

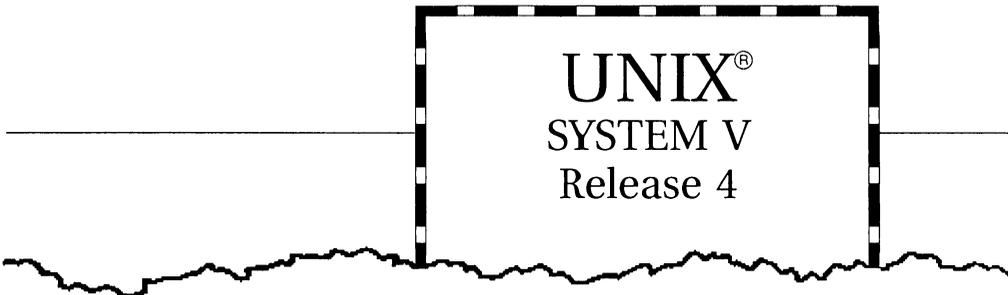
UNIX[®]
SYSTEM V
Release 4

**System Calls
and Library Functions
Reference Manual**

for
Motorola Processors

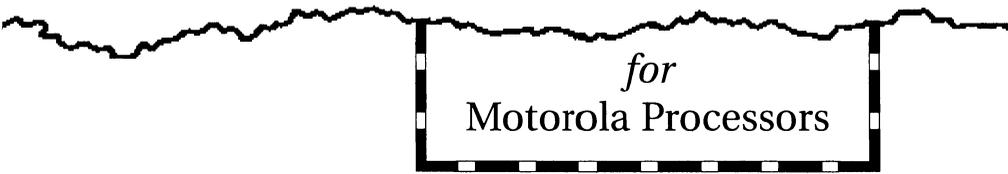


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fpgetround, fpsetround, fpgetmask, fpsetmask, fpgetsticky, fpsetsticky(3C)
 IEEE floating-point environment control

fread, fwrite(3S) binary input/output

frexp, ldexp, logb, modf, modff, nextafter, scalb(3C)
 manipulate parts of floating-point numbers

fseek, rewind, ftell(3S) reposition a file pointer in a stream

fsetpos, fgetpos(3C) reposition a file pointer in a stream

fsync(2) synchronize a file's in-memory state with that on the physical medium

ftime(2) get time and date

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| <code>ftime(3C)</code> | get date and time |
| <code>ftw, nftw(3C)</code> | walk a file tree |
| <code>gamma, lgamma(3M)</code> | log gamma function |
| <code>getc, getchar, fgetc, getw(3S)</code> | get character or word from a stream |
| <code>getcontext, setcontext(2)</code> | get and set current user context |
| <code>getcwd(3C)</code> | get pathname of current working directory |
| <code>getdate(3C)</code> | convert user format date and time |
| <code>getdents(2)</code> | read directory entries and put in a file system independent format |
| <code>getdtablesize(3)</code> | get descriptor table size |
| <code>getenv(3C)</code> | return value for environment name |
| <code>getgrent, getgrgid, getgrnam, setgrent, endgrent, fgetgrent(3C)</code> | get group file entry |
| <code>getgroups, setgroups(2)</code> | get or set supplementary group access list IDs |
| <code>gethostent, gethostbyaddr, gethostbyname, sethostent, endhostent, herror(3N)</code> | get network host entry |
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getsubopt(3C) parse suboptions from a string

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gettimeofday, settimeofday(3C) get or set the date and time

gettxt(3C) retrieve a text string

getuid, geteuid, getgid, getegid(2)
 get real user, effective user, real group, and effective group IDs

getusershell, setusershell, endusershell(3) get legal user shells

getut: getutent, getutid, getutline, pututline, setutent, endutent, utmpname(3C)
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getutx: getutxent, getutxid, getutxline, pututxline, setutxent, endutxent,
 utmpxname, getutmp, getutmpx, updwtmp, updwtmpx(3C) access utmpx file entry

getvfsent, getvfsfile, getvfsspec, getvfsany(3C) get vfstab file entry

getwc, getwchar, fgetwc(3W) get wchar_t character from a stream

getwd(3) get current working directory pathname

getwidth(3W) get information of supplementary code sets

getws, fgetws(3W) get a wchar_t string from a stream

gmatch(3G) shell global pattern matching

grantpt(3C) grant access to the slave pseudo-terminal device

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hypot(3M) Euclidean distance function

