERTAttribute **attributes;
} CERTCertificateRequest;
typedef struct CERTCertificateStr {
    PLArenaPool *arena;
    char *subjectName;
    char *issuerName;
    CERTSignedData signatureWrap;
    SECItem derCert;
    SECItem derIssuer;
    SECItem derSubject;
    SECItem derPublicKey;
    SECItem certKey;
    SECItem version;
    SECItem serialNumber;
    SECAlgorithmID signature;
    CERTName issuer;
    CERTValidity validity;
    CERTName subject;
    CERTSubjectPublicKeyInfo subjectPublicKeyInfo;
    SECItem issuerID;
    SECItem subjectID;
    CERTCertExtension **extensions;
    char *emailAddr;
    CERTCertDBHandle *dbhandle;
    SECItem subjectKeyID;
    PRBool keyIDGenerated;
    unsigned int keyUsage;
    unsigned int rawKeyUsage;
    PRBool keyUsagePresent;
    PRUint32 nsCertType;
    PRBool keepSession;
    PRBool timeOK;
    CERTOKDomainName *domainOK;
    PRBool isperm;
    PRBool istemp;
    char *nickname;
    char *dbnickname;
    struct NSSCertificateStr *nssCertificate;
    CERTCertTrust *trust;
    int referenceCount;
    CERTSubjectList *subjectList;
    CERTAuthKeyID *authKeyID;
    PRBool isRoot;
    union {
        void *apointer;
        struct {
            unsigned int hasUnsupportedCriticalExt;
        } bits;
    } options;
    int series;
    PK11SlotInfo *slot;
    CK_OBJECT_HANDLE pkcs11ID;
    PRBool ownSlot;
} CERTCertificate;
typedef struct CERTVerifyLogStr {
    PLArenaPool *arena;
    unsigned int count;
    struct CERTVerifyLogNodeStr *head;
    struct CERTVerifyLogNodeStr *tail;
} CERTVerifyLog;
typedef struct CRLDistributionPointStr {
```

```
        DistributionPointTypes distPointType;
        union {
            CERTGeneralName *fullName;
            CERTRDN relativeName;
        } distPoint;
        SECItem reasons;
        CERTGeneralName *crlIssuer;
        SECItem derDistPoint;
        SECItem derRelativeName;
        SECItem **derCrlIssuer;
        SECItem **derFullName;
        SECItem bitsmap;
    } CRLDistributionPoint;
    typedef enum SECCertUsageEnum {
        certUsageSSLClient,
        certUsageSSLServer = 1,
        certUsageSSLServerWithStepUp = 2,
        certUsageSSLCA = 3,
        certUsageEmailSigner = 4,
        certUsageEmailRecipient = 5,
        certUsageObjectSigner = 6,
        certUsageUserCertImport = 7,
        certUsageVerifyCA = 8,
        certUsageProtectedObjectSigner = 9,
        certUsageStatusResponder = 10,
        certUsageAnyCA = 11
    } SECCertUsage;
    typedef PRInt64 SECCertificateUsage;
    typedef enum SECCertTimeValidityEnum {
        secCertTimeValid,
        secCertTimeExpired = 1,
        secCertTimeNotValidYet = 2,
        secCertTimeUndetermined = 3
    } SECCertTimeValidity;
    typedef enum CERTCompareValidityStatusEnum {
        certValidityUndetermined,
        certValidityChooseB = 1,
        certValidityEqual = 2,
        certValidityChooseA = 3
    } CERTCompareValidityStatus;
    typedef enum CERTGeneralNameTypeEnum {
        certOtherName = 1,
        certRFC822Name = 2,
        certDNSName = 3,
        certX400Address = 4,
        certDirectoryName = 5,
        certEDIPartyName = 6,
        certURI = 7,
        certIPAddress = 8,
        certRegisterID = 9
    } CERTGeneralNameType;
    typedef struct CERTNameConstraintStr {
        CERTGeneralName name;
        SECItem DERName;
        SECItem min;
        SECItem max;
        PRCList l;
    } CERTNameConstraint;
    typedef enum DistributionPointTypesEnum {
        generalName = 1,
        relativeDistinguishedName = 2
    } DistributionPointTypes;
    struct CERTVerifyLogNodeStr {
        CERTCertificate *cert;
        long int error;
        unsigned int depth;
```

```
    void *arg;
    struct CERTVerifyLogNodeStr *next;
    struct CERTVerifyLogNodeStr *prev;
};
typedef SECStatus(*CERTStatusChecker) (CERTCertDBHandle *,
                                       CERTCertificate        *,
PRInt64, void *);
typedef SECStatus(*CERTStatusDestroy) (CERTStatusConfig *);
typedef struct {
    SECOidTag oid;
    SECItem qualifierID;
    SECItem qualifierValue;
} CERTPolicyQualifier;
typedef struct {
    SECOidTag oid;
    SECItem policyID;
    CERTPolicyQualifier **policyQualifiers;
} CERTPolicyInfo;
typedef struct {
    PLArenaPool *arena;
    CERTPolicyInfo **policyInfos;
} CERTCertificatePolicies;
typedef struct {
    SECItem organization;
    SECItem **noticeNumbers;
} CERTNoticeReference;
typedef struct {
    PLArenaPool *arena;
    CERTNoticeReference noticeReference;
    SECItem derNoticeReference;
    SECItem displayText;
} CERTUserNotice;
typedef struct {
    PLArenaPool *arena;
    SECItem **oids;
} CERTOidSequence;
```

14.4.4 nss3/cmsreclist.h

```
#define _CMSRECLIST_H

typedef struct NSSCMSRecipientStr {
    int riIndex;
    int subIndex;
    enum {
        RLIssuerSN,
        RLSubjKeyID = 1
    } kind;
    union {
        CERTIssuerAndSN *issuerAndSN;
        SECItem *subjectKeyID;
    } id;
    CERTCertificate *cert;
    SECKEYPrivateKey *privkey;
    PK11SlotInfo *slot;
} NSSCMSRecipient;
```

14.4.5 nss3/cryptoht.h

```
#define _CRYPTOHT_H_

typedef struct SGNContextStr SGNContext;
typedef struct VFYContextStr VFYContext;
```

14.4.6 nss3/hasht.h

```
#define _HASHT_H_
#define MD2_LENGTH      16
#define MD5_LENGTH      16
#define SHA1_LENGTH     20
#define SHA256_LENGTH   32
#define SHA384_LENGTH   48
#define SHA512_LENGTH   64
#define HASH_LENGTH_MAX SHA512_LENGTH

typedef struct SECHashObjectStr {
    unsigned int length;
    void *(*create) (void);
    void *(*clone) (void *);
    void (*destroy) (void *, PRBool);
    void (*begin) (void *);
    void (*update) (void *, const unsigned char *, unsigned int);
    void (*end) (void *, unsigned char *, unsigned int *,
unsigned int);
    unsigned int blocklength;
    HASH_HashType type;
} SECHashObject;
typedef struct HASHContextStr {
    const struct SECHashObjectStr *hashobj;
    void *hash_context;
} HASHContext;
typedef enum {
    HASH_AlgNULL,
    HASH_AlgMD2 = 1,
    HASH_AlgMD5 = 2,
    HASH_AlgSHA1 = 3,
    HASH_AlgSHA256 = 4,
    HASH_AlgSHA384 = 5,
    HASH_AlgSHA512 = 6,
    HASH_AlgTOTAL = 7
} HASH_HashType;
```

14.4.7 nss3/key.h

```
#define _KEY_H_
```

14.4.8 nss3/keyhi.h

```
#define _KEYHI_H_

extern void SECKEY_DestroyPrivateKey(SECKEYPrivateKey * key);
```

14.4.9 nss3/keyt.h

```
#define _KEYT_H_
```

14.4.10 nss3/keythi.h

```
#define _KEYTHI_H_

typedef enum {
    nullKey,
    rsaKey = 1,
    dsaKey = 2,
```

```
        fortezzaKey = 3,
        dhKey = 4,
        keaKey = 5,
        ecKey = 6
} KeyType;
typedef struct SECKEYRSAPublicKeyStr {
        PLArenaPool *arena;
        SECItem modulus;
        SECItem publicExponent;
} SECKEYRSAPublicKey;
typedef struct SECKEYPQGParamsStr {
        PLArenaPool *arena;
        SECItem prime;
        SECItem subPrime;
        SECItem base;
} SECKEYPQGParams;
typedef struct SECKEYDSAPublicKeyStr {
        SECKEYPQGParams params;
        SECItem publicValue;
} SECKEYDSAPublicKey;
typedef struct SECKEYDHParamsStr {
        PLArenaPool *arena;
        SECItem prime;
        SECItem base;
} SECKEYDHParams;
typedef struct SECKEYDHPublicKeyStr {
        PLArenaPool *arena;
        SECItem prime;
        SECItem base;
        SECItem publicValue;
} SECKEYDHPublicKey;
typedef SECItem SECKEYECParams;
typedef struct SECKEYECPublicKeyStr {
        SECKEYECParams DEREncodedParams;
        int size;
        SECItem publicValue;
} SECKEYECPublicKey;
typedef struct SECKEYFortezzaPublicKeyStr {
        int KEAversion;
        int DSSversion;
        unsigned char KMID[8];
        SECItem clearance;
        SECItem KEApriviledge;
        SECItem DSSpriviledge;
        SECItem KEAKey;
        SECItem DSSKey;
        SECKEYPQGParams params;
        SECKEYPQGParams keaParams;
} SECKEYFortezzaPublicKey;
typedef struct SECKEYKEAParamsStr {
        PLArenaPool *arena;
        SECItem hash;
} SECKEYKEAParams;
typedef struct SECKEYKEAPublicKeyStr {
        SECKEYKEAParams params;
        SECItem publicValue;
} SECKEYKEAPublicKey;
typedef struct SECKEYPublicKeyStr {
        PLArenaPool *arena;
        KeyType keyType;
        PK11SlotInfo *pkcs11Slot;
        CK_OBJECT_HANDLE pkcs11ID;
        union {
                SECKEYRSAPublicKey rsa;
                SECKEYDSAPublicKey dsa;
                SECKEYDHPublicKey dh;
```

```
        SECKEYKEAPublicKey kea;
        SECKEYFortezzaPublicKey fortezza;
        SECKEYECPublicKey ec;
    } u;
} SECKEYPublicKey;
typedef struct SECKEYPrivateKeyStr {
    PLArenaPool *arena;
    KeyType keyType;
    PK11SlotInfo *pkcs11Slot;
    CK_OBJECT_HANDLE pkcs11ID;
    PRBool pkcs11IsTemp;
    void *wincx;
    PRUint32 staticflags;
} SECKEYPrivateKey;
typedef struct {
    PRCList links;
    SECKEYPrivateKey *key;
} SECKEYPrivateKeyListNode;
typedef struct {
    PRCList list;
    PLArenaPool *arena;
} SECKEYPrivateKeyList;
typedef struct {
    PRCList list;
    PLArenaPool *arena;
} SECKEYPublicKeyList;
```

14.4.11 nss3/nss.h

```
#define __nss_h_
#define NSS_INIT_READONLY       0x1
#define NSS_INIT_NOROOTINIT     0x10
#define NSS_INIT_NOPK11FINALIZE 0x100
#define NSS_INIT_NOCERTDB       0x2
#define NSS_INIT_OPTIMIZESPACE  0x20
#define NSS_INIT_RESERVED       0x200
#define NSS_INIT_NOMODDB        0x4
#define NSS_INIT_PK11THREADSAFE 0x40
#define NSS_INIT_FORCEOPEN      0x8
#define NSS_INIT_PK11RELOAD     0x80
#define NSS_VMINOR      11
#define NSS_VMAJOR      3
#define NSS_VERSION     "3.11.4"
#define NSS_VPATCH      4
#define  NSS_INIT_COOPERATE              NSS_INIT_PK11THREADSAFE  |
NSS_INIT_PK11RELOAD | NSS_INIT_NOPK11FINALIZE | NSS_INIT_RESERVED
#define SECMOD_DB       "secmod.db"

extern SECStatus NSS_Init(const char *configdir);
extern SECStatus NSS_InitReadWrite(const char *configdir);
extern SECStatus NSS_NoDB_Init(const char *configdir);
extern SECStatus NSS_Shutdown(void);
```

14.4.12 nss3/nssb64.h

```
#define _NSSB64_H_
```

14.4.13 nss3/nssb64t.h

```
#define _NSSB64T_H_

typedef struct NSSBase64DecoderStr NSSBase64Decoder;
```

```
typedef struct NSSBase64EncoderStr NSSBase64Encoder;
```

14.4.14 nss3/nssilckt.h

```
#define _NSSILCKT_H_

typedef enum {
    nssILockArena,
    nssILockSession = 1,
    nssILockObject = 2,
    nssILockRefLock = 3,
    nssILockCert = 4,
    nssILockCertDB = 5,
    nssILockDBM = 6,
    nssILockCache = 7,
    nssILockSSL = 8,
    nssILockList = 9,
    nssILockSlot = 10,
    nssILockFreelist = 11,
    nssILockOID = 12,
    nssILockAttribute = 13,
    nssILockPK11cxt = 14,
    nssILockRWLock = 15,
    nssILockOther = 16,
    nssILockSelfServ = 17,
    nssILockKeyDB = 18,
    nssILockLast = 19
} nssILockType;
```

14.4.15 nss3/nssrwlkt.h

```
#define nssrwlkt_h___

typedef struct nssRWLockStr NSSRWLock;
```

14.4.16 nss3/ocspt.h

```
#define _OCSPT_H_

typedef struct CERTOCSPRequestStr CERTOCSPRequest;
typedef struct CERTOCSPResponseStr CERTOCSPResponse;
typedef struct CERTOCSPCertIDStr CERTOCSPCertID;
typedef struct CERTOCSPSingleResponseStr CERTOCSPSingleResponse;
```

14.4.17 nss3/pk11pub.h

```
#define _PK11PUB_H_

extern   CERTCertificate   *PK11_FindCertFromNickname(const   char
*nickname,
                                                void *wincx);
extern SECKEYPrivateKey *PK11_FindKeyByAnyCert(CERTCertificate *
cert,
                                                void *wincx);
extern char *PK11_GetSlotName(PK11SlotInfo * slot);
extern char *PK11_GetTokenName(PK11SlotInfo * slot);
extern PRBool PK11_IsHW(PK11SlotInfo * slot);
extern PRBool PK11_IsPresent(PK11SlotInfo * slot);
extern PRBool PK11_IsReadOnly(PK11SlotInfo * slot);
extern void PK11_SetPasswordFunc(PK11PasswordFunc func);
```

14.4.18 nss3/pkcs11t.h

```
#define _PKCS11T_H_

typedef unsigned char CK_BYTE;
typedef CK_BYTE CK_CHAR;
typedef CK_BYTE CK_UTF8CHAR;
typedef unsigned long int CK_ULONG;
typedef CK_ULONG CK_FLAGS;
typedef void *CK_VOID_PTR;
typedef struct CK_VERSION {
    CK_BYTE major;
    CK_BYTE minor;
} CK_VERSION;
typedef struct CK_INFO {
    CK_VERSION cryptokiVersion;
    CK_UTF8CHAR manufacturerID[31];
    CK_FLAGS flags;
    CK_UTF8CHAR libraryDescription[31];
    CK_VERSION libraryVersion;
} CK_INFO;
typedef CK_ULONG CK_SLOT_ID;
typedef struct CK_SLOT_INFO {
    CK_UTF8CHAR slotDescription[63];
    CK_UTF8CHAR manufacturerID[31];
    CK_FLAGS flags;
    CK_VERSION hardwareVersion;
    CK_VERSION firmwareVersion;
} CK_SLOT_INFO;
typedef struct CK_TOKEN_INFO {
    CK_UTF8CHAR label[31];
    CK_UTF8CHAR manufacturerID[31];
    CK_UTF8CHAR model[15];
    CK_CHAR serialNumber[15];
    CK_FLAGS flags;
    CK_ULONG ulMaxSessionCount;
    CK_ULONG ulSessionCount;
    CK_ULONG ulMaxRwSessionCount;
    CK_ULONG ulRwSessionCount;
    CK_ULONG ulMaxPinLen;
    CK_ULONG ulMinPinLen;
    CK_ULONG ulTotalPublicMemory;
    CK_ULONG ulFreePublicMemory;
    CK_ULONG ulTotalPrivateMemory;
    CK_ULONG ulFreePrivateMemory;
    CK_VERSION hardwareVersion;
    CK_VERSION firmwareVersion;
    CK_CHAR utcTime[15];
} CK_TOKEN_INFO;
typedef CK_ULONG CK_SESSION_HANDLE;
typedef CK_ULONG CK_OBJECT_HANDLE;
typedef CK_ULONG CK_OBJECT_CLASS;
typedef CK_ULONG CK_KEY_TYPE;
typedef CK_ULONG CK_ATTRIBUTE_TYPE;
typedef struct CK_ATTRIBUTE {
    CK_ATTRIBUTE_TYPE type;
    CK_VOID_PTR pValue;
    CK_ULONG ulValueLen;
} CK_ATTRIBUTE;
typedef CK_ATTRIBUTE *CK_ATTRIBUTE_PTR;
typedef CK_ULONG CK_MECHANISM_TYPE;
typedef struct CK_MECHANISM {
    CK_MECHANISM_TYPE mechanism;
    CK_VOID_PTR pParameter;
    CK_ULONG ulParameterLen;
```

```
} CK_MECHANISM;
typedef CK_MECHANISM *CK_MECHANISM_PTR;
typedef CK_ULONG CK_RV;
```

14.4.19 nss3/pkcs7t.h

```
#define _PKCS7T_H_

typedef struct SEC_PKCS7RecipientInfoStr {
    SECItem version;
    CERTIssuerAndSN *issuerAndSN;
    SECAlgorithmID keyEncAlg;
    SECItem encKey;
    CERTCertificate *cert;
} SEC_PKCS7RecipientInfo;
```

14.4.20 nss3/secasn1t.h

```
#define _SECASN1T_H_

typedef struct sec_ASN1Template_struct {
    unsigned long int kind;
    unsigned long int offset;
    const void *sub;
    unsigned int size;
} SEC_ASN1Template;
typedef struct sec_DecoderContext_struct SEC_ASN1DecoderContext;
typedef struct sec_EncoderContext_struct SEC_ASN1EncoderContext;
typedef enum {
    SEC_ASN1_Identifier,
    SEC_ASN1_Length = 1,
    SEC_ASN1_Contents = 2,
    SEC_ASN1_EndOfContents = 3
} SEC_ASN1EncodingPart;
typedef void (*SEC_ASN1NotifyProc) (void *, PRBool, void *, int);
typedef void (*SEC_ASN1WriteProc) (void *, const char *, unsigned
long int,
                                   int, SEC_ASN1EncodingPart);
```

14.4.21 nss3/seccomon.h

```
#define _SECCOMMON_H_

typedef enum {
    siBuffer,
    siClearDataBuffer = 1,
    siCipherDataBuffer = 2,
    siDERCertBuffer = 3,
    siEncodedCertBuffer = 4,
    siDERNameBuffer = 5,
    siEncodedNameBuffer = 6,
    siAsciiNameString = 7,
    siAsciiString = 8,
    siDEROID = 9,
    siUnsignedInteger = 10,
    siUTCTime = 11,
    siGeneralizedTime = 12,
    siVisibleString = 13,
    siUTF8String = 14,
    siBMPString = 15
} SECItemType;
typedef struct SECItemStr {
```

```
    SECItemType type;
    unsigned char *data;
    unsigned int len;
} SECItem;
typedef enum _SECStatus {
    SECWouldBlock = -2,
    SECFailure = -1,
    SECSuccess
} SECStatus;
typedef enum _SECComparison {
    SECLessThan = -1,
    SECEqual,
    SECGreaterThan = 1
} SECComparison;
```

14.4.22 nss3/secdert.h

```
#define _SECDERT_H_

typedef struct DERTemplateStr {
    unsigned long int kind;
    unsigned int offset;
    DERTemplate *sub;
    unsigned long int arg;
} DERTemplate;
```

14.4.23 nss3/secdigt.h

```
#define _SECDIGT_H_

typedef struct SGNDigestInfoStr {
    PLArenaPool *arena;
    SECAlgorithmID digestAlgorithm;
    SECItem digest;
} SGNDigestInfo;
```

14.4.24 nss3/secmodt.h

```
#define _SECMODT_H_
#define SECMOD_MAKE_NSS_FLAGS(fips,slot)          \
        "Flags=internal,critical"fips" \
        slotparams=("#slot"={"SECMOD_SLOT_FLAGS"})"
#define  SECMOD_FIPS_NAME              "NSS Internal FIPS PKCS #11
Module"
#define SECMOD_INT_NAME "NSS Internal PKCS #11 Module"
#define                                       SECMOD_SLOT_FLAGS
"slotFlags=[RSA,DSA,DH,RC2,RC4,DES,RANDOM,SHA1,MD5,MD2,SSL,TLS,AE
S,SHA256,SHA512]"
#define SECMOD_EXTERNAL 0
#define CRL_IMPORT_DEFAULT_OPTIONS     0x00000000
#define CRL_IMPORT_BYPASS_CHECKS       0x00000001
#define PK11_ATTR_TOKEN 0x00000001L
#define SECMOD_RSA_FLAG 0x00000001L
#define PK11_ATTR_SESSION       0x00000002L
#define SECMOD_DSA_FLAG 0x00000002L
#define PK11_ATTR_PRIVATE       0x00000004L
#define SECMOD_RC2_FLAG 0x00000004L
#define PK11_ATTR_PUBLIC        0x00000008L
#define SECMOD_RC4_FLAG 0x00000008L
#define PK11_ATTR_MODIFIABLE    0x00000010L
#define SECMOD_DES_FLAG 0x00000010L
#define PK11_ATTR_UNMODIFIABLE  0x00000020L
```

```
#define SECMOD_DH_FLAG  0x00000020L
#define PK11_ATTR_SENSITIVE       0x00000040L
#define SECMOD_FORTEZZA_FLAG      0x00000040L
#define PK11_ATTR_INSENSITIVE     0x00000080L
#define SECMOD_RC5_FLAG 0x00000080L
#define PK11_ATTR_EXTRACTABLE     0x00000100L
#define SECMOD_SHA1_FLAG          0x00000100L
#define PK11_ATTR_UNEXTRACTABLE 0x00000200L
#define SECMOD_MD5_FLAG 0x00000200L
#define SECMOD_MD2_FLAG 0x00000400L
#define SECMOD_SSL_FLAG 0x00000800L
#define SECMOD_TLS_FLAG 0x00001000L
#define SECMOD_AES_FLAG 0x00002000L
#define SECMOD_SHA256_FLAG        0x00004000L
#define SECMOD_SHA512_FLAG        0x00008000L
#define SECMOD_END_WAIT 0x01
#define SECMOD_WAIT_SIMULATED_EVENT     0x02
#define SECMOD_WAIT_PKCS11_EVENT        0x04
#define SECMOD_RESERVED_FLAG      0X08000000L
#define SECMOD_FRIENDLY_FLAG      0x10000000L
#define PK11_OWN_PW_DEFAULTS      0x20000000L
#define PK11_DISABLE_FLAG         0x40000000L
#define SECMOD_RANDOM_FLAG        0x80000000L
#define CKM_FAKE_RANDOM 0x80000efeL
#define CKM_INVALID_MECHANISM   0xffffffffL
#define SECMOD_INTERNAL 1
#define SECMOD_FIPS     2
#define PK11_PW_AUTHENTICATED   "AUTH"
#define PK11_PW_RETRY   "RETRY"
#define SECMOD_INT_FLAGS        SECMOD_MAKE_NSS_FLAGS("",1)
#define SECMOD_FIPS_FLAGS       SECMOD_MAKE_NSS_FLAGS(",fips",3)
#define PK11_PW_TRY     "TRY"

typedef struct SECMODModuleStr {
    PLArenaPool *arena;
    PRBool internal;
    PRBool loaded;
    PRBool isFIPS;
    char *dllName;
    char *commonName;
    void *library;
    void *functionList;
    PRLock *refLock;
    int refCount;
    PK11SlotInfo **slots;
    int slotCount;
    PK11PreSlotInfo *slotInfo;
    int slotInfoCount;
    SECMODModuleID moduleID;
    PRBool isThreadSafe;
    unsigned long int ssl[1];
    char *libraryParams;
    void *moduleDBFunc;
    SECMODModule *parent;
    PRBool isCritical;
    PRBool isModuleDB;
    PRBool moduleDBOnly;
    int trustOrder;
    int cipherOrder;
    unsigned long int evControlMask;
    CK_VERSION cryptokiVersion;
} SECMODModule;
typedef struct SECMODModuleListStr {
    SECMODModuleList *next;
    SECMODModule *module;
} SECMODModuleList;
```

```
typedef NSSRWLock SECMODListLock;
typedef struct PK11SlotInfoStr PK11SlotInfo;
typedef struct PK11PreSlotInfoStr PK11PreSlotInfo;
typedef struct PK11SymKeyStr PK11SymKey;
typedef struct PK11ContextStr PK11Context;
typedef struct PK11SlotListStr PK11SlotList;
typedef struct PK11SlotListElementStr PK11SlotListElement;
typedef unsigned long int SECMODModuleID;
typedef struct PK11DefaultArrayEntryStr PK11DefaultArrayEntry;
typedef struct PK11GenericObjectStr PK11GenericObject;
typedef void (*PK11FreeDataFunc) (void *);
typedef enum {
    PK11CertListUnique,
    PK11CertListUser = 1,
    PK11CertListRootUnique = 2,
    PK11CertListCA = 3,
    PK11CertListCAUnique = 4,
    PK11CertListUserUnique = 5,
    PK11CertListAll = 6
} PK11CertListType;
typedef PRUint32 PK11AttrFlags;
typedef enum {
    PK11_OriginNULL,
    PK11_OriginDerive = 1,
    PK11_OriginGenerated = 2,
    PK11_OriginFortezzaHack = 3,
    PK11_OriginUnwrap = 4
} PK11Origin;
typedef enum {
    PK11_DIS_NONE,
    PK11_DIS_USER_SELECTED = 1,
    PK11_DIS_COULD_NOT_INIT_TOKEN = 2,
    PK11_DIS_TOKEN_VERIFY_FAILED = 3,
    PK11_DIS_TOKEN_NOT_PRESENT = 4
} PK11DisableReasons;
typedef enum {
    PK11_TypeGeneric,
    PK11_TypePrivKey = 1,
    PK11_TypePubKey = 2,
    PK11_TypeCert = 3,
    PK11_TypeSymKey = 4
} PK11ObjectType;
typedef char *(*PK11PasswordFunc) (PK11SlotInfo *, PRBool, void
*);
typedef struct SECKEYAttributeStr {
    SECItem attrType;
    SECItem **attrValue;
} SECKEYAttribute;
typedef struct SECKEYPrivateKeyInfoStr {
    PLArenaPool *arena;
    SECItem version;
    SECAlgorithmID algorithm;
    SECItem privateKey;
    SECKEYAttribute **attributes;
} SECKEYPrivateKeyInfo;
typedef struct SECKEYEncryptedPrivateKeyInfoStr {
    PLArenaPool *arena;
    SECAlgorithmID algorithm;
    SECItem encryptedData;
} SECKEYEncryptedPrivateKeyInfo;
typedef enum {
    PK11TokenNotRemovable,
    PK11TokenPresent = 1,
    PK11TokenChanged = 2,
    PK11TokenRemoved = 3
} PK11TokenStatus;
```

```
typedef enum {
    PK11TokenRemovedOrChangedEvent,
    PK11TokenPresentEvent = 1
} PK11TokenEvent;
```

14.4.25 nss3/secoidt.h

```
#define _SECOIDT_H_

typedef struct SECOidDataStr {
    SECItem oid;
    SECOidTag offset;
    const char *desc;
    unsigned long int mechanism;
    SECSupportExtenTag supportedExtension;
} SECOidData;
typedef struct SECAlgorithmIDStr {
    SECItem algorithm;
    SECItem parameters;
} SECAlgorithmID;
typedef enum {
    SEC_OID_UNKNOWN,
    SEC_OID_MD2 = 1,
    SEC_OID_MD4 = 2,
    SEC_OID_MD5 = 3,
    SEC_OID_SHA1 = 4,
    SEC_OID_RC2_CBC = 5,
    SEC_OID_RC4 = 6,
    SEC_OID_DES_EDE3_CBC = 7,
    SEC_OID_RC5_CBC_PAD = 8,
    SEC_OID_DES_ECB = 9,
    SEC_OID_DES_CBC = 10,
    SEC_OID_DES_OFB = 11,
    SEC_OID_DES_CFB = 12,
    SEC_OID_DES_MAC = 13,
    SEC_OID_DES_EDE = 14,
    SEC_OID_ISO_SHA_WITH_RSA_SIGNATURE = 15,
    SEC_OID_PKCS1_RSA_ENCRYPTION = 16,
    SEC_OID_PKCS1_MD2_WITH_RSA_ENCRYPTION = 17,
    SEC_OID_PKCS1_MD4_WITH_RSA_ENCRYPTION = 18,
    SEC_OID_PKCS1_MD5_WITH_RSA_ENCRYPTION = 19,
    SEC_OID_PKCS1_SHA1_WITH_RSA_ENCRYPTION = 20,
    SEC_OID_PKCS5_PBE_WITH_MD2_AND_DES_CBC = 21,
    SEC_OID_PKCS5_PBE_WITH_MD5_AND_DES_CBC = 22,
    SEC_OID_PKCS5_PBE_WITH_SHA1_AND_DES_CBC = 23,
    SEC_OID_PKCS7 = 24,
    SEC_OID_PKCS7_DATA = 25,
    SEC_OID_PKCS7_SIGNED_DATA = 26,
    SEC_OID_PKCS7_ENVELOPED_DATA = 27,
    SEC_OID_PKCS7_SIGNED_ENVELOPED_DATA = 28,
    SEC_OID_PKCS7_DIGESTED_DATA = 29,
    SEC_OID_PKCS7_ENCRYPTED_DATA = 30,
    SEC_OID_PKCS9_EMAIL_ADDRESS = 31,
    SEC_OID_PKCS9_UNSTRUCTURED_NAME = 32,
    SEC_OID_PKCS9_CONTENT_TYPE = 33,
    SEC_OID_PKCS9_MESSAGE_DIGEST = 34,
    SEC_OID_PKCS9_SIGNING_TIME = 35,
    SEC_OID_PKCS9_COUNTER_SIGNATURE = 36,
    SEC_OID_PKCS9_CHALLENGE_PASSWORD = 37,
    SEC_OID_PKCS9_UNSTRUCTURED_ADDRESS = 38,
    SEC_OID_PKCS9_EXTENDED_CERTIFICATE_ATTRIBUTES = 39,
    SEC_OID_PKCS9_SMIME_CAPABILITIES = 40,
    SEC_OID_AVA_COMMON_NAME = 41,
    SEC_OID_AVA_COUNTRY_NAME = 42,
    SEC_OID_AVA_LOCALITY = 43,
```

```
SEC_OID_AVA_STATE_OR_PROVINCE = 44,
SEC_OID_AVA_ORGANIZATION_NAME = 45,
SEC_OID_AVA_ORGANIZATIONAL_UNIT_NAME = 46,
SEC_OID_AVA_DN_QUALIFIER = 47,
SEC_OID_AVA_DC = 48,
SEC_OID_NS_TYPE_GIF = 49,
SEC_OID_NS_TYPE_JPEG = 50,
SEC_OID_NS_TYPE_URL = 51,
SEC_OID_NS_TYPE_HTML = 52,
SEC_OID_NS_TYPE_CERT_SEQUENCE = 53,
SEC_OID_MISSI_KEA_DSS_OLD = 54,
SEC_OID_MISSI_DSS_OLD = 55,
SEC_OID_MISSI_KEA_DSS = 56,
SEC_OID_MISSI_DSS = 57,
SEC_OID_MISSI_KEA = 58,
SEC_OID_MISSI_ALT_KEA = 59,
SEC_OID_NS_CERT_EXT_NETSCAPE_OK = 60,
SEC_OID_NS_CERT_EXT_ISSUER_LOGO = 61,
SEC_OID_NS_CERT_EXT_SUBJECT_LOGO = 62,
SEC_OID_NS_CERT_EXT_CERT_TYPE = 63,
SEC_OID_NS_CERT_EXT_BASE_URL = 64,
SEC_OID_NS_CERT_EXT_REVOCATION_URL = 65,
SEC_OID_NS_CERT_EXT_CA_REVOCATION_URL = 66,
SEC_OID_NS_CERT_EXT_CA_CRL_URL = 67,
SEC_OID_NS_CERT_EXT_CA_CERT_URL = 68,
SEC_OID_NS_CERT_EXT_CERT_RENEWAL_URL = 69,
SEC_OID_NS_CERT_EXT_CA_POLICY_URL = 70,
SEC_OID_NS_CERT_EXT_HOMEPAGE_URL = 71,
SEC_OID_NS_CERT_EXT_ENTITY_LOGO = 72,
SEC_OID_NS_CERT_EXT_USER_PICTURE = 73,
SEC_OID_NS_CERT_EXT_SSL_SERVER_NAME = 74,
SEC_OID_NS_CERT_EXT_COMMENT = 75,
SEC_OID_NS_CERT_EXT_LOST_PASSWORD_URL = 76,
SEC_OID_NS_CERT_EXT_CERT_RENEWAL_TIME = 77,
SEC_OID_NS_KEY_USAGE_GOVT_APPROVED = 78,
SEC_OID_X509_SUBJECT_DIRECTORY_ATTR = 79,
SEC_OID_X509_SUBJECT_KEY_ID = 80,
SEC_OID_X509_KEY_USAGE = 81,
SEC_OID_X509_PRIVATE_KEY_USAGE_PERIOD = 82,
SEC_OID_X509_SUBJECT_ALT_NAME = 83,
SEC_OID_X509_ISSUER_ALT_NAME = 84,
SEC_OID_X509_BASIC_CONSTRAINTS = 85,
SEC_OID_X509_NAME_CONSTRAINTS = 86,
SEC_OID_X509_CRL_DIST_POINTS = 87,
SEC_OID_X509_CERTIFICATE_POLICIES = 88,
SEC_OID_X509_POLICY_MAPPINGS = 89,
SEC_OID_X509_POLICY_CONSTRAINTS = 90,
SEC_OID_X509_AUTH_KEY_ID = 91,
SEC_OID_X509_EXT_KEY_USAGE = 92,
SEC_OID_X509_AUTH_INFO_ACCESS = 93,
SEC_OID_X509_CRL_NUMBER = 94,
SEC_OID_X509_REASON_CODE = 95,
SEC_OID_X509_INVALID_DATE = 96,
SEC_OID_X500_RSA_ENCRYPTION = 97,
SEC_OID_RFC1274_UID = 98,
SEC_OID_RFC1274_MAIL = 99,
SEC_OID_PKCS12 = 100,
SEC_OID_PKCS12_MODE_IDS = 101,
SEC_OID_PKCS12_ESPVK_IDS = 102,
SEC_OID_PKCS12_BAG_IDS = 103,
SEC_OID_PKCS12_CERT_BAG_IDS = 104,
SEC_OID_PKCS12_OIDS = 105,
SEC_OID_PKCS12_PBE_IDS = 106,
SEC_OID_PKCS12_SIGNATURE_IDS = 107,
SEC_OID_PKCS12_ENVELOPING_IDS = 108,
SEC_OID_PKCS12_PKCS8_KEY_SHROUDING = 109,
```

```
    SEC_OID_PKCS12_KEY_BAG_ID = 110,
    SEC_OID_PKCS12_CERT_AND_CRL_BAG_ID = 111,
    SEC_OID_PKCS12_SECRET_BAG_ID = 112,
    SEC_OID_PKCS12_X509_CERT_CRL_BAG = 113,
    SEC_OID_PKCS12_SDSI_CERT_BAG = 114,
    SEC_OID_PKCS12_PBE_WITH_SHA1_AND_128_BIT_RC4 = 115,
    SEC_OID_PKCS12_PBE_WITH_SHA1_AND_40_BIT_RC4 = 116,
    SEC_OID_PKCS12_PBE_WITH_SHA1_AND_TRIPLE_DES_CBC = 117,
    SEC_OID_PKCS12_PBE_WITH_SHA1_AND_128_BIT_RC2_CBC = 118,
    SEC_OID_PKCS12_PBE_WITH_SHA1_AND_40_BIT_RC2_CBC = 119,
    SEC_OID_PKCS12_RSA_ENCRYPTION_WITH_128_BIT_RC4 = 120,
    SEC_OID_PKCS12_RSA_ENCRYPTION_WITH_40_BIT_RC4 = 121,
    SEC_OID_PKCS12_RSA_ENCRYPTION_WITH_TRIPLE_DES = 122,
    SEC_OID_PKCS12_RSA_SIGNATURE_WITH_SHA1_DIGEST = 123,
    SEC_OID_ANSIX9_DSA_SIGNATURE = 124,
    SEC_OID_ANSIX9_DSA_SIGNATURE_WITH_SHA1_DIGEST = 125,
    SEC_OID_BOGUS_DSA_SIGNATURE_WITH_SHA1_DIGEST = 126,
    SEC_OID_VERISIGN_USER_NOTICES = 127,
    SEC_OID_PKIX_CPS_POINTER_QUALIFIER = 128,
    SEC_OID_PKIX_USER_NOTICE_QUALIFIER = 129,
    SEC_OID_PKIX_OCSP = 130,
    SEC_OID_PKIX_OCSP_BASIC_RESPONSE = 131,
    SEC_OID_PKIX_OCSP_NONCE = 132,
    SEC_OID_PKIX_OCSP_CRL = 133,
    SEC_OID_PKIX_OCSP_RESPONSE = 134,
    SEC_OID_PKIX_OCSP_NO_CHECK = 135,
    SEC_OID_PKIX_OCSP_ARCHIVE_CUTOFF = 136,
    SEC_OID_PKIX_OCSP_SERVICE_LOCATOR = 137,
    SEC_OID_PKIX_REGCTRL_REGTOKEN = 138,
    SEC_OID_PKIX_REGCTRL_AUTHENTICATOR = 139,
    SEC_OID_PKIX_REGCTRL_PKIPUBINFO = 140,
    SEC_OID_PKIX_REGCTRL_PKI_ARCH_OPTIONS = 141,
    SEC_OID_PKIX_REGCTRL_OLD_CERT_ID = 142,
    SEC_OID_PKIX_REGCTRL_PROTOCOL_ENC_KEY = 143,
    SEC_OID_PKIX_REGINFO_UTF8_PAIRS = 144,
    SEC_OID_PKIX_REGINFO_CERT_REQUEST = 145,
    SEC_OID_EXT_KEY_USAGE_SERVER_AUTH = 146,
    SEC_OID_EXT_KEY_USAGE_CLIENT_AUTH = 147,
    SEC_OID_EXT_KEY_USAGE_CODE_SIGN = 148,
    SEC_OID_EXT_KEY_USAGE_EMAIL_PROTECT = 149,
    SEC_OID_EXT_KEY_USAGE_TIME_STAMP = 150,
    SEC_OID_OCSP_RESPONDER = 151,
    SEC_OID_NETSCAPE_SMIME_KEA = 152,
    SEC_OID_FORTEZZA_SKIPJACK = 153,
    SEC_OID_PKCS12_V2_PBE_WITH_SHA1_AND_128_BIT_RC4 = 154,
    SEC_OID_PKCS12_V2_PBE_WITH_SHA1_AND_40_BIT_RC4 = 155,
    SEC_OID_PKCS12_V2_PBE_WITH_SHA1_AND_3KEY_TRIPLE_DES_CBC      =
156,
    SEC_OID_PKCS12_V2_PBE_WITH_SHA1_AND_2KEY_TRIPLE_DES_CBC      =
157,
    SEC_OID_PKCS12_V2_PBE_WITH_SHA1_AND_128_BIT_RC2_CBC = 158,
    SEC_OID_PKCS12_V2_PBE_WITH_SHA1_AND_40_BIT_RC2_CBC = 159,
    SEC_OID_PKCS12_SAFE_CONTENTS_ID = 160,
    SEC_OID_PKCS12_PKCS8_SHROUDED_KEY_BAG_ID = 161,
    SEC_OID_PKCS12_V1_KEY_BAG_ID = 162,
    SEC_OID_PKCS12_V1_PKCS8_SHROUDED_KEY_BAG_ID = 163,
    SEC_OID_PKCS12_V1_CERT_BAG_ID = 164,
    SEC_OID_PKCS12_V1_CRL_BAG_ID = 165,
    SEC_OID_PKCS12_V1_SECRET_BAG_ID = 166,
    SEC_OID_PKCS12_V1_SAFE_CONTENTS_BAG_ID = 167,
    SEC_OID_PKCS9_X509_CERT = 168,
    SEC_OID_PKCS9_SDSI_CERT = 169,
    SEC_OID_PKCS9_X509_CRL = 170,
    SEC_OID_PKCS9_FRIENDLY_NAME = 171,
    SEC_OID_PKCS9_LOCAL_KEY_ID = 172,
    SEC_OID_BOGUS_KEY_USAGE = 173,
```

```
SEC_OID_X942_DIFFIE_HELMAN_KEY = 174,
SEC_OID_NETSCAPE_NICKNAME = 175,
SEC_OID_NETSCAPE_RECOVERY_REQUEST = 176,
SEC_OID_CERT_RENEWAL_LOCATOR = 177,
SEC_OID_NS_CERT_EXT_SCOPE_OF_USE = 178,
SEC_OID_CMS_EPHEMERAL_STATIC_DIFFIE_HELLMAN = 179,
SEC_OID_CMS_3DES_KEY_WRAP = 180,
SEC_OID_CMS_RC2_KEY_WRAP = 181,
SEC_OID_SMIME_ENCRYPTION_KEY_PREFERENCE = 182,
SEC_OID_AES_128_ECB = 183,
SEC_OID_AES_128_CBC = 184,
SEC_OID_AES_192_ECB = 185,
SEC_OID_AES_192_CBC = 186,
SEC_OID_AES_256_ECB = 187,
SEC_OID_AES_256_CBC = 188,
SEC_OID_SDN702_DSA_SIGNATURE = 189,
SEC_OID_MS_SMIME_ENCRYPTION_KEY_PREFERENCE = 190,
SEC_OID_SHA256 = 191,
SEC_OID_SHA384 = 192,
SEC_OID_SHA512 = 193,
SEC_OID_PKCS1_SHA256_WITH_RSA_ENCRYPTION = 194,
SEC_OID_PKCS1_SHA384_WITH_RSA_ENCRYPTION = 195,
SEC_OID_PKCS1_SHA512_WITH_RSA_ENCRYPTION = 196,
SEC_OID_AES_128_KEY_WRAP = 197,
SEC_OID_AES_192_KEY_WRAP = 198,
SEC_OID_AES_256_KEY_WRAP = 199,
SEC_OID_ANSIX962_EC_PUBLIC_KEY = 200,
SEC_OID_ANSIX962_ECDSA_SHA1_SIGNATURE = 201,
SEC_OID_ANSIX962_EC_PRIME192V1 = 202,
SEC_OID_ANSIX962_EC_PRIME192V2 = 203,
SEC_OID_ANSIX962_EC_PRIME192V3 = 204,
SEC_OID_ANSIX962_EC_PRIME239V1 = 205,
SEC_OID_ANSIX962_EC_PRIME239V2 = 206,
SEC_OID_ANSIX962_EC_PRIME239V3 = 207,
SEC_OID_ANSIX962_EC_PRIME256V1 = 208,
SEC_OID_SECG_EC_SECP112R1 = 209,
SEC_OID_SECG_EC_SECP112R2 = 210,
SEC_OID_SECG_EC_SECP128R1 = 211,
SEC_OID_SECG_EC_SECP128R2 = 212,
SEC_OID_SECG_EC_SECP160K1 = 213,
SEC_OID_SECG_EC_SECP160R1 = 214,
SEC_OID_SECG_EC_SECP160R2 = 215,
SEC_OID_SECG_EC_SECP192K1 = 216,
SEC_OID_SECG_EC_SECP224K1 = 217,
SEC_OID_SECG_EC_SECP224R1 = 218,
SEC_OID_SECG_EC_SECP256K1 = 219,
SEC_OID_SECG_EC_SECP384R1 = 220,
SEC_OID_SECG_EC_SECP521R1 = 221,
SEC_OID_ANSIX962_EC_C2PNB163V1 = 222,
SEC_OID_ANSIX962_EC_C2PNB163V2 = 223,
SEC_OID_ANSIX962_EC_C2PNB163V3 = 224,
SEC_OID_ANSIX962_EC_C2PNB176V1 = 225,
SEC_OID_ANSIX962_EC_C2TNB191V1 = 226,
SEC_OID_ANSIX962_EC_C2TNB191V2 = 227,
SEC_OID_ANSIX962_EC_C2TNB191V3 = 228,
SEC_OID_ANSIX962_EC_C2ONB191V4 = 229,
SEC_OID_ANSIX962_EC_C2ONB191V5 = 230,
SEC_OID_ANSIX962_EC_C2PNB208W1 = 231,
SEC_OID_ANSIX962_EC_C2TNB239V1 = 232,
SEC_OID_ANSIX962_EC_C2TNB239V2 = 233,
SEC_OID_ANSIX962_EC_C2TNB239V3 = 234,
SEC_OID_ANSIX962_EC_C2ONB239V4 = 235,
SEC_OID_ANSIX962_EC_C2ONB239V5 = 236,
SEC_OID_ANSIX962_EC_C2PNB272W1 = 237,
SEC_OID_ANSIX962_EC_C2PNB304W1 = 238,
SEC_OID_ANSIX962_EC_C2TNB359V1 = 239,
```

```
        SEC_OID_ANSIX962_EC_C2PNB368W1 = 240,
        SEC_OID_ANSIX962_EC_C2TNB431R1 = 241,
        SEC_OID_SECG_EC_SECT113R1 = 242,
        SEC_OID_SECG_EC_SECT113R2 = 243,
        SEC_OID_SECG_EC_SECT131R1 = 244,
        SEC_OID_SECG_EC_SECT131R2 = 245,
        SEC_OID_SECG_EC_SECT163K1 = 246,
        SEC_OID_SECG_EC_SECT163R1 = 247,
        SEC_OID_SECG_EC_SECT163R2 = 248,
        SEC_OID_SECG_EC_SECT193R1 = 249,
        SEC_OID_SECG_EC_SECT193R2 = 250,
        SEC_OID_SECG_EC_SECT233K1 = 251,
        SEC_OID_SECG_EC_SECT233R1 = 252,
        SEC_OID_SECG_EC_SECT239K1 = 253,
        SEC_OID_SECG_EC_SECT283K1 = 254,
        SEC_OID_SECG_EC_SECT283R1 = 255,
        SEC_OID_SECG_EC_SECT409K1 = 256,
        SEC_OID_SECG_EC_SECT409R1 = 257,
        SEC_OID_SECG_EC_SECT571K1 = 258,
        SEC_OID_SECG_EC_SECT571R1 = 259,
        SEC_OID_NETSCAPE_AOLSCREENNAME = 260,
        SEC_OID_AVA_SURNAME = 261,
        SEC_OID_AVA_SERIAL_NUMBER = 262,
        SEC_OID_AVA_STREET_ADDRESS = 263,
        SEC_OID_AVA_TITLE = 264,
        SEC_OID_AVA_POSTAL_ADDRESS = 265,
        SEC_OID_AVA_POSTAL_CODE = 266,
        SEC_OID_AVA_POST_OFFICE_BOX = 267,
        SEC_OID_AVA_GIVEN_NAME = 268,
        SEC_OID_AVA_INITIALS = 269,
        SEC_OID_AVA_GENERATION_QUALIFIER = 270,
        SEC_OID_AVA_HOUSE_IDENTIFIER = 271,
        SEC_OID_AVA_PSEUDONYM = 272,
        SEC_OID_PKIX_CA_ISSUERS = 273,
        SEC_OID_PKCS9_EXTENSION_REQUEST = 274,
        SEC_OID_ANSIX962_ECDSA_SIGNATURE_RECOMMENDED_DIGEST = 275,
        SEC_OID_ANSIX962_ECDSA_SIGNATURE_SPECIFIED_DIGEST = 276,
        SEC_OID_ANSIX962_ECDSA_SHA224_SIGNATURE = 277,
        SEC_OID_ANSIX962_ECDSA_SHA256_SIGNATURE = 278,
        SEC_OID_ANSIX962_ECDSA_SHA384_SIGNATURE = 279,
        SEC_OID_ANSIX962_ECDSA_SHA512_SIGNATURE = 280,
        SEC_OID_X509_HOLD_INSTRUCTION_CODE = 281,
        SEC_OID_X509_DELTA_CRL_INDICATOR = 282,
        SEC_OID_X509_ISSUING_DISTRIBUTION_POINT = 283,
        SEC_OID_X509_CERT_ISSUER = 284,
        SEC_OID_X509_FRESHEST_CRL = 285,
        SEC_OID_X509_INHIBIT_ANY_POLICY = 286,
        SEC_OID_X509_SUBJECT_INFO_ACCESS = 287,
        SEC_OID_CAMELLIA_128_CBC = 288,
        SEC_OID_CAMELLIA_192_CBC = 289,
        SEC_OID_CAMELLIA_256_CBC = 290,
        SEC_OID_PKCS5_PBKDF2 = 291,
        SEC_OID_PKCS5_PBES2 = 292,
        SEC_OID_PKCS5_PBMAC1 = 293,
        SEC_OID_HMAC_SHA1 = 294,
        SEC_OID_HMAC_SHA224 = 295,
        SEC_OID_HMAC_SHA256 = 296,
        SEC_OID_HMAC_SHA384 = 297,
        SEC_OID_HMAC_SHA512 = 298,
        SEC_OID_PKIX_TIMESTAMPING = 299,
        SEC_OID_PKIX_CA_REPOSITORY = 300,
        SEC_OID_ISO_SHA1_WITH_RSA_SIGNATURE = 301,
        SEC_OID_TOTAL = 302
} SECOidTag;
typedef enum {
        INVALID_CERT_EXTENSION,
```

```
    UNSUPPORTED_CERT_EXTENSION = 1,
    SUPPORTED_CERT_EXTENSION = 2
} SECSupportExtenTag;
```

14.4.26 nss3/secpkcs5.h

```
#define _SECPKCS5_H_

typedef enum {
    pbeBitGenIDNull,
    pbeBitGenCipherKey = 1,
    pbeBitGenCipherIV = 2,
    pbeBitGenIntegrityKey = 3
} PBEBitGenID;
typedef struct PBEBitGenContextStr PBEBitGenContext;
```

14.4.27 nss3/secport.h

```
#define _SECPORT_H_

typedef  PRBool(*PORTCharConversionWSwapFunc)  (PRBool,  unsigned
char *,
                                                unsigned int,
                                                unsigned char *,
                                                unsigned       int,
unsigned int *,
                                                PRBool);
typedef PRBool(*PORTCharConversionFunc) (PRBool, unsigned char *,
                                          unsigned  int,  unsigned
char *,
                                          unsigned  int,  unsigned
int *);
```

14.5 Interfaces for libssl3

Table 14-5 defines the library name and shared object name for the libssl3 library

Table 14-5 libssl3 Definition

Library:	libssl3
SONAME:	libssl3.so

The behavior of the interfaces in this library is specified by the following specifications:

 [NSS SSL] Mozilla's NSS SSL Reference

14.5.1 NSS SSL

14.5.1.1 Interfaces for NSS SSL

An LSB conforming implementation shall provide the generic functions for NSS SSL specified in Table 14-6, with the full mandatory functionality as described in the referenced underlying specification.

Table 14-6 libssl3 - NSS SSL Function Interfaces

NSS_CmpCertChainW CANames(NSS_3.2)	NSS_FindCertKEAType (NSS_3.2) [NSS SSL]	NSS_GetClientAuthDat a(NSS_3.2) [NSS SSL]

[NSS SSL]		
SSL_AuthCertificate(NSS_3.2) [NSS SSL]	SSL_AuthCertificateHook(NSS_3.2) [NSS SSL]	SSL_BadCertHook(NSS_3.2) [NSS SSL]
SSL_CipherPolicyGet(NSS_3.2) [NSS SSL]	SSL_CipherPolicySet(NSS_3.2) [NSS SSL]	SSL_CipherPrefGet(NSS_3.2) [NSS SSL]
SSL_CipherPrefGetDefault(NSS_3.2) [NSS SSL]	SSL_CipherPrefSet(NSS_3.2) [NSS SSL]	SSL_CipherPrefSetDefault(NSS_3.2) [NSS SSL]
SSL_ClearSessionCache(NSS_3.2) [NSS SSL]	SSL_ConfigMPServerSIDCache(NSS_3.2) [NSS SSL]	SSL_ConfigSecureServer(NSS_3.2) [NSS SSL]
SSL_ConfigServerSessionIDCache(NSS_3.2) [NSS SSL]	SSL_DataPending(NSS_3.2) [NSS SSL]	SSL_ForceHandshake(NSS_3.2) [NSS SSL]
SSL_GetClientAuthDataHook(NSS_3.2) [NSS SSL]	SSL_GetSessionID(NSS_3.2) [NSS SSL]	SSL_HandshakeCallback(NSS_3.2) [NSS SSL]
SSL_ImportFD(NSS_3.2) [NSS SSL]	SSL_InheritMPServerSIDCache(NSS_3.2) [NSS SSL]	SSL_InvalidateSession(NSS_3.2) [NSS SSL]
SSL_OptionGet(NSS_3.2) [NSS SSL]	SSL_OptionGetDefault(NSS_3.2) [NSS SSL]	SSL_OptionSet(NSS_3.2) [NSS SSL]
SSL_OptionSetDefault(NSS_3.2) [NSS SSL]	SSL_PeerCertificate(NSS_3.2) [NSS SSL]	SSL_ReHandshake(NSS_3.2) [NSS SSL]
SSL_ResetHandshake(NSS_3.2) [NSS SSL]	SSL_RevealPinArg(NSS_3.2) [NSS SSL]	SSL_RevealURL(NSS_3.2) [NSS SSL]
SSL_SecurityStatus(NSS_3.2) [NSS SSL]	SSL_SetPKCS11PinArg(NSS_3.2) [NSS SSL]	SSL_SetSockPeerID(NSS_3.2) [NSS SSL]
SSL_SetURL(NSS_3.2) [NSS SSL]		

14.6 Data Definitions for libssl3

This section defines global identifiers and their values that are associated with interfaces contained in libssl3. These definitions are organized into groups that correspond to system headers. This convention is used as a convenience for the reader, and does not imply the existence of these headers, or their content. Where an interface is defined as requiring a particular system header file all of the data definitions for that system header file presented here shall be in effect.

This section gives data definitions to promote binary application portability, not to repeat source interface definitions available elsewhere. System providers and application developers should use this ABI to supplement - not to replace - source interface definition specifications.

This specification uses the ISO C (1999) C Language as the reference programming language, and data definitions are specified in ISO C format. The C language is used here as a convenient notation. Using a C language description of these data objects does not preclude their use by other programming languages.

14.6.1 nss3/ecl-exp.h

```
#define __ecl_exp_h_
#define ECCurve_SECG_CHAR2_163R2          ECCurve_NIST_B163
#define ECCurve_SECG_CHAR2_233R1          ECCurve_NIST_B233
#define ECCurve_WTLS_11 ECCurve_NIST_B233
#define ECCurve_SECG_CHAR2_283R1          ECCurve_NIST_B283
#define ECCurve_SECG_CHAR2_409R1          ECCurve_NIST_B409
#define ECCurve_SECG_CHAR2_571R1          ECCurve_NIST_B571
#define ECCurve_SECG_CHAR2_163K1          ECCurve_NIST_K163
#define ECCurve_WTLS_3  ECCurve_NIST_K163
#define ECCurve_SECG_CHAR2_233K1          ECCurve_NIST_K233
#define ECCurve_WTLS_10 ECCurve_NIST_K233
#define ECCurve_SECG_CHAR2_283K1          ECCurve_NIST_K283
#define ECCurve_SECG_CHAR2_409K1          ECCurve_NIST_K409
#define ECCurve_SECG_CHAR2_571K1          ECCurve_NIST_K571
#define ECCurve_SECG_PRIME_192R1          ECCurve_NIST_P192
#define ECCurve_X9_62_PRIME_192V1         ECCurve_NIST_P192
#define ECCurve_SECG_PRIME_224R1          ECCurve_NIST_P224
#define ECCurve_WTLS_12 ECCurve_NIST_P224
#define ECCurve_SECG_PRIME_256R1          ECCurve_NIST_P256
#define ECCurve_X9_62_PRIME_256V1         ECCurve_NIST_P256
#define ECCurve_SECG_PRIME_384R1          ECCurve_NIST_P384
#define ECCurve_SECG_PRIME_521R1          ECCurve_NIST_P521
#define ECCurve_WTLS_4  ECCurve_SECG_CHAR2_113R1
#define ECCurve_WTLS_6  ECCurve_SECG_PRIME_112R1
#define ECCurve_WTLS_7  ECCurve_SECG_PRIME_160R1
#define ECCurve_WTLS_5  ECCurve_X9_62_CHAR2_PNB163V1

enum ECField {
    ECField_GFp = 0,
    ECField_GF2m = 1
};
typedef struct ECCurveParamsStr {
    char *text;
    enum ECField field;
    unsigned int size;
    char *irr;
    char *curvea;
    char *curveb;
    char *genx;
    char *geny;
    char *order;
    int cofactor;
} ECCurveParams;
enum ECCurveName {
    ECCurve_noName = 0,
    ECCurve_NIST_P192 = 1,
    ECCurve_NIST_P224 = 2,
    ECCurve_NIST_P256 = 3,
    ECCurve_NIST_P384 = 4,
    ECCurve_NIST_P521 = 5,
    ECCurve_NIST_K163 = 6,
    ECCurve_NIST_B163 = 7,
    ECCurve_NIST_K233 = 8,
    ECCurve_NIST_B233 = 9,
    ECCurve_NIST_K283 = 10,
    ECCurve_NIST_B283 = 11,
    ECCurve_NIST_K409 = 12,
    ECCurve_NIST_B409 = 13,
    ECCurve_NIST_K571 = 14,
    ECCurve_NIST_B571 = 15,
    ECCurve_X9_62_PRIME_192V2 = 16,
    ECCurve_X9_62_PRIME_192V3 = 17,
    ECCurve_X9_62_PRIME_239V1 = 18,
```

```
    ECCurve_X9_62_PRIME_239V2 = 19,
    ECCurve_X9_62_PRIME_239V3 = 20,
    ECCurve_X9_62_CHAR2_PNB163V1 = 21,
    ECCurve_X9_62_CHAR2_PNB163V2 = 22,
    ECCurve_X9_62_CHAR2_PNB163V3 = 23,
    ECCurve_X9_62_CHAR2_PNB176V1 = 24,
    ECCurve_X9_62_CHAR2_TNB191V1 = 25,
    ECCurve_X9_62_CHAR2_TNB191V2 = 26,
    ECCurve_X9_62_CHAR2_TNB191V3 = 27,
    ECCurve_X9_62_CHAR2_PNB208W1 = 28,
    ECCurve_X9_62_CHAR2_TNB239V1 = 29,
    ECCurve_X9_62_CHAR2_TNB239V2 = 30,
    ECCurve_X9_62_CHAR2_TNB239V3 = 31,
    ECCurve_X9_62_CHAR2_PNB272W1 = 32,
    ECCurve_X9_62_CHAR2_PNB304W1 = 33,
    ECCurve_X9_62_CHAR2_TNB359V1 = 34,
    ECCurve_X9_62_CHAR2_PNB368W1 = 35,
    ECCurve_X9_62_CHAR2_TNB431R1 = 36,
    ECCurve_SECG_PRIME_112R1 = 37,
    ECCurve_SECG_PRIME_112R2 = 38,
    ECCurve_SECG_PRIME_128R1 = 39,
    ECCurve_SECG_PRIME_128R2 = 40,
    ECCurve_SECG_PRIME_160K1 = 41,
    ECCurve_SECG_PRIME_160R1 = 42,
    ECCurve_SECG_PRIME_160R2 = 43,
    ECCurve_SECG_PRIME_192K1 = 44,
    ECCurve_SECG_PRIME_224K1 = 45,
    ECCurve_SECG_PRIME_256K1 = 46,
    ECCurve_SECG_CHAR2_113R1 = 47,
    ECCurve_SECG_CHAR2_113R2 = 48,
    ECCurve_SECG_CHAR2_131R1 = 49,
    ECCurve_SECG_CHAR2_131R2 = 50,
    ECCurve_SECG_CHAR2_163R1 = 51,
    ECCurve_SECG_CHAR2_193R1 = 52,
    ECCurve_SECG_CHAR2_193R2 = 53,
    ECCurve_SECG_CHAR2_239K1 = 54,
    ECCurve_WTLS_1 = 55,
    ECCurve_WTLS_8 = 56,
    ECCurve_WTLS_9 = 57,
    ECCurve_pastLastCurve = 58
};
```

14.6.2 nss3/ssl.h

```
#define __ssl_h_
#define SSL_IS_SSL2_CIPHER(which)          (((which) & 0xfff0) ==
0xff00)
#define SSL_REQUIRE_NEVER       ((PRBool)0)
#define SSL_REQUIRE_ALWAYS      ((PRBool)1)
#define SSL_REQUIRE_FIRST_HANDSHAKE    ((PRBool)2)
#define SSL_REQUIRE_NO_ERROR    ((PRBool)3)
#define SSL_SECURITY_STATUS_NOOPT      -1
#define SSL_NOT_ALLOWED 0
#define SSL_SECURITY_STATUS_OFF 0
#define SSL_ALLOWED     1
#define SSL_SECURITY    1
#define SSL_SECURITY_STATUS_ON_HIGH    1
#define SSL_REQUIRE_CERTIFICATE 10
#define SSL_ENABLE_FDX  11
#define SSL_V2_COMPATIBLE_HELLO 12
#define SSL_ENABLE_TLS  13
#define SSL_ROLLBACK_DETECTION  14
#define SSL_NO_STEP_DOWN        15
#define SSL_BYPASS_PKCS11       16
#define SSL_NO_LOCKS    17
```

```
#define SSL_RESTRICTED  2
#define SSL_SECURITY_STATUS_ON_LOW      2
#define SSL_SOCKS       2
#define SSL_REQUEST_CERTIFICATE 3
#define SSL_HANDSHAKE_AS_CLIENT 5
#define SSL_HANDSHAKE_AS_SERVER 6
#define SSL_ENABLE_SSL2 7
#define SSL_ENABLE_SSL3 8
#define SSL_NO_CACHE    9
#define SSL_ENV_VAR_NAME        "SSL_INHERITANCE"

typedef  SECStatus(*SSLAuthCertificate) (void *, PRFileDesc *,
PRBool,
                                            PRBool);
typedef SECStatus(*SSLGetClientAuthData) (void *, PRFileDesc *,
                                            CERTDistNames *,
                                            CERTCertificate * *,
                                            SECKEYPrivateKey * *);
typedef SECStatus(*SSLBadCertHandler) (void *, PRFileDesc *);
typedef void (*SSLHandshakeCallback) (PRFileDesc *, void *);
extern SECStatus NSS_CmpCertChainWCANames(CERTCertificate * cert,
                                            CERTDistNames       *
caNames);
extern SSLKEAType NSS_FindCertKEAType(CERTCertificate * cert);
extern SECStatus NSS_GetClientAuthData(void *arg, PRFileDesc *
socket,
                                            struct    CERTDistNamesStr
*caNames,
                                            struct CERTCertificateStr
                                            **pRetCert,
                                            struct SECKEYPrivateKeyStr
                                            **pRetKey);
extern SECStatus SSL_AuthCertificate(void *arg, PRFileDesc * fd,
                                            PRBool    checkSig,    PRBool
isServer);
extern SECStatus SSL_AuthCertificateHook(PRFileDesc * fd,
                                            SSLAuthCertificate    f,
void *arg);
extern    SECStatus    SSL_BadCertHook(PRFileDesc    *    fd,
SSLBadCertHandler f,
                                void *arg);
extern SECStatus SSL_CipherPolicyGet(PRInt32 cipher, PRInt32 *
policy);
extern  SECStatus  SSL_CipherPolicySet(PRInt32  cipher,  PRInt32
policy);
extern  SECStatus  SSL_CipherPrefGet(PRFileDesc  *  fd,  PRInt32
cipher,
                                PRBool * enabled);
extern SECStatus SSL_CipherPrefGetDefault(PRInt32 cipher,
                                PRBool * enabled);
extern  SECStatus  SSL_CipherPrefSet(PRFileDesc  *  fd,  PRInt32
cipher,
                                PRBool enabled);
extern SECStatus SSL_CipherPrefSetDefault(PRInt32 cipher, PRBool
enabled);
extern void SSL_ClearSessionCache(void);
extern SECStatus SSL_ConfigMPServerSIDCache(int maxCacheEntries,
                                            PRUint32 timeout,
                                            PRUint32
ssl3_timeout,
                                            const              char
*directory);
extern SECStatus SSL_ConfigSecureServer(PRFileDesc * fd,
                                            CERTCertificate * cert,
                                            SECKEYPrivateKey * key,
                                            SSLKEAType kea);
```

```
extern        SECStatus         SSL_ConfigServerSessionIDCache(int
maxCacheEntries,
                                          PRUint32 timeout,
                                          PRUint32
ssl3_timeout,
                                          const        char
*directory);
extern int SSL_DataPending(PRFileDesc * fd);
extern SECStatus SSL_ForceHandshake(PRFileDesc * fd);
extern SECStatus SSL_GetClientAuthDataHook(PRFileDesc * fd,
                                          SSLGetClientAuthData
f,
                                          void *a);
extern SECItem *SSL_GetSessionID(PRFileDesc * fd);
extern SECStatus SSL_HandshakeCallback(PRFileDesc * fd,
                                      SSLHandshakeCallback cb,
                                      void *client_data);
extern PRFileDesc *SSL_ImportFD(PRFileDesc * model, PRFileDesc *
fd);
extern    SECStatus    SSL_InheritMPServerSIDCache(const    char
*envString);
extern SECStatus SSL_InvalidateSession(PRFileDesc * fd);
extern SECStatus SSL_OptionGet(PRFileDesc * fd, PRInt32 option,
                              PRBool * on);
extern   SECStatus   SSL_OptionGetDefault(PRInt32   option,   PRBool   *
on);
extern   SECStatus   SSL_OptionSet(PRFileDesc   *   fd,   PRInt32   option,
PRBool on);
extern SECStatus SSL_OptionSetDefault(PRInt32 option, PRBool on);
extern CERTCertificate *SSL_PeerCertificate(PRFileDesc * fd);
extern   SECStatus   SSL_ReHandshake(PRFileDesc   *   fd,   PRBool
flushCache);
extern   SECStatus   SSL_ResetHandshake(PRFileDesc   *   fd,   PRBool
asServer);
extern void *SSL_RevealPinArg(PRFileDesc * socket);
extern char *SSL_RevealURL(PRFileDesc * socket);
extern SECStatus SSL_SecurityStatus(PRFileDesc * fd, int *on,
                                    char **cipher, int *keySize,
                                    int    *secretKeySize,    char
**issuer,
                                    char **subject);
extern SECStatus SSL_SetPKCS11PinArg(PRFileDesc * fd, void *a);
extern   SECStatus   SSL_SetSockPeerID(PRFileDesc   *   fd,   const   char
*peerID);
extern SECStatus SSL_SetURL(PRFileDesc * fd, const char *url);
```

14.6.3 nss3/sslerr.h

```
#define __SSL_ERR_H_
#define IS_SSL_ERROR(code)          \
      (((code)      >=      SSL_ERROR_BASE)      &&      ((code)      <
SSL_ERROR_LIMIT))
#define SSL_ERROR_BASE  (-0x3000)
#define SSL_ERROR_LIMIT (SSL_ERROR_BASE + 1000)

typedef enum {
    SSL_ERROR_EXPORT_ONLY_SERVER = (SSL_ERROR_BASE + 0),
    SSL_ERROR_US_ONLY_SERVER = (SSL_ERROR_BASE + 1),
    SSL_ERROR_NO_CYPHER_OVERLAP = (SSL_ERROR_BASE + 2),
    SSL_ERROR_NO_CERTIFICATE = (SSL_ERROR_BASE + 3),
    SSL_ERROR_BAD_CERTIFICATE = (SSL_ERROR_BASE + 4),
    SSL_ERROR_BAD_CLIENT = (SSL_ERROR_BASE + 6),
    SSL_ERROR_BAD_SERVER = (SSL_ERROR_BASE + 7),
    SSL_ERROR_UNSUPPORTED_CERTIFICATE_TYPE  =  (SSL_ERROR_BASE  +
8),
```

```
    SSL_ERROR_UNSUPPORTED_VERSION = (SSL_ERROR_BASE + 9),
    SSL_ERROR_WRONG_CERTIFICATE = (SSL_ERROR_BASE + 11),
    SSL_ERROR_BAD_CERT_DOMAIN = (SSL_ERROR_BASE + 12),
    SSL_ERROR_POST_WARNING = (SSL_ERROR_BASE + 13),
    SSL_ERROR_SSL2_DISABLED = (SSL_ERROR_BASE + 14),
    SSL_ERROR_BAD_MAC_READ = (SSL_ERROR_BASE + 15),
    SSL_ERROR_BAD_MAC_ALERT = (SSL_ERROR_BASE + 16),
    SSL_ERROR_BAD_CERT_ALERT = (SSL_ERROR_BASE + 17),
    SSL_ERROR_REVOKED_CERT_ALERT = (SSL_ERROR_BASE + 18),
    SSL_ERROR_EXPIRED_CERT_ALERT = (SSL_ERROR_BASE + 19),
    SSL_ERROR_SSL_DISABLED = (SSL_ERROR_BASE + 20),
    SSL_ERROR_FORTEZZA_PQG = (SSL_ERROR_BASE + 21),
    SSL_ERROR_UNKNOWN_CIPHER_SUITE = (SSL_ERROR_BASE + 22),
    SSL_ERROR_NO_CIPHERS_SUPPORTED = (SSL_ERROR_BASE + 23),
    SSL_ERROR_BAD_BLOCK_PADDING = (SSL_ERROR_BASE + 24),
    SSL_ERROR_RX_RECORD_TOO_LONG = (SSL_ERROR_BASE + 25),
    SSL_ERROR_TX_RECORD_TOO_LONG = (SSL_ERROR_BASE + 26),
    SSL_ERROR_RX_MALFORMED_HELLO_REQUEST = (SSL_ERROR_BASE + 27),
    SSL_ERROR_RX_MALFORMED_CLIENT_HELLO = (SSL_ERROR_BASE + 28),
    SSL_ERROR_RX_MALFORMED_SERVER_HELLO = (SSL_ERROR_BASE + 29),
    SSL_ERROR_RX_MALFORMED_CERTIFICATE = (SSL_ERROR_BASE + 30),
    SSL_ERROR_RX_MALFORMED_SERVER_KEY_EXCH  = (SSL_ERROR_BASE  +
31),
    SSL_ERROR_RX_MALFORMED_CERT_REQUEST = (SSL_ERROR_BASE + 32),
    SSL_ERROR_RX_MALFORMED_HELLO_DONE = (SSL_ERROR_BASE + 33),
    SSL_ERROR_RX_MALFORMED_CERT_VERIFY = (SSL_ERROR_BASE + 34),
    SSL_ERROR_RX_MALFORMED_CLIENT_KEY_EXCH  = (SSL_ERROR_BASE  +
35),
    SSL_ERROR_RX_MALFORMED_FINISHED = (SSL_ERROR_BASE + 36),
    SSL_ERROR_RX_MALFORMED_CHANGE_CIPHER = (SSL_ERROR_BASE + 37),
    SSL_ERROR_RX_MALFORMED_ALERT = (SSL_ERROR_BASE + 38),
    SSL_ERROR_RX_MALFORMED_HANDSHAKE = (SSL_ERROR_BASE + 39),
    SSL_ERROR_RX_MALFORMED_APPLICATION_DATA  =  (SSL_ERROR_BASE  +
40),
    SSL_ERROR_RX_UNEXPECTED_HELLO_REQUEST   =   (SSL_ERROR_BASE   +
41),
    SSL_ERROR_RX_UNEXPECTED_CLIENT_HELLO = (SSL_ERROR_BASE + 42),
    SSL_ERROR_RX_UNEXPECTED_SERVER_HELLO = (SSL_ERROR_BASE + 43),
    SSL_ERROR_RX_UNEXPECTED_CERTIFICATE = (SSL_ERROR_BASE + 44),
    SSL_ERROR_RX_UNEXPECTED_SERVER_KEY_EXCH  =  (SSL_ERROR_BASE  +
45),
    SSL_ERROR_RX_UNEXPECTED_CERT_REQUEST = (SSL_ERROR_BASE + 46),
    SSL_ERROR_RX_UNEXPECTED_HELLO_DONE = (SSL_ERROR_BASE + 47),
    SSL_ERROR_RX_UNEXPECTED_CERT_VERIFY = (SSL_ERROR_BASE + 48),
    SSL_ERROR_RX_UNEXPECTED_CLIENT_KEY_EXCH  =  (SSL_ERROR_BASE  +
49),
    SSL_ERROR_RX_UNEXPECTED_FINISHED = (SSL_ERROR_BASE + 50),
    SSL_ERROR_RX_UNEXPECTED_CHANGE_CIPHER   =   (SSL_ERROR_BASE   +
51),
    SSL_ERROR_RX_UNEXPECTED_ALERT = (SSL_ERROR_BASE + 52),
    SSL_ERROR_RX_UNEXPECTED_HANDSHAKE = (SSL_ERROR_BASE + 53),
    SSL_ERROR_RX_UNEXPECTED_APPLICATION_DATA  =  (SSL_ERROR_BASE  +
54),
    SSL_ERROR_RX_UNKNOWN_RECORD_TYPE = (SSL_ERROR_BASE + 55),
    SSL_ERROR_RX_UNKNOWN_HANDSHAKE = (SSL_ERROR_BASE + 56),
    SSL_ERROR_RX_UNKNOWN_ALERT = (SSL_ERROR_BASE + 57),
    SSL_ERROR_CLOSE_NOTIFY_ALERT = (SSL_ERROR_BASE + 58),
    SSL_ERROR_HANDSHAKE_UNEXPECTED_ALERT = (SSL_ERROR_BASE + 59),
    SSL_ERROR_DECOMPRESSION_FAILURE_ALERT   =   (SSL_ERROR_BASE   +
60),
    SSL_ERROR_HANDSHAKE_FAILURE_ALERT = (SSL_ERROR_BASE + 61),
    SSL_ERROR_ILLEGAL_PARAMETER_ALERT = (SSL_ERROR_BASE + 62),
    SSL_ERROR_UNSUPPORTED_CERT_ALERT = (SSL_ERROR_BASE + 63),
    SSL_ERROR_CERTIFICATE_UNKNOWN_ALERT = (SSL_ERROR_BASE + 64),
    SSL_ERROR_GENERATE_RANDOM_FAILURE = (SSL_ERROR_BASE + 65),
    SSL_ERROR_SIGN_HASHES_FAILURE = (SSL_ERROR_BASE + 66),
```