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ieee_handler(3M) IEEE exception trap handler function

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malloc, free, realloc, calloc, mallopt, mallinfo(3X) memory allocator

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matherr(3M) error-handling function

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mbstring: mbstowcs, wcstombs(3C) multibyte string functions

mctl(3) memory management control

memcntl(2) memory management control

memory: memccpy, memchr, memcmp, memcpy, memmove, memset(3C)

..... memory operations

menu_attributes: set_menu_fore, menu_fore, set_menu_back, menu_back,

set_menu_grey, menu_grey, set_menu_pad, menu_pad(3X)

..... control menus display attributes

menu_cursor: pos_menu_cursor(3X) correctly position a menus cursor

menu_driver(3X) command processor for the menus subsystem

menu_format: set_menu_format, menu_format(3X)

..... set and get maximum numbers of rows and columns in menus

menu_hook: set_item_init, item_init, set_item_term, item_term, set_menu_init,

menu_init, set_menu_term, menu_term(3X)

..... assign application-specific routines for automatic invocation by menus

menu_item_current: set_current_item, current_item, set_top_row, top_row,

item_index(3X) set and get current menus items

menu_item_name: item_name, item_description(3X) get menu item name and description

menu_item_new: new_item, free_item(3X) create and destroy menus items

menu_item_opts: set_item_opts, item_opts_on, item_opts_off, item_opts(3X)
 menus item option routines

menu_item_userptr: set_item_userptr, item_userptr(3X)
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menu_item_value: set_item_value, item_value(3X) set and get menus item values

menu_item_visible: item_visible(3X) tell if menus item is visible

menu_items: set_menu_items, menu_items, item_count(3X)
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menu_new: new_menu, free_menu(3X) create and destroy menus

menu_opts: set_menu_opts, menu_opts_on, menu_opts_off, menu_opts(3X)
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menu_post: post_menu, unpost_menu(3X)
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menu_userptr: set_menu_userptr, menu_userptr(3X) associate application data with menus

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 menus window and subwindow association routines

menus(3X) character based menus package

mincore(2) determine residency of memory pages

mkdir(2) make a directory

mkdirp, rmdirp(3G) create, remove directories in a path

mkfifo(3C) create a new FIFO

mknod(2) make a directory, or a special or ordinary file

mknod(2) make a directory, or a special or ordinary file

mkstemp(3) make a unique file name

mktemp(3C) make a unique file name

mktime(3C) converts a tm structure to a calendar time

mlock, munlock(3C) lock (or unlock) pages in memory

mlockall, munlockall(3C) lock or unlock address space

mmap(2) map pages of memory

monitor(3C) prepare execution profile

mount(2) mount a file system

mp: madd, msub, mult, mdiv, mcmp, min, mout, pow, gcd, rpow, msqrt, sdiv, itom,
 xtom, mtox, mfree(3) multiple precision integer arithmetic

mprotect(2) set protection of memory mapping

msgctl(2) message control operations

msgget(2) get message queue

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| munmap(2) | unmap pages of memory |
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| netdir_getbyname, netdir_getbyaddr, netdir_free, taddr2uaddr, uaddr2taddr, netdir_perror, netdir_spperror(3N) | generic transport name-to-address translation |
| nice(2) | change priority of a time-sharing process |
| nice(3C) | change priority of a process |
| nl_langinfo(3C) | language information |
| nl_types(5) | native language data types |
| nlist(3E) | get entries from name list |
| nlist(3) | get entries from symbol table |
| nlsgetcall(3N) | get client's data passed via the listener |
| nlsprovider(3N) | get name of transport provider |
| nlsrequest(3N) | format and send listener service request message |
| offsetof(3C) | offset of structure member |
| open(2) | open for reading or writing |
| opensem(2) | open a semaphore |
| p2open, p2close(3G) | open, close pipes to and from a command |
| p_online(2) | turn a processor online or offline |
| panel_above: panel_above, panel_below(3X) | panels deck traversal primitives |
| panel_move: move_panel(3X) | move a panels window on the virtual screen |
| panel_new: new_panel, del_panel(3X) | create and destroy panels |
| panel_show: show_panel, hide_panel, panel_hidden(3X) | panels deck manipulation routines |
| panel_top: top_panel, bottom_panel(3X) | panels deck manipulation routines |
| panel_update: update_panels(3X) | panels virtual screen refresh routine |
| panel_userptr: set_panel_userptr, panel_userptr(3X) | associate application data with a panels panel |
| panel_window: panel_window, replace_panel(3X) | get or set the current window of a panels panel |
| panels(3X) | character based panels package |
| pathfind(3G) | search for named file in named directories |
| pause(2) | suspend process until signal |
| perror(3C) | print system error messages |
| pfmt(3C) | display error message in standard format |
| pipe(2) | create an interprocess channel |
| plock(2) | lock into memory or unlock process, text, or data |
| poll(2) | input/output multiplexing |
| popen, pclose(3S) | initiate pipe to/from a process |
| printf, fprintf, sprintf(3S) | print formatted output |
| printf, fprintf, sprintf(3W) | print formatted output |
| printf, fprintf, sprintf, vprintf, vfprintf, vsprintf(3) | formatted output conversion |