```
    SSL_ERROR_EXTRACT_PUBLIC_KEY_FAILURE = (SSL_ERROR_BASE + 67),
    SSL_ERROR_SERVER_KEY_EXCHANGE_FAILURE   =   (SSL_ERROR_BASE   +
68),
    SSL_ERROR_CLIENT_KEY_EXCHANGE_FAILURE   =   (SSL_ERROR_BASE   +
69),
    SSL_ERROR_ENCRYPTION_FAILURE = (SSL_ERROR_BASE + 70),
    SSL_ERROR_DECRYPTION_FAILURE = (SSL_ERROR_BASE + 71),
    SSL_ERROR_SOCKET_WRITE_FAILURE = (SSL_ERROR_BASE + 72),
    SSL_ERROR_MD5_DIGEST_FAILURE = (SSL_ERROR_BASE + 73),
    SSL_ERROR_SHA_DIGEST_FAILURE = (SSL_ERROR_BASE + 74),
    SSL_ERROR_MAC_COMPUTATION_FAILURE = (SSL_ERROR_BASE + 75),
    SSL_ERROR_SYM_KEY_CONTEXT_FAILURE = (SSL_ERROR_BASE + 76),
    SSL_ERROR_SYM_KEY_UNWRAP_FAILURE = (SSL_ERROR_BASE + 77),
    SSL_ERROR_PUB_KEY_SIZE_LIMIT_EXCEEDED   =   (SSL_ERROR_BASE   +
78),
    SSL_ERROR_IV_PARAM_FAILURE = (SSL_ERROR_BASE + 79),
    SSL_ERROR_INIT_CIPHER_SUITE_FAILURE = (SSL_ERROR_BASE + 80),
    SSL_ERROR_SESSION_KEY_GEN_FAILURE = (SSL_ERROR_BASE + 81),
    SSL_ERROR_NO_SERVER_KEY_FOR_ALG = (SSL_ERROR_BASE + 82),
    SSL_ERROR_TOKEN_INSERTION_REMOVAL = (SSL_ERROR_BASE + 83),
    SSL_ERROR_TOKEN_SLOT_NOT_FOUND = (SSL_ERROR_BASE + 84),
    SSL_ERROR_NO_COMPRESSION_OVERLAP = (SSL_ERROR_BASE + 85),
    SSL_ERROR_HANDSHAKE_NOT_COMPLETED = (SSL_ERROR_BASE + 86),
    SSL_ERROR_BAD_HANDSHAKE_HASH_VALUE = (SSL_ERROR_BASE + 87),
    SSL_ERROR_CERT_KEA_MISMATCH = (SSL_ERROR_BASE + 88),
    SSL_ERROR_NO_TRUSTED_SSL_CLIENT_CA = (SSL_ERROR_BASE + 89),
    SSL_ERROR_SESSION_NOT_FOUND = (SSL_ERROR_BASE + 90),
    SSL_ERROR_DECRYPTION_FAILED_ALERT = (SSL_ERROR_BASE + 91),
    SSL_ERROR_RECORD_OVERFLOW_ALERT = (SSL_ERROR_BASE + 92),
    SSL_ERROR_UNKNOWN_CA_ALERT = (SSL_ERROR_BASE + 93),
    SSL_ERROR_ACCESS_DENIED_ALERT = (SSL_ERROR_BASE + 94),
    SSL_ERROR_DECODE_ERROR_ALERT = (SSL_ERROR_BASE + 95),
    SSL_ERROR_DECRYPT_ERROR_ALERT = (SSL_ERROR_BASE + 96),
    SSL_ERROR_EXPORT_RESTRICTION_ALERT = (SSL_ERROR_BASE + 97),
    SSL_ERROR_PROTOCOL_VERSION_ALERT = (SSL_ERROR_BASE + 98),
    SSL_ERROR_INSUFFICIENT_SECURITY_ALERT   =   (SSL_ERROR_BASE   +
99),
    SSL_ERROR_INTERNAL_ERROR_ALERT = (SSL_ERROR_BASE + 100),
    SSL_ERROR_USER_CANCELED_ALERT = (SSL_ERROR_BASE + 101),
    SSL_ERROR_NO_RENEGOTIATION_ALERT = (SSL_ERROR_BASE + 102),
    SSL_ERROR_SERVER_CACHE_NOT_CONFIGURED   =   (SSL_ERROR_BASE   +
103),
    SSL_ERROR_UNSUPPORTED_EXTENSION_ALERT   =   (SSL_ERROR_BASE   +
104),
    SSL_ERROR_CERTIFICATE_UNOBTAINABLE_ALERT  =  (SSL_ERROR_BASE  +
105),
    SSL_ERROR_UNRECOGNIZED_NAME_ALERT = (SSL_ERROR_BASE + 106),
    SSL_ERROR_BAD_CERT_STATUS_RESPONSE_ALERT  =  (SSL_ERROR_BASE  +
107),
    SSL_ERROR_BAD_CERT_HASH_VALUE_ALERT = (SSL_ERROR_BASE + 108)
} SSLErrorCodes;
```

14.6.4 nss3/sslproto.h

```
#define __sslproto_h_
#define SSL_MT_ERROR     0
#define SSL_NULL_WITH_NULL_NULL 0x0000
#define SSL_PE_NO_CYPHERS        0x0001
#define SSL_RSA_WITH_NULL_MD5    0x0001
#define SSL_LIBRARY_VERSION_2    0x0002
#define SSL_PE_NO_CERTIFICATE    0x0002
#define SSL_RSA_WITH_NULL_SHA    0x0002
#define SSL_RSA_EXPORT_WITH_RC4_40_MD5  0x0003
#define SSL_PE_BAD_CERTIFICATE   0x0004
#define SSL_RSA_WITH_RC4_128_MD5        0x0004
```

```
#define SSL_RSA_WITH_RC4_128_SHA          0x0005
#define SSL_PE_UNSUPPORTED_CERTIFICATE_TYPE       0x0006
#define SSL_RSA_EXPORT_WITH_RC2_CBC_40_MD5        0x0006
#define SSL_RSA_WITH_IDEA_CBC_SHA         0x0007
#define SSL_RSA_EXPORT_WITH_DES40_CBC_SHA         0x0008
#define SSL_RSA_WITH_DES_CBC_SHA          0x0009
#define SSL_RSA_WITH_3DES_EDE_CBC_SHA     0x000a
#define SSL_DH_DSS_EXPORT_WITH_DES40_CBC_SHA      0x000b
#define SSL_DH_DSS_WITH_DES_CBC_SHA       0x000c
#define SSL_DH_DSS_WITH_3DES_EDE_CBC_SHA          0x000d
#define SSL_DH_RSA_EXPORT_WITH_DES40_CBC_SHA      0x000e
#define SSL_DH_RSA_WITH_DES_CBC_SHA       0x000f
#define SSL_DH_RSA_WITH_3DES_EDE_CBC_SHA          0x0010
#define SSL_DHE_DSS_EXPORT_WITH_DES40_CBC_SHA     0x0011
#define SSL_DHE_DSS_WITH_DES_CBC_SHA      0x0012
#define SSL_DHE_DSS_WITH_3DES_EDE_CBC_SHA         0x0013
#define SSL_DHE_RSA_EXPORT_WITH_DES40_CBC_SHA     0x0014
#define SSL_DHE_RSA_WITH_DES_CBC_SHA      0x0015
#define SSL_DHE_RSA_WITH_3DES_EDE_CBC_SHA         0x0016
#define SSL_DH_ANON_EXPORT_WITH_RC4_40_MD5        0x0017
#define SSL_DH_ANON_WITH_RC4_128_MD5      0x0018
#define SSL_DH_ANON_EXPORT_WITH_DES40_CBC_SHA     0x0019
#define SSL_DH_ANON_WITH_DES_CBC_SHA      0x001a
#define SSL_DH_ANON_WITH_3DES_EDE_CBC_SHA         0x001b
#define SSL_FORTEZZA_DMS_WITH_NULL_SHA    0x001c
#define SSL_FORTEZZA_DMS_WITH_FORTEZZA_CBC_SHA    0x001d
#define SSL_FORTEZZA_DMS_WITH_RC4_128_SHA         0x001e
#define TLS_RSA_WITH_AES_128_CBC_SHA      0x002F
#define TLS_DH_DSS_WITH_AES_128_CBC_SHA 0x0030
#define TLS_DH_RSA_WITH_AES_128_CBC_SHA 0x0031
#define TLS_DHE_DSS_WITH_AES_128_CBC_SHA          0x0032
#define TLS_DHE_RSA_WITH_AES_128_CBC_SHA          0x0033
#define TLS_DH_ANON_WITH_AES_128_CBC_SHA          0x0034
#define TLS_RSA_WITH_AES_256_CBC_SHA      0x0035
#define TLS_DH_DSS_WITH_AES_256_CBC_SHA 0x0036
#define TLS_DH_RSA_WITH_AES_256_CBC_SHA 0x0037
#define TLS_DHE_DSS_WITH_AES_256_CBC_SHA          0x0038
#define TLS_DHE_RSA_WITH_AES_256_CBC_SHA          0x0039
#define TLS_DH_ANON_WITH_AES_256_CBC_SHA          0x003A
#define TLS_RSA_EXPORT1024_WITH_DES_CBC_SHA       0x0062
#define TLS_DHE_DSS_EXPORT1024_WITH_DES_CBC_SHA 0x0063
#define TLS_RSA_EXPORT1024_WITH_RC4_56_SHA        0x0064
#define TLS_DHE_DSS_EXPORT1024_WITH_RC4_56_SHA    0x0065
#define TLS_DHE_DSS_WITH_RC4_128_SHA      0x0066
#define SSL_AT_MD5_WITH_RSA_ENCRYPTION    0x01
#define SSL_CK_RC4_128_WITH_MD5 0x01
#define SSL_CT_X509_CERTIFICATE 0x01
#define SSL_CK_RC4_128_EXPORT40_WITH_MD5          0x02
#define SSL_CK_RC2_128_CBC_WITH_MD5       0x03
#define SSL_LIBRARY_VERSION_3_0 0x0300
#define SSL_LIBRARY_VERSION_3_1_TLS       0x0301
#define SSL_CK_RC2_128_CBC_EXPORT40_WITH_MD5      0x04
#define SSL_CK_IDEA_128_CBC_WITH_MD5      0x05
#define SSL_CK_DES_64_CBC_WITH_MD5        0x06
#define SSL_CK_DES_192_EDE3_CBC_WITH_MD5          0x07
#define TLS_ECDH_ECDSA_WITH_NULL_SHA      0xC001
#define TLS_ECDH_ECDSA_WITH_RC4_128_SHA 0xC002
#define TLS_ECDH_ECDSA_WITH_3DES_EDE_CBC_SHA      0xC003
#define TLS_ECDH_ECDSA_WITH_AES_128_CBC_SHA       0xC004
#define TLS_ECDH_ECDSA_WITH_AES_256_CBC_SHA       0xC005
#define TLS_ECDHE_ECDSA_WITH_NULL_SHA     0xC006
#define TLS_ECDHE_ECDSA_WITH_RC4_128_SHA          0xC007
#define TLS_ECDHE_ECDSA_WITH_3DES_EDE_CBC_SHA     0xC008
#define TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA      0xC009
#define TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA      0xC00A
#define TLS_ECDH_RSA_WITH_NULL_SHA        0xC00B
```

```
#define TLS_ECDH_RSA_WITH_RC4_128_SHA    0xC00C
#define TLS_ECDH_RSA_WITH_3DES_EDE_CBC_SHA      0xC00D
#define TLS_ECDH_RSA_WITH_AES_128_CBC_SHA       0xC00E
#define TLS_ECDH_RSA_WITH_AES_256_CBC_SHA       0xC00F
#define TLS_ECDHE_RSA_WITH_NULL_SHA     0xC010
#define TLS_ECDHE_RSA_WITH_RC4_128_SHA  0xC011
#define TLS_ECDHE_RSA_WITH_3DES_EDE_CBC_SHA     0xC012
#define TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA      0xC013
#define TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA      0xC014
#define TLS_ECDH_anon_WITH_NULL_SHA     0xC015
#define TLS_ECDH_anon_WITH_RC4_128_SHA  0xC016
#define TLS_ECDH_anon_WITH_3DES_EDE_CBC_SHA     0xC017
#define TLS_ECDH_anon_WITH_AES_128_CBC_SHA      0xC018
#define TLS_ECDH_anon_WITH_AES_256_CBC_SHA      0xC019
#define SSL_RSA_FIPS_WITH_DES_CBC_SHA    0xfefe
#define SSL_RSA_FIPS_WITH_3DES_EDE_CBC_SHA      0xfeff
#define SSL_RSA_OLDFIPS_WITH_3DES_EDE_CBC_SHA   0xffe0
#define SSL_RSA_OLDFIPS_WITH_DES_CBC_SHA        0xffe1
#define SSL_HL_CLIENT_FINISHED_HBYTES    1
#define SSL_HL_SERVER_FINISHED_HBYTES    1
#define SSL_HL_SERVER_VERIFY_HBYTES      1
#define SSL_MT_CLIENT_HELLO      1
#define SSL_HL_CLIENT_MASTER_KEY_HBYTES 10
#define SSL_HL_SERVER_HELLO_HBYTES       11
#define SSL_HL_REQUEST_CERTIFICATE_HBYTES       2
#define SSL_MT_CLIENT_MASTER_KEY        2
#define SSL_HL_ERROR_HBYTES      3
#define SSL_MT_CLIENT_FINISHED  3
#define SSL_MT_SERVER_HELLO      4
#define SSL_MT_SERVER_VERIFY     5
#define SSL_HL_CLIENT_CERTIFICATE_HBYTES        6
#define SSL_MT_SERVER_FINISHED  6
#define SSL_MT_REQUEST_CERTIFICATE       7
#define SSL_MT_CLIENT_CERTIFICATE        8
#define SSL_HL_CLIENT_HELLO_HBYTES       9
```

14.6.5 nss3/sslt.h

```
#define __sslt_h_

typedef enum {
    ssl_kea_null,
    ssl_kea_rsa = 1,
    ssl_kea_dh = 2,
    ssl_kea_fortezza = 3,
    ssl_kea_ecdh = 4,
    ssl_kea_size = 5
} SSLKEAType;
typedef enum {
    ssl_sign_null,
    ssl_sign_rsa = 1,
    ssl_sign_dsa = 2,
    ssl_sign_ecdsa = 3
} SSLSignType;
typedef enum {
    ssl_auth_null,
    ssl_auth_rsa = 1,
    ssl_auth_dsa = 2,
    ssl_auth_kea = 3,
    ssl_auth_ecdsa = 4
} SSLAuthType;
typedef enum {
    ssl_calg_null,
    ssl_calg_rc4 = 1,
    ssl_calg_rc2 = 2,
```

```
        ssl_calg_des = 3,
        ssl_calg_3des = 4,
        ssl_calg_idea = 5,
        ssl_calg_fortezza = 6,
        ssl_calg_aes = 7,
        ssl_calg_camellia = 8
} SSLCipherAlgorithm;
typedef enum {
        ssl_mac_null,
        ssl_mac_md5 = 1,
        ssl_mac_sha = 2,
        ssl_hmac_md5 = 3,
        ssl_hmac_sha = 4
} SSLMACAlgorithm;
typedef struct SSLChannelInfoStr {
        PRUint32 length;
        PRUint16 protocolVersion;
        PRUint16 cipherSuite;
        PRUint32 authKeyBits;
        PRUint32 keaKeyBits;
        PRUint32 creationTime;
        PRUint32 lastAccessTime;
        PRUint32 expirationTime;
        PRUint32 sessionIDLength;
        PRUint8 sessionID[31];
} SSLChannelInfo;
typedef struct SSLCipherSuiteInfoStr {
        PRUint16 length;
        PRUint16 cipherSuite;
        const char *cipherSuiteName;
        const char *authAlgorithmName;
        SSLAuthType authAlgorithm;
        const char *keaTypeName;
        SSLKEAType keaType;
        const char *symCipherName;
        SSLCipherAlgorithm symCipher;
        PRUint16 symKeyBits;
        PRUint16 symKeySpace;
        PRUint16 effectiveKeyBits;
        const char *macAlgorithmName;
        SSLMACAlgorithm macAlgorithm;
        PRUint16 macBits;
        PRUintn isFIPS:1;
        PRUintn isExportable:1;
        PRUintn nonStandard:1;
        PRUintn reservedBits:29;
} SSLCipherSuiteInfo;
```

VI Commands and Utilities

15 Commands and Utilities

15.1 Commands and Utilities

An LSB conforming implementation shall provide the commands and utilities as described in Table 15-1, with at least the behavior described as mandatory in the referenced underlying specification, with the following exceptions:

1. If any operand (except one which follows --) starts with a hyphen, the behavior is unspecified.

   Rationale (Informative): Applications should place options before operands, or use --, as needed. This text is needed because, by default, GNU option parsing differs from POSIX, unless the environment variable POSIXLY_CORRECT is set. For example, **ls . -a** in GNU **ls** means to list the current directory, showing all files (that is, "." is an operand and -a is an option). In POSIX, "." and -a are both operands, and the command means to list the current directory, and also the file named -a. Suggesting that applications rely on the setting of the POSIXLY_CORRECT environment variable, or try to set it, seems worse than just asking the applications to invoke commands in ways which work with either the POSIX or GNU behaviors.

Table 15-1 Commands And Utilities

[[1]	dmesg [2]	id [1]	msgfmt [2]	split [1]
ar [2]	du [2]	install [2]	mv [1]	strings [1]
at [2]	echo [2]	install_initd [2]	newgrp [2]	strip [1]
awk [2]	ed [1]	ipcrm [2]	nice [1]	stty [1]
basename [1]	egrep [2]	ipcs [2]	nl [1]	su [2]
batch [2]	env [1]	join [1]	nohup [1]	sync [2]
bc [2]	expand [1]	kill [1]	od [2]	tail [1]
cat [1]	expr [1]	killall [2]	passwd [2]	tar [2]
chfn [2]	false [1]	ln [1]	paste [1]	tee [1]
chgrp [1]	fgrep [2]	locale [1]	patch [2]	test [1]
chmod [1]	file [2]	localedef [1]	pathchk [1]	time [1]
chown [1]	find [2]	logger [1]	pax [1]	touch [1]
chsh [2]	find [1]	logname [1]	pidof [2]	tr [1]
cksum [1]	fold [1]	lp [1]	pr [1]	true [1]
cmp [1]	fuser [2]	lpr [2]	printf [1]	tsort [1]
col [2]	gencat [1]	ls [2]	ps [1]	tty [1]
comm [1]	getconf [1]	lsb_release [2]	pwd [1]	umount [2]
cp [1]	gettext [2]	m4 [2]	remove_initd [2]	uname [1]

cpio [2]	grep [2]	mailx [1]	renice [2]	unexpand [1]
crontab [2]	groupadd [2]	make [1]	rm [1]	uniq [1]
csplit [1]	groupdel [2]	man [1]	rmdir [1]	useradd [2]
cut [2]	groupmod [2]	md5sum [2]	sed [2]	userdel [2]
cut [1]	groups [2]	mkdir [1]	sendmail [2]	usermod [2]
date [1]	gunzip [2]	mkfifo [1]	seq [2]	wc [1]
dd [1]	gzip [2]	mknod [2]	sh [2]	xargs [2]
df [2]	head [1]	mktemp [2]	shutdown [2]	zcat [2]
diff [1]	hostname [2]	more [2]	sleep [1]	
dirname [1]	iconv [1]	mount [2]	sort [1]	

Referenced Specification(s)

[1]. POSIX 1003.1-2001 (ISO/IEC 9945-2003)

[2]. This Specification

An LSB conforming implementation shall provide the shell built in utilities as described in Table 15-2, with at least the behavior described as mandatory in the referenced underlying specification, with the following exceptions:

1. The built in commands and utilities shall be provided by the **sh** utility itself, and need not be implemented in a manner so that they can be accessed via the exec family of functions as defined in POSIX 1003.1-2001 (ISO/IEC 9945-2003) and should not be invoked directly by those standard utilities that execute other utilities (**env**, **find**, **nice**, **nohup**, **time**, **xargs**).

   Rationale (Informative): Since the built in utilities must affect the environment of the calling process, they have no effect when executed as a file.

Table 15-2 Built In Utilities

alias [1]	command [1]	getopts [1]	read [1]	umask [1]
bg [1]	fc [1]	hash [1]	type [1]	unalias [1]
cd [1]	fg [1]	jobs [1]	ulimit [1]	wait [1]

Referenced Specification(s)

[1]. POSIX 1003.1-2001 (ISO/IEC 9945-2003)

15.2 Command Behavior

This section contains descriptions for commands and utilities whose specified behavior in the LSB contradicts or extends the standards referenced. It also contains commands and utilities only required by the LSB and not specified by other standards.

ar

Name

`ar` — create and maintain library archives (DEPRECATED)

Description

ar is deprecated from the LSB and is expected to disappear from a future version of the LSB.

> **Rationale:** The LSB generally does not include software development utilities nor does it specify .o and .a file formats.

ar is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003) but with differences as listed below.

Differences

-T
-C

> need not be accepted.

-l

> has unspecified behavior.

-q

> has unspecified behavior; using -r is suggested.

at

Name

at — examine or delete jobs for later execution

Description

at is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003) but with differences as listed below.

Differences

Options

-d

> is functionally equivalent to the -r option specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

-r

> need not be supported, but the '-d' option is equivalent.

-t time

> need not be supported.

Optional Control Files

The implementation shall support the XSI optional behavior for access control; however the files at.allow and at.deny may reside in /etc rather than /usr/lib/cron.

awk

Name

awk — pattern scanning and processing language

Description

awk is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003) but with differences as listed below.

Differences

Certain aspects of internationalized regular expressions are optional; see Regular Expressions.

batch

Name

`batch` — schedule commands to be executed in a batch queue

Description

The specification for **batch** is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

Optional Control Files

The implementation shall support the XSI optional behavior for access control; however the files `at.allow` and `at.deny` may reside in `/etc` rather than `/usr/lib/cron`.

bc

Name

`bc` — an arbitrary precision calculator language

Description

bc is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003) but with extensions as listed below.

Extensions

The bc language may be extended in an implementation defined manner. If an implementation supports extensions, it shall also support the additional options:

-s|--standard

>   processes exactly the POSIX **bc** language.

-w|--warn

>   gives warnings for extensions to POSIX bc.

chfn

Name

`chfn` — change user name and information

Synopsis

chfn [-f *full_name*] [-h *home_phone*] [user]

Description

chfn shall update the user database. An unprivileged user may only change the fields for their own account, a user with appropriate privileges may change the fields for any account.

The fields *full_name* and *home_phone* may contain any character except:

any control character
comma
colon
equal sign

If none of the options are selected, **chfn** operates in an interactive fashion. The prompts and expected input in interactive mode are unspecified and should not be relied upon.

As it is possible for the system to be configured to restrict which fields a non-privileged user is permitted to change, applications should be written to gracefully handle these situations.

Standard Options

-f full_name

> sets the user's full name.

-h home_phone

> sets the user's home phone number.

Future Directions

The following two options are expected to be added in a future version of the LSB:

-o office

> sets the user's office room number.

-p office_phone

> sets the user's office phone number.

Note that some implementations contain a "-o other" option which specifies an additional field called "other". Traditionally, this field is not subject to the constraints about legitimate characters in fields. Also, one traditionally shall have appropriate privileges to change the other field. At this point there is no consensus about whether it is desirable to specify the other field; applications may wish to avoid using it.

The "-w work_phone" field found in some implementations should be replaced by the "-p office_phone" field. The "-r room_number" field found in some implementations is the equivalent of the "-o office" option mentioned above; which one of these two options to specify will depend on implementation experience and the decision regarding the other field.

chsh

Name

chsh — change login shell

Synopsis

chsh [-s *login_shell*] [*user*]

Description

chsh changes the user login shell. This determines the name of the user's initial login command. An unprivileged user may only change the login shell for their own account, a user with appropriate privilege may change the login shell for any account specified by *user*.

Unless the user has appropriate privilege, the initial login command name shall be one of those listed in /etc/shells. The *login_shell* shall be the absolute path (i.e. it must start with '/') to an executable file. Accounts which are restricted (in an implementation-defined manner) may not change their login shell.

If the *-s* option is not selected, **chsh** operates in an interactive mode. The prompts and expected input in this mode are unspecified.

Standard Options

-s login_shell

> sets the login shell.

col

Name

col — filter reverse line feeds from input

Description

col is as specified in SUSv2 but with differences as listed below.

Differences

The *-p* option has unspecified behavior.

> **Note:** Although **col** is shown as legacy in SUSv2, it is not (yet) deprecated in the LSB.

cpio

Name

cpio — copy file archives in and out

Description

cpio is as specified in SUSv2, but with differences as listed below.

Differences

Some elements of the Pattern Matching Notation are optional; see Pattern Matching Notation.

crontab

Name

crontab — maintain crontab files for individual users

Synopsis

crontab [-u user] file **crontab** [-u user] {-l | -r | -e}

Description

crontab is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

Optional Control Files

The implementation shall support the XSI optional behavior for access control; however the files cron.allow and cron.deny may reside in /etc rather than /usr/lib/cron.

df

Name

df — report file system disk space usage

Description

The **df** command shall behave as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

Differences

Options

If the *-k* option is not specified, disk space is shown in unspecified units. If the *-P* option is specified, the size of the unit shall be printed on the header line in the format `"%4s-blocks"`. Applications should specify *-k*.

The XSI option *-t* has unspecified behavior. Applications should not specify *-t*.

> **Rationale:** The most common implementation of **df** uses the *-t* option for a different purpose (restricting output to a particular file system type), and use of *-t* is therefore non-portable.

Operand May Identify Special File

If an argument is the absolute file name of a special file containing a mounted file system, **df** shall show the space available on that file system rather than on the file system containing the special file (which is typically the root file system).

> **Note:** In POSIX 1003.1-2001 (ISO/IEC 9945-2003) the XSI optional behavior permits an operand to name a special file, but appears to require the operation be performed on the file system containing the special file. A defect report has been submitted for this case.

dmesg

Name

dmesg — print or control the system message buffer

Synopsis

dmesg [-c | -n *level* | -s *bufsize*]

Description

dmesg examines or controls the system message buffer. Only a user with appropriate privileges may modify the system message buffer parameters or contents.

Standard Options

-c

> If the user has appropriate privilege, clears the system message buffer contents after printing.

-n level

> If the user has appropriate privilege, sets the level at which logging of messages is done to the console.

-s bufsize

> uses a buffer of *bufsize* to query the system message buffer. This is 16392 by default.

du

Name

du — estimate file space usage

Description

du is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

Differences

If the *-k* option is not specified, disk space is shown in unspecified units. Applications should specify *-k*.

echo

Name

`echo` — write arguments to standard output

Synopsis

echo `[string...]`

Description

The **echo** command is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with the following differences.

Implementations may support implementation-defined options to **echo**. The behavior of **echo** if any arguments contain backslashes is also implementation defined.

Application Usage

Conforming applications should not run **echo** with a first argument starting with a hyphen, or with any arguments containing backslashes; they should use **printf** in those cases.

> **Note:** The behavior specified here is similar to that specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003) without the XSI option. However, the LSB strongly recommends conforming applications not use any options (even if the implementation provides them) while POSIX 1003.1-2001 (ISO/IEC 9945-2003) specifies behavior if the first operand is the string *-n*.

egrep

Name

`egrep` — search a file with an Extended Regular Expression pattern

Description

egrep is equivalent to **grep -E**. For further details, see the specification for **grep**.

fgrep

Name

`fgrep` — search a file with a fixed pattern

Description

fgrep is equivalent to grep -F. For further details, see the specification for **grep**.

file

Name

file — determine file type

Description

file is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

Differences

The *-M*, *-h*, *-d*, and *-i* options need not be supported.

fuser

Name

fuser — identify processes using files or sockets

Description

fuser is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

Differences

The **fuser** command is a system administration utility, see Path For System Administration Utilities.

Option Differences

-c

    has unspecified behavior.

-f

    has unspecified behavior.

gettext

Name

gettext — retrieve text string from message catalog

Synopsis

gettext [options] [textdomain] msgid **gettext** -s [options] msgid...

Description

The **gettext** utility retrieves a translated text string corresponding to string *msgid* from a message object generated with **msgfmt** utility.

The message object name is derived from the optional argument *textdomain* if present, otherwise from the TEXTDOMAIN environment variable. If no domain is specified, or if a corresponding string cannot be found, **gettext** prints *msgid*.

Ordinarily **gettext** looks for its message object in *dirname*/*lang*/LC_MESSAGES where *dirname* is the implementation-defined default directory and *lang* is the locale name. If present, the TEXTDOMAINDIR environment variable replaces the *dirname*.

This utility interprets C escape sequences such as \t for tab. Use \\ to print a backslash. To produce a message on a line of its own, either put a \n at the end of *msgid,* or use this command in conjunction with the **printf** utility.

When used with the *-s* option the **gettext** utility behaves like the **echo** utility, except that the message corresponding to *msgid* in the selected catalog provides the arguments.

Options

-d domainname
--domain=domainname

> PARAMETER translated messages from domainname.

-e

> Enable expansion of some escape sequences.

-n

> Suppress trailing newline.

Operands

The following operands are supported:

textdomain

> A domain name used to retrieve the messages.

msgid

> A key to retrieve the localized message.

Environment Variables

LANGUAGE

> Specifies one or more locale names.

LANG

> Specifies locale name.

LC_MESSAGES

> Specifies messaging locale, and if present overrides LANG for messages.

TEXTDOMAIN

> Specifies the text domain name, which is identical to the message object filename without .mo suffix.

TEXTDOMAINDIR

> Specifies the pathname to the message catalog, and if present replaces the implementation-defined default directory.

Exit Status

The following exit values are returned:

0

> Successful completion.

>0

> An error occurred.

grep

Name

grep — print lines matching a pattern

Description

grep is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

LSB Differences

Certain aspects of regular expression matching are optional; see Regular Expressions.

groupadd

Name

groupadd — create a new group

Synopsis

groupadd [-g gid [-o]] group

Description

If the caller has appropriate privilege, the **groupadd** command shall create a new group named *group*. The group name shall be unique in the group database. If no *gid* is specified, **groupadd** shall create the new group with a unique group ID.

The **groupadd** command is a system administration utility, see Path For System Administration Utilities.

Options

-g gid [-o]

> The new group shall have group ID *gid*. If the *-o* option is not used, no other group shall have this group ID. The value of *gid* shall be non-negative.

groupdel

Name

groupdel — delete a group

Synopsis

groupdel group

Description

If the caller has sufficient privilege, the **groupdel** command shall modify the system group database, deleting the group named *group*. If the group named *group* does not exist, **groupdel** shall issue a diagnostic message and exit with a non-zero exit status.

The **groupdel** command is a system administration utility, see Path For System Administration Utilities.

groupmod

Name

groupmod — modify a group

Synopsis

groupmod [-g *gid* [-o]] [-n *group_name*] group

Description

If the caller has appropriate privilege, the **groupmod** command shall modify the entry in the system group database corresponding to a group named *group*.

The **groupmod** command is a system administration utility, see Path For System Administration Utilities.

Options

-g gid [-o]

Modify the group's group ID, setting it to *gid*. If the *-o* option is not used, no other group shall have this group ID. The value of *gid*shall be non-negative.

Note: Only the group ID in the database is altered; any files with group ownership set to the original group ID are unchanged by this modification.

-n group_name

changes the name of the group from *group* to *group_name*.

groups

Name

groups — display a group

Synopsis

groups [user]

Description

The **groups** command shall behave as **id -Gn *[user]***, as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003). The optional *user* parameter will display the groups for the named user.

gunzip

Name

gunzip — uncompress files

Description

gunzip is equivalent to **gzip -d**. See the specification for **gzip** for further details.

Filesystem Hierarchy Standard requires that if **gunzip** exists, it must be a symbolic or hard link to /bin/gzip. This specification additionally allows **gunzip** to be a wrapper script which calls **gzip -d**.

gzip

Name

gzip — compress or expand files

Synopsis

gzip [-cdfhlLnNrtvV19] [-S suffix] [name...]

Description

The **gzip** command shall attempt to reduce the size of the named files. Whenever possible, each file is replaced by one with the extension .gz, while keeping the same ownership, modes, access and modification times. If no files are specified, or if a file name is -, the standard input is compressed to the standard output. **gzip** shall only attempt to compress regular files. In particular, it will ignore symbolic links.

When compressing, gzip uses the deflate algorithm specified in RFC 1951: DEFLATE Compressed Data Format Specification and stores the result in a file using the gzip file format specified in RFC 1952: GZIP File Format Specification.

Options

-c, --stdout, --to-stdout

> writes output on standard output, leaving the original files unchanged. If there are several input files, the output consists of a sequence of independently compressed members. To obtain better compression, concatenate all input files before compressing them.

-d, --decompress, --uncompress

> the name operands are compressed files, and **gzip** shall decompress them.

-f, --force

> forces compression or decompression even if the file has multiple links or the corresponding file already exists, or if the compressed data is read from or written to a terminal. If the input data is not in a format recognized by **gzip**, and if the option *--stdout* is also given, copy the input data without change to the standard ouput: let **gzip** behave as **cat**. If *-f* is not given, and when not running in the background, **gzip** prompts to verify whether an existing file should be overwritten.

-l, --list

> lists the compressed size, uncompressed size, ratio and uncompressed name for each compressed file. For files that are not in **gzip** format, the uncompressed size shall be given as -1. If the *--verbose* or *-v* option is also specified, the crc and timestamp for the uncompressed file shall also be displayed.

> For decompression, **gzip** shall support at least the following compression methods:

> • deflate (RFC 1951: DEFLATE Compressed Data Format Specification)

> • compress (POSIX 1003.1-2001 (ISO/IEC 9945-2003))

> The crc shall be given as ffffffff for a file not in **gzip** format.

If the `--name` or `-N` option is also specified, the uncompressed name, date and time are those stored within the compressed file, if present.

If the `--quiet` or `-q` option is also specified, the title and totals lines are not displayed.

-L, --license

displays the **gzip** license and quit.

-n, --no-name

does not save the original file name and time stamp by default when compressing. (The original name is always saved if the name had to be truncated.) When decompressing, do not restore the original file name if present (remove only the gzip suffix from the compressed file name) and do not restore the original time stamp if present (copy it from the compressed file). This option is the default when decompressing.

-N, --name

always saves the original file name and time stamp when compressing; this is the default. When decompressing, restore the original file name and time stamp if present. This option is useful on systems which have a limit on file name length or when the time stamp has been lost after a file transfer.

-q, --quiet

suppresses all warnings.

-r, --recursive

travels the directory structure recursively. If any of the file names specified on the command line are directories, **gzip** will descend into the directory and compress all the files it finds there (or decompress them in the case of **gunzip**).

-S .suf, --sufix .suf

uses suffix `.suf` instead of `.gz`.

-t, --test

checks the compressed file integrity.

-v, --verbose

displays the name and percentage reduction for each file compressed or decompressed.

-#, --fast, --best

regulates the speed of compression using the specified digit #, where `-1` or `--fast` indicates the fastest compression method (less compression) and `-9` or `--best` indicates the slowest compression method (best compression). The default compression level is `-6` (that is, biased towards high compression at expense of speed).

LSB Deprecated Options

The behaviors specified in this section are expected to disappear from a future version of the LSB; applications should only use the non-LSB-deprecated behaviors.

-V, --version

> displays the version number and compilation options, then quits.

hostname

Name

`hostname` — show or set the system's host name

Synopsis

hostname [name]

Description

hostname is used to either display or, with appropriate privileges, set the current host name of the system. The host name is used by many applications to identify the machine.

When called without any arguments, the program displays the name of the system as returned by the `gethostname()` function.

When called with a *name* argument, and the user has appropriate privilege, the command sets the host name.

> **Note:** It is not specified if the hostname displayed will be a fully qualified domain name. Applications requiring a particular format of hostname should check the output and take appropriate action.

install

Name

install — copy files and set attributes

Synopsis

install [option...] SOURCE DEST **install** [option...] SOURCE... DEST **install** [-d | --directory] [option...] DIRECTORY...

Description

In the first two formats, copy *SOURCE* to *DEST* or multiple *SOURCE(s)* to the existing *DEST* directory, optionally setting permission modes and file ownership. In the third format, each *DIRECTORY* and any missing parent directories shall be created.

Standard Options

--backup[=METHOD]

> makes a backup of each existing destination file. *METHOD* may be one of the following:

> *none* or *off*

>> never make backups.

> *numbered* or *t*

>> make numbered backups. A numbered backup has the form `"%s.~%d~"`, `target_name`, `version_number`. Each backup shall increment the version number by 1.

> *existing* or *nil*

>> behave as numbered if numbered backups exist, or simple otherwise.

> *simple* or *never*

>> append a suffix to the name. The default suffix is '~', but can be overriden by setting SIMPLE_BACKUP_SUFFIX in the environment, or via the *-S* or *--suffix* option.

> If no *METHOD* is specified, the environment variable VERSION_CONTROL shall be examined for one of the above. Unambiguous abbreviations of *METHOD* shall be accepted. If no *METHOD* is specified, or if *METHOD* is empty, the backup method shall default to `existing`.

> If *METHOD* is invalid or ambiguous, **install** shall fail and issue a diagnostic message.

-b

> is equivalent to *--backup=existing*.

-d, --directory

> treats all arguments as directory names; creates all components of the specified directories.

-D

creates all leading components of DEST except the last, then copies SOURCE to DEST; useful in the 1st format.

-g GROUP, --group=GROUP

if the user has appropriate privilege, sets group ownership, instead of process' current group. *GROUP* is either a name in the user group database, or a positive integer, which shall be used as a group-id.

-m MODE, --mode=MODE

sets permission mode (specified as in **chmod**), instead of the default `rwxr-xr-x`.

-o OWNER, --owner=OWNER

if the user has appropriate privilege, sets ownership. *OWNER* is either a name in the user login database, or a positive integer, which shall be used as a user-id.

-p, --preserve-timestamps

copies the access and modification times of *SOURCE* files to corresponding destination files.

-s, --strip

strips symbol tables, only for 1st and 2nd formats.

-S SUFFIX, --suffix=SUFFIX

equivalent to `--backup=existing`, except if a simple suffix is required, use *SUFFIX*.

--verbose

prints the name of each directory as it is created.

-v, --verbose

print the name of each file before copying it to `stdout`.

install_initd

Name

`install_initd` — activate an init script

Synopsis

/usr/lib/lsb/install_initd `initd_file`

Description

install_initd shall activate a system initialization file that has been copied to an implementation defined location such that this file shall be run at the appropriate point during system initialization. The **install_initd** command is typically called in the postinstall script of a package, after the script has been copied to `/etc/init.d`. See also Installation and Removal of Init Scripts.

ipcrm

Name

ipcrm — remove IPC Resources

Synopsis

ipcrm [-q *msgid* | -Q *msgkey* | -s *semid* | -S *semkey* | -m *shmid* | -M *shmkey*]...**ipcrm** [shm | msg | msg] id...

Description

If any of the *-q, -Q, -s, -S, -m, or -M* arguments are given, the **ipcrm** shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

Otherwise, **ipcrm** shall remove the resource of the specified type identified by *id*.

Future Directions

A future revision of this specification may deprecate the second synopsis form.

> **Rationale:** In its first Linux implementation, **ipcrm** used the second syntax shown in the SYNOPSIS. Functionality present in other implementations of **ipcrm** has since been added, namely the ability to delete resources by key (not just identifier), and to respect the same command line syntax. The previous syntax is still supported for backwards compatibility only.

ipcs

Name

`ipcs` — provide information on ipc facilities

Synopsis

ipcs [-smq] [-tcp]

Description

ipcs provides information on the ipc facilities for which the calling process has read access.

> **Note:** Although this command has many similarities with the optional **ipcs** utility described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), it has substantial differences and is therefore described separately. The options specified here have similar meaning to those in POSIX 1003.1-2001 (ISO/IEC 9945-2003); other options specified there have unspecified behavior on an LSB conforming implementation. See Application Usage below. The output format is not specified.

Resource display options

-m

> shared memory segments.

-q

> message queues.

-s

> semaphore arrays.

Output format options

-t

> time.

-p

> pid.

-c

> creator.

Application Usage

In some implementations of ipcs the `-a` option will print all information available. In other implementations the `-a` option will print all resource types. Therefore, applications shall not use the `-a` option.

Some implementations of **ipcs** provide more output formats than are specified here. These options are not consistent between differing implementations of **ipcs**. Therefore, only the `-t`, `-c` and `-p` option formatting flags may be used. At least one of the `-t`, `-c` and `-p` options and at least one of `-m`, `-q` and `-s` options shall be specified. If no options are specified, the output is unspecified.

killall

Name

killall — kill processes by name

Synopsis

killall [-egiqvw] [-signal] name... **killall** -l **killall** -V

Description

killall sends a signal to all processes running any of the specified commands. If no signal name is specified, SIGTERM is sent.

Signals can be specified either by name (e.g. -HUP) or by number (e.g. -1). Signal 0 (check if a process exists) can only be specified by number.

If the command name contains a slash (/), processes executing that particular file will be selected for killing, independent of their name.

killall returns a non-zero return code if no process has been killed for any of the listed commands. If at least one process has been killed for each command, **killall** returns zero.

A **killall** process never kills itself (but may kill other **killall** processes).

Standard Options

-e

> requires an exact match for very long names. If a command name is longer than 15 characters, the full name may be unavailable (i.e. it is swapped out). In this case, **killall** will kill everything that matches within the first 15 characters. With -e, such entries are skipped. **killall** prints a message for each skipped entry if -v is specified in addition to -e.

-g

> kills the process group to which the process belongs. The kill signal is only sent once per group, even if multiple processes belonging to the same process group were found.

-i

> asks interactively for confirmation before killing.

-l

> lists all known signal names.

-q

> does not complain if no processes were killed.

-v

> reports if the signal was successfully sent.

LSB Deprecated Options

The behaviors specified in this section are expected to disappear from a future version of the LSB; applications should only use the non-LSB-deprecated behaviors.

-V

> displays version information.

lpr

Name

lpr — off line print

Synopsis

lpr [-l] [-p] [-Pprinter] [-h] [-s] [-#copies] [-J name] [-T title] [name
......]

Description

lpr uses a spooling daemon to print the named files when facilities become
available. If no names appear, the standard input is assumed.

Standard Options

-l

> identifies binary data that is not to be filtered but sent as raw input to
> printer.

-p

> formats with "pr" before sending to printer.

-Pprinter

> sends output to the printer named printer instead of the default printer.

-h

> suppresses header page.

-s

> uses symbolic links.

-#copies

> specifies copies as the number of copies to print.

-J name

> specifies name as the job name for the header page.

-T title

> specifies title as the title used for "pr".

ls

Name

ls — list directory contents

Description

ls shall behave as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with extensions listed below.

Extensions

-l

If the file is a character special or block special file, the size of the file shall be replaced with two unsigned numbers in the format `"%u, %u"`, representing the major and minor device numbers associated with the special file.

Note: The LSB does not specify the meaning of the major and minor devices numbers.

-p

in addition to POSIX 1003.1-2001 (ISO/IEC 9945-2003) XSI optional behavior of printing a slash for a directory, **ls -p** may display other characters for other file types.

lsb_release

Name

`lsb_release` — print distribution specific information

Synopsis

lsb_release [OPTION...]

Description

The **lsb_release** command prints certain LSB (Linux Standard Base) and Distribution information.

If no options are given, the *-v* option is assumed.

Options

-v, --version

> displays version of LSB against which distribution is compliant. The version is expressed as a colon separated list of LSB module descriptions. LSB module descriptions are dash separated tuples containing the module name, version, and architecture name. The output is a single line of text of the following format:

> `LSB Version:\t`*ListAsDescribedAbove*

> > **Note:** An implementation may support multiple releases of the same module. Version specific library interfaces, if any, will be selected by the program interpreter, which changes from release to release. Version specific commands and utilities, if any, will be described in the relevant specification.

-i, --id

> displays string id of distributor. The output is a single line of text of the following format:

> `Distributor ID:\t`*DistributorID*

-d, --description

> displays single line text description of distribution. The output is of the following format:

> `Description:\t`*Description*

-r, --release

> displays release number of distribution. The output is a single line of text of the following format:

> `Release:\t`*Release*

-c, --codename

> displays codename according to distribution release. The output is a single line of text of the following format.

> `Codename:\t`*Codename*

-a, --all

> displays all of the above information.

-s, --short

   displays all of the above information in short output format.

-h, --help

   displays a human-readable help message.

Example

The following command will list the LSB Profiles which are currently supported on this platform.