priocntl(2) process scheduler control
 priocntlset(2) generalized process scheduler control
 processor_bind(2) bind a process to a processor
 processor_info(2) get information about one processor
 prof(5) profile within a function
 profil(2) execution time profile
 psignal, psiginfo(3C) system signal messages
 psignal, sys_siglist(3) system signal messages
 ptrace(2) process trace
 ptsname(3C) get name of the slave pseudo-terminal device
 publickey: getpublickey, getsecretkey(3N) retrieve public or secret key
 putc, putchar, fputc, putw(3S) put character or word on a stream
 putenv(3C) change or add value to environment
 putmsg(2) send a message on a stream
 putpwent(3C) write password file entry
 puts, fputs(3S) put a string on a stream
 putspent(3C) write shadow password file entry
 putwc, putwchar, fputwc(3W) put wchar_t character on a stream
 putws, fputs(3W) put a wchar_t string on a stream
 qsort(3C) quicker sort
 raise(3C) send signal to program
 rand, srand(3C) simple random-number generator
 rand, srand(3C) simple random number generator
 random, srand, initState, setState(3)
 better random number generator; routines for changing generators
 rcmd, rresvport, ruserok(3N) routines for returning a stream to a remote command
 rdchk(2) check to see if there is data to be read
 read(2) read from file
 readlink(2) read the value of a symbolic link
 realpath(3C) returns the real file name
 reboot(3) reboot system or halt processor
 recv, recvfrom, recvmsg(3N) receive a message from a socket
 regcmp, regex(3G) compile and execute regular expression
 regex, re_comp, re_exec(3) regular expression handler
 regexpr: compile, step, advance(5) regular expression compile and match routines
 regexpr: compile, step, advance(3G) regular expression compile and match routines
 remove(3C) remove file
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| rexec(3N) | return stream to a remote command |
| rmdir(2) | remove a directory |
| rpc(3N) | library routines for remote procedure calls |
| rpc_clnt_auth: auth_destroy, authnone_create, authsys_create, authsys_create_default(3N) | library routines for client side remote procedure call authentication |
| rpc_clnt_calls: clnt_call, clnt_freeres, clnt_geterr, clnt_perrno, clnt_perror, clnt_sperrno, clnt_sperror, rpc_broadcast, rpc_call(3N) | library routines for client side calls |
| rpc_clnt_create: clnt_control, clnt_create, clnt_destroy, clnt_dg_create, clnt_pcreateerror, clnt_raw_create, clnt_spcreateerror, clnt_tli_create, clnt_tp_create, clnt_vc_create(3N) | library routines for dealing with creation and manipulation of CLIENT handles |
| rpc_svc_calls: rpc_reg, svc_reg, svc_unreg, xprt_register, xprt_unregister(3N) | library routines for registering servers |
| rpc_svc_create: svc_create, svc_destroy, svc_dg_create, svc_fd_create, svc_raw_create, svc_tli_create, svc_tp_create, svc_vc_create(3N) | library routines for dealing with the creation of server handles |
| rpc_svc_err: svcerr_auth, svcerr_decode, svcerr_noproc, svcerr_noprogram, svcerr_progvers, svcerr_systemerr, svcerr_weakauth(3N) | library routines for server side remote procedure call errors |
| rpc_svc_reg: svc_freeargs, svc_getargs, svc_getreqset, svc_getrpccaller, svc_run, svc_sendreply(3N) | library routines for RPC servers |
| rpc_xdr: xdr_accepted_reply, xdr_authsys_parms, xdr_callhdr, xdr_callmsg, xdr_opaque_auth, xdr_rejected_reply, xdr_replymsg(3N) | XDR library routines for remote procedure calls |
| rpcbind: rpcb_getmaps, rpcb_getaddr, rpcb_gettime, rpcb_rmtcall, rpcb_set, rpcb_unset(3N) | library routines for RPC bind service |
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| rwall(3N) | write to specified remote machines |
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| scanf, fscanf, sscanf(3W) | convert formatted input |
| scenter, sdleave(2) | synchronize access to a shared data segment |
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secure_rpc: authdes_seccreate, authdes_getucred, getnetname, host2netname,
key_decryptsession, key_encryptsession, key_gendes, key_setsecret,
netname2host, netname2user, user2netname(3N)
..... library routines for secure remote procedure calls

select(3C) synchronous I/O multiplexing

semctl(2) semaphore control operations

semget(2) get set of semaphores

semop(2) semaphore operations

send, sendto, sendmsg(3N) send a message from a socket

setbuf, setvbuf(3S) assign buffering to a stream

setbuf, setbuffer, setlinebuf, setvbuf(3S) assign buffering to a stream

setbuffer, setlinebuf(3S) assign buffering to a stream

setcat(3C) define default catalog

setjmp, longjmp(3C) non-local goto

setjmp, longjmp, _setjmp, _longjmp, sigsetjmp, siglongjmp(3) non-local goto

setlabel(3C) define the label for pfmt() and lfmt()

setlocale(3C) modify and query a program's locale

setpgid(2) set process group ID

setpgrp(2) set process group ID

setregid(3) set real and effective group IDs

setreuid(3) set real and effective user IDs

setsid(2) set session ID

setuid, setgid(2) set user and group IDs

shmctl(2) shared memory control operations

shmget(2) get shared memory segment identifier

shmop: shmat, shmdt(2) shared memory operations

shutdown(3N) shut down part of a full-duplex connection

sigaction(2) detailed signal management

sigaltstack(2) set or get signal alternate stack context

sigblock, sigmask(3) block signals

sigfpe(3) signal handling for specific SIGFPE codes

siginfo(5) signal generation information

siginterrupt(3) allow signals to interrupt system calls

signal, sigset, sighold, sigrelse, sigignore, sigpause(2) simplified signal management

signal(3) simplified software signal facilities

signal(5) base signals

sigpause(3) automatically release blocked signals and wait for interrupt

sigpending(2) examine signals that are blocked and pending

sigprocmask(2) change or examine signal mask

sigsem(2) signal a process waiting on a semaphore

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| sigsetmask(3) | set current signal mask |
| sigemptyset, sigfillset, sigaddset, sigdelset, sigismember(3C) | manipulate sets of signals |
| sigstack(3) | set and/or get signal stack context |
| sigsuspend(2) | install a signal mask and suspend process until signal |
| sigvec(3) | software signal facilities |
| sinh, sinhf, cosh, coshf, tanh, tanhf, asinh, acosh, atanh(3M) | hyperbolic functions |
| sleep(3C) | suspend execution for interval |
| sleep(3) | suspend execution for interval |
| socket(3N) | create an endpoint for communication |
| socketpair(3N) | create a pair of connected sockets |
| spray(3N) | scatter data in order to check the network |
| sputl, sgetl(3X) | access long integer data in a machine-independent fashion |
| ssignal, gsignal(3C) | software signals |
| stat, lstat, fstat(2) | get file status |
| stat(5) | data returned by stat system call |
| stat, lstat, fstat(2) | get file status |
| statvfs, fstatvfs(2) | get file system information |
| stdarg(5) | handle variable argument list |
| stdio(3S) | standard buffered input/output package |
| stdipc: ftok(3C) | standard interprocess communication package |
| stime(2) | set time |
| stkprotect(2) | set permissions of stack |
| str: strfind, strrspn, strtrns(3G) | string manipulations |
| strccpy: streadd, strcadd, strecpy(3G) | copy strings, compressing or expanding escape codes |
| strcoll(3C) | string collation |
| strerror(3C) | get error message string |
| strftime, cftime, asctime(3C) | convert date and time to string |
| string: strcat, strdup, strncat, strcmp, strncmp, strepy, strncpy, strlen, strchr, strrchr, strpbrk, strspn, strcspn, strtok, strstr(3C) | string operations |
| string: strcasecmp, strncasecmp(3) | string operations |
| strtod, atof(3C) | convert string to double-precision number |
| strtol, strtoul, atol, atoi(3C) | convert string to integer |
| strxfrm(3C) | string transformation |
| swab(3C) | swap bytes |
| swapctl(2) | manage swap space |
| symlink(2) | make a symbolic link to a file |
| sync(2) | update super block |
| syscall(3) | indirect system call |