```
example% lsb_release -v
LSB     Version:     core-3.0-ia32:core-3.0-noarch:graphics-3.0-
ia32:graphics-3.0-noarch
```

m4

Name

m4 — macro processor

Description

m4 is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with extensions as listed below.

Extensions

-P

   forces all builtins to be prefixed with m4_. For example, define becomes m4_define.

-I *directory*

   Add *directory* to the end of the search path for includes.

md5sum

Name

md5sum — generate or check MD5 message digests

Synopsis

md5sum [-c [file] | file]

Description

For each file, write to standard output a line containing the MD5 message digest of that file, followed by one or more blank characters, followed by the name of the file. The MD5 message digest shall be calculated according to RFC 1321: The MD5 Message-Digest Algorithm and output as 32 hexadecimal digits.

If no file names are specified as operands, read from standard input and use `"-"` as the file name in the output.

Options

-c [file]

checks the MD5 message digest of all files named in `file` against the message digest listed in the same file. The actual format of `file` is the same as the output of **md5sum**. That is, each line in the file describes a file. If `file` is not specified, read message digests from stdin.

Exit Status

md5sum shall exit with status 0 if the sum was generated successfully, or, in check mode, if the check matched. Otherwise, **md5sum** shall exit with a non-zero status.

mknod

Name

mknod — make special files

Synopsis

mknod [-m *mode* | --mode=*mode*] name type [major minor]**mknod** [--version]

Description

The **mknod** command shall create a special file named *name* of the given *type*.

The *type* shall be one of the following:

b

> creates a block (buffered) special file with the specified *major* and *minor* device numbers.

c, u

> creates a character (unbuffered) special file with the specified *major* and *minor* device numbers.

p

> creates a FIFO.

Options

-m *mode*, --mode=*mode*

> create the special file with file access permissions set as described in *mode*. The permissions may be any absolute value (i.e. one not containing '+' or '-') acceptable to the **chmod** command.

--version

> output version information and exit.

> **Note:** This option may be deprecated in a future release of this specification.

If *type* is p, *major* and *minor* shall not be specified. Otherwise, these parameters are mandatory.

Future Directions

This command may be deprecated in a future version of this specification. The *major* and *minor* operands are insufficently portable to be specified usefully here. Only a FIFO can be portably created by this command, and the **mkfifo** command is a simpler interface for that purpose.

mktemp

Name

mktemp — make temporary file name (unique)

Synopsis

mktemp [-q] [-u] template

Description

The **mktemp** command takes the given file name *template* and overwrites a portion of it to create a file name. This file name shall be unique and suitable for use by the application.

The *template* should have at least six trailing 'X' characters. These characters are replaced with characters from the portable filename character set in order to generate a unique name.

If **mktemp** can successfully generate a unique file name, and the *-u* option is not present, the file shall be created with read and write permission only for the current user. The **mktemp** command shall write the filename generated to the standard output.

Options

-q

fail silently if an error occurs. Diagnostic messages to stderr are suppressed, but the command shall still exit with a non-zero exit status if an error occurs.

-u

operates in `unsafe' mode. A unique name is generated, but the temporary file shall be unlinked before **mktemp** exits. Use of this option is not encouraged.

more

Name

`more` — display files on a page-by-page basis

Description

more is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

Differences

The **more** command need not respect the LINES and COLUMNS environment variables.

The following additional options may be supported:

`-num`

specifies an integer which is the screen size (in lines).

`+num`

starts at line number `num`.

`+/pattern`

Start at the first line matching the pattern, equivalent to executing the search forward (`/`) command with the given pattern immediately after opening each file.

The following options from POSIX 1003.1-2001 (ISO/IEC 9945-2003) may behave differently:

-e

has unspecified behavior.

-i

has unspecified behavior.

-n

has unspecified behavior.

-p

Either clear the whole screen before displaying any text (instead of the usual scrolling behavior), or provide the behavior specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003). In the latter case, the syntax is "`-p command`".

-t

has unspecified behavior.

The **more** command need not support the following interactive commands:

g
G
u
control u
control f
newline
j
k
r
R
m
' (return to mark)
/!
?
N
:e
:t
control g
ZZ

Rationale

The +*num* and +/*string* options are deprecated in SUSv2, and have been removed in POSIX 1003.1-2001 (ISO/IEC 9945-2003); however this specification continues to specify them because the publicly available `util-linux` package does not support the replacement (-p *command*). The +*command* option as found in SUSv2 is more general than is specified here, but the `util-linux` package appears to only support the more specific +*num* and +/*string* forms.

mount

Name

mount — mount a file system

Synopsis

mount [-hV]**mount** [-a] [-fFnrsvw] [-t *vfstype*]**mount** [-fnrsvw] [-o *options*]
[,...]] [device | dir]**mount** [-fnrsvw] [-t *vfstype*] [-o options] device dir

Description

As described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), all files in the system
are organized in a directed graph, known as the file hierarchy, rooted at /.
These files can be spread out over several underlying devices. The **mount**
command shall attach the file system found on some underlying device to the
file hierarchy.

Options

-v

> invoke verbose mode. The **mount** command shall provide diagnostic
> messages on stdout.

-a

> mount all file systems (of the given types) mentioned in /etc/fstab.

-F

> If the -a option is also present, fork a new incarnation of **mount** for each
> device to be mounted. This will do the mounts on different devices or
> different NFS servers in parallel.

-f

> cause everything to be done except for the actual system call; if it's not
> obvious, this `fakes' mounting the file system.

-n

> mount without writing in /etc/mtab. This is necessary for example when
> /etc is on a read-only file system.

-s

> ignore **mount** options not supported by a file system type. Not all file
> systems support this option.

-r

> mount the file system read-only. A synonym is -o ro.

-w

> mount the file system read/write. (default) A synonym is -o rw.

-L label

> If the file /proc/partitions is supported, mount the partition that has the
> specified label.

-U uuid

If the file `/proc/partitions` is supported, mount the partition that has the specified uuid.

-t vfstype

indicate a file system type of `vfstype`.

More than one type may be specified in a comma separated list. The list of file system types can be prefixed with `no` to specify the file system types on which no action should be taken.

-o

options are specified with a `-o` flag followed by a comma-separated string of options. Some of these options are only useful when they appear in the `/etc/fstab` file. The following options apply to any file system that is being mounted:

async

perform all I/O to the file system asynchronously.

atime

update inode access time for each access. (default)

auto

in `/etc/fstab`, indicate the device is mountable with `-a`.

defaults

use default options: `rw`, `suid`, `dev`, `exec`, `auto`, `nouser`, `async`.

dev

interpret character or block special devices on the file system.

exec

permit execution of binaries.

noatime

do not update file access times on this file system.

noauto

in `/etc/fstab`, indicates the device is only explicitly mountable.

nodev

do not interpret character or block special devices on the file system.

noexec

do not allow execution of any binaries on the mounted file system.

nosuid

do not allow set-user-identifier or set-group-identifier bits to take effect.

nouser

forbid an unprivileged user to mount the file system. (default)

remount

> remount an already-mounted file system. This is commonly used to change the mount options for a file system, especially to make a read-only file system writable.

ro

> mount the file system read-only.

rw

> mount the file system read-write.

suid

> allow set-user-identifier or set-group-identifier bits to take effect.

sync

> do all I/O to the file system synchronously.

user

> allow an unprivilieged user to mount the file system. This option implies the options `noexec`, `nosuid`, `nodev` unless overridden by subsequent options.

LSB Deprecated Options

The behaviors specified in this section are expected to disappear from a future version of the LSB; applications should only use the non-LSB-deprecated behaviors.

-V

> output version and exit.

msgfmt

Name

msgfmt — create a message object from a message file

Synopsis

msgfmt [options...] *filename...*

Description

The **msgfmt** command generates a binary message catalog from a textual translation description. Message catalogs, or message object files, are stored in files with a .mo extension.

> **Note:** The format of message object files is not guaranteed to be portable. Message catalogs should always be generated on the target architecture using the **msgfmt** command.

The source message files, otherwise known as portable object files, have a .po extension.

The *filename* operands shall be portable object files. The .po file contains messages to be displayed to users by system utilities or by application programs. The portable object files are text files, and the messages in them can be rewritten in any language supported by the system.

If any *filename* is -, a portable object file shall be read from the standard input.

The **msgfmt** command interprets data as characters according to the current setting of the LC_CTYPE locale category.

Options

-c
--check

> Detect and diagnose input file anomalies which might represent translation errors. The msgid and msgstr strings are studied and compared. It is considered abnormal that one string starts or ends with a newline while the other does not.
>
> If the message is flagged as c-format (see Comment Handling), check that the msgid string and the msgstr translation have the same number of % format specifiers, with matching types.

-D *directory*
--directory=*directory*

> Add directory to list for input files search. If *filename* is not an absolute pathname and *filename* cannot be opened, search for it in *directory*. This option may be repeated. Directories shall be searched in order, with the leftmost *directory* searched first.

-f
--use-fuzzy

> Use entries marked as fuzzy in output. If this option is not specified, such entries are not included into the output. See Comment Handling below.

-o *output-file*

--output-file=`output-file`

> Specify the output file name as `output-file`. If multiple domains or duplicate msgids in the `.po` file are present, the behavior is unspecified. If output-file is `-`, output is written to standard output.

--strict

> Ensure that all output files have a `.mo` extension. Output files are named either by the `-o` (or `--output-file`) option, or by domains found in the input files.

-v
--verbose

> Print additional information to the standard error, including the number of translated strings processed.

Operands

The `filename` operands are treated as portable object files. The format of portable object files is defined in EXTENDED DESCRIPTION.

Standard Input

The standard input is not used unless a `filename` operand is specified as "-".

Environment Variables

LANGUAGE

> Specifies one or more locale names.

LANG

> Specifies locale name.

LC_ALL

> Specifies locale name for all categories. If defined, overrides LANG, LC_CTYPE and LC_MESSAGES.

LC_CTYPE

> Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single-byte as opposed to multi-byte characters in arguments and input files).

LC_MESSAGES

> Specifies messaging locale, and if present overrides LANG for messages.

Standard Output

The standard output is not used unless the option-argument of the `-o` option is specified as `-`.

Extended Description

The format of portable object files (`.po` files) is defined as follows. Each `.po` file contains one or more lines, with each line containing either a comment or a statement. Comments start the line with a hash mark (#) and end with the newline character. Empty lines, or lines containing only white-space, shall be ignored. Comments can in certain circumstances alter the behavior of **msgfmt**. See Comment Handling below for details on comment processing. The format of a statement is:

```
directive value
```

Each `directive` starts at the beginning of the line and is separated from `value` by white space (such as one or more space or tab characters). The `value` consists of one or more quoted strings separated by white space. If two or more strings are specified as `value`, they are normalized into single string using the string normalization syntax specified in ISO C (1999). The following directives are supported:

```
domain domainname

msgid message_identifier

msgid_plural untranslated_string_plural

msgstr message_string

msgstr[n] message_string
```

The behavior of the `domain` directive is affected by the options used. See OPTIONS for the behavior when the `-o` option is specified. If the `-o` option is not specified, the behavior of the `domain` directive is as follows:

1. All msgids from the beginning of each `.po` file to the first `domain` directive are put into a default message object file, messages (or `messages.mo` if the `--strict` option is specified).

2. When **msgfmt** encounters a `domain domainname` directive in the `.po` file, all following *msgids* until the next `domain` directive are put into the message object file domainname (or `domainname.mo` if `--strict` option is specified).

3. Duplicate *msgids* are defined in the scope of each domain. That is, a *msgid* is considered a duplicate only if the identical *msgid* exists in the same domain.

4. All duplicate *msgids* are ignored.

The `msgid` directive specifies the value of a message identifier associated with the directive that follows it. The `msgid_plural` directive specifies the plural form message specified to the plural message handling functions `ngettext()`, `dngettext()` or `dcngettext()`. The message_identifier string identifies a target string to be used at retrieval time. Each statement containing a `msgid` directive shall be followed by a statement containing a `msgstr` directive or `msgstr[n]` directives.

The `msgstr` directive specifies the target string associated with the *message_identifier* string declared in the immediately preceding `msgid` directive.

The `msgstr[n]` (where n = 0, 1, 2, ...) directive specifies the target string to be used with plural form handling functions `ngettext()`, `dngettext()` and `dcngettext()`.

Message strings can contain the following escape sequences:

Table 15-1 Escape Sequences

\n	newline
\t	tab
\v	vertical tab
\b	backspace
\r	carriage return
\f	formfeed
\\	backslash
\"	double quote
\ddd	octal bit pattern
\xHH	hexadecimal bit pattern

Comment Handling

Comments are introduced by a #, and continue to the end of the line. The second character (i.e. the character following the #) has special meaning. Regular comments should follow a space character. Other comment types include:

```
# normal-comments

#. automatic-comments

#: reference...

#, flag
```

Automatic and reference comments are typically generated by external utilities, and are not specified by the LSB. The **msgfmt** command shall ignore such comments.

> **Note:** Portable object files may be produced by unspecified tools. Some of the comment types described here may arise from the use of such tools. It is beyond the scope of this specification to describe these tools.

The #, comments require one or more flags separated by the comma (,) character. The following flags can be specified:

fuzzy

> This flag shows that the following msgstr string might not be a correct translation. Only the translator (i.e. the individual undertaking the translation) can judge if the translation requires further modification, or is acceptable as is. Once satisfied with the translation, the translator then removes this fuzzy flag.

> If this flag is specified, the **msgfmt** utility will not generate the entry for the immediately following msgid in the output message catalog, unless the --use-fuzzy is specified.

c-format
no-c-format

> The c-format flag indicates that the msgid string is used as format string by printf()-like functions. If the c-format flag is given for a string the **msgfmt** utility may perform additional tests to check the validity of the translation.

Plurals

The msgid entry with empty string ("") is called the header entry and is treated specially. If the message string for the header entry contains `nplurals=value`, the value indicates the number of plural forms. For example, if `nplurals=4`, there are 4 plural forms. If `nplurals` is defined, there should be a `plural=expression` on the same line, separated by a semicolon (;) character. The expression is a C language expression to determine which version of `msgstr[n]` to be used based on the value of n, the last argument of `ngettext()`, `dngettext()` or `dcngettext()`. For example:

```
nplurals=2; plural=n == 1 ? 0 : 1
```

indicates that there are 2 plural forms in the language; `msgstr[0]` is used if n == 1, otherwise `msgstr[1]` is used. Another example:

```
nplurals=3; plural=n==1 ? 0 : n==2 ? 1 : 2
```

indicates that there are 3 plural forms in the language; `msgstr[0]` is used if n == 1, `msgstr[1]` is used if n == 2, otherwise `msgstr[2]` is used.

If the header entry contains `charset=codeset` string, the *codeset* is used to indicate the codeset to be used to encode the message strings. If the output string's codeset is different from the message string's codeset, codeset conversion from the message strings's codeset to the output string's codeset will be performed upon the call of `gettext()`, `dgettext()`, `dcgettext()`, `ngettext()`, `dngettext()`, and `dcngettext()`. The output string's codeset is determined by the current locale's codeset (the return value of nl_langinfo(CODESET)) by default, and can be changed by the call of `bind_textdomain_codeset()`.

Exit Status

The following exit values are returned:

0

    Successful completion.

>0

    An error occurred.

Application Usage

Neither **msgfmt** nor any `gettext()` function imposes a limit on the total length of a message. Installing message catalogs under the C locale is pointless, since they are ignored for the sake of efficiency.

Examples

Example 1: Examples of creating message objects from message files.

In this example `module1.po`, `module2.po` and `module3.po` are portable message object files.

```
example% cat module1.po

# default domain "messages"

msgid "message one"
```

```
msgstr "mensaje número uno"

#

domain "help_domain"

msgid "help two"

msgstr "ayuda número dos"

#

domain "error_domain"

msgid "error three"

msgstr "error número tres"


example% cat module2.po

# default domain "messages"

msgid "message four"

msgstr "mensaje número cuatro"

#

domain "error_domain"

msgid "error five"

msgstr "error número cinco"

#

domain "window_domain"

msgid "window six"

msgstr "ventana número seises"

example% cat module3.po

# default domain "messages"

msgid "message seven"

msgstr "mensaje número siete"
```

The following command will produce the output files `messages`, `help_domain`, and `error_domain`.

```
example% msgfmt module1.po
```

The following command will produce the output files `messages.mo`, `help_domain.mo`, `error_domain.mo`, and `window_domain.mo`.

```
example% msgfmt module1.po module2.po
```

The following example will produce the output file `hello.mo`.