sysconf(3C) retrieves configurable system variables

sysfs(2) get file system type information

sysinfo(2) get and set system information strings

syslog, openlog, closelog, setlogmask(3) control system log

sysm68k(2) machine-specific functions

sysm88k(2) machine-specific functions

system(3S) issue a shell command

t_accept(3N) accept a connect request

t_alloc(3N) allocate a library structure

t_bind(3N) bind an address to a transport endpoint

t_close(3N) close a transport endpoint

t_connect(3N) establish a connection with another transport user

t_error(3N) produce error message

t_free(3N) free a library structure

t_getinfo(3N) get protocol-specific service information

t_getstate(3N) get the current state

t_listen(3N) listen for a connect request

t_look(3N) look at the current event on a transport endpoint

t_open(3N) establish a transport endpoint

t_optmgmt(3N) manage options for a transport endpoint

t_rcv(3N) receive data or expedited data sent over a connection

t_rcvconnect(3N) receive the confirmation from a connect request

t_rcvdis(3N) retrieve information from disconnect

t_rcvrel(3N) acknowledge receipt of an orderly release indication

t_rcvudata(3N) receive a data unit

t_rcvuderr(3N) receive a unit data error indication

t_snd(3N) send data or expedited data over a connection

t_snddis(3N) send user-initiated disconnect request

t_sndrel(3N) initiate an orderly release

t_sndudata(3N) send a data unit

t_sync(3N) synchronize transport library

t_unbind(3N) disable a transport endpoint

tam(3X) TAM transition libraries

tcsetpgrp(3C) set terminal foreground process group id

termios: tcgetattr, tcsetattr, tcsendbreak, tcdrain, tcflush, tcflow, cfgetospeed,
 cfgetispeed, cfsetispeed, cfsetospeed, tcgetpgrp, tcsetpgrp, tcgetsid(2)
 general terminal interface

time(2) get time

times(2) get process and child process times

times(3C) get process times

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| tmpfile(3S) | | create a temporary file |
| tmpnam, tmpnam(3S) | | create a name for a temporary file |
| trig: sin, sinf, cos, cosf, tan, tanf, asin, asinf, acos, acosf, atan, atanf, atan2, atan2f(3M) | ..... | trigonometric functions |
| truncate, ftruncate(3C) | ..... | set a file to a specified length |
| tsearch, tfind, tdelete, twalk(3C) | ..... | manage binary search trees |
| ttyname, isatty(3C) | ..... | find name of a terminal |
| ttyslot(3C) | ..... | find the slot in the utmp file of the current user |
| types(5) | ..... | primitive system data types |
| uadmin(2) | ..... | administrative control |
| ualarm(3) | ..... | schedule signal after interval in microseconds |
| ucontext(5) | ..... | user context |
| ulimit(2) | ..... | get and set user limits |
| umask(2) | ..... | set and get file creation mask |
| umount(2) | ..... | unmount a file system |
| uname(2) | ..... | get name of current UNIX system |
| ungetc(3S) | ..... | push character back onto input stream |
| ungetwc(3W) | ..... | push wchar_t character back into input stream |
| unlink(2) | ..... | remove directory entry |
| unlockpt(3C) | ..... | unlock a pseudo-terminal master/slave pair |
| usleep(3) | ..... | suspend execution for interval in microseconds |
| ustat(2) | ..... | get file system statistics |
| utime(2) | ..... | set file access and modification times |
| utimes(3) | ..... | set file times |
| values(5) | ..... | machine-dependent values |
| varargs(5) | ..... | handle variable argument list |
| vfork(2) | ..... | spawn new process in a virtual memory efficient way |
| vlfmt(3C) | ..... | display error message in standard format and pass to logging and monitoring services |
| vpfmt(3C) | ..... | display error message in standard format and pass to logging and monitoring services |
| vprintf, vprintf, vsprintf(3S) | ..... | print formatted output of a variable argument list |
| vprintf, vprintf, vsprintf(3W) | ..... | print formatted output of a variable argument list |
| wait(2) | ..... | wait for child process to stop or terminate |
| wait, wait3, WIFSTOPPED, WIFSIGNALED, WIFEXITED(3) | ..... | wait for process to terminate or stop |
| waitid(2) | ..... | wait for child process to change state |
| waitpid(2) | ..... | wait for child process to change state |
| waitsem, nbwaitsem(2) | ..... | await and check access to a resource governed by a semaphore |