```
example% msgfmt -o hello.mo module3.po
```

newgrp

Name

newgrp — change group ID

Synopsis

newgrp [group]

Description

The **newgrp** command is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

Differences

The -l option specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003) need not be supported.

od

Name

od — dump files in octal and other formats

Synopsis

od [-abcdfilox] [-w *width* | --width-*width*] [-v] [-A *address_base*] [-j *skip*]
[-n *count*] [-t *type_string*] [file...]**od** --traditional [options] [file]
[[+]offset [.] [b]] [[+]label [.] [b]]

Description

The **od** command shall provide all of the madatory functionality specified in
POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with extensions and differences to
the XSI optional behavior as listed below.

Extensions and Differences

-s

unspecified behavior.

Note: Applications wishing to achieve the POSIX 1003.1-2001 (ISO/IEC 9945-2003)
behavior for -*s* should instead use -*t d2*.

-w*width*, --width[=*width*]

each output line is limited to *width* bytes from the input.

--traditional

accepts arguments in traditional form, see Traditional Usage below.

Note: The XSI optional behavior for offset handling described in POSIX 1003.1-2001
(ISO/IEC 9945-2003) is not supported unless the --*traditional* option is also
specified.

Pre-POSIX and XSI Specifications

The LSB supports mixing options between the mandatory and XSI optional
synopsis forms in POSIX 1003.1-2001 (ISO/IEC 9945-2003). The LSB shall
support the following options:

-a

is equivalent to -*t a*, selects named characters.

-b

is equivalent to -*t o1*, selects octal bytes.

-c

is equivalent to -*t c*, selects characters.

-d

is equivalent to -*t u2*, selects unsigned decimal two byte units.

-f

is equivalent to -*t fF*, selects floats.

-i

> is equivalent to `-t d2`, selects decimal two byte units.
>
> **Note:** This usage may change in future releases; portable applications should use `-t d2`.

-l

> is equivalent to `-t d4`, selects decimal longs.

-o

> is equivalent to `-t o2`, selects octal two byte units.

-x

> is equivalent to `-t x2`, selects hexadecimal two byte units.

Note that the XSI option `-s` need not be supported.

Traditional Usage

If the `--traditional` option is specified, there may be between zero and three operands specified.

If no operands are specified, then **od** shall read the standard input.

If there is exactly one operand, and it is an offset of the form `[+]offset[.][b]`, then it shall be interpreted as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003). The file to be dumped shall be the standard input.

If there are exactly two operands, and they are both of the form `[+]offset[.][b]`, then the first shall be treated as an offset (as above), and the second shall be a label, in the same format as the offset. If a label is specified, then the first output line produced for each input block shall be preceded by the input offset, cumulative across input files, of the next byte to be written, followed by the label, in parentheses. The label shall increment in the same manner as the offset.

If there are three operands, then the first shall be the file to dump, the second the offset, and the third the label.

> **Note:** Recent versions of **coreutils** contain an **od** utility that conforms to POSIX 1003.1-2001 (ISO/IEC 9945-2003). However, in April 2005, this version was not in widespread use. A future version of this specification may remove the differences.

passwd

Name

passwd — change user password

Synopsis

passwd [-x max] [-n min] [-w warn] [-i inact] name **passwd** {-l | -u} name

Description

passwd changes authentication information for user and group accounts, including passwords and password expiry details, and may be used to enable and disable accounts. Only a user with appropriate privilege may change the password for other users or modify the expiry information.

Options

-x max

    sets the maximum number of days a password remains valid.

-n min

    sets the minimum number of days before a password may be changed.

-w warn

    sets the number of days warning the user will receive before their password will expire.

-i inactive

    disables an account after the password has been expired for the given number of days.

-l

    disables an account by changing the password to a value which matches no possible encrypted value.

-u

    re-enables an account by changing the password back to its previous value.

patch

Name

`patch` — apply a diff file to an original

Description

patch is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with extensions as listed below.

Extensions

--binary

> reads and write all files in binary mode, except for standard output and /dev/tty. This option has no effect on POSIX-compliant systems.

-u, --unified

> interprets the patch file as a unified context diff.

pidof

Name

`pidof` — find the process ID of a running program

Synopsis

pidof [-s] [-x] [-o omitpid...] program...

Description

Return the process ID of a process which is running the program named on the command line.

The **pidof** command is a system administration utility, see Path For System Administration Utilities.

Options

-s

> instructs the program to only return one pid.

-x

> causes the program to also return process id's of shells running the named scripts.

-o

> omits processes with specified process id.

remove_initd

Name

`remove_initd` — clean up init script system modifications introduced by install_initd

Synopsis

/usr/lib/lsb/remove_initd `initd_file`

Description

remove_initd processes the removal of the modifications made to a distribution's init script system by the **install_initd** program. This cleanup is performed in the preuninstall script of a package; however, the package manager is still responsible for removing the script from the repository. See also Installation and Removal of Init Scripts.

renice

Name

`renice` — alter priority of running processes

Description

renice is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

Differences

-n increment

> has unspecified behavior.

sed

Name

`sed` — stream editor

Description

sed is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

LSB Differences

Certain aspects of internationalized regular expressions are optional; see Regular Expressions.

sendmail

Name

sendmail — an electronic mail transport agent

Synopsis

/usr/sbin/sendmail [options] [address...]

Description

To deliver electronic mail (email), applications shall support the interface provided by **sendmail** (described here). This interface shall be the default delivery method for applications.

This program sends an email message to one or more recipients, routing the message as necessary. This program is not intended as a user interface routine.

With no options, **sendmail** reads its standard input up to an end-of-file or a line consisting only of a single dot and sends a copy of the message found there to all of the addresses listed. It determines the network(s) to use based on the syntax and contents of the addresses.

If an address is preceded by a backslash, `'\'`, it is unspecified if the address is subject to local alias expansion.

The format of messages shall be as defined in RFC 2822:Internet Message Format.

> **Note:** The name **sendmail** was chosen for historical reasons, but the **sendmail** command specified here is intended to reflect functionality provided by **smail**, **exim** and other implementations, not just the **sendmail** implementation.

Options

-bm

read mail from standard input and deliver it to the recipient addresses. This is the default mode of operation.

-bp

If the user has sufficient privilege, list information about messages currently in the mail queue.

-bs

use the SMTP protocol as described in RFC 2821:Simple Mail Transfer Protocol; read SMTP commands on standard input and write SMTP responses on standard output.

In this mode, **sendmail** shall accept `\r\n` (CR-LF), as required by RFC 2821:Simple Mail Transfer Protocol, and `\n` (LF) line terminators.

-F fullname

explicitly set the full name of the sender for incoming mail unless the message already contains a `From:` message header.

If the user running **sendmail** is not sufficiently trusted, then the actual sender may be indicated in the message, depending on the configuration of the agent.

-f name

>   explicitly set the envelope sender address for incoming mail. If there is no `From:` header, the address specified in the `From:` header will also be set.
>
>   If the user running **sendmail** is not sufficiently trusted, then the actual sender shall be indicated in the message.

-i

>   ignore dots alone on lines by themselves in incoming messages. If this options is not specified, a line consisting of a single dot shall terminate the input. If -bs is also used, the behavior is unspecified.

-odb

>   deliver any mail in background, if supported; otherwise ignored.

-odf

>   deliver any mail in foreground, if supported; otherwise ignored.

-oem or -em

>   mail errors back to the sender. (default)

-oep or -ep

>   write errors to the standard error output.

-oeq or -eq

>   do not send notification of errors to the sender. This only works for mail delivered locally.

-oi

>   is equivalent to -i.

-om

>   indicate that the sender of a message should receive a copy of the message if the sender appears in an alias expansion. Ignored if aliases are not supported.

-t

>   read the message to obtain recipients from the `To:`, `Cc:`, and `Bcc:` headers in the message instead of from the command arguments. If a `Bcc:` header is present, it is removed from the message unless there is no `To:` or `Cc:` header, in which case a `Bcc:` header with no data is created, in accordance with RFC 2822:Internet Message Format.
>
>   If there are any operands, the recipients list is unspecified.
>
>   This option may be ignored when not in *-bm* mode (the default).
>
>   **Note:** It is recommended that applications use as few options as necessary, none if possible.

Exit status

0

successful completion on all addresses. This does not indicate successful delivery.

>0

there was an error.

seq

Name

seq — generate a sequence of numbers

Synopsis

/usr/bin/seq [-f fmt_str] [-s sep_str] [first_num] [inc_num] last_num

Description

The **seq** command shall output a sequence of numbers from *first_num* to *last_num*, stepping by the increment *inc_num*. The *first_num* and *last_num* parameters may be omitted, and default to 1 even when *first_num* is greater than *last_num*. Floating-point values may be specified for *first_num*, *inc_num*, and *last_num*.

The *fmt_str* parameter is a floating point format string like the one used for the printf() function in C.

The *sep_str* parameter string separates the values that are output. The default is a newline character (/n).

> **Note:** If *first_num* is less than *last_num* and *inc_num* is negative, or *first_num* is greater than *last_num* and *inc_num* is positive, **seq** shall not generate any output.

Standard Options

-f fmt_str

Format the numbers in the output sequence according to *fmt_str*, a floating point format string like the one used for the printf() function in C.

-s sep_str

Separate the numbers in the output sequence with *sep_str*. The default separator string is a newline character (\n).

first_num

The first number in the output sequence. Defaults to 1. May be a floating point value.

inc_num

The increment for the output sequence. Defaults to 1. May be a floating point value.

last_num

The last number in the output sequence. May be a floating point value.

sh

Name

sh — shell, the standard command language interpreter

Description

The **sh** utility shall behave as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with extensions listed below.

Shell Invocation

The shell shall support an additional option, `-l` (the letter *ell*). If the `-l` option is specified, or if the first character of argument zero (the command name) is a `'-'`, this invocation of the shell is a *login shell*.

An interactive shell, as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), that is also a login shell, or any shell if invoked with the `-l` option, shall, prior to reading from the input file, first read and execute commands from the file `/etc/profile`, if that file exists, and then from a file called `~/.profile`, if such a file exists.

> **Note:** This specification requires that the **sh** utility shall also read and execute commands in its current execution environment from all the shell scripts in the directory `/etc/profile.d`. Such scripts are read and executed as a part of reading and executing `/etc/profile`.

shutdown

Name

shutdown — shut the system down

Synopsis

/sbin/shutdown [-t sec] [-h | -r] [-akfF] time [warning-
message]**/sbin/shutdown** -c [warning-message]

Description

The **shutdown** command shall shut the system down in a secure way (first
synopsis), or cancel a pending shutdown (second synopsis). When the
shutdown is initiated, all logged-in users shall be notified immediately that the
system is going down, and users shall be prevented from logging in to the
system. The *time* specifies when the actual shutdown shall commence. See
below for details. At the specified time all processes are first notified that the
system is going down by the signal SIGTERM. After an interval (see -t) all
processes shall be sent the signal SIGKILL. If neither the -h or the -r argument
is specified, then the default behavior shall be to take the system to a runlevel
where administrative tasks can be run. See also Run Levels.

> **Note:** This is sometimes referred to as "single user mode".

The -h and -r options are mutually exclusive. If either the -h or -r options are
specified, the system shall be halted or rebooted respectively.

Standard Options

-a

use access control. See below.

-t sec

tell the system to wait *sec* seconds between sending processes the warning
and the kill signal, before changing to another runlevel. The default period
is unspecified.

-k

do not really shutdown; only send the warning messages to everybody.

-r

reboot after shutdown.

-h

halt after shutdown. Actions after halting are unspecified (e.g. power off).

-f

advise the system to skip file system consistency checks on reboot.

-F

advise the system to force file system consistency checks on reboot.

-c

cancel an already running **shutdown**.

time

specify when to shut down.

The time argument shall have the following format: `[now | [+]mins | hh:mm]` If the format is `hh:mm`, `hh` shall specify the hour (1 or 2 digits) and `mm` is the minute of the hour (exactly two digits), and the shutdown shall commence at the next occurence of the specified time. If the format is `mins` (or `+mins`), where `mins` is a decimal number, shutdown shall commence in the specified number of minutes. The word `now` is an alias for `+0`.

warning-message

specify a message to send to all users.

Access Control

If the **shutdown** utility is invoked with the `-a` option, it shall check that an authorized user is currently logged in on the system console. Authorized users are listed, one per line, in the file `/etc/shutdown.allow`. Lines in this file that begin with a `'#'` or are blank shall be ignored.

Note: The intent of this scheme is to allow a keyboard sequence entered on the system console (e.g. `CTRL-ALT-DEL`, or `STOP-A`) to automatically invoke **shutdown -a**, and can be used to prevent unauthorized users from shutting the system down in this fashion.

su

Name

su — change user ID

Synopsis

su [options] [-] [username [ARGS]]

Description

The **su** command shall start a shell running with the real and effective user and group IDs of the user `username`. If `username` is not specified, **su** shall default to an unspecified user with all appropriate privileges. If the `-s` or `--shell` is not specified, the shell to be invoked shall be that specified for `username` in the user database (see `getpwnam()`), or `/bin/sh` if there is no shell specified in the user database.

If the `-` option is specified, or if the first operand is `-`, the environment for the shell shall be initialized as if the new shell was a login shell (see Shell Invocation).

If the invoking user does not have appropriate privileges, the **su** command shall prompt for a password and validate this before continuing. Invalid passwords shall produce an error message. The **su** command shall log in an unspecified manner all invokations, whether successful or unsuccessful.

Any operands specified after the `username` shall be passed to the invoked shell.

If the option `-` is not specified, and if the first operand is not `-`, the environemnt for the new shell shall be intialized from the current environment. If none of the `-m`, `-p`, or `--preserve-environment` options are specified, the environment may be modified in unspecified ways before invoking the shell. If any of the `-m`, `-p`, or `--preserve-environment` options are specified, the environment shall not be altered.

> **Note:** Although the **su** command shall not alter the environment, the invoked shell may still alter it before it is ready to intepret any commands.

Standard Options

-

the invoked shell shall be a login shell.

-c `command`, --command=`command`

Invoke the shell with the option `-c command`.

-m, -p, --preserve-environment

The current environment shall be passed to the invoked shell. If the environment variable SHELL is set, it shall specify the shell to invoke, if it matches an entry in `/etc/shells`. If there is no matching entry in `/etc/shells`, this option shall be ignored if the `-` option is also specified, or if the first operand is `-`.

-s `shell`, --shell=`shell`

Invoke `shell` as the comamnd interpreter. The shell specified shall be present in `/etc/shells`.

sync

Name

sync — flush file system buffers

Synopsis

sync

Description

Force changed blocks to disk, update the super block.

tar

Name

tar — file archiver

Description

tar is as specified in SUSv2, but with differences as listed below.

Differences

Some elements of the Pattern Matching Notation are optional; see Pattern Matching Notation.

-h

doesn't dump symlinks; dumps the files they point to.

-z

filters the archive through **gzip**.

umount

Name

umount — unmount file systems

Synopsis

umount [-hV]**umount** -a [-nrv] [-t vfstype]**umount** [-nrv] device | dir

Description

umount detaches the file system(s) mentioned from the file hierarchy. A file system is specified by giving the directory where it has been mounted.

Standard Options

-v

   invokes verbose mode.

-n

   unmounts without writing in /etc/mtab.

-r

   tries to remount read-only if unmounting fails.

-a

   unmounts all of the file systems described in /etc/mtab except for the proc file system.

-t vfstype

   indicates that the actions should only be taken on file systems of the specified type. More than one type may be specified in a comma separated list. The list of file system types can be prefixed with no to specify the file system types on which no action should be taken.

-f

   forces unmount (in case of an unreachable NFS system).

LSB Deprecated Options

The behaviors specified in this section are expected to disappear from a future version of the LSB; applications should only use the non-LSB-deprecated behaviors.

-V

   print version and exits.

useradd

Name

useradd — create a new user or update default new user information

Synopsis

useradd [-c comment] [-d home_dir] [-g initial_group] [-G group...] [-m [-k skeleton_dir]] [-p passwd] [-r] [-s shell] [-u uid [-o]] login **useradd** -D [-g default_group] [-b default_home] [-s default_shell]

Description

When invoked without the *-D* option, and with appropriate privilege, **useradd** creates a new user account using the values specified on the command line and the default values from the system. The new user account will be entered into the system files as needed, the home directory will be created, and initial files copied, depending on the command line options.

When invoked with the *-D* option, **useradd** will either display the current default values, or, with appropriate privilege, update the default values from the command line. If no options are specified, **useradd** displays the current default values.

The **useradd** command is a system administration utility, see Path For System Administration Utilities.

Standard Options

-c comment

> specifies the new user's password file comment field value.

-d home_dir

> creates the new user using home_dir as the value for the user's login directory. The default is to append the login name to default_home and use that as the login directory name.

-g initial_group

> specifies the group name or number of the user's initial login group. The group name shall exist. A group number shall refer to an already existing group. If *-g* is not specified, the implementation will follow the normal user default for that system. This may create a new group or choose a default group that normal users are placed in. Applications which require control of the groups into which a user is placed should specify *-g*.

-G group[,...]

> specifies a list of supplementary groups which the user is also a member of. Each group is separated from the next by a comma, with no intervening whitespace. The groups are subject to the same restrictions as the group given with the *-g* option. The default is for the user to belong only to the initial group.

-m [-k skeleton_dir]

specifies the user's home directory will be created if it does not exist. The files contained in `skeleton_dir` will be copied to the home directory if the `-k` option is used, otherwise the files contained in `/etc/skel` will be used instead. Any directories contained in `skeleton_dir` or `/etc/skel` will be created in the user's home directory as well. The `-k` option is only valid in conjunction with the `-m` option. The default is to not create the directory and to not copy any files.

-p passwd

is the encrypted password, as returned by `crypt()`. The default is to disable the account.

-r

creates a system account, that is, a user with a User ID in the range reserved for system account users. If there is not a User ID free in the reserved range the command will fail.

-s shell

specifies the name of the user's login shell. The default is to leave this field blank, which causes the system to select the default login shell.

-u uid [-o]

specifies the numerical value of the user's ID. This value shall be unique, unless the `-o` option is used. The value shall be non-negative. The default is the smallest ID value greater than 499 which is not yet used.

Change Default Options

-b default_home

specifies the initial path prefix for a new user's home directory. The user's name will be affixed to the end of default_home to create the new directory name if the -d option is not used when creating a new account.

-g default_group

specifies the group name or ID for a new user's initial group. The named group shall exist, and a numerical group ID shall have an existing entry.

-s default_shell

specifies the name of the new user's login shell. The named program will be used for all future new user accounts.

-c comment

specifies the new user's password file comment field value.

Application Usage

The `-D` option will typically be used by system administration packages. Most applications should not change defaults which will affect other applications and users.

userdel

Name

userdel — delete a user account and related files

Synopsis

userdel [-r] login

Description

Delete the user account named *login*. If there is also a group named *login*, this command may delete the group as well, or may leave it alone.

The **userdel** command is a system administration utility, see Path For System Administration Utilities.

Options

-r

removes files in the user's home directory along with the home directory itself. Files located in other file system will have to be searched for and deleted manually.

usermod

Name

usermod — modify a user account

Synopsis

usermod [-c comment] [-d home_dir [-m]] [-g initial_group] [-G group
[,...]] [-l login_name] [-p passwd] [-s shell] [-u uid [-o]] login

Description

The **usermod** command shall modify an entry in the user account database.

The **usermod** command is a system administration utility, see Path For System Administration Utilities.

Options

-c comment

 specifies the new value of the user's password file comment field.

-d home_dir

 specifies the user's new login directory. If the -m option is given the contents of the current home directory will be moved to the new home directory, which is created if it does not already exist.

-g initial_group

 specifies the group name or number of the user's new initial login group. The group name shall exist. A group number shall refer to an already existing group.

-G group,[...]

 specifies a list of supplementary groups which the user is also a member of. Each group is separated from the next by a comma, with no intervening whitespace. The groups are subject to the same restrictions as the group given with the -g option. If the user is currently a member of a group which is not listed, the user will be removed from the group.

-l login_name

 changes the name of the user from login to login_name. Nothing else is changed. In particular, the user's home directory name should probably be changed to reflect the new login name.

-p passwd

 is the encrypted password, as returned by crypt(3).

-s shell

 specifies the name of the user's new login shell. Setting this field to blank causes the system to select the default login shell.

-u uid [-o]

specifies the numerical value of the user's ID. This value shall be unique, unless the -o option is used. The value shall be non-negative. Any files which the user owns and which are located in the directory tree rooted at the user's home directory will have the file user ID changed automatically. Files outside of the user's home directory shall be altered manually.

xargs

Name

xargs — build and execute command lines from standard input

Description

xargs is as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), but with differences as listed below.

Differences

-E

> has unspecified behavior.

-I

> has unspecified behavior.

-L

> has unspecified behavior.

> **Note:** These options have been implemented in **findutils-4.2.9**, but this version of the utilities is not in widespread use as of April 2005. However, future versions of this specification will require support for these arguments.

zcat

Name

zcat — uncompress files to standard output

Description

The **zcat** utility shall behave as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), with differences listed below.

The Filesystem Hierarchy Standard requires that if **zcat** exists, it must be a symbolic or hard link to /bin/gzip. This specification additionally allows **zcat** to be a wrapper script which calls **gzip -c -d**.

Differences

The **zcat** utility shall write to standard output the uncompressed form of files that have been compressed using any of the compression methods supported by the **gzip** utility. It is the equivalent of **gzip -c -d**. Input files are not affected.

VII Execution Environment

16 File System Hierarchy

An LSB conforming implementation shall provide the mandatory portions of the file system hierarchy specified in the Filesystem Hierarchy Standard (FHS), together with any additional requirements made in this specification.

An LSB conforming application shall conform to the Filesystem Hierarchy Standard.

The FHS allows many components or subsystems to be optional. An application shall check for the existence of an optional component before using it, and should behave in a reasonable manner if the optional component is not present.

The FHS requirement to locate the operating system kernel in either `/` or `/boot` does not apply if the operating system kernel does not exist as a file in the file system.

The FHS specifies certain behaviors for a variety of commands if they are present (for example, **ping** or **python**). However, LSB conforming applications shall not rely on any commands beyond those specified by the LSB. The mere existence of a command may not be used as an indication that the command behaves in any particular way.

The following directories or links need not be present: `/etc/X11 /usr/bin/X11 /usr/lib/X11 /proc`

16.1 `/dev`: Device Files

The devices described in Chapter 6. "Operating System Specific Annex", Section 6.1. "Linux", subsection 6.1.3. "/dev: Devices and special files" in the Filesystem Hierarchy Standard are required on an LSB conforming system. Other devices may also exist in `/dev`. Device names may exist as symbolic links to other device nodes located in `/dev` or subdirectories of `/dev`. There is no requirement concerning major/minor number values.

16.2 `/etc`: Host-specific system configuration

In addition to the requirements for `/etc` in the Filesystem Hierarchy Standard, an LSB conforming system shall also provide the following directories or symbolic links to directories:

`/etc/cron.d`

A directory containing extended **crontab** files; see Cron Jobs.

`/etc/cron.daily`

A directory containing shell scripts to be executed once a day; see Cron Jobs.

`/etc/cron.hourly`

A directory containing shell scripts to be executed once per hour; see Cron Jobs.

`/etc/cron.monthly`

A directory containing shell scripts to be executed once per month; see Cron Jobs.

```
/etc/cron.weekly
```

A directory containing shell scripts to be executed once a week; see Cron Jobs.

```
/etc/init.d
```

A directory containing system initialization scripts; see Installation and Removal of Init Scripts.

```
/etc/profile.d
```

A directory containing shell scripts. Script names should follow the same conventions as specified for cron jobs (see Cron Jobs, but should have the suffix `.sh`. The behavior is unspecified if a script is installed in this directory that does not have the suffix `.sh`.

The **sh** utility shall read and execute commands in its current execution environment from all the shell scripts in this directory that have the suffix `.sh` when invoked as an interactive login shell, or if the `-l` (the letter *ell*) is specified (see Shell Invocation).

Future Directions: These directories are required at this version of the LSB since there is not yet an agreed method for abstracting the implementation so that applications need not be aware of these locations during installation.

16.2.1 File Naming Conventions

Conforming implementations and applications installing files into any of the above locations under `/etc` may only use filenames from the following managed namespaces:

- Assigned names. Such names must be chosen from the character set `[a-z0-9]`. In order to avoid conflicts these names shall be reserved through the Linux Assigned Names and Numbers Authority (LANANA). Information about the LANANA may be found at www.lanana.org (http://www.lanana.org).

  Note: Commonly used names should be reserved in advance; developers for projects are encouraged to reserve names from LANANA, so that each distribution can use the same name, and to avoid conflicts with other projects.

- Hierarchical names. Script names in this category take the form: `<hier1>-<hier2>-...-<name>`, where name is taken from the character set `[a-z0-9]`, and where there may be one or more `<hier-n>` components. `<hier1>` may either be an LSB provider name assigned by the LANANA, or it may be owners' DNS name in lower case, with at least one `'.'`. e.g. `"debian.org"`, `"staroffice.sun.com"`, etc. The LSB provider name assigned by LANANA shall only consist of the ASCII characters `[a-z0-9]`.

- Reserved names. Names that begin with the character `'_'` are reserved for distribution use only. These names should be used for essential system packages only.

  Note: A non-conforming application may still have polluted these managed namespaces with unregistered filenames; a conforming application should check for namespace collisions and take appropriate steps if they occur.

  In general, if a package or some system function is likely to be used on multiple systems, the package developers or the distribution should get a registered name through LANANA, and distributions should strive to use the same name whenever possible. For applications which may not be essential or may not be commonly

installed, the hierarchical namespace may be more appropriate. An advantage to the hierarchical namespace is that there is no need to consult with the LANANA before obtaining an assigned name.

Short names are highly desirable, since system administrators may need to manually start and stop services. Given this, they should be standardized on a per-package basis. This is the rationale behind having the LANANA organization assign these names. The LANANA may be called upon to handle other namespace issues, such as package/prerequisites naming.

16.3 User Accounting Databases

The Filesystem Hierarchy Standard specifies two optional locations for user accounting databases used by the `getutent()`, `getutent_r()`, `getutxent()`, `getutxid()`, `getutxline()`, and `pututxline()` functions. These are `/var/run/utmp` and `/var/run/wtmp`.

The LSB does not specify the format or structure of these files, or even if they are files at all. They should be used only as "magic cookies" to the `utmpname()` function.

16.4 Path For System Administration Utilities

Certain utilities used for system administration (and other privileged commands) may be stored in `/sbin`, `/usr/sbin`, and `/usr/local/sbin`. Applications requiring to use commands identified as system administration utilities should add these directories to their PATH. By default, as described in POSIX 1003.1-2001 (ISO/IEC 9945-2003), standard utilities shall be found on the PATH returned by **getconf PATH** (or **command -p getconf PATH** to be guaranteed to invoke the correct version of **getconf**).

17 Additional Recommendations

17.1 Recommendations for applications on ownership and permissions

17.1.1 Directory Write Permissions

The application should not depend on having directory write permission in any directory except `/tmp`, `/var/tmp`, and the invoking user's home directory.

In addition, the application may store variable data in `/var/opt/`*package*, (where *package* is the name of the application package), if such a directory is created with appropriate permissions during the package installation.

For these directories the application should be able to work with directory write permissions restricted by the `S_ISVTXT` bit, implementing the restricted deletion mode as described for the XSI option for POSIX 1003.1-2001 (ISO/IEC 9945-2003)..

17.1.2 File Write Permissions

The application should not depend on file write permission to any file that it does not itself create.

17.1.3 File Read and execute Permissions

The application should not depend on having read permission to every file and directory.

17.1.4 SUID and SGID Permissions

The application should not depend on the set user ID or set group ID (the `S_ISUID` or `S_ISGID` permission bits) permissions of a file not packaged with the application. Instead, the distribution is responsible for assuming that all system commands have the required permissions and work correctly.

> **Rationale:** In order to implement common security policies it is strongly advisable for applications to use the minimum set of security attributes necessary for correct operation. Applications that require substantial appropriate privilege are likely to cause problems with such security policies.

17.1.5 Privileged users

In general, applications should not depend on running as a privileged user. This specification uses the term "appropriate privilege" throughout to identify operations that cannot be achieved without some special granting of additional privilege.

Applications that have a reason to run with appropriate privilege should outline this reason clearly in their documentation. Users of the application should be informed, that "this application demands security privileges, which could interfere with system security".

The application should not contain binary-only software that requires being run with appropriate privilege, as this makes security auditing harder or even impossible.

17.1.6 Changing permissions

The application shall not change permissions of files and directories that do not belong to its own package. Should an application require that certain files and directories not directly belonging to the package have a particular ownership, the application shall document this requirement, and may fail during installation if the permissions on these files is inappropriate.

17.1.7 Removable Media (Cdrom, Floppy, etc.)

Applications that expect to be runnable from removable media should not depend on logging in as a privileged user, and should be prepared to deal with a restrictive environment. Examples of such restrictions could be default mount options that disable set-user/group-ID attributes, disabling block or character-special files on the medium, or remapping the user and group IDs of files away from any privileged value.

> **Rationale:** System vendors and local system administrators want to run applications from removable media, but want the possibility to control what the application can do.

17.1.8 Installable applications

Where the installation of an application needs additional privileges, it must clearly document all files and system databases that are modified outside of those in `/opt/pkg-name` and `/var/opt/pkg-name`, other than those that may be updated by system logging or auditing activities.

Without this, the local system administrator would have to blindly trust a piece of software, particularly with respect to its security.

18 Additional Behaviors

18.1 Mandatory Optional Behaviors

This section specifies behaviors in which there is optional behavior in one of the standards on which this specification relies, and where this specification requires a specific behavior.

> **Note:** This specification does not require the kernel to be Linux; the set of mandated options reflects current existing practice, but may be modified in future releases.

LSB conforming implementations shall support the following options defined within the *POSIX 1003.1-2001 (ISO/IEC 9945-2003)*:

```
_POSIX_FSYNC
_POSIX_MAPPED_FILES
_POSIX_MEMLOCK
_POSIX_MEMLOCK_RANGE
_POSIX_MEMORY_PROTECTION
_POSIX_PRIORITY_SCHEDULING
_POSIX_REALTIME_SIGNALS
_POSIX_THREAD_ATTR_STACKADDR
_POSIX_THREAD_ATTR_STACKSIZE
_POSIX_THREAD_PROCESS_SHARED
_POSIX_THREAD_SAFE_FUNCTIONS
_POSIX_THREADS
```

The `opendir()` function shall consume a file descriptor in the same fashion as `open()`, and therefore may fail with `EMFILE` or `ENFILE`.

The `START` and `STOP termios` characters shall be changeable, as described as optional behavior in the "General Terminal Interface" section of the *POSIX 1003.1-2001 (ISO/IEC 9945-2003)*.

The `access()` function function shall fail with `errno` set to `EINVAL` if the *amode* argument contains bits other than those set by the bitwise inclusive OR of `R_OK`, `W_OK`, `X_OK` and `F_OK`.

The `link()` function shall require access to the existing file in order to succeed, as described as optional behavior in the *POSIX 1003.1-2001 (ISO/IEC 9945-2003)*.

Calling `unlink()` on a directory shall fail. Calling `link()` specifying a directory as the first argument shall fail. See also unlink.

> **Note:** Linux allows `rename()` on a directory without having write access, but this specification does not require this behavior.

18.1.1 Special Requirements

LSB conforming systems shall enforce certain special additional restrictions above and beyond those required by POSIX 1003.1-2001 (ISO/IEC 9945-2003).

> **Note:** These additional restrictions are required in order to support the testing and certification programs associated with the LSB. In each case, these are values that defined macros must not have; conforming applications that use these values shall trigger a failure in the interface that is otherwise described as a "may fail".

The `fcntl()` function shall treat the "cmd" value -1 as invalid.

The *whence* value -1 shall be an invalid value for the `lseek()`, `fseek()` and `fcntl()` functions.

The value -5 shall be an invalid signal number.

If the `sigaddset()` or `sigdelset()` functions are passed an invalid signal number, they shall return with EINVAL. Implementations are only required to enforce this requirement for signal numbers which are specified to be invalid by this specification (such as the -5 mentioned above).

The mode value -1 to the `access()` function shall be treated as invalid.

A value of -1 shall be an invalid "_PC_..." value for `pathconf()`.

A value of -1 shall be an invalid "_SC..." value for `sysconf()`.

The *nl_item* value -1 shall be invalid for `nl_langinfo()`.

The value -1 shall be an invalid "_CS_..." value for `confstr()`.

The value `"a"` shall be an invalid *mode* argument to `popen()`.

The `fcntl()` function shall fail and set errno to EDEADLK if the *cmd* argument is `F_SETLKW`, and the lock is blocked by a lock from another process already blocked by the current process.

The `opendir()` function shall consume a file descriptor; the `readdir()` function shall fail and set errno to EBADF if the underlying file descriptor is closed.

The `link()` function shall not work across file systems, and shall fail and set errno to EXDEV as described as optional behavior in POSIX 1003.1-2001 (ISO/IEC 9945-2003).

18.2 Optional Mandatory Behaviors

This section specifies behaviors that are mandatory in one of the standards on which this specification relies, but which are optional in this specification.

POSIX 1003.1-2001 (ISO/IEC 9945-2003) describes the behavior of the file access time, available as the *st_atime* field of the `stat` and `stat64` structures. An LSB conforming implementation need not update this information every time a file is accessed.

Note: A subsequent edition of the POSIX standard no longer mandates updating of *st_atime* but the older edition is still the guiding standard for this specification, thus this exception is needed.

18.3 Executable Scripts

An executable script is an executable file of which the first two characters are #! as defined in the portable character set. In POSIX 1003.1-2001 (ISO/IEC 9945-2003), this construct is undefined, but reserved for implementations which wish to provide this functionality. LSB conforming implementations shall support executable scripts.

A successful call to a function of the exec family with an executable script as the first parameter shall result in a new process, where the process image started is that of the interpreter. The path name of the interpreter follows the #! characters.

If the executable script has a first line

```
#! interpreter [arg]
```

then `interpreter` shall be called with an argument array consisting of an unspecified zeroth argument, followed by `arg` (if present), followed by a path name for the script, followed by the arguments following the zeroth argument in the exec call of the script.

The interpreter shall not perform any operations on the first line of an executable script.

The first line of the executable script shall meet all of the following criteria otherwise the results are unspecified:

1. Is of one of the forms:

   ```
   #!interpreter
   #! interpreter
   #!interpreter arg
   #! interpreter arg
   ```

2. The `interpreter` argument is an absolute pathname of an executable file other than an executable script.

3. Neither the `interpreter` argument nor the `arg` argument, if present, contain any quoting characters.

4. Neither the `interpreter` argument nor the `arg` argument, if present, contain any whitespace characters.

5. The length of the entire line is no longer than 80 bytes.

If the interpreter is required by this specification to be in a specfic named directory, a conforming application must use that path for `interpreter`, as implementations are not prohibited from having other, possibly non-conforming, versions of the same interpreter installed on the system. If the interpreter is a required command in this specification, but does not have a required path, the application should take special measures to insure the appropriate version is selected. If the interpreter is not a required command in this specification, the application must make appropriate provisions that the interpreter is available at the appropriate path.

> **Note:** In case the path is not specified, it is recommended that an installation script for executable scripts use the standard PATH returned by a call to the **getconf** command with the argument `PATH`, combined with the **command** command to determine the location of a standard command.
>
> For example to determine the location of the standard **awk** command:
>
> ```
> PATH=`getconf PATH` command -v awk
> ```
>
> The installation script should ensure that the returned pathname is an absolute pathname prior to use, since a shell builtin might be returned for some utilities.
>
> Use of the common form `#!/usr/bin/env interpreter` is not recommended as the PATH will be unknown at execution time and an alternative version of `interpreter` might be selected.

19 Localization

19.1 Introduction

In order to install a message catalog, the installation procedure shall supply the message catalog in a format readable by the **msgfmt** command, which shall be invoked to compile the message catalog into an appropriate binary format on the target system.

> **Rationale:** The original intent was to allow an application to contain the binary GNU MO format files. However, the format of these files is not officially stable, hence it is necessary to compile these catalogs on the target system. These binary catalogs may differ from architecture to architecture as well.

The resulting binary message catalog shall be located in the package's private area under `/opt`, and the application may use `bindtextdomain()` to specify this location.

Implementations shall support the POSIX and C locales as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003). Other locales may be supported.

Implementations may define additional locale categories not defined by that standard.

> **Note:** Implementations choosing additional locale categories should be aware of ISO/IEC TR14652 and are advised not to choose names that conflict with that specification. If implementations provide locale categories whose names are part of the FDCC set of ISO/IEC TR14652, they should behave as defined by that specification.

19.2 Regular Expressions

Utilities that process regular expressions shall support Basic Regular Expressions and Extended Regular Expressions as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), with the following exceptions:

Range expression (such as `[a-z]`) can be based on code point order instead of collating element order.

Equivalence class expression (such as `[=a=]`) and multi-character collating element expression (such as `[.ch.]`) are optional.

Handling of a multi-character collating element is optional.

This affects at least the following utilities:

- **awk** (see awk)
- **grep** (see grep) (including **egrep** , see egrep)
- **sed** (see sed)

It also affects the behavior of interfaces in the base libraries, including at least

- `regexec()` (see regexec)

19.3 Pattern Matching Notation

Utilities that perform filename pattern matching (also known as Filename Globbing) shall do it as specified in POSIX 1003.1-2001 (ISO/IEC 9945-2003), Pattern Matching Notation, with the following exceptions:

Pattern bracket expressions (such as `[a-z]`) can be based on code point order instead of collating element order.

Equivalence class expression (such as `[=a=]`) and multi-character collating element expression (such as `[.ch.]`) are optional.

Handling of a multi-character collating element is optional.

This affects at least the following utilities: **cpio** (cpio), **find** and **tar** (tar).

VIII System Initialization

20 System Initialization

20.1 Cron Jobs

In addition to the individual user `crontab` files specified by POSIX 1003.1-2001 (ISO/IEC 9945-2003), which are located in `/var/spool/cron` as specified by the Filesystem Hierarchy Standard (FHS), the process that executes scheduled commands shall also process the following additional `crontab` files, which are in a different format (see below). `/etc/crontab`, `/etc/cron.d/*`. The installation of a package shall not modify the crontab file `/etc/crontab`, and shall not directly modify the user crontab files in `/var/spool/cron/crontabs`. but may use the **crontab** command to modify the latter.

If a package wishes to install a job that has to be executed periodically, it shall place an executable *cron script* in one of the following directories:

```
/etc/cron.hourly
/etc/cron.daily
/etc/cron.weekly
/etc/cron.monthly
```

As these directory names suggest, the files within them are executed on a hourly, daily, weekly, or monthly basis, respectively, under the control of an entry in one of the system `crontab` files, at an unspecified time of day. See below for the rules concerning the names of cron scripts.

> **Note:** It is recommended that cron scripts installed in any of these directories be script files rather than compiled binaries so that they may be modified by the local system administrator. Conforming applications may only install cron scripts which use an interpreter required by this specification or provided by this or another conforming application.
>
> This specification does not define the concept of a package *upgrade*. Implementations may do different things when packages are upgraded, including not replacing a cron script if it marked as a configuration file, particularly if the cron script appears to have been modified since installation. In some circumstances, the cron script may not be removed when the package is uninstalled. Applications should design their installation procedure and cron scripts to be robust in the face of such behavior. In particular, cron scripts should not fail obscurely if run in unexpected circumstances. Testing for the existence of application binaries before executing them is suggested.

If a certain task has to be executed at other than the predefined frequencies, the package shall install a file `/etc/cron.d/cron-name`. The file shall have the same format as that described for the **crontab** command in POSIX 1003.1-2001 (ISO/IEC 9945-2003), except that there shall be an additional field, `username`, before the name of the command to execute. For completeness, the seven fields shall be:

1. Minute [0,59]

2. Hour [0,23]

3. Day of the month [1,31]

4. Month of the year [1,12]

5. Day of the week [0,6] (with 0=Sunday)

6. Username

7. command [args ...]

This file shall be processed by the system automatically, with the named command being run at the specified time, as the specified username.

Applications installing files in these directories shall use the LSB naming conventions (see File Naming Conventions).

20.2 Init Script Actions

Conforming applications which need to execute commands on changes to the system run level (including boot and shutdown), may install one or more *init scripts*. Init scripts provided by conforming applications shall accept a single argument which selects the action:

start	start the service
stop	stop the service
restart	stop and restart the service if the service is already running, otherwise start the service
try-restart	restart the service if the service is already running
reload	cause the configuration of the service to be reloaded without actually stopping and restarting the service
force-reload	cause the configuration to be reloaded if the service supports this, otherwise restart the service if it is running
status	print the current status of the service

The **start**, **stop**, **restart**, **force-reload**, and **status** actions shall be supported by all init scripts; the **reload** and the **try-restart** actions are optional. Other init-script actions may be defined by the init script.

Init scripts shall ensure that they will behave sensibly if invoked with **start** when the service is already running, or with **stop** when not running, and that they do not kill similarly-named user processes. The best way to achieve this is to use the init-script functions provided by `/lib/lsb/init-functions` (see Init Script Functions)

If a service reloads its configuration automatically (as in the case of cron, for example), the **reload** action of the init script shall behave as if the configuration was reloaded successfully. The **restart**, **try-restart**, **reload** and **force-reload** actions may be atomic; that is if a service is known not to be operational after a restart or reload, the script may return an error without any further action.

> **Note:** This specification does not define the concept of a package *upgrade*. Implementations may do different things when packages are upgraded, including not replacing an init script if it is marked as a configuration file, particularly if the file appears to have been modified since installation. In some circumstances, the init script may not be removed when the package is uninstalled. Applications should design their installation procedure and init scripts to be robust in the face of such behavior. In particular, init scripts should not fail obscurely if run in unexpected circumstances. Testing for the existence of application binaries before executing them is suggested.

If the **status** action is requested, the init script will return the following exit status codes.

0	program is running or service is OK
1	program is dead and /var/run pid file exists

2	program is dead and /var/lock lock file exists
3	program is not running
4	program or service status is unknown
5-99	reserved for future LSB use
100-149	reserved for distribution use
150-199	reserved for application use
200-254	reserved

For all other init-script actions, the init script shall return an exit status of zero if the action was successful. Otherwise, the exit status shall be non-zero, as defined below. In addition to straightforward success, the following situations are also to be considered successful:

- restarting a service (instead of reloading it) with the **force-reload** argument

- running **start** on a service already running

- running **stop** on a service already stopped or not running

- running **restart** on a service already stopped or not running

- running **try-restart** on a service already stopped or not running

In case of an error while processing any init-script action except for **status**, the init script shall print an error message and exit with a non-zero status code:

1	generic or unspecified error (current practice)
2	invalid or excess argument(s)
3	unimplemented feature (for example, "reload")
4	user had insufficient privilege
5	program is not installed
6	program is not configured
7	program is not running
8-99	reserved for future LSB use
100-149	reserved for distribution use
150-199	reserved for application use
200-254	reserved

Error and status messages should be printed with the logging functions (see Init Script Functions) `log_success_msg()`, `log_failure_msg()` and `log_warning_msg()`. Scripts may write to standard error or standard output, but implementations need not present text written to standard error/output to the user or do anything else with it.

> **Note:** Since init scripts may be run manually by a system administrator with non-standard environment variable values for PATH, USER, LOGNAME, etc., init scripts should not depend on the values of these environment variables. They should set them to some known/default values if they are needed.

20.3 Comment Conventions for Init Scripts

Conforming applications may install one or more init scripts. These init scripts must be activated by invoking the **install_initd** command. Prior to package removal, the changes applied by **install_initd** must be undone by invoking **remove_initd**. See Installation and Removal of Init Scripts for more details.

install_initd and **remove_initd** determine actions to take by decoding a specially formatted block of lines in the script. This block shall be delimited by the lines

```
### BEGIN INIT INFO
### END INIT INFO
```

The delimiter lines may contain trailing whitespace, which shall be ignored. All lines inside the block shall begin with a hash character `#` in the first column, so the shell interprets them as comment lines which do not affect operation of the script. The lines shall be of the form:

```
# {keyword}: arg1 [arg2...]
```

with exactly one space character between the `#` and the keyword, with a single exception. In lines following a line containing the **Description** keyword, and until the next keyword or block ending delimiter is seen, a line where the `#` is followed by more than one space or a tab character shall be treated as a continuation of the previous line.

The information extracted from the block is used by the installation tool or the init-script system to assure that init scripts are run in the correct order. It is unspecified whether the information is evaluated only when **install_initd** runs, when the init scripts are executed, or both. The information extracted includes run levels, defined in Run Levels, and boot facilities, defined in Facility Names.

The following keywords, with their arguments, are defined:

Provides: `boot_facility_1 [boot_facility_2...]`

> boot facilities provided by this init script. When an init script is run with a **start** argument, the boot facility or facilities specified by the **Provides** keyword shall be deemed present and hence init scripts which require those boot facilities should be started later. When an init script is run with a **stop** argument, the boot facilities specified by the **Provides** keyword are deemed no longer present.

Required-Start: `boot_facility_1 [boot_facility_2...]`

> facilities which must be available during startup of this service. The init-script system should insure init scripts which provide the **Required-Start** facilities are started before starting this script.

Required-Stop: `boot_facility_1 [boot_facility_2...]`

> facilities which must be available during the shutdown of this service. The init-script system should avoid stopping init scripts which provide the **Required-Stop** facilities until this script is stopped.

Should-Start: `boot_facility_1 [boot_facility_2...]`

> facilities which, if present, should be available during startup of this service. This allows for weak dependencies which do not cause the service to fail if a facility is not available. The service may provide reduced functionality in this situation. Conforming applications should not rely on the existence of this feature.

Should-Stop: `boot_facility_1 [boot_facility_2...]`

> facilities which should be available during shutdown of this service.

```
Default-Start: run_level_1 [run_level_2...]
Default-Stop: run_level_1 [run_level_2...]
```

which run levels should by default run the init script with a **start** (**stop**) argument to start (stop) the services controlled by the init script.

For example, if a service should run in runlevels 3, 4, and 5 only, specify "Default-Start: 3 4 5" and "Default-Stop: 0 1 2 6".

Short-Description: `short_description`

provide a brief description of the actions of the init script. Limited to a single line of text.

Description: `multiline_description`

provide a more complete description of the actions of the init script. May span mulitple lines. In a multiline description, each continuation line shall begin with a '#' followed by tab character or a '#' followed by at least two space characters. The multiline description is terminated by the first line that does not match this criteria.

Additional keywords may be defined in future versions of this specification. Also, implementations may define local extensions by using the prefix **X-implementor**. For example, **X-RedHat-foobardecl**, or **X-Debian-xyzzydecl**.

Example:

```
### BEGIN INIT INFO
    # Provides: lsb-ourdb
    # Required-Start: $local_fs $network $remote_fs
    # Required-Stop: $local_fs $network $remote_fs
    # Default-Start:  2 3 4 5
    # Default-Stop: 0 1 6
    # Short-Description: start and stop OurDB
    # Description: OurDB is a very fast and reliable database
    #         engine used for illustrating init scripts
### END INIT INFO
```

The comment conventions described in this section are only required for init scripts installed by conforming applications. Conforming runtime implementations are not required to use this scheme in their system provided init scripts.

> **Note:** This specification does not require, but is designed to allow, the development of a system which runs init scripts in parallel. Hence, enforced-serialization of scripts is avoided unless it is explicitly necessary.

20.4 Installation and Removal of Init Scripts

Conforming applications may install one or more initialization scripts (or *init scripts*). An init script shall be installed in `/etc/init.d` (which may be a symbolic link to another location), by the package installer.

During the installer's post-install processing phase the program **/usr/lib/lsb/install_initd** must be called to activate the init script. Activation consists of arranging for the init script to be called in the correct order on system run-level changes (including system boot and shutdown), based on dependencies supplied in the init script (see Comment Conventions for Init Scripts). The **install_initd** command should be thought of as a wrapper which hides the implementation details; how any given implementation arranges for the init script to be called at the appropriate time is not specified.

Example: if an init script specified "Default-Start: 3 4 5" and "Default-Stop: 0 1 2 6", **install_initd** might create "start" symbolic links with names starting with 'S' in `/etc/rc3.d`, `/etc/rc4.d` and `/etc/rc5.d` and "stop" symbolic links with names starting with 'K' in `/etc/rc0.d`, `/etc/rc1.d`, `/etc/rc2.d` and `/etc/rc6.d`. Such a scheme would be similar to the System V Init mechanism, but is by no means the only way this specification could be implemented.

The **install_initd** command takes a single argument, the full pathname of the installed init script. The init script must already be installed in `/etc/init.d`. The **install_initd** command will not copy it there, only activate it once it has been installed. For example:

```
/usr/lib/lsb/install_initd /etc/init.d/example.com-coffeed
```

The **install_initd** command shall return an exit status of zero if the init-script activation was successful or if the init script was already activated. If the dependencies in the init script (see Comment Conventions for Init Scripts) cannot be met, an exit status of one shall be returned and the init script shall not be activated.

When a software package is removed, **/usr/lib/lsb/remove_initd** must be called to deactivate the init script. This must occur before the init script itself is removed, as the dependency information in the script may be required for successful completion. Thus the installer's pre-remove processing phase must call **remove_initd**, and pass the full pathname of the installed init script. The package installer is still responsible for removing the init script. For example:

```
/usr/lib/lsb/remove_initd /etc/init.d/example.com-coffeed
```

The **remove_initd** program shall return an exit status of zero if the init script has been successfully deactivated or if the init script is not activated. If another init script which depends on a boot facility provided by this init script is activated, an exit status of one shall be returned and the init script shall remain activated. The installer must fail on such an exit code so it does not subsequently remove the init script.

> **Note:** This specification does not describe a mechanism for the system administrator to manipulate the run levels at which an init script is started or stopped. There is no assurance that modifying the comment block for this purpose will have the desired effect.

20.5 Run Levels

The following *run levels* are specified for use by the **Default-Start** and **Default-Stop** actions defined in Comment Conventions for Init Scripts as hints to the **install_initd** command. Conforming implementations are not required to provide these exact run levels or give them the meanings described here, and may map any level described here to a different level which provides the equivalent functionality. Applications may not depend on specific run-level numbers.

0	halt
1	single user mode
2	multiuser with no network services exported
3	normal/full multiuser
4	reserved for local use, default is normal/full multiuser
5	multiuser with a display manager or

	equivalent
6	reboot

> **Note:** These run levels were chosen as reflecting the most frequent existing practice, and in the absence of other considerations, implementors are strongly encouraged to follow this convention to provide consistency for system administrators who need to work with multiple distributions.

20.6 Facility Names

Boot *facilities* are used to indicate dependencies in initialization scripts, as defined in Comment Conventions for Init Scripts. Facility names are assigned to scripts by the **Provides:** keyword. Facility names that begin with a dollar sign ('$') are reserved system facility names.

> **Note:** Facility names are only recognized in the context of the init script comment block and are not available in the body of the init script. In particular, the use of the leading '$' character does not imply system facility names are subject to shell variable expansion, since they appear inside comments.

Conforming applications shall not provide facilities that begin with a dollar sign. Implementations shall provide the following facility names:

$local_fs

all local file systems are mounted

$network

basic networking support is available. Example: a server program could listen on a socket.

$named

IP name-to-address translation, using the interfaces described in this specification, are available to the level the system normally provides them. Example: if a DNS query daemon normally provides this facility, then that daemon has been started.

$portmap

daemons providing SunRPC/ONCRPC portmapping service as defined in RFC 1833: Binding Protocols for ONC RPC Version 2 (if present) are running.

$remote_fs

all remote file systems are available. In some configurations, file systems such as /usr may be remote. Many applications that require **$local_fs** will probably also require **$remote_fs**.

$syslog

system logger is operational.

$time

the system time has been set, for example by using a network-based time program such as **ntp** or **rdate**, or via the hardware Real Time Clock.

Other (non-system) facilities may be defined by other conforming applications. These facilities shall be named using the same conventions defined for naming

init scripts (see Script Names). Commonly, the facility provided by a conforming init script will have the same name as the name assigned to the init script.

20.7 Script Names

Since init scripts live in a single directory, they must share a single namespace. To avoid conflicts, applications installing files in this directories shall use the LSB naming conventions (see File Naming Conventions).

20.8 Init Script Functions

Each conforming init script shall execute the commands in the file `/lib/lsb/init-functions` in the current environment (see shell special built-in command **dot**). This file shall cause the following shell script commands to be defined in an unspecified manner.

> **Note:** This can be done either by adding a directory to the PATH variable which defines these commands, or by defining shell aliases or functions.

> Although the commands made available via this mechanism need not be conforming applications in their own right, applications that use them should only depend on features described in this specification.

Conforming scripts shall not specify the "exit on error" option (i.e. **set -e**) when sourcing this file, or calling any of the commands thus made available.

The **start_daemon**, **killproc** and **pidofproc** functions shall use the following algorithm for determining the status and the process identifiers of the specified program.

1. If the `-p pidfile` option is specified, and the named `pidfile` exists, a single line at the start of the `pidfile` shall be read. If this line contains one or more numeric values, separated by spaces, these values shall be used. If the `-p pidfile` option is specified and the named `pidfile` does not exist, the functions shall assume that the daemon is not running.

2. Otherwise, `/var/run/basename.pid` shall be read in a similar fashion. If this contains one or more numeric values on the first line, these values shall be used. Optionally, implementations may use unspecified additional methods to locate the process identifiers required.

The method used to determine the status is implementation defined, but should allow for non-binary programs.

> **Note:** Commonly used methods check either for the existence of the `/proc/pid` directory or use `/proc/pid/exe` and `/proc/pid/cmdline`. Relying only on `/proc/pid/exe` is discouraged since this specification does not specify the existence of, or semantics for, `/proc`. Additionally, using `/proc/pid/exe` may result in a not-running status for daemons that are written in a script language.

Conforming implementations may use other mechanisms besides those based on pidfiles, unless the `-p pidfile` option has been used. Conforming applications should not rely on such mechanisms and should always use a `pidfile`. When a program is stopped, it should delete its `pidfile`. Multiple process identifiers shall be separated by a single space in the `pidfile` and in the output of **pidofproc**.

start_daemon `[-f] [-n nicelevel] [-p pidfile] pathname [args...]`

runs the specified program as a daemon. The **start_daemon** function shall check if the program is already running using the algorithm given above. If so, it shall not start another copy of the daemon unless the `-f` option is given. The `-n` option specifies a nice level. See **nice**. **start_daemon** shall return the LSB defined exit status codes. It shall return 0 if the program has been successfully started or is running and not 0 otherwise.

killproc `[-p pidfile] pathname [signal]`

The **killproc** function shall stop the specified program. The program is found using the algorithm given above. If a signal is specified, using the `-signal_name` or `-signal_number` syntaxes as specified by the **kill** command, the program is sent that signal. Otherwise, a SIGTERM followed by a SIGKILL after an unspecified number of seconds shall be sent. If a program has been terminated, the `pidfile` should be removed if the terminated process has not already done so. The **killproc** function shall return the LSB defined exit status codes. If called without a signal, it shall return 0 if the program has been stopped or is not running and not 0 otherwise. If a signal is given, it shall return 0 only if the program is running.

pidofproc `[-p pidfile] pathname`

The **pidofproc** function shall return one or more process identifiers for a particular daemon using the algorithm given above. Only process identifiers of running processes should be returned. Multiple process identifiers shall be separated by a single space.

Note: A process may exit between **pidofproc** discovering its identity and the caller of **pidofproc** being able to act on that identity. As a result, no test assertion can be made that the process identifiers returned by **pidofproc** *shall* be running processes.

The **pidofproc** function shall return the LSB defined exit status codes for "status". It shall return 0 if the program is running and not 0 otherwise.

log_success_msg `message`

The **log_success_msg** function shall cause the system to write a success message to an unspecified log file. The format of the message is unspecified. The **log_success_msg** function may also write a message to the standard output.

Note: The message should be relatively short; no more than 60 characters is highly desirable.

log_failure_msg `message`

The **log_failure_msg** function shall cause the system to write a failure message to an unspecified log file. The format of the message is unspecified. The **log_failure_msg** function may also write a message to the standard output.

Note: The message should be relatively short; no more than 60 characters is highly desirable.

log_warning_msg `message`

The **log_warning_msg** function shall cause the system to write a warning message to an unspecified log file. The format of the message is

unspecified. The **log_warning_msg** function may also write a message to the standard output.

Note: The message should be relatively short; no more than 60 characters is highly desirable.

IX Users & Groups

21 Users & Groups

21.1 User and Group Database

The format of the User and Group databases is not specified. Programs may only read these databases using the provided API. Changes to these databases should be made using the provided commands.

21.2 User & Group Names

Table 21-1 describes required mnemonic user and group names. This specification makes no attempt to numerically assign user or group identity numbers, with the exception that both the User ID and Group ID for the user `root` shall be equal to 0.

Table 21-1 Required User & Group Names

User	Group	Comments
root	root	Administrative user with all appropriate privileges
bin	bin	Legacy User ID/Group ID[a]
daemon	daemon	Legacy User ID/Group ID[b]

Notes:
a   The `bin` User ID/Group ID is included for compatibility with legacy
    applications. New applications should no longer use the `bin` User
    ID/Group ID.
b   The `daemon` User ID/Group ID was used as an unprivileged User
    ID/Group ID for daemons to execute under in order to limit their access
    to the system. Generally daemons should now run under individual User
    ID/Group IDs in order to further partition daemons from one another.

Table 21-2 is a table of optional mnemonic user and group names. This specification makes no attempt to numerically assign uid or gid numbers. If the username exists on a system, then they should be in the suggested corresponding group. These user and group names are for use by distributions, not by applications.

Table 21-2 Optional User & Group Names

User	Group	Comments
adm	adm	Administrative special privileges
lp	lp	Printer special privileges
sync	sync	Login to sync the system
shutdown	shutdown	Login to shutdown the

User	Group	Comments
		system
halt	halt	Login to halt the system
mail	mail	Mail special privileges
news	news	News special privileges
uucp	uucp	UUCP special privileges
operator	root	Operator special privileges
man	man	Man special privileges
nobody	nobody	Used by NFS

Only a minimum working set of "user names" and their corresponding "user groups" are required. Applications cannot assume non system user or group names will be defined.

Applications cannot assume any policy for the default file creation mask (**umask**) or the default directory permissions a user may have. Applications should enforce user only file permissions on private files such as mailboxes. The location of the users home directory is also not defined by policy other than the recommendations of the Filesystem Hierarchy Standard and should be obtained by the `getpwnam()`, `getpwnam_r()`, `getpwent()`, `getpwuid()`, and `getpwuid_r()` functions.

21.3 User ID Ranges

The system User IDs from 0 to 99 should be statically allocated by the system, and shall not be created by applications.

The system User IDs from 100 to 499 should be reserved for dynamic allocation by system administrators and post install scripts using **useradd**.

21.4 Rationale

The purpose of specifying optional users and groups is to reduce the potential for name conflicts between applications and distributions.

X Package Format and Installation

22 Software Installation

22.1 Introduction

Applications shall either be packaged in the RPM packaging format as defined in this specification, or supply an installer which is LSB conforming (for example, calls LSB commands and utilities).

> **Note:** Supplying an RPM format package is encouraged because it makes systems easier to manage. This specification does not require the implementation to use RPM as the package manager; it only specifies the format of the package file.
>
> Applications are also encouraged to uninstall cleanly.

A package in RPM format may include a dependency on the LSB Core and other LSB specifications, as described in Section 22.6. Packages that are not in RPM format may test for the presence of a conforming implementation by means of the **lsb_release** utility.

Implementations shall provide a mechanism for installing applications in this packaging format with some restrictions listed below.

> **Note:** The implementation itself may use a different packaging format for its own packages, and of course it may use any available mechanism for installing the LSB-conformant packages.

22.2 Package File Format

An RPM format file consists of 4 sections, the Lead, Signature, Header, and the Payload. All values are stored in network byte order.

Table 22-1 RPM File Format

Lead
Signature
Header
Payload

These 4 sections shall exist in the order specified.

The lead section is used to identify the package file.

The signature section is used to verify the integrity, and optionally, the authenticity of the majority of the package file.

The header section contains all available information about the package. Entries such as the package's name, version, and file list, are contained in the header.

The payload section holds the files to be installed.

22.2.1 Lead Section

```
struct rpmlead {
    unsigned char magic[4];
    unsigned char major, minor;
    short type;
    short archnum;
    char name[66];
    short osnum;
```

```
    short signature_type;
    char reserved[16];
} ;
```

magic

> Value identifying this file as an RPM format file. This value shall be "\355\253\356\333".

major

> Value indicating the major version number of the file format version. This value shall be 3.

minor

> Value indicating the minor revision number of file format version. This value shall be 0.

type

> Value indicating whether this is a source or binary package. This value shall be 0 to indicate a binary package.

archnum

> Value indicating the architecture for which this package is valid. This value is specified in the relevant architecture specific part of ISO/IEC 23360.

name

> A NUL terminated string that provides the package name. This name shall conform with the Package Naming section of this specification.

osnum

> Value indicating the Operating System for which this package is valid. This value shall be 1.

signature_type

> Value indicating the type of the signature used in the Signature part of the file. This value shall be 5.

reserved

> Reserved space. The value is undefined.

22.2.2 Header Structure

The Header structure is used for both the Signature and Header Sections. A Header Structure consists of 3 parts, a Header record, followed by 1 or more Index records, followed by 0 or more bytes of data associated with the Index records. A Header structure shall be aligned to an 8 byte boundary.

Table 22-2 Signature Format

Header Record
Array of Index Records
Store of Index Values

22.2.2.1 Header Record

```
struct rpmheader {
    unsigned char magic[4];
    unsigned char reserved[4];
    int nindex;
    int hsize;
    } ;
```

magic

> Value identifying this record as an RPM header record. This value shall be
> "\216\255\350\001".

reserved

> Reserved space. This value shall be "\000\000\000\000".

nindex

> The number of Index Records that follow this Header Record. There should
> be at least 1 Index Record.

hsize

> The size in bytes of the storage area for the data pointed to by the Index
> Records.

22.2.2.2 Index Record

```
struct rpmhdrindex {
    int tag;
    int type;
    int offset;
    int count;
    } ;
```

tag

> Value identifying the purpose of the data associated with this Index
> Record. The value of this field is dependent on the context in which the
> Index Record is used, and is defined below and in later sections.

type

> Value identifying the type of the data associated with this Index Record.
> The possible *type* values are defined below.

offset

> Location in the Store of the data associated with this Index Record. This
> value should between 0 and the value contained in the *hsize* of the Header
> Structure.

count

> Size of the data associated with this Index Record. The *count* is the number
> of elements whose size is defined by the type of this Record.

22.2.2.2.1 Index Type Values

The possible values for the *type* field are defined in this table.

Table 22-3 Index Type values

Type	Value	Size (in bytes)	Alignment
RPM_NULL_TYPE	0	Not Implemented.	
RPM_CHAR_TYPE	1	1	1
RPM_INT8_TYPE	2	1	1
RPM_INT16_TYPE	3	2	2
RPM_INT32_TYPE	4	4	4
RPM_INT64_TYPE	5	Reserved.	
RPM_STRING_TYPE	6	variable, NUL terminated	1
RPM_BIN_TYPE	7	1	1
RPM_STRING_ARRAY_TYPE	8	Variable, sequence of NUL terminated strings	1
RPM_I18NSTRING_TYPE	9	variable, sequence of NUL terminated strings	1

The string arrays specified for entries of type RPM_STRING_ARRAY_TYPE and RPM_I18NSTRING_TYPE are vectors of strings in a contiguous block of memory, each element separated from its neighbors by a NUL character.

Index records with type RPM_I18NSTRING_TYPE shall always have a *count* of 1. The array entries in an index of type RPM_I18NSTRING_TYPE correspond to the locale names contained in the RPMTAG_HDRI18NTABLE index.

22.2.2.2.2 Index Tag Values

Some values are designated as header private, and may appear in any header structure. These are defined here. Additional values are defined in later sections.

Table 22-4 Header Private Tag Values

Name	Tag Value	Type	Count	Status
RPMTAG_HEADERSIGNATURES	62	BIN	16	Optional
RPMTAG_HEADERIMMUTABLE	63	BIN	16	Optional
RPMTAG_HEADERI18NTABLE	100	STRING_ARRAY		Optional

RPMTAG_HEADERSIGNATURES

> The signature tag differentiates a signature header from a metadata header, and identifies the original contents of the signature header.

RPMTAG_HEADERIMMUTABLE

> This tag contains an index record which specifies the portion of the Header Record which was used for the calculation of a signature. This data shall be preserved or any header-only signature will be invalidated.

RPMTAG_HEADERI18NTABLE

> Contains a list of locales for which strings are provided in other parts of the package.

Not all Index records defined here will be present in all packages. Each tag value has a status which is defined here.

Required

> This Index Record shall be present.

Optional

> This Index Record may be present.

Informational

> This Index Record may be present, but does not contribute to the processing of the package.

Deprecated

> This Index Record should not be present.

Obsolete

> This Index Record shall not be present.

Reserved

> This Index Record shall not be present.

22.2.2.3 Header Store

The header store contains the values specified by the Index structures. These values are aligned according to their type and padding is used if needed. The store is located immediately following the Index structures.

22.2.3 Signature Section

The Signature section is implemented using the Header structure. The signature section defines the following additional tag values which may be used in the Index structures.

These values exist to provide additional information about the rest of the package.

Table 22-5 Signature Tag Values

Name	Tag Value	Type	Count	Status
RPMSIGTAG_S IZE	1000	INT32	1	Required

Name	Tag Value	Type	Count	Status
`RPMSIGTAG_P` `AYLOADSIZE`	1007	INT32	1	Optional

`RPMSIGTAG_SIZE`

> This tag specifies the combined size of the Header and Payload sections.

`RPMSIGTAG_PAYLOADSIZE`

> This tag specifies the uncompressed size of the Payload archive, including the cpio headers.

These values exist to ensure the integrity of the rest of the package.

Table 22-6 Signature Digest Tag Values

Name	Tag Value	Type	Count	Status
`RPMSIGTAG_S` `HA1`	269	STRING	1	Optional
`RPMSIGTAG_M` `D5`	1004	BIN	16	Required

`RPMSIGTAG_SHA1`

> This index contains the SHA1 checksum of the entire Header Section, including the Header Record, Index Records and Header store.

`RPMSIGTAG_MD5`

> This tag specifies the 128-bit MD5 checksum of the combined Header and Archive sections.

These values exist to provide authentication of the package.

Table 22-7 Signature Signing Tag Values

Name	Tag Value	Type	Count	Status
`RPMSIGTAG_D` `SA`	267	BIN	65	Optional
`RPMSIGTAG_R` `SA`	268	BIN	1	Optional
`RPMSIGTAG_P` `GP`	1002	BIN	1	Optional
`RPMSIGTAG_G` `PG`	1005	BIN	65	Optional

`RPMSIGTAG_DSA`

> The tag contains the DSA signature of the Header section. The data is formatted as a Version 3 Signature Packet as specified in RFC 2440: OpenPGP Message Format. If this tag is present, then the SIGTAG_GPG tag shall also be present.

`RPMSIGTAG_RSA`

> The tag contains the RSA signature of the Header section.The data is formatted as a Version 3 Signature Packet as specified in RFC 2440:

OpenPGP Message Format. If this tag is present, then the SIGTAG_PGP shall also be present.

RPMSIGTAG_PGP

This tag specifies the RSA signature of the combined Header and Payload sections. The data is formatted as a Version 3 Signature Packet as specified in RFC 2440: OpenPGP Message Format.

RPMSIGTAG_GPG

The tag contains the DSA signature of the combined Header and Payload sections. The data is formatted as a Version 3 Signature Packet as specified in RFC 2440: OpenPGP Message Format.

22.2.4 Header Section

The Header section is implemented using the Header structure. The Header section defines the following additional tag values which may be used in the Index structures.

22.2.4.1 Package Information

The following tag values are used to indicate information that describes the package as a whole.

Table 22-8 Package Info Tag Values

Name	Tag Value	Type	Count	Status
RPMTAG_NAME	1000	STRING	1	Required
RPMTAG_VERSION	1001	STRING	1	Required
RPMTAG_RELEASE	1002	STRING	1	Required
RPMTAG_SUMMARY	1004	I18NSTRING	1	Required
RPMTAG_DESCRIPTION	1005	I18NSTRING	1	Required
RPMTAG_SIZE	1009	INT32	1	Required
RPMTAG_DISTRIBUTION	1010	STRING	1	Informational
RPMTAG_VENDOR	1011	STRING	1	Informational
RPMTAG_LICENSE	1014	STRING	1	Required
RPMTAG_PACKAGER	1015	STRING	1	Informational
RPMTAG_GROUP	1016	I18NSTRING	1	Required
RPMTAG_URL	1020	STRING	1	Informational
RPMTAG_OS	1021	STRING	1	Required

Name	Tag Value	Type	Count	Status
RPMTAG_ARCH	1022	STRING	1	Required
RPMTAG_SOURCERPM	1044	STRING	1	Informational
RPMTAG_ARCHIVESIZE	1046	INT32	1	Optional
RPMTAG_RPMVERSION	1064	STRING	1	Informational
RPMTAG_COOKIE	1094	STRING	1	Optional
RPMTAG_DISTURL	1123	STRING	1	Informational
RPMTAG_PAYLOADFORMAT	1124	STRING	1	Required
RPMTAG_PAYLOADCOMPRESSOR	1125	STRING	1	Required
RPMTAG_PAYLOADFLAGS	1126	STRING	1	Required

RPMTAG_NAME

This tag specifies the name of the package.

RPMTAG_VERSION

This tag specifies the version of the package.

RPMTAG_RELEASE

This tag specifies the release of the package.

RPMTAG_SUMMARY

This tag specifies the summary description of the package. The summary value pointed to by this index record contains a one line description of the package.

RPMTAG_DESCRIPTION

This tag specifies the description of the package. The description value pointed to by this index record contains a full desription of the package.

RPMTAG_SIZE

This tag specifies the sum of the sizes of the regular files in the archive.

RPMTAG_DISTRIBUTION

A string containing the name of the distribution on which the package was built.

RPMTAG_VENDOR

A string containing the name of the organization that produced the package.

RPMTAG_LICENSE

> This tag specifies the license which applies to this package.

RPMTAG_PACKAGER

> A string identifying the tool used to build the package.

RPMTAG_GROUP

> This tag specifies the administrative group to which this package belongs.

RPMTAG_URL

> Generic package information URL.

RPMTAG_OS

> This tag specifies the OS of the package. The OS value pointed to by this index record shall be "linux".

RPMTAG_ARCH

> This tag specifies the architecture of the package. The architecture value pointed to by this index record is defined in architecture specific LSB specification.

RPMTAG_SOURCERPM

> This tag specifies the name of the source RPM.

RPMTAG_ARCHIVESIZE

> This tag specifies the uncompressed size of the Payload archive, including the cpio headers.

RPMTAG_RPMVERSION

> This tag indicates the version of RPM tool used to build this package. The value is unused.

RPMTAG_COOKIE

> This tag contains an opaque string whose contents are undefined.

RPMTAG_DISTURL

> URL for package.

RPMTAG_PAYLOADFORMAT

> This tag specifies the format of the Archive section. The format value pointed to by this index record shall be 'cpio'.

RPMTAG_PAYLOADCOMPRESSOR

> This tag specifies the compression used on the Archive section. The compression value pointed to by this index record shall be 'gzip'.

RPMTAG_PAYLOADFLAGS

> This tag indicates the compression level used for the Payload. This value shall always be '9'.

22.2.4.2 Installation Information

The following tag values are used to provide information needed during the installation of the package.

Table 22-9 Installation Tag Values

Name	Tag Value	Type	Count	Status
RPMTAG_PREI N	1023	STRING	1	Optional
RPMTAG_POST IN	1024	STRING	1	Optional
RPMTAG_PREU N	1025	STRING	1	Optional
RPMTAG_POST UN	1026	STRING	1	Optional
RPMTAG_PREI NPROG	1085	STRING	1	Optional
RPMTAG_POST INPROG	1086	STRING	1	Optional
RPMTAG_PREU NPROG	1087	STRING	1	Optional
RPMTAG_POST UNPROG	1088	STRING	1	Optional

RPMTAG_PREIN

> This tag specifies the preinstall scriptlet. If present, then RPMTAG_PREINPROG shall also be present.

RPMTAG_POSTIN

> This tag specifies the postinstall scriptlet. If present, then RPMTAG_POSTINPROG shall also be present.

RPMTAG_PREUN

> his tag specifies the preuninstall scriptlet. If present, then RPMTAG_PREUNPROG shall also be present.

RPMTAG_POSTUN

> This tag specified the postuninstall scriptlet. If present, then RPMTAG_POSTUNPROG shall also be present.

RPMTAG_PREINPROG

> This tag specifies the name of the intepreter to which the preinstall scriptlet will be passed. The intepreter pointed to by this index record shall be /bin/sh.

RPMTAG_POSTINPROG

> This tag specifies the name of the intepreter to which the postinstall scriptlet will be passed. The intepreter pointed to by this index record shall be /bin/sh.

RPMTAG_PREUNPROG

>   This tag specifies the name of the intepreter to which the preuninstall
>   scriptlet will be passed. The intepreter pointed to by this index record shall
>   be `/bin/sh`.

RPMTAG_POSTUNPROG

>   This program specifies the name of the intepreter to which the
>   postuninstall scriptlet will be passed. The intepreter pointed to by this
>   index record shall be `/bin/sh`.

22.2.4.3 File Information

The following tag values are used to provide information about the files in the
payload. This information is provided in the header to allow more efficient
access of the information.

Table 22-10 File Info Tag Values

Name	Tag Value	Type	Count	Status
RPMTAG_OLDF ILENAMES	1027	STRING_AR RAY		Optional
RPMTAG_FILE SIZES	1028	INT32		Required
RPMTAG_FILE MODES	1030	INT16		Required
RPMTAG_FILE RDEVS	1033	INT16		Required
RPMTAG_FILE MTIMES	1034	INT32		Required
RPMTAG_FILE MD5S	1035	STRING_AR RAY		Required
RPMTAG_FILE LINKTOS	1036	STRING_AR RAY		Required
RPMTAG_FILE FLAGS	1037	INT32		Required
RPMTAG_FILE USERNAME	1039	STRING_AR RAY		Required
RPMTAG_FILE GROUPNAME	1040	STRING_AR RAY		Required
RPMTAG_FILE DEVICES	1095	INT32		Required
RPMTAG_FILE INODES	1096	INT32		Required
RPMTAG_FILE LANGS	1097	STRING_AR RAY		Required
RPMTAG_DIRI NDEXES	1116	INT32		Optional
RPMTAG_BASE	1117	STRING_AR		Optional

Name	Tag Value	Type	Count	Status
`NAMES`		RAY		
`RPMTAG_DIRN` `AMES`	1118	STRING_AR RAY		Optional

`RPMTAG_OLDFILENAMES`

> This tag specifies the filenames when not in a compressed format as determined by the absence of rpmlib(CompressedFileNames) in the RPMTAG_REQUIRENAME index.

`RPMTAG_FILESIZES`

> This tag specifies the size of each file in the archive.

`RPMTAG_FILEMODES`

> This tag specifies the mode of each file in the archive.

`RPMTAG_FILERDEVS`

> This tag specifies the device number from which the file was copied.

`RPMTAG_FILEMTIMES`

> This tag specifies the modification time in seconds since the epoch of each file in the archive.

`RPMTAG_FILEMD5S`

> This tag specifies the ASCII representation of the MD5 sum of the corresponding file contents. This value is empty if the corresponding archive entry is not a regular file.

`RPMTAG_FILELINKTOS`

> The target for a symlink, otherwise NULL.

`RPMTAG_FILEFLAGS`

> This tag specifies the bit(s) to classify and control how files are to be installed. See below.

`RPMTAG_FILEUSERNAME`

> This tag specifies the owner of the corresponding file.

`RPMTAG_FILEGROUPNAME`

> This tag specifies the group of the corresponding file.

`RPMTAG_FILEDEVICES`

> This tag specifies the 16 bit device number from which the file was copied.

`RPMTAG_FILEINODES`

> This tag specifies the inode value from the original file system on the the system on which it was built.

`RPMTAG_FILELANGS`

> This tag specifies a per-file locale marker used to install only locale specific subsets of files when the package is installed.

RPMTAG_DIRINDEXES

> This tag specifies the index into the array provided by the RPMTAG_DIRNAMES Index which contains the directory name for the corresponding filename.

RPMTAG_BASENAMES

> This tag specifies the base portion of the corresponding filename.

RPMTAG_DIRNAMES

One of `RPMTAG_OLDFILENAMES` or the tuple `RPMTAG_DIRINDEXES,RPMTAG_BASENAMES,RPMTAG_DIRNAMES` shall be present, but not both.

22.2.4.3.1 File Flags

The `RPMTAG_FILEFLAGS` tag value shall identify various characteristics of the file in the payload that it describes. It shall be an INT32 value consisting of either the value `RPMFILE_NONE` (0) or the bitwise inclusive or of one or more of the following values:

Table 22-11 File Flags

Name	Value
RPMFILE_CONFIG	(1 << 0)
RPMFILE_DOC	(1 << 1)
RPMFILE_DONOTUSE	(1 << 2)
RPMFILE_MISSINGOK	(1 << 3)
RPMFILE_NOREPLACE	(1 << 4)
RPMFILE_SPECFILE	(1 << 5)
RPMFILE_GHOST	(1 << 6)
RPMFILE_LICENSE	(1 << 7)
RPMFILE_README	(1 << 8)
RPMFILE_EXCLUDE	(1 << 9)

These bits have the following meaning:

RPMFILE_CONFIG

> The file is a configuration file, and an existing file should be saved during a package upgrade operation and not removed during a pakage removal operation.

RPMFILE_DOC

> The file contains documentation.

RPMFILE_DONOTUSE

> This value is reserved for future use; conforming packages may not use this flag.

RPMFILE_MISSINGOK

The file need not exist on the installed system.

RPMFILE_NOREPLACE

Similar to the `RPMFILE_CONFIG`, this flag indicates that during an upgrade operation the original file on the system should not be altered.

RPMFILE_SPECFILE

The file is a package specification.

RPMFILE_GHOST

The file is not actually included in the payload, but should still be considered as a part of the package. For example, a log file generated by the application at run time.

RPMFILE_LICENSE

The file contains the license conditions.

RPMFILE_README

The file contains high level notes about the package.

RPMFILE_EXCLUDE

The corresponding file is not a part of the package, and should not be installed.

22.2.4.4 Dependency Information

The following tag values are used to provide information about interdependencies between packages.

Table 22-12 Package Dependency Tag Values

Name	Tag Value	Type	Count	Status
RPMTAG_PROVIDENAME	1047	STRING_ARRAY	1	Required
RPMTAG_REQUIREFLAGS	1048	INT32		Required
RPMTAG_REQUIRENAME	1049	STRING_ARRAY		Required
RPMTAG_REQUIREVERSION	1050	STRING_ARRAY		Required
RPMTAG_CONFLICTFLAGS	1053	INT32		Optional
RPMTAG_CONFLICTNAME	1054	STRING_ARRAY		Optional
RPMTAG_CONFLICTVERSION	1055	STRING_ARRAY		Optional
RPMTAG_OBSOLETENAME	1090	STRING_ARRAY		Optional
RPMTAG_PROV	1112	INT32		Required

Name	Tag Value	Type	Count	Status
IDEFLAGS				
RPMTAG_PROVIDEVERSION	1113	STRING_ARRAY		Required
RPMTAG_OBSOLETEFLAGS	1114	INT32	1	Optional
RPMTAG_OBSOLETEVERSION	1115	STRING_ARRAY		Optional

RPMTAG_PROVIDENAME

> This tag indicates the name of the dependency provided by this package.

RPMTAG_REQUIREFLAGS

> Bits(s) to specify the dependency range and context.

RPMTAG_REQUIRENAME

> This tag indicates the dependencies for this package.

RPMTAG_REQUIREVERSION

> This tag indicates the versions associated with the values found in the RPMTAG_REQUIRENAME Index.

RPMTAG_CONFLICTFLAGS

> Bits(s) to specify the conflict range and context.

RPMTAG_CONFLICTNAME

> This tag indicates the conflicting dependencies for this package.

RPMTAG_CONFLICTVERSION

> This tag indicates the versions associated with the values found in the RPMTAG_CONFLICTNAME Index.

RPMTAG_OBSOLETENAME

> This tag indicates the obsoleted dependencies for this package.

RPMTAG_PROVIDEFLAGS

> Bits(s) to specify the conflict range and context.

RPMTAG_PROVIDEVERSION

> This tag indicates the versions associated with the values found in the RPMTAG_PROVIDENAME Index.

RPMTAG_OBSOLETEFLAGS

> Bits(s) to specify the conflict range and context.

RPMTAG_OBSOLETEVERSION

> This tag indicates the versions associated with the values found in the RPMTAG_OBSOLETENAME Index.

22.2.4.4.1 Package Dependency Values

The package dependencies are stored in the `RPMTAG_REQUIRENAME` and `RPMTAG_REQUIREVERSION` index records. The following values may be used.

Table 22-13 Index Type values

Name	Version	Meaning	Status
rpmlib(VersionedDependencies)	3.0.3-1	Indicates that the package contains `RPMTAG_PROVIDENAME`, `RPMTAG_OBSOLETENAME` or `RPMTAG_PREREQ` records that have a version associated with them.	Optional
rpmlib(PayloadFilesHavePrefix)	4.0-1	Indicates the filenames in the Archive have had "." prepended to them.	Optional
rpmlib(CompressedFileNames)	3.0.4-1	Indicates that the filenames in the Payload are represented in the `RPMTAG_DIRINDEXES`, `RPMTAG_DIRNAME` and `RPMTAG_BASENAMES` indexes.	Optional
/bin/sh		Interpreter usually required for installation scripts.	Optional

Additional dependencies are specified in the Package Dependencies section of this specification, and in the relevant architecture specific part of ISO/IEC 23360.

22.2.4.4.2 Package Dependencies Attributes

The package dependency attributes are stored in the `RPMTAG_REQUIREFLAGS`, `RPMTAG_PROVIDEFLAGS` and `RPMTAG_OBSOLETEFLAGS` index records. The following values may be used.

Table 22-14 Package Dependency Attributes

Name	Value	Meaning

Name	Value	Meaning
`RPMSENSE_LESS`	`0x02`	
`RPMSENSE_GREATER`	`0x04`	
`RPMSENSE_EQUAL`	`0x08`	
`RPMSENSE_PREREQ`	`0x40`	
`RPMSENSE_INTERP`	`0x100`	
`RPMSENSE_SCRIPT_PRE`	`0x200`	
`RPMSENSE_SCRIPT_POST`	`0x400`	
`RPMSENSE_SCRIPT_PREUN`	`0x800`	
`RPMSENSE_SCRIPT_POSTUN`	`0x1000`	
`RPMSENSE_RPMLIB`	`0x1000000`	

22.2.4.5 Other Information

The following tag values are also found in the Header section.

Table 22-15 Other Tag Values

Name	Tag Value	Type	Count	Status
`RPMTAG_BUILDTIME`	1006	INT32	1	Informational
`RPMTAG_BUILDHOST`	1007	STRING	1	Informational
`RPMTAG_FILEVERIFYFLAGS`	1045	INT32		Optional
`RPMTAG_CHANGELOGTIME`	1080	INT32		Optional
`RPMTAG_CHANGELOGNAME`	1081	STRING_ARRAY		Optional
`RPMTAG_CHANGELOGTEXT`	1082	STRING_ARRAY		Optional
`RPMTAG_OPTFLAGS`	1122	STRING	1	Informational
`RPMTAG_RHNPLATFORM`	1131	STRING	1	Deprecated
`RPMTAG_PLATFORM`	1132	STRING	1	Informational

`RPMTAG_BUILDTIME`

> This tag specifies the time as seconds since the epoch at which the package was built.

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RPMTAG_BUILDHOST

This tag specifies the hostname of the system on which which the package was built.

RPMTAG_FILEVERIFYFLAGS

This tag specifies the bit(s) to control how files are to be verified after install, specifying which checks should be performed.

RPMTAG_CHANGELOGTIME

This tag specifies the Unix time in seconds since the epoch associated with each entry in the Changelog file.

RPMTAG_CHANGELOGNAME

This tag specifies the name of who made a change to this package.

RPMTAG_CHANGELOGTEXT

This tag specifies the changes asssociated with a changelog entry.

RPMTAG_OPTFLAGS

This tag indicates additional flags which may have been passed to the compiler when building this package.

RPMTAG_RHNPLATFORM

This tag contains an opaque string whose contents are undefined.

RPMTAG_PLATFORM

This tag contains an opaque string whose contents are undefined.

22.2.5 Payload Section

The Payload section contains a compressed cpio archive. The format of this section is defined by RFC 1952: GZIP File Format Specification.

When uncompressed, the cpio archive contains a sequence of records for each file. Each record contains a CPIO Header, Filename, Padding, and File Data.

Table 22-16 CPIO File Format

CPIO Header	Header structure as defined below.
Filename	NUL terminated ASCII string containing the name of the file.
Padding	0-3 bytes as needed to align the file stream to a 4 byte boundary.
File data	The contents of the file.
Padding	0-3 bytes as needed to align the file stream to a 4 byte boundary.

The CPIO Header uses the following header structure (sometimes referred to as "new ASCII" or "SVR4 cpio"). All numbers are stored as ASCII representations of their hexadecimal value with leading zeros as needed to fill the field. With the exception of $c\_namesize$ and the corresponding name string, and $c\_checksum$, all information contained in the CPIO Header is also represented

in the Header Section. The values in the CPIO Header shall match the values contained in the Header Section.

```
struct {
        char    c_magic[6];
        char    c_ino[8];
        char    c_mode[8];
        char    c_uid[8];
        char    c_gid[8];
        char    c_nlink[8];
        char    c_mtime[8];
        char    c_filesize[8];
        char    c_devmajor[8];
        char    c_devminor[8];
        char    c_rdevmajor[8];
        char    c_rdevminor[8];
        char    c_namesize[8];
        char    c_checksum[8];
        };
```

c_magic

Value identifying this cpio format. This value shall be "070701".

c_ino

This field contains the inode number from the filesystem from which the file was read. This field is ignored when installing a package. This field shall match the corresponding value in the RPMTAG_FILEINODES index in the Header section.

c_mode

Permission bits of the file. This is an ascii representation of the hexadecimal number representing the bit as defined for the *st_mode* field of the stat structure defined for the stat function. This field shall match the corresponding value in the RPMTAG_FILEMODES index in the Header section.

c_uid

Value identifying this owner of this file. This value matches the uid value of the corresponding user in the RPMTAG_FILEUSERNAME as found on the system where this package was built. The username specified in RPMTAG_FILEUSERNAME should take precedence when installing the package.

c_gid

Value identifying this group of this file. This value matches the gid value of the corresponding user in the RPMTAG_FILEGROUPNAME as found on the system where this package was built. The groupname specified in RPMTAG_FILEGROUPNAME should take precedence when installing the package.

c_nlink

Value identifying the number of links associated with this file. If the value is greater than 1, then this filename will be linked to 1 or more files in this archive that has a matching value for the c_ino, c_devmajor and c_devminor fields.

c_mtime

> Value identifying the modification time of the file when it was read. This field shall match the corresponding value in the RPMTAG_FILEMTIMES index in the Header section.

c_filesize

> Value identifying the size of the file. This field shall match the corresponding value in the RPMTAG_FILESIZES index in the Header section.

c_devmajor

> The major number of the device containing the file system from which the file was read. With the exception of processing files with c_nlink >1, this field is ignored when installing a package. This field shall match the corresponding value in the RPMTAG_FILEDEVICES index in the Header section.

c_devminor

> The minor number of the device containing the file system from which the file was read. With the exception of processing files with c_nlink >1, this field is ignored when installing a package. This field shall match the corresponding value in the RPMTAG_FILEDEVICES index in the Header section.

c_rdevmajor

> The major number of the raw device containing the file system from which the file was read. This field is ignored when installing a package. This field shall match the corresponding value in the RPMTAG_RDEVS index in the Header section.

c_rdevminor

> The minor number of the raw device containing the file system from which the file was read. This field is ignored when installing a package. This field shall match the corresponding value in the RPMTAG_RDEVS index in the Header section.

c_namesize

> Value identifying the length of the filename, which is located immediately following the CPIO Header structure.

c_checksum

> Value containing the CRC checksum of the file data. This field is not used, and shall contain the value "00000000". This field is ignored when installing a package.

A record with the filename "TRAILER!!!" indicates the last record in the archive.

22.3 Package Script Restrictions

Scripts used as part of the package install and uninstall shall only use commands and interfaces that are specified by the LSB. All other commands are not guaranteed to be present, or to behave in expected ways.

Packages shall not use RPM triggers.

Packages shall not depend on the order in which scripts are executed (pre-install, pre-uninstall, etc), when doing an upgrade.

22.4 Package Tools

The LSB does not specify the interface to the tools used to manipulate LSB-conformant packages. Each conforming implementation shall provide documentation for installing LSB packages.

22.5 Package Naming

Packages supplied by implementations and applications shall follow the following rules for the name field within the package. These rules are not required for the filename of the package file itself.

> **Note:** There are discrepancies among implementations concerning whether the name might be `frobnicator-1.7-21-ppc32.rpm` or `frobnicator-1.7-21-powerpc32.rpm`. The architecture aside, recommended practice is for the filename of the package file to match the name within the package.

The following rules apply to the name field alone, not including any release or version.

> **Note:** If the name with the release and version is `frobnicator-1.7-21`, the name part is `frobnicator` and falls under the rules for a name with no hyphens.

* If the name begins with `lsb-` and contains no other hyphens, the name shall be assigned by the Linux Assigned Names and Numbers Authority (http://www.lanana.org) (LANANA), which shall maintain a registry of LSB names. The name may be registered by either an implementation or an application.

* If the package name begins with `lsb-` and contains more than one hyphen (for example `lsb-distro.example.com-database` or `lsb-gnome-gnumeric`), then the portion of the package name between first and second hyphens shall either be an LSB provider name assigned by the LANANA, or it may be one of the owners' fully-qualified domain names in lower case (e.g., `debian.org`, `staroffice.sun.com`). The LSB provider name assigned by LANANA shall only consist of the ASCII characters [a-z0-9]. The provider name or domain name may be either that of an implementation or an application.

* Package names containing no hyphens are reserved for use by implementations. Applications shall not use such names.

* Package names which do not start with `lsb-` and which contain a hyphen are open to both implementations and applications. Implementations may name packages in any part of this namespace. They are encouraged to use names from one of the other namespaces available to them, but this is not required due to the large amount of current practice to the contrary.

> **Note:** Widespread existing practice includes such names as `ssh-common`, `ssh-client`, `kernel-pcmcia`, and the like. Possible alternative names include `sshcommon`, `foolinux-ssh-common` (where `foolinux` is registered to the implementation), or `lsb-foolinux-ssh-common`.

Applications may name their packages this way, but only if the portion of the name before the first hyphen is a provider name or registered domain name as described above.

> **Note:** If an application vendor has domain name such as `visicalc.example.com` and has registered `visicalc` as a provider name, they might name packages `visicalc-base`, `visicalc.example.com-charting`, and the like.

Package names in this namespace are available to both the implementation and an application. Implementations and applications will need to consider this potential for conflicts when deciding to use these names rather than the alternatives (such as names starting with `lsb-`).

22.6 Package Dependencies

Packages shall have a dependency that indicates which LSB modules are required. LSB module descriptions are dash seperated tuples containing the name 'lsb', the module name, and the architecture name. The following dependencies may be used.

lsb-core-*arch*

> This dependency is used to indicate that the application is dependent on features contained in the LSB-Core specification.

lsb-core-noarch

> This dependency is used to indicate that the application is dependent on features contained in the LSB-Core specification and that the package does not contain any architecture specific files.

These dependencies shall have a version of 3.0.

Packages shall not depend on other system-provided dependencies. They shall not depend on non-system-provided dependencies unless the package provider also makes available the LSB conforming packages needed to satisfy such dependencies.

Other modules in the LSB may supplement this list. The architecture specific dependencies are described in the relevant architecture specific LSB.

22.7 Package Architecture Considerations

Packages which do not contain any architecture specific files should specify an architecture of `noarch`. An LSB runtime environment shall accept values `noarch`, or the value specified in the relevant architecture specific part of ISO/IEC 23360.

Additional specifications or restrictions may be found in the architecture specific LSB specification.

Annex A Alphabetical Listing of Interfaces

A.1 libc

The behavior of the interfaces in this library is specified by the following Standards.

Large File Support [LFS]
This Specification [LSB]
RFC 1831/1832 RPC & XDR [RPC & XDR]
SUSv2 [SUSv2]
POSIX 1003.1-2001 (ISO/IEC 9945-2003) [SUSv3]
POSIX 1003.1-2008 (ISO/IEC 9945-2009) [SUSv4]
SVID Issue 4 [SVID.4]

Table A-1 libc Function Interfaces

_Exit[SUSv3]	getdate[SUSv3]	sched_getaffinity(GLIBC_2.3.4)[LSB]
_IO_feof[LSB]	getdelim[SUSv4]	sched_getparam[SUSv3]
_IO_getc[LSB]	getdomainname[LSB]	sched_getscheduler[SUSv3]
_IO_putc[LSB]	getdtablesize[LSB]	sched_rr_get_interval[SUSv3]
_IO_puts[LSB]	getegid[SUSv3]	sched_setaffinity(GLIBC_2.3.4)[LSB]
__assert_fail[LSB]	getenv[SUSv3]	sched_setparam[SUSv3]
__chk_fail(GLIBC_2.3.4)[LSB]	geteuid[SUSv3]	sched_setscheduler[LSB]
__confstr_chk(GLIBC_2.4)[LSB]	getgid[SUSv3]	sched_yield[SUSv3]
__ctype_b_loc(GLIBC_2.3)[LSB]	getgrent[SUSv3]	seed48[SUSv3]
__ctype_get_mb_cur_max[LSB]	getgrent_r[LSB]	seed48_r[LSB]
__ctype_tolower_loc(GLIBC_2.3)[LSB]	getgrgid[SUSv3]	seekdir[SUSv3]
__ctype_toupper_loc(GLIBC_2.3)[LSB]	getgrgid_r[SUSv3]	select[SUSv3]
__cxa_atexit[LSB]	getgrnam[SUSv3]	semctl[SUSv3]
__cxa_finalize[LSB]	getgrnam_r[SUSv3]	semget[SUSv3]
__errno_location[LSB]	getgrouplist[LSB]	semop[SUSv3]
__fgets_chk(GLIBC_2.4)[LSB]	getgroups[SUSv3]	send[SUSv4]

__fgets_unlocked_chk(GLIBC_2.4)[LSB]	gethostbyaddr[SUSv3]	sendfile[LSB]
__fgetws_chk(GLIBC_2.4)[LSB]	gethostbyaddr_r[LSB]	sendfile64(GLIBC_2.3)[LSB]
__fgetws_unlocked_chk(GLIBC_2.4)[LSB]	gethostbyname[SUSv3]	sendmsg[SUSv4]
__fpending[LSB]	gethostbyname2[LSB]	sendto[SUSv4]
__fprintf_chk[LSB]	gethostbyname2_r[LSB]	setbuf[SUSv3]
__fwprintf_chk(GLIBC_2.4)[LSB]	gethostbyname_r[LSB]	setbuffer[LSB]
__fxstat[LSB]	gethostid[SUSv3]	setcontext[SUSv3]
__fxstat64[LSB]	gethostname[SUSv3]	setegid[SUSv3]
__fxstatat(GLIBC_2.4)[LSB]	getitimer[SUSv3]	setenv[SUSv3]
__fxstatat64(GLIBC_2.4)[LSB]	getline[SUSv4]	seteuid[SUSv3]
__getcwd_chk(GLIBC_2.4)[LSB]	getloadavg[LSB]	setgid[SUSv3]
__getgroups_chk(GLIBC_2.4)[LSB]	getlogin[SUSv3]	setgrent[SUSv3]
__gethostname_chk(GLIBC_2.4)[LSB]	getlogin_r[SUSv3]	setgroups[LSB]
__getlogin_r_chk(GLIBC_2.4)[LSB]	getnameinfo[SUSv3]	sethostname[LSB]
__getpagesize[LSB]	getopt[LSB]	setitimer[SUSv3]
__getpgid[LSB]	getopt_long[LSB]	setlocale[SUSv3]
__h_errno_location[LSB]	getopt_long_only[LSB]	setlogmask[SUSv3]
__isinf[LSB]	getpagesize[LSB]	setpgid[SUSv3]
__isinff[LSB]	getpeername[SUSv3]	setpgrp[SUSv3]
__isinfl[LSB]	getpgid[SUSv3]	setpriority[SUSv3]
__isnan[LSB]	getpgrp[SUSv3]	setprotoent[SUSv3]
__isnanf[LSB]	getpid[SUSv3]	setpwent[SUSv3]
__isnanl[LSB]	getppid[SUSv3]	setregid[SUSv3]
__libc_current_sigrtmax[LSB]	getpriority[SUSv3]	setreuid[SUSv3]
__libc_current_sigrtmin[LSB]	getprotobyname[SUSv3]	setrlimit[SUSv3]
__libc_start_main[LSB]	getprotobyname_r[LSB]	setrlimit64[LFS]

__lxstat[LSB]	getprotobynumber[SUSv3]	setservent[SUSv3]
__lxstat64[LSB]	getprotobynumber_r[LSB]	setsid[SUSv3]
__mbsnrtowcs_chk(GLIBC_2.4)[LSB]	getprotoent[SUSv3]	setsockopt[LSB]
__mbsrtowcs_chk(GLIBC_2.4)[LSB]	getprotoent_r[LSB]	setstate[SUSv3]
__mbstowcs_chk(GLIBC_2.4)[LSB]	getpwent[SUSv3]	setstate_r[LSB]
__memcpy_chk(GLIBC_2.3.4)[LSB]	getpwent_r[LSB]	setuid[SUSv3]
__memmove_chk(GLIBC_2.3.4)[LSB]	getpwnam[SUSv3]	setutent[LSB]
__mempcpy[LSB]	getpwnam_r[SUSv3]	setutxent[SUSv3]
__mempcpy_chk(GLIBC_2.3.4)[LSB]	getpwuid[SUSv3]	setvbuf[SUSv3]
__memset_chk(GLIBC_2.3.4)[LSB]	getpwuid_r[SUSv3]	shmat[SUSv3]
__pread64_chk(GLIBC_2.4)[LSB]	getrlimit[SUSv3]	shmctl[SUSv3]
__pread_chk(GLIBC_2.4)[LSB]	getrlimit64[LFS]	shmdt[SUSv3]
__printf_chk[LSB]	getrusage[SUSv3]	shmget[SUSv3]
__rawmemchr[LSB]	getservbyname[SUSv3]	shutdown[SUSv3]
__read_chk(GLIBC_2.4)[LSB]	getservbyname_r[LSB]	sigaction[SUSv3]
__readlink_chk(GLIBC_2.4)[LSB]	getservbyport[SUSv3]	sigaddset[SUSv3]
__realpath_chk(GLIBC_2.4)[LSB]	getservbyport_r[LSB]	sigaltstack[SUSv3]
__recv_chk(GLIBC_2.4)[LSB]	getservent[SUSv3]	sigandset[LSB]
__recvfrom_chk(GLIBC_2.4)[LSB]	getservent_r[LSB]	sigdelset[SUSv3]
__register_atfork(GLIBC_2.3.2)[LSB]	getsid[SUSv3]	sigemptyset[SUSv3]
__sigsetjmp[LSB]	getsockname[SUSv3]	sigfillset[SUSv3]
__snprintf_chk[LSB]	getsockopt[LSB]	sighold[SUSv3]
__sprintf_chk[LSB]	getsubopt[SUSv3]	sigignore[SUSv3]
__stack_chk_fail(GLIBC	gettext[LSB]	siginterrupt[SUSv3]

_2.4)[LSB]		
__stpcpy[LSB]	gettimeofday[SUSv3]	sigisemptyset[LSB]
__stpcpy_chk(GLIBC_2.3.4)[LSB]	getuid[SUSv3]	sigismember[SUSv3]
__stpncpy_chk(GLIBC_2.4)[LSB]	getutent[LSB]	siglongjmp[SUSv3]
__strcat_chk(GLIBC_2.3.4)[LSB]	getutent_r[LSB]	signal[SUSv3]
__strcpy_chk(GLIBC_2.3.4)[LSB]	getutxent[SUSv3]	sigorset[LSB]
__strdup[LSB]	getutxid[SUSv3]	sigpause[LSB]
__strncat_chk(GLIBC_2.3.4)[LSB]	getutxline[SUSv3]	sigpending[SUSv3]
__strncpy_chk(GLIBC_2.3.4)[LSB]	getw[SUSv2]	sigprocmask[SUSv3]
__strtod_internal[LSB]	getwc[SUSv3]	sigqueue[SUSv3]
__strtof_internal[LSB]	getwc_unlocked[LSB]	sigrelse[SUSv3]
__strtok_r[LSB]	getwchar[SUSv3]	sigreturn[LSB]
__strtol_internal[LSB]	getwchar_unlocked[LSB]	sigset[SUSv3]
__strtold_internal[LSB]	getwd[SUSv3]	sigsuspend[SUSv3]
__strtoll_internal[LSB]	glob[SUSv3]	sigtimedwait[SUSv3]
__strtoul_internal[LSB]	glob64[LSB]	sigwait[SUSv3]
__strtoull_internal[LSB]	globfree[SUSv3]	sigwaitinfo[SUSv3]
__swprintf_chk(GLIBC_2.4)[LSB]	globfree64[LSB]	sleep[SUSv3]
__sysconf[LSB]	gmtime[SUSv3]	snprintf[SUSv3]
__syslog_chk(GLIBC_2.4)[LSB]	gmtime_r[SUSv3]	sockatmark[SUSv3]
__sysv_signal[LSB]	gnu_get_libc_release[LSB]	socket[SUSv3]
__ttyname_r_chk(GLIBC_2.4)[LSB]	gnu_get_libc_version[LSB]	socketpair[SUSv3]
__vfprintf_chk[LSB]	grantpt[SUSv3]	sprintf[SUSv3]
__vfwprintf_chk(GLIBC_2.4)[LSB]	hcreate[SUSv3]	srand[SUSv3]
__vprintf_chk[LSB]	hcreate_r[LSB]	srand48[SUSv3]
__vsnprintf_chk[LSB]	hdestroy[SUSv3]	srand48_r[LSB]
__vsprintf_chk[LSB]	hdestroy_r[LSB]	srandom[SUSv3]

__vswprintf_chk(GLIBC_2.4)[LSB]	hsearch[SUSv3]	srandom_r[LSB]
__vsyslog_chk(GLIBC_2.4)[LSB]	hsearch_r[LSB]	sscanf[LSB]
__vwprintf_chk(GLIBC_2.4)[LSB]	htonl[SUSv3]	statfs[LSB]
__wcpcpy_chk(GLIBC_2.4)[LSB]	htons[SUSv3]	statfs64[LSB]
__wcpncpy_chk(GLIBC_2.4)[LSB]	iconv[SUSv3]	statvfs[SUSv3]
__wcrtomb_chk(GLIBC_2.4)[LSB]	iconv_close[SUSv3]	statvfs64[LFS]
__wcscat_chk(GLIBC_2.4)[LSB]	iconv_open[SUSv3]	stime[LSB]
__wcscpy_chk(GLIBC_2.4)[LSB]	if_freenameindex[SUSv3]	stpcpy[LSB]
__wcsncat_chk(GLIBC_2.4)[LSB]	if_indextoname[SUSv3]	stpncpy[LSB]
__wcsncpy_chk(GLIBC_2.4)[LSB]	if_nameindex[SUSv3]	strcasecmp[SUSv3]
__wcsnrtombs_chk(GLIBC_2.4)[LSB]	if_nametoindex[SUSv3]	strcasestr[LSB]
__wcsrtombs_chk(GLIBC_2.4)[LSB]	imaxabs[SUSv3]	strcat[SUSv3]
__wcstod_internal[LSB]	imaxdiv[SUSv3]	strchr[SUSv3]
__wcstof_internal[LSB]	index[SUSv3]	strcmp[SUSv3]
__wcstol_internal[LSB]	inet_addr[SUSv3]	strcoll[SUSv3]
__wcstold_internal[LSB]	inet_aton[LSB]	strcpy[SUSv3]
__wcstombs_chk(GLIBC_2.4)[LSB]	inet_ntoa[SUSv3]	strcspn[SUSv3]
__wcstoul_internal[LSB]	inet_ntop[SUSv3]	strdup[SUSv3]
__wctomb_chk(GLIBC_2.4)[LSB]	inet_pton[SUSv3]	strerror[SUSv3]
__wmemcpy_chk(GLIBC_2.4)[LSB]	initgroups[LSB]	strerror_r[LSB]
__wmemmove_chk(GLIBC_2.4)[LSB]	initstate[SUSv3]	strfmon[SUSv3]
__wmempcpy_chk(GLIBC_2.4)[LSB]	initstate_r[LSB]	strftime[SUSv3]

__wmemset_chk(GLIBC_2.4)[LSB]	inotify_add_watch(GLIBC_2.4)[LSB]	strlen[SUSv3]
__wprintf_chk(GLIBC_2.4)[LSB]	inotify_init(GLIBC_2.4)[LSB]	strncasecmp[SUSv3]
__xmknod[LSB]	inotify_rm_watch(GLIBC_2.4)[LSB]	strncat[SUSv3]
__xmknodat(GLIBC_2.4)[LSB]	insque[SUSv3]	strncmp[SUSv3]
__xpg_basename[LSB]	ioctl[LSB]	strncpy[SUSv3]
__xpg_sigpause[LSB]	isalnum[SUSv3]	strndup[LSB]
__xpg_strerror_r(GLIBC_2.3.4)[LSB]	isalpha[SUSv3]	strnlen[LSB]
__xstat[LSB]	isascii[SUSv3]	strpbrk[SUSv3]
__xstat64[LSB]	isatty[SUSv3]	strptime[LSB]
_exit[SUSv3]	isblank[SUSv3]	strrchr[SUSv3]
_longjmp[SUSv3]	iscntrl[SUSv3]	strsep[LSB]
_setjmp[SUSv3]	isdigit[SUSv3]	strsignal[LSB]
_tolower[SUSv3]	isgraph[SUSv3]	strspn[SUSv3]
_toupper[SUSv3]	islower[SUSv3]	strstr[SUSv3]
a64l[SUSv3]	isprint[SUSv3]	strtod[SUSv3]
abort[SUSv3]	ispunct[SUSv3]	strtof[SUSv3]
abs[SUSv3]	isspace[SUSv3]	strtoimax[SUSv3]
accept[SUSv3]	isupper[SUSv3]	strtok[SUSv3]
access[SUSv3]	iswalnum[SUSv3]	strtok_r[SUSv3]
acct[LSB]	iswalpha[SUSv3]	strtol[SUSv3]
adjtime[LSB]	iswblank[SUSv3]	strtold[SUSv3]
alarm[SUSv3]	iswcntrl[SUSv3]	strtoll[SUSv3]
alphasort[SUSv4]	iswctype[SUSv3]	strtoq[LSB]
alphasort64[LSB]	iswdigit[SUSv3]	strtoul[SUSv3]
asctime[SUSv3]	iswgraph[SUSv3]	strtoull[SUSv3]
asctime_r[SUSv3]	iswlower[SUSv3]	strtoumax[SUSv3]
asprintf[LSB]	iswprint[SUSv3]	strtouq[LSB]
atof[SUSv3]	iswpunct[SUSv3]	strxfrm[SUSv3]
atoi[SUSv3]	iswspace[SUSv3]	svc_getreqset[SVID.4]
atol[SUSv3]	iswupper[SUSv3]	svc_register[LSB]
atoll[SUSv3]	iswxdigit[SUSv3]	svc_run[LSB]

authnone_create[SVID.4]	isxdigit[SUSv3]	svc_sendreply[LSB]
backtrace[LSB]	jrand48[SUSv3]	svcerr_auth[SVID.4]
backtrace_symbols[LSB]	jrand48_r[LSB]	svcerr_decode[SVID.4]
backtrace_symbols_fd[LSB]	key_decryptsession[SVID.4]	svcerr_noproc[SVID.4]
basename[LSB]	kill[LSB]	svcerr_noprog[SVID.4]
bcmp[SUSv3]	killpg[SUSv3]	svcerr_progvers[SVID.4]
bcopy[SUSv3]	l64a[SUSv3]	svcerr_systemerr[SVID.4]
bind[SUSv3]	labs[SUSv3]	svcerr_weakauth[SVID.4]
bind_textdomain_codeset[LSB]	lchown[SUSv3]	svcfd_create[RPC & XDR]
bindresvport[LSB]	lcong48[SUSv3]	svcraw_create[RPC & XDR]
bindtextdomain[LSB]	lcong48_r[LSB]	svctcp_create[LSB]
brk[SUSv2]	ldiv[SUSv3]	svcudp_create[LSB]
bsd_signal[SUSv3]	lfind[SUSv3]	swab[SUSv3]
bsearch[SUSv3]	link[LSB]	swapcontext[SUSv3]
btowc[SUSv3]	linkat(GLIBC_2.4)[SUSv4]	swprintf[SUSv3]
bzero[SUSv3]	listen[SUSv3]	swscanf[LSB]
calloc[SUSv3]	llabs[SUSv3]	symlink[SUSv3]
callrpc[RPC & XDR]	lldiv[SUSv3]	symlinkat(GLIBC_2.4)[SUSv4]
catclose[SUSv3]	localeconv[SUSv3]	sync[SUSv3]
catgets[SUSv3]	localtime[SUSv3]	sysconf[LSB]
catopen[SUSv3]	localtime_r[SUSv3]	sysinfo[LSB]
cfgetispeed[SUSv3]	lockf[SUSv3]	syslog[SUSv3]
cfgetospeed[SUSv3]	lockf64[LFS]	system[LSB]
cfmakeraw[LSB]	longjmp[SUSv3]	tcdrain[SUSv3]
cfsetispeed[SUSv3]	lrand48[SUSv3]	tcflow[SUSv3]
cfsetospeed[SUSv3]	lrand48_r[LSB]	tcflush[SUSv3]
cfsetspeed[LSB]	lsearch[SUSv3]	tcgetattr[SUSv3]
chdir[SUSv3]	lseek[SUSv3]	tcgetpgrp[SUSv3]

chmod[SUSv3]	lseek64[LFS]	tcgetsid[SUSv3]
chown[SUSv3]	makecontext[SUSv3]	tcsendbreak[SUSv3]
chroot[SUSv2]	malloc[SUSv3]	tcsetattr[SUSv3]
clearerr[SUSv3]	mblen[SUSv3]	tcsetpgrp[SUSv3]
clearerr_unlocked[LSB]	mbrlen[SUSv3]	tdelete[SUSv3]
clnt_create[SVID.4]	mbrtowc[SUSv3]	telldir[SUSv3]
clnt_pcreateerror[SVID.4]	mbsinit[SUSv3]	tempnam[SUSv3]
clnt_perrno[SVID.4]	mbsnrtowcs[LSB]	textdomain[LSB]
clnt_perror[SVID.4]	mbsrtowcs[SUSv3]	tfind[SUSv3]
clnt_spcreateerror[SVID.4]	mbstowcs[SUSv3]	time[SUSv3]
clnt_sperrno[SVID.4]	mbtowc[SUSv3]	times[SUSv3]
clnt_sperror[SVID.4]	memccpy[SUSv3]	tmpfile[SUSv3]
clntraw_create[RPC & XDR]	memchr[SUSv3]	tmpfile64[LFS]
clnttcp_create[RPC & XDR]	memcmp[SUSv3]	tmpnam[SUSv3]
clntudp_bufcreate[RPC & XDR]	memcpy[SUSv3]	toascii[SUSv3]
clntudp_create[RPC & XDR]	memmem[LSB]	tolower[SUSv3]
clock[SUSv3]	memmove[SUSv3]	toupper[SUSv3]
close[SUSv3]	memrchr[LSB]	towctrans[SUSv3]
closedir[SUSv3]	memset[SUSv3]	towlower[SUSv3]
closelog[SUSv3]	mkdir[SUSv3]	towupper[SUSv3]
confstr[SUSv3]	mkdirat(GLIBC_2.4)[SUSv4]	truncate[SUSv3]
connect[SUSv3]	mkdtemp[SUSv4]	truncate64[LFS]
creat[SUSv3]	mkfifo[SUSv3]	tsearch[SUSv3]
creat64[LFS]	mkfifoat(GLIBC_2.4)[SUSv4]	ttyname[SUSv3]
ctermid[SUSv3]	mkstemp[SUSv3]	ttyname_r[SUSv3]
ctime[SUSv3]	mkstemp64[LSB]	twalk[SUSv3]
ctime_r[SUSv3]	mktemp[SUSv3]	tzset[SUSv3]
cuserid[SUSv2]	mktime[SUSv3]	ualarm[SUSv3]
daemon[LSB]	mlock[SUSv3]	ulimit[SUSv3]

dcgettext[LSB]	mlockall[SUSv3]	umask[SUSv3]
dcngettext[LSB]	mmap[SUSv3]	uname[SUSv3]
dgettext[LSB]	mmap64[LFS]	ungetc[SUSv3]
difftime[SUSv3]	mprotect[SUSv3]	ungetwc[SUSv3]
dirfd[SUSv4]	mrand48[SUSv3]	unlink[LSB]
dirname[SUSv3]	mrand48_r[LSB]	unlinkat(GLIBC_2.4)[SUSv4]
div[SUSv3]	mremap[LSB]	unlockpt[SUSv3]
dl_iterate_phdr[LSB]	msgctl[SUSv3]	unsetenv[SUSv3]
dngettext[LSB]	msgget[SUSv3]	uselocale(GLIBC_2.3)[LSB]
dprintf[SUSv4]	msgrcv[SUSv3]	usleep[SUSv3]
drand48[SUSv3]	msgsnd[SUSv3]	utime[SUSv3]
drand48_r[LSB]	msync[SUSv3]	utimes[SUSv3]
dup[SUSv3]	munlock[SUSv3]	utmpname[LSB]
dup2[SUSv3]	munlockall[SUSv3]	vasprintf[LSB]
duplocale(GLIBC_2.3)[LSB]	munmap[SUSv3]	vdprintf[LSB]
ecvt[SUSv3]	nanosleep[SUSv3]	verrx[LSB]
endgrent[SUSv3]	newlocale(GLIBC_2.3)[LSB]	vfork[SUSv3]
endprotoent[SUSv3]	nftw[SUSv3]	vfprintf[SUSv3]
endpwent[SUSv3]	nftw64[LFS]	vfscanf[LSB]
endservent[SUSv3]	ngettext[LSB]	vfwprintf[SUSv3]
endutent[LSB]	nice[SUSv3]	vfwscanf[LSB]
endutxent[SUSv3]	nl_langinfo[SUSv3]	vprintf[SUSv3]
epoll_create(GLIBC_2.3.2)[LSB]	nrand48[SUSv3]	vscanf[LSB]
epoll_ctl(GLIBC_2.3.2)[LSB]	nrand48_r[LSB]	vsnprintf[SUSv3]
epoll_wait(GLIBC_2.3.2)[LSB]	ntohl[SUSv3]	vsprintf[SUSv3]
erand48[SUSv3]	ntohs[SUSv3]	vsscanf[LSB]
erand48_r[LSB]	open[SUSv3]	vswprintf[SUSv3]
err[LSB]	open64[LFS]	vswscanf[LSB]
error[LSB]	open_memstream[SUSv4]	vsyslog[LSB]

errx[LSB]	open_wmemstream(GLIBC_2.4)[SUSv4]	vwprintf[SUSv3]
execl[SUSv3]	openat(GLIBC_2.4)[SUSv4]	vwscanf[LSB]
execle[SUSv3]	openat64(GLIBC_2.4)[LSB]	wait[SUSv3]
execlp[SUSv3]	opendir[SUSv3]	wait4[LSB]
execv[SUSv3]	openlog[SUSv3]	waitid[SUSv3]
execve[SUSv3]	pathconf[SUSv3]	waitpid[SUSv3]
execvp[SUSv3]	pause[SUSv3]	warn[LSB]
exit[SUSv3]	pclose[SUSv3]	warnx[LSB]
faccessat(GLIBC_2.4)[SUSv4]	perror[SUSv3]	wcpcpy[LSB]
fchdir[SUSv3]	pipe[SUSv3]	wcpncpy[LSB]
fchmod[SUSv3]	pmap_getport[LSB]	wcrtomb[SUSv3]
fchmodat(GLIBC_2.4)[SUSv4]	pmap_set[LSB]	wcscasecmp[LSB]
fchown[SUSv3]	pmap_unset[LSB]	wcscat[SUSv3]
fchownat(GLIBC_2.4)[SUSv4]	poll[SUSv3]	wcschr[SUSv3]
fclose[SUSv3]	popen[SUSv3]	wcscmp[SUSv3]
fcntl[LSB]	posix_fadvise[SUSv3]	wcscoll[SUSv3]
fcvt[SUSv3]	posix_fadvise64[LSB]	wcscpy[SUSv3]
fdatasync[SUSv3]	posix_fallocate[SUSv3]	wcscspn[SUSv3]
fdopen[SUSv3]	posix_fallocate64[LSB]	wcsdup[LSB]
fdopendir(GLIBC_2.4)[SUSv4]	posix_madvise[SUSv3]	wcsftime[SUSv3]
feof[SUSv3]	posix_memalign[SUSv3]	wcslen[SUSv3]
feof_unlocked[LSB]	posix_openpt[SUSv3]	wcsncasecmp[LSB]
ferror[SUSv3]	posix_spawn[SUSv3]	wcsncat[SUSv3]
ferror_unlocked[LSB]	posix_spawn_file_actions_addclose[SUSv3]	wcsncmp[SUSv3]
fexecve[SUSv4]	posix_spawn_file_actions_adddup2[SUSv3]	wcsncpy[SUSv3]
fflush[SUSv3]	posix_spawn_file_actions_addopen[SUSv3]	wcsnlen[LSB]
fflush_unlocked[LSB]	posix_spawn_file_actions_destroy[SUSv3]	wcsnrtombs[LSB]

ffs[SUSv3]	posix_spawn_file_actions_init[SUSv3]	wcspbrk[SUSv3]
fgetc[SUSv3]	posix_spawnattr_destroy[SUSv3]	wcsrchr[SUSv3]
fgetc_unlocked[LSB]	posix_spawnattr_getflags[SUSv3]	wcsrtombs[SUSv3]
fgetpos[SUSv3]	posix_spawnattr_getpgroup[SUSv3]	wcsspn[SUSv3]
fgetpos64[LFS]	posix_spawnattr_getschedparam[SUSv3]	wcsstr[SUSv3]
fgets[SUSv3]	posix_spawnattr_getschedpolicy[SUSv3]	wcstod[SUSv3]
fgets_unlocked[LSB]	posix_spawnattr_getsigdefault[SUSv3]	wcstof[SUSv3]
fgetwc[SUSv3]	posix_spawnattr_getsigmask[SUSv3]	wcstoimax[SUSv3]
fgetwc_unlocked[LSB]	posix_spawnattr_init[SUSv3]	wcstok[SUSv3]
fgetws[SUSv3]	posix_spawnattr_setflags[SUSv3]	wcstol[SUSv3]
fgetws_unlocked[LSB]	posix_spawnattr_setpgroup[SUSv3]	wcstold[SUSv3]
fileno[SUSv3]	posix_spawnattr_setschedparam[SUSv3]	wcstoll[SUSv3]
fileno_unlocked[LSB]	posix_spawnattr_setschedpolicy[SUSv3]	wcstombs[SUSv3]
flock[LSB]	posix_spawnattr_setsigdefault[SUSv3]	wcstoq[LSB]
flockfile[SUSv3]	posix_spawnattr_setsigmask[SUSv3]	wcstoul[SUSv3]
fmemopen[SUSv4]	posix_spawnp[SUSv3]	wcstoull[SUSv3]
fmtmsg[SUSv3]	pread[SUSv3]	wcstoumax[SUSv3]
fnmatch[SUSv3]	pread64[LSB]	wcstouq[LSB]
fopen[SUSv3]	printf[SUSv3]	wcswcs[SUSv3]
fopen64[LFS]	pselect[SUSv3]	wcswidth[SUSv3]
fork[SUSv3]	psignal[LSB]	wcsxfrm[SUSv3]
fpathconf[SUSv3]	ptrace[LSB]	wctob[SUSv3]
fprintf[SUSv3]	ptsname[SUSv3]	wctomb[SUSv3]
fputc[SUSv3]	putc[SUSv3]	wctrans[SUSv3]
fputc_unlocked[LSB]	putc_unlocked[SUSv3]	wctype[SUSv3]

fputs[SUSv3]	putchar[SUSv3]	wcwidth[SUSv3]
fputs_unlocked[LSB]	putchar_unlocked[SUSv3]	wmemchr[SUSv3]
fputwc[SUSv3]	putenv[SUSv3]	wmemcmp[SUSv3]
fputwc_unlocked[LSB]	puts[SUSv3]	wmemcpy[SUSv3]
fputws[SUSv3]	pututxline[SUSv3]	wmemmove[SUSv3]
fputws_unlocked[LSB]	putw[SUSv2]	wmemset[SUSv3]
fread[SUSv3]	putwc[SUSv3]	wordexp[SUSv3]
fread_unlocked[LSB]	putwc_unlocked[LSB]	wordfree[SUSv3]
free[SUSv3]	putwchar[SUSv3]	wprintf[SUSv3]
freeaddrinfo[SUSv3]	putwchar_unlocked[LSB]	write[SUSv3]
freelocale(GLIBC_2.3)[LSB]	pwrite[SUSv3]	writev[SUSv3]
freopen[SUSv3]	pwrite64[LSB]	wscanf[LSB]
freopen64[LFS]	qsort[SUSv3]	xdr_accepted_reply[SVID.4]
fscanf[LSB]	raise[SUSv3]	xdr_array[SVID.4]
fseek[SUSv3]	rand[SUSv3]	xdr_bool[SVID.4]
fseeko[SUSv3]	rand_r[SUSv3]	xdr_bytes[SVID.4]
fseeko64[LFS]	random[SUSv3]	xdr_callhdr[SVID.4]
fsetpos[SUSv3]	random_r[LSB]	xdr_callmsg[SVID.4]
fsetpos64[LFS]	read[SUSv3]	xdr_char[SVID.4]
fstatfs[LSB]	readdir[SUSv3]	xdr_double[SVID.4]
fstatfs64[LSB]	readdir64[LFS]	xdr_enum[SVID.4]
fstatvfs[SUSv3]	readdir64_r[LSB]	xdr_float[SVID.4]
fstatvfs64[LFS]	readdir_r[SUSv3]	xdr_free[SVID.4]
fsync[SUSv3]	readlink[SUSv3]	xdr_int[SVID.4]
ftell[SUSv3]	readlinkat(GLIBC_2.4)[SUSv4]	xdr_long[SVID.4]
ftello[SUSv3]	readv[SUSv3]	xdr_opaque[SVID.4]
ftello64[LFS]	realloc[SUSv3]	xdr_opaque_auth[SVID.4]
ftime[SUSv3]	realpath[SUSv3]	xdr_pointer[SVID.4]
ftok[SUSv3]	recv[SUSv3]	xdr_reference[SVID.4]
ftruncate[SUSv3]	recvfrom[SUSv3]	xdr_rejected_reply[SVID.4]

ftruncate64[LFS]	recvmsg[SUSv3]	xdr_replymsg[SVID.4]
ftrylockfile[SUSv3]	regcomp[SUSv3]	xdr_short[SVID.4]
ftw[SUSv3]	regerror[SUSv3]	xdr_string[SVID.4]
ftw64[LFS]	regexec[LSB]	xdr_u_char[SVID.4]
funlockfile[SUSv3]	regfree[SUSv3]	xdr_u_int[LSB]
fwide[SUSv3]	remove[SUSv3]	xdr_u_long[SVID.4]
fwprintf[SUSv3]	remque[SUSv3]	xdr_u_short[SVID.4]
fwrite[SUSv3]	rename[SUSv3]	xdr_union[SVID.4]
fwrite_unlocked[LSB]	renameat(GLIBC_2.4)[SUSv4]	xdr_vector[SVID.4]
fwscanf[LSB]	rewind[SUSv3]	xdr_void[SVID.4]
gai_strerror[SUSv3]	rewinddir[SUSv3]	xdr_wrapstring[SVID.4]
gcvt[SUSv3]	rindex[SUSv3]	xdrmem_create[SVID.4]
getaddrinfo[SUSv3]	rmdir[SUSv3]	xdrrec_create[SVID.4]
getc[SUSv3]	sbrk[SUSv2]	xdrrec_endofrecord[RPC & XDR]
getc_unlocked[SUSv3]	scandir[SUSv4]	xdrrec_eof[SVID.4]
getchar[SUSv3]	scandir64[LSB]	xdrrec_skiprecord[RPC & XDR]
getchar_unlocked[SUSv3]	scanf[LSB]	xdrstdio_create[LSB]
getcontext[SUSv3]	sched_get_priority_max [SUSv3]	
getcwd[SUSv3]	sched_get_priority_min [SUSv3]	

Table A-2 libc Data Interfaces

__daylight[LSB]	__tzname[LSB]	in6addr_loopback[SUSv3]
__environ[LSB]	_sys_errlist[LSB]	
__timezone[LSB]	in6addr_any[SUSv3]	

A.2 libcrypt

The behavior of the interfaces in this library is specified by the following Standards.

POSIX 1003.1-2001 (ISO/IEC 9945-2003) [SUSv3]

Table A-3 libcrypt Function Interfaces

crypt[SUSv3]	encrypt[SUSv3]	setkey[SUSv3]

A.3 libdl

The behavior of the interfaces in this library is specified by the following Standards.

This Specification [LSB]
POSIX 1003.1-2001 (ISO/IEC 9945-2003) [SUSv3]

Table A-4 libdl Function Interfaces

dladdr[LSB]	dlerror[SUSv3]	dlsym[LSB]
dlclose[SUSv3]	dlopen[LSB]	dlvsym[LSB]

A.4 libgcc_s

The behavior of the interfaces in this library is specified by the following Standards.

This Specification [LSB]

Table A-5 libgcc_s Function Interfaces

_Unwind_Backtrace[LSB]	_Unwind_GetGR[LSB]	_Unwind_RaiseException[LSB]
_Unwind_DeleteException[LSB]	_Unwind_GetIP[LSB]	_Unwind_Resume[LSB]
_Unwind_FindEnclosingFunction[LSB]	_Unwind_GetIPInfo(GCC_4.2.0)[LSB]	_Unwind_Resume_or_Rethrow[LSB]
_Unwind_ForcedUnwind[LSB]	_Unwind_GetLanguageSpecificData[LSB]	_Unwind_SetGR[LSB]
_Unwind_GetCFA[LSB]	_Unwind_GetRegionStart[LSB]	_Unwind_SetIP[LSB]

A.5 libm

The behavior of the interfaces in this library is specified by the following Standards.

This Specification [LSB]
POSIX 1003.1-2001 (ISO/IEC 9945-2003) [SUSv3]

Table A-6 libm Function Interfaces

__finite[LSB]	csinl[SUSv3]	llroundf[SUSv3]
__finitef[LSB]	csqrt[SUSv3]	llroundl[SUSv3]
__finitel[LSB]	csqrtf[SUSv3]	log[SUSv3]
__fpclassify[LSB]	csqrtl[SUSv3]	log10[SUSv3]
__fpclassifyf[LSB]	ctan[SUSv3]	log10f[SUSv3]
__signbit[LSB]	ctanf[SUSv3]	log10l[SUSv3]
__signbitf[LSB]	ctanh[SUSv3]	log1p[SUSv3]
acos[SUSv3]	ctanhf[SUSv3]	log1pf[SUSv3]

acosf[SUSv3]	ctanhl[SUSv3]	log1pl[SUSv3]
acosh[SUSv3]	ctanl[SUSv3]	log2[SUSv3]
acoshf[SUSv3]	drem[LSB]	log2f[SUSv3]
acoshl[SUSv3]	dremf[LSB]	log2l[SUSv3]
acosl[SUSv3]	dreml[LSB]	logb[SUSv3]
asin[SUSv3]	erf[SUSv3]	logbf[SUSv3]
asinf[SUSv3]	erfc[SUSv3]	logbl[SUSv3]
asinh[SUSv3]	erfcf[SUSv3]	logf[SUSv3]
asinhf[SUSv3]	erfcl[SUSv3]	logl[SUSv3]
asinhl[SUSv3]	erff[SUSv3]	lrint[SUSv3]
asinl[SUSv3]	erfl[SUSv3]	lrintf[SUSv3]
atan[SUSv3]	exp[SUSv3]	lrintl[SUSv3]
atan2[SUSv3]	exp10[LSB]	lround[SUSv3]
atan2f[SUSv3]	exp10f[LSB]	lroundf[SUSv3]
atan2l[SUSv3]	exp10l[LSB]	lroundl[SUSv3]
atanf[SUSv3]	exp2[SUSv3]	matherr[LSB]
atanh[SUSv3]	exp2f[SUSv3]	modf[SUSv3]
atanhf[SUSv3]	expf[SUSv3]	modff[SUSv3]
atanhl[SUSv3]	expl[SUSv3]	modfl[SUSv3]
atanl[SUSv3]	expm1[SUSv3]	nan[SUSv3]
cabs[SUSv3]	expm1f[SUSv3]	nanf[SUSv3]
cabsf[SUSv3]	expm1l[SUSv3]	nanl[SUSv3]
cabsl[SUSv3]	fabs[SUSv3]	nearbyint[SUSv3]
cacos[SUSv3]	fabsf[SUSv3]	nearbyintf[SUSv3]
cacosf[SUSv3]	fabsl[SUSv3]	nearbyintl[SUSv3]
cacosh[SUSv3]	fdim[SUSv3]	nextafter[SUSv3]
cacoshf[SUSv3]	fdimf[SUSv3]	nextafterf[SUSv3]
cacoshl[SUSv3]	fdiml[SUSv3]	nextafterl[SUSv3]
cacosl[SUSv3]	feclearexcept[SUSv3]	nexttoward[SUSv3]
carg[SUSv3]	fedisableexcept[LSB]	nexttowardf[SUSv3]
cargf[SUSv3]	feenableexcept[LSB]	nexttowardl[SUSv3]
cargl[SUSv3]	fegetenv[SUSv3]	pow[SUSv3]
casin[SUSv3]	fegetexcept[LSB]	pow10[LSB]
casinf[SUSv3]	fegetexceptflag[SUSv3]	pow10f[LSB]

casinh[SUSv3]	fegetround[SUSv3]	pow10l[LSB]
casinhf[SUSv3]	feholdexcept[SUSv3]	powf[SUSv3]
casinhl[SUSv3]	feraiseexcept[SUSv3]	powl[SUSv3]
casinl[SUSv3]	fesetenv[SUSv3]	remainder[SUSv3]
catan[SUSv3]	fesetexceptflag[SUSv3]	remainderf[SUSv3]
catanf[SUSv3]	fesetround[SUSv3]	remainderl[SUSv3]
catanh[SUSv3]	fetestexcept[SUSv3]	remquo[SUSv3]
catanhf[SUSv3]	feupdateenv[SUSv3]	remquof[SUSv3]
catanhl[SUSv3]	finite[LSB]	remquol[SUSv3]
catanl[SUSv3]	finitef[LSB]	rint[SUSv3]
cbrt[SUSv3]	finitel[LSB]	rintf[SUSv3]
cbrtf[SUSv3]	floor[SUSv3]	rintl[SUSv3]
cbrtl[SUSv3]	floorf[SUSv3]	round[SUSv3]
ccos[SUSv3]	floorl[SUSv3]	roundf[SUSv3]
ccosf[SUSv3]	fma[SUSv3]	roundl[SUSv3]
ccosh[SUSv3]	fmaf[SUSv3]	scalb[SUSv3]
ccoshf[SUSv3]	fmal[SUSv3]	scalbf[LSB]
ccoshl[SUSv3]	fmax[SUSv3]	scalbl[LSB]
ccosl[SUSv3]	fmaxf[SUSv3]	scalbln[SUSv3]
ceil[SUSv3]	fmaxl[SUSv3]	scalblnf[SUSv3]
ceilf[SUSv3]	fmin[SUSv3]	scalblnl[SUSv3]
ceill[SUSv3]	fminf[SUSv3]	scalbn[SUSv3]
cexp[SUSv3]	fminl[SUSv3]	scalbnf[SUSv3]
cexpf[SUSv3]	fmod[SUSv3]	scalbnl[SUSv3]
cexpl[SUSv3]	fmodf[SUSv3]	significand[LSB]
cimag[SUSv3]	fmodl[SUSv3]	significandf[LSB]
cimagf[SUSv3]	frexp[SUSv3]	significandl[LSB]
cimagl[SUSv3]	frexpf[SUSv3]	sin[SUSv3]
clog[SUSv3]	frexpl[SUSv3]	sincos[LSB]
clog10[LSB]	gamma[LSB]	sincosf[LSB]
clog10f[LSB]	gammaf[LSB]	sincosl[LSB]
clog10l[LSB]	gammal[LSB]	sinf[SUSv3]
clogf[SUSv3]	hypot[SUSv3]	sinh[SUSv3]
clogl[SUSv3]	hypotf[SUSv3]	sinhf[SUSv3]

conj[SUSv3]	hypotl[SUSv3]	sinhl[SUSv3]
conjf[SUSv3]	ilogb[SUSv3]	sinl[SUSv3]
conjl[SUSv3]	ilogbf[SUSv3]	sqrt[SUSv3]
copysign[SUSv3]	ilogbl[SUSv3]	sqrtf[SUSv3]
copysignf[SUSv3]	j0[SUSv3]	sqrtl[SUSv3]
copysignl[SUSv3]	j0f[LSB]	tan[SUSv3]
cos[SUSv3]	j0l[LSB]	tanf[SUSv3]
cosf[SUSv3]	j1[SUSv3]	tanh[SUSv3]
cosh[SUSv3]	j1f[LSB]	tanhf[SUSv3]
coshf[SUSv3]	j1l[LSB]	tanhl[SUSv3]
coshl[SUSv3]	jn[SUSv3]	tanl[SUSv3]
cosl[SUSv3]	jnf[LSB]	tgamma[SUSv3]
cpow[SUSv3]	jnl[LSB]	tgammaf[SUSv3]
cpowf[SUSv3]	ldexp[SUSv3]	tgammal[SUSv3]
cpowl[SUSv3]	ldexpf[SUSv3]	trunc[SUSv3]
cproj[SUSv3]	ldexpl[SUSv3]	truncf[SUSv3]
cprojf[SUSv3]	lgamma[SUSv3]	truncl[SUSv3]
cprojl[SUSv3]	lgamma_r[LSB]	y0[SUSv3]
creal[SUSv3]	lgammaf[SUSv3]	y0f[LSB]
crealf[SUSv3]	lgammaf_r[LSB]	y0l[LSB]
creall[SUSv3]	lgammal[SUSv3]	y1[SUSv3]
csin[SUSv3]	lgammal_r[LSB]	y1f[LSB]
csinf[SUSv3]	llrint[SUSv3]	y1l[LSB]
csinh[SUSv3]	llrintf[SUSv3]	yn[SUSv3]
csinhf[SUSv3]	llrintl[SUSv3]	ynf[LSB]
csinhl[SUSv3]	llround[SUSv3]	ynl[LSB]

Table A-7 libm Data Interfaces

signgam[SUSv3]		

A.6 libncurses

The behavior of the interfaces in this library is specified by the following Standards.

This Specification [LSB]
X/Open Curses [SUS-CURSES]

Table A-8 libncurses Function Interfaces

addch[SUS-CURSES]	mvdelch[SUS-CURSES]	slk_refresh[SUS-CURSES]
addchnstr[SUS-CURSES]	mvderwin[SUS-CURSES]	slk_restore[SUS-CURSES]
addchstr[SUS-CURSES]	mvgetch[SUS-CURSES]	slk_set[SUS-CURSES]
addnstr[SUS-CURSES]	mvgetnstr[SUS-CURSES]	slk_touch[SUS-CURSES]
addstr[SUS-CURSES]	mvgetstr[SUS-CURSES]	standend[SUS-CURSES]
attr_get[SUS-CURSES]	mvhline[SUS-CURSES]	standout[SUS-CURSES]
attr_off[SUS-CURSES]	mvinch[SUS-CURSES]	start_color[SUS-CURSES]
attr_on[SUS-CURSES]	mvinchnstr[LSB]	subpad[SUS-CURSES]
attr_set[SUS-CURSES]	mvinchstr[LSB]	subwin[SUS-CURSES]
attroff[SUS-CURSES]	mvinnstr[SUS-CURSES]	syncok[SUS-CURSES]
attron[SUS-CURSES]	mvinsch[SUS-CURSES]	termattrs[SUS-CURSES]
attrset[SUS-CURSES]	mvinsnstr[SUS-CURSES]	termname[SUS-CURSES]
baudrate[SUS-CURSES]	mvinsstr[SUS-CURSES]	tgetent[SUS-CURSES]
beep[SUS-CURSES]	mvinstr[LSB]	tgetflag[SUS-CURSES]
bkgd[SUS-CURSES]	mvprintw[SUS-CURSES]	tgetnum[SUS-CURSES]
bkgdset[SUS-CURSES]	mvscanw[LSB]	tgetstr[SUS-CURSES]
border[SUS-CURSES]	mvvline[SUS-CURSES]	tgoto[SUS-CURSES]
box[SUS-CURSES]	mvwaddch[SUS-CURSES]	tigetflag[SUS-CURSES]
can_change_color[SUS-CURSES]	mvwaddchnstr[SUS-CURSES]	tigetnum[SUS-CURSES]
cbreak[SUS-CURSES]	mvwaddchstr[SUS-CURSES]	tigetstr[SUS-CURSES]
chgat[SUS-CURSES]	mvwaddnstr[SUS-CURSES]	timeout[SUS-CURSES]
clear[SUS-CURSES]	mvwaddstr[SUS-CURSES]	touchline[SUS-CURSES]
clearok[SUS-CURSES]	mvwchgat[SUS-CURSES]	touchwin[SUS-CURSES]
clrtobot[SUS-CURSES]	mvwdelch[SUS-CURSES]	tparm[SUS-CURSES]
clrtoeol[SUS-CURSES]	mvwgetch[SUS-	tputs[SUS-CURSES]

	CURSES]	
color_content[SUS-CURSES]	mvwgetnstr[SUS-CURSES]	typeahead[SUS-CURSES]
color_set[SUS-CURSES]	mvwgetstr[SUS-CURSES]	unctrl[SUS-CURSES]
copywin[SUS-CURSES]	mvwhline[SUS-CURSES]	ungetch[SUS-CURSES]
curs_set[SUS-CURSES]	mvwin[SUS-CURSES]	untouchwin[SUS-CURSES]
def_prog_mode[SUS-CURSES]	mvwinch[SUS-CURSES]	use_env[SUS-CURSES]
def_shell_mode[SUS-CURSES]	mvwinchnstr[LSB]	vidattr[SUS-CURSES]
del_curterm[SUS-CURSES]	mvwinchstr[LSB]	vidputs[SUS-CURSES]
delay_output[SUS-CURSES]	mvwinnstr[SUS-CURSES]	vline[SUS-CURSES]
delch[SUS-CURSES]	mvwinsch[SUS-CURSES]	vw_printw[SUS-CURSES]
deleteln[SUS-CURSES]	mvwinsnstr[SUS-CURSES]	vw_scanw[LSB]
delscreen[SUS-CURSES]	mvwinsstr[SUS-CURSES]	vwprintw[SUS-CURSES]
delwin[SUS-CURSES]	mvwinstr[LSB]	vwscanw[LSB]
derwin[SUS-CURSES]	mvwprintw[SUS-CURSES]	waddch[SUS-CURSES]
doupdate[SUS-CURSES]	mvwscanw[LSB]	waddchnstr[SUS-CURSES]
dupwin[SUS-CURSES]	mvwvline[SUS-CURSES]	waddchstr[SUS-CURSES]
echo[SUS-CURSES]	napms[SUS-CURSES]	waddnstr[SUS-CURSES]
echochar[SUS-CURSES]	newpad[SUS-CURSES]	waddstr[SUS-CURSES]
endwin[SUS-CURSES]	newterm[SUS-CURSES]	wattr_get[SUS-CURSES]
erase[SUS-CURSES]	newwin[SUS-CURSES]	wattr_off[SUS-CURSES]
erasechar[SUS-CURSES]	nl[SUS-CURSES]	wattr_on[SUS-CURSES]
filter[SUS-CURSES]	nocbreak[SUS-CURSES]	wattr_set[SUS-CURSES]
flash[SUS-CURSES]	nodelay[SUS-CURSES]	wattroff[SUS-CURSES]

flushinp[SUS-CURSES]	noecho[SUS-CURSES]	wattron[SUS-CURSES]
getbkgd[SUS-CURSES]	nonl[SUS-CURSES]	wattrset[SUS-CURSES]
getch[SUS-CURSES]	noqiflush[SUS-CURSES]	wbkgd[SUS-CURSES]
getnstr[SUS-CURSES]	noraw[SUS-CURSES]	wbkgdset[SUS-CURSES]
getstr[SUS-CURSES]	notimeout[SUS-CURSES]	wborder[SUS-CURSES]
getwin[SUS-CURSES]	overlay[SUS-CURSES]	wchgat[SUS-CURSES]
halfdelay[SUS-CURSES]	overwrite[SUS-CURSES]	wclear[SUS-CURSES]
has_colors[SUS-CURSES]	pair_content[SUS-CURSES]	wclrtobot[SUS-CURSES]
has_ic[SUS-CURSES]	pechochar[SUS-CURSES]	wclrtoeol[SUS-CURSES]
has_il[SUS-CURSES]	pnoutrefresh[SUS-CURSES]	wcolor_set[SUS-CURSES]
hline[SUS-CURSES]	prefresh[SUS-CURSES]	wcursyncup[SUS-CURSES]
idcok[SUS-CURSES]	printw[SUS-CURSES]	wdelch[SUS-CURSES]
idlok[SUS-CURSES]	putp[SUS-CURSES]	wdeleteln[SUS-CURSES]
immedok[SUS-CURSES]	putwin[SUS-CURSES]	wechochar[SUS-CURSES]
inch[SUS-CURSES]	qiflush[SUS-CURSES]	werase[SUS-CURSES]
inchnstr[LSB]	raw[SUS-CURSES]	wgetch[SUS-CURSES]
inchstr[LSB]	redrawwin[SUS-CURSES]	wgetnstr[SUS-CURSES]
init_color[SUS-CURSES]	refresh[SUS-CURSES]	wgetstr[SUS-CURSES]
init_pair[SUS-CURSES]	reset_prog_mode[SUS-CURSES]	whline[SUS-CURSES]
initscr[SUS-CURSES]	reset_shell_mode[SUS-CURSES]	winch[SUS-CURSES]
innstr[SUS-CURSES]	resetty[SUS-CURSES]	winchnstr[LSB]
insch[SUS-CURSES]	restartterm[SUS-CURSES]	winchstr[LSB]
insdelln[SUS-CURSES]	ripoffline[LSB]	winnstr[SUS-CURSES]
insertln[SUS-CURSES]	savetty[SUS-CURSES]	winsch[SUS-CURSES]
insnstr[SUS-CURSES]	scanw[LSB]	winsdelln[SUS-

		CURSES]
insstr[SUS-CURSES]	scr_dump[SUS-CURSES]	winsertln[SUS-CURSES]
instr[LSB]	scr_init[SUS-CURSES]	winsnstr[SUS-CURSES]
intrflush[SUS-CURSES]	scr_restore[SUS-CURSES]	winsstr[SUS-CURSES]
is_linetouched[SUS-CURSES]	scr_set[SUS-CURSES]	winstr[LSB]
is_wintouched[SUS-CURSES]	scrl[SUS-CURSES]	wmove[SUS-CURSES]
isendwin[SUS-CURSES]	scroll[SUS-CURSES]	wnoutrefresh[SUS-CURSES]
keyname[SUS-CURSES]	scrollok[SUS-CURSES]	wprintw[SUS-CURSES]
keypad[SUS-CURSES]	set_curterm[SUS-CURSES]	wredrawln[SUS-CURSES]
killchar[SUS-CURSES]	set_term[SUS-CURSES]	wrefresh[SUS-CURSES]
leaveok[SUS-CURSES]	setscrreg[SUS-CURSES]	wscanw[LSB]
longname[SUS-CURSES]	setupterm[SUS-CURSES]	wscrl[SUS-CURSES]
meta[SUS-CURSES]	slk_attr_set[SUS-CURSES]	wsetscrreg[SUS-CURSES]
move[SUS-CURSES]	slk_attroff[SUS-CURSES]	wstandend[SUS-CURSES]
mvaddch[SUS-CURSES]	slk_attron[SUS-CURSES]	wstandout[SUS-CURSES]
mvaddchnstr[SUS-CURSES]	slk_attrset[SUS-CURSES]	wsyncdown[SUS-CURSES]
mvaddchstr[SUS-CURSES]	slk_clear[SUS-CURSES]	wsyncup[SUS-CURSES]
mvaddnstr[SUS-CURSES]	slk_color[SUS-CURSES]	wtimeout[SUS-CURSES]
mvaddstr[SUS-CURSES]	slk_init[SUS-CURSES]	wtouchln[SUS-CURSES]
mvchgat[SUS-CURSES]	slk_label[SUS-CURSES]	wvline[SUS-CURSES]
mvcur[LSB]	slk_noutrefresh[SUS-CURSES]	

Table A-9 libncurses Data Interfaces

COLORS[SUS-CURSES]	LINES[SUS-CURSES]	curscr[SUS-CURSES]
COLOR_PAIRS[SUS-CURSES]	acs_map[SUS-CURSES]	stdscr[SUS-CURSES]

COLS[SUS-CURSES]	cur_term[SUS-CURSES]	

A.7 libpam

The behavior of the interfaces in this library is specified by the following Standards.

This Specification [LSB]

Table A-10 libpam Function Interfaces

pam_acct_mgmt(LIBPAM_1.0)[LSB]	pam_fail_delay(LIBPAM_1.0)[LSB]	pam_putenv(LIBPAM_1.0)[LSB]
pam_authenticate(LIBPAM_1.0)[LSB]	pam_get_item(LIBPAM_1.0)[LSB]	pam_set_item(LIBPAM_1.0)[LSB]
pam_chauthtok(LIBPAM_1.0)[LSB]	pam_getenv(LIBPAM_1.0)[LSB]	pam_setcred(LIBPAM_1.0)[LSB]
pam_close_session(LIBPAM_1.0)[LSB]	pam_getenvlist(LIBPAM_1.0)[LSB]	pam_start(LIBPAM_1.0)[LSB]
pam_end(LIBPAM_1.0)[LSB]	pam_open_session(LIBPAM_1.0)[LSB]	pam_strerror(LIBPAM_1.0)[LSB]

A.8 libpthread

The behavior of the interfaces in this library is specified by the following Standards.

Large File Support [LFS]
This Specification [LSB]
POSIX 1003.1-2001 (ISO/IEC 9945-2003) [SUSv3]
POSIX 1003.1-2008 (ISO/IEC 9945-2009) [SUSv4]

Table A-11 libpthread Function Interfaces

_pthread_cleanup_pop[LSB]	pthread_condattr_destroy[SUSv3]	pthread_rwlock_init[SUSv3]
_pthread_cleanup_push[LSB]	pthread_condattr_getpshared[SUSv3]	pthread_rwlock_rdlock[SUSv3]
lseek64[LFS]	pthread_condattr_init[SUSv3]	pthread_rwlock_timedrdlock[SUSv3]
open64[LFS]	pthread_condattr_setpshared[SUSv3]	pthread_rwlock_timedwrlock[SUSv3]
pread[SUSv3]	pthread_create[SUSv3]	pthread_rwlock_tryrdlock[SUSv3]
pread64[LSB]	pthread_detach[SUSv3]	pthread_rwlock_trywrlock[SUSv3]
pthread_attr_destroy[SUSv3]	pthread_equal[SUSv3]	pthread_rwlock_unlock[SUSv3]
pthread_attr_getdetachstate[SUSv3]	pthread_exit[SUSv3]	pthread_rwlock_wrlock[SUSv3]

pthread_attr_getguardsize[SUSv3]	pthread_getattr_np[LSB]	pthread_rwlockattr_destroy[SUSv3]
pthread_attr_getinheritsched[SUSv3]	pthread_getconcurrency[SUSv3]	pthread_rwlockattr_getkind_np[LSB]
pthread_attr_getschedparam[SUSv3]	pthread_getcpuclockid[SUSv3]	pthread_rwlockattr_getpshared[SUSv3]
pthread_attr_getschedpolicy[SUSv3]	pthread_getschedparam[SUSv3]	pthread_rwlockattr_init[SUSv3]
pthread_attr_getscope[SUSv3]	pthread_getspecific[SUSv3]	pthread_rwlockattr_setkind_np[LSB]
pthread_attr_getstack[SUSv3]	pthread_join[SUSv3]	pthread_rwlockattr_setpshared[SUSv3]
pthread_attr_getstackaddr[SUSv3]	pthread_key_create[SUSv3]	pthread_self[SUSv3]
pthread_attr_getstacksize[SUSv3]	pthread_key_delete[SUSv3]	pthread_setcancelstate[SUSv3]
pthread_attr_init[SUSv3]	pthread_kill[SUSv3]	pthread_setcanceltype[SUSv3]
pthread_attr_setdetachstate[SUSv3]	pthread_mutex_consistent_np[LSB]	pthread_setconcurrency[SUSv3]
pthread_attr_setguardsize[SUSv3]	pthread_mutex_destroy[SUSv3]	pthread_setschedparam[SUSv3]
pthread_attr_setinheritsched[SUSv3]	pthread_mutex_getprioceiling(GLIBC_2.4)[SUSv4]	pthread_setschedprio(GLIBC_2.3.4)[SUSv3]
pthread_attr_setschedparam[SUSv3]	pthread_mutex_init[SUSv3]	pthread_setspecific[SUSv3]
pthread_attr_setschedpolicy[SUSv3]	pthread_mutex_lock[SUSv3]	pthread_sigmask[SUSv3]
pthread_attr_setscope[SUSv3]	pthread_mutex_setprioceiling(GLIBC_2.4)[SUSv4]	pthread_spin_destroy[SUSv3]
pthread_attr_setstack[SUSv3]	pthread_mutex_timedlock[SUSv3]	pthread_spin_init[SUSv3]
pthread_attr_setstackaddr[SUSv3]	pthread_mutex_trylock[SUSv3]	pthread_spin_lock[SUSv3]
pthread_attr_setstacksize[SUSv3]	pthread_mutex_unlock[SUSv3]	pthread_spin_trylock[SUSv3]
pthread_barrier_destroy[SUSv3]	pthread_mutexattr_destroy[SUSv3]	pthread_spin_unlock[SUSv3]
pthread_barrier_init[SUSv3]	pthread_mutexattr_getprioceiling(GLIBC_2.4)[SUSv4]	pthread_testcancel[SUSv3]

pthread_barrier_wait[SUSv3]	pthread_mutexattr_getprotocol(GLIBC_2.4)[SUSv4]	pwrite[SUSv3]
pthread_barrierattr_destroy[SUSv3]	pthread_mutexattr_getpshared[SUSv3]	pwrite64[LSB]
pthread_barrierattr_getpshared(GLIBC_2.3.3)[SUSv3]	pthread_mutexattr_getrobust_np[LSB]	sem_close[SUSv3]
pthread_barrierattr_init[SUSv3]	pthread_mutexattr_gettype[SUSv3]	sem_destroy[SUSv3]
pthread_barrierattr_setpshared[SUSv3]	pthread_mutexattr_init[SUSv3]	sem_getvalue[SUSv3]
pthread_cancel[SUSv3]	pthread_mutexattr_setprioceiling(GLIBC_2.4)[SUSv4]	sem_init[SUSv3]
pthread_cond_broadcast[SUSv3]	pthread_mutexattr_setprotocol(GLIBC_2.4)[SUSv4]	sem_open[SUSv3]
pthread_cond_destroy[SUSv3]	pthread_mutexattr_setpshared[SUSv3]	sem_post[SUSv3]
pthread_cond_init[SUSv3]	pthread_mutexattr_setrobust_np[LSB]	sem_timedwait[SUSv3]
pthread_cond_signal[SUSv3]	pthread_mutexattr_settype[SUSv3]	sem_trywait[SUSv3]
pthread_cond_timedwait[SUSv3]	pthread_once[SUSv3]	sem_unlink[SUSv3]
pthread_cond_wait[SUSv3]	pthread_rwlock_destroy[SUSv3]	sem_wait[SUSv3]

A.9 librt

The behavior of the interfaces in this library is specified by the following Standards.

 POSIX 1003.1-2001 (ISO/IEC 9945-2003) [SUSv3]

Table A-12 librt Function Interfaces

clock_getcpuclockid[SUSv3]	mq_open(GLIBC_2.3.4)[SUSv3]	shm_unlink[SUSv3]
clock_getres[SUSv3]	mq_receive(GLIBC_2.3.4)[SUSv3]	timer_create[SUSv3]
clock_gettime[SUSv3]	mq_send(GLIBC_2.3.4)[SUSv3]	timer_delete[SUSv3]
clock_nanosleep[SUSv3]	mq_setattr(GLIBC_2.3.4)[SUSv3]	timer_getoverrun[SUSv3]

clock_settime[SUSv3]	mq_timedreceive(GLIBC_2.3.4)[SUSv3]	timer_gettime[SUSv3]
mq_close(GLIBC_2.3.4)[SUSv3]	mq_timedsend(GLIBC_2.3.4)[SUSv3]	timer_settime[SUSv3]
mq_getattr(GLIBC_2.3.4)[SUSv3]	mq_unlink(GLIBC_2.3.4)[SUSv3]	
mq_notify(GLIBC_2.3.4)[SUSv3]	shm_open[SUSv3]	

A.10 libutil

The behavior of the interfaces in this library is specified by the following Standards.

 This Specification [LSB]

Table A-13 libutil Function Interfaces

forkpty[LSB]	login_tty[LSB]	logwtmp[LSB]
login[LSB]	logout[LSB]	openpty[LSB]

A.11 libz

The behavior of the interfaces in this library is specified by the following Standards.

 This Specification [LSB]

Table A-14 libz Function Interfaces

adler32[LSB]	gzclose[LSB]	gztell[LSB]
compress[LSB]	gzdopen[LSB]	gzwrite[LSB]
compress2[LSB]	gzeof[LSB]	inflate[LSB]
compressBound[LSB]	gzerror[LSB]	inflateEnd[LSB]
crc32[LSB]	gzflush[LSB]	inflateInit2_[LSB]
deflate[LSB]	gzgetc[LSB]	inflateInit_[LSB]
deflateBound[LSB]	gzgets[LSB]	inflateReset[LSB]
deflateCopy[LSB]	gzopen[LSB]	inflateSetDictionary[LSB]
deflateEnd[LSB]	gzprintf[LSB]	inflateSync[LSB]
deflateInit2_[LSB]	gzputc[LSB]	inflateSyncPoint[LSB]
deflateInit_[LSB]	gzputs[LSB]	uncompress[LSB]
deflateParams[LSB]	gzread[LSB]	zError[LSB]
deflateReset[LSB]	gzrewind[LSB]	zlibVersion[LSB]
deflateSetDictionary[LSB]	gzseek[LSB]	

| get_crc_table[LSB] | gzsetparams[LSB] | |

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