wconv: towupper, tolower(3W) translate characters

wctype: iswalph, iswupper, iswlower, iswdigit, iswxdigit, iswalnum, iswspace,
iswpunct, iswprint, iswgraph, iswcntrl, iswascii, isphonogram, isideogram,
isenglish, isnumber, isspecial (3W)
..... classify ASCII and supplementary code set characters

widec(3W) multibyte character I/O routines

write, writev(2) write on a file

wstat(5) wait status

wstring: wscat, wscncat, wscmp, wscncmp, wscpy, wscncpy, wslen, wschr, wschr,
wspbrk, wsspn, wscspn, wstok, wstokr, strtows(3W)
..... wchar_t string operations and type transformation

xdr(3N) library routines for external data representation

xdr_admin: xdr_getpos, xdr_inline, xdrrec_eof, xdr_setpos(3N)
..... library routines for external data representation

xdr_complex: xdr_array, xdr_bytes, xdr_opaque, xdr_pointer, xdr_reference,
xdr_string, xdr_union, xdr_vector, xdr_wrapstring(3N)
..... library routines for external data representation

xdr_create: xdr_destroy, xdrmem_create, xdrrec_create, xdrstdio_create(3N)
..... library routines for external data representation stream creation

xdr_simple: xdr_bool, xdr_char, xdr_double, xdr_enum, xdr_float, xdr_free, xdr_int,
xdr_long, xdr_short, xdr_u_char, xdr_u_long, xdr_u_short, xdr_void(3N)
..... library routines for external data representation

ypclnt, yp_get_default_domain, yp_bind, yp_unbind, yp_match, yp_first, yp_next,
yp_all, yp_order, yp_master, yperr_string, ypprot_err(3N) NIS client interface

yp_update(3N) change NIS information

Table of Contents

Introduction

Reference Manuals

Description Manual pages provide technical reference information about the interfaces and execution behavior of each UNIX SYSTEM V Release 4 component.

Organization The *type* of component being described is indicated by the numerical section suffix. Within each section there may be subsections indicated by a single letter. Related sections are organized into reference manuals and alphabetized by name. The following table shows the contents of the reference manuals and their section suffixes.

| Title and Contents | Sections |
|--|----------|
| <i>Commands Reference Manual Volumes 1 and 2</i> | |
| General-purpose user commands | 1 |
| Basic networking commands | 1C |
| Form and Menu Language Interpreter (FMLI) | 1F |
| System maintenance commands | 1M |
| Enhanced networking commands | 1N |
| Miscellaneous reference information related to commands. | 5 |
| <i>System Calls and Library Functions Reference Manual</i> | |
| System calls | 2 |
| BSD system compatibility library | 3 |
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| Executable and linking format library | 3E |

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Reference Manuals, Continued

| Contents | Sections |
|---|-----------------|
| <i>System Calls and Library Functions Reference Manual (continued)</i> | |
| General-purpose library | 3G |
| Math library | 3M |
| Networking library | 3N |
| Standard I/O library | 3S |
| Specialized library | 3X |
| Miscellaneous reference information related to programming. | 5 |
| <i>System Files and Devices Reference Manual</i> | |
| System file formats | 4 |
| Special files (devices) | 7 |
| <i>Device Driver Interface/Driver - Kernel Interface Reference Manual</i> | |
| Driver Data Definitions | D1 |
| Driver Entry Point Routines | D2 |
| Kernel Utility Routines | D3 |
| Kernel Data Structures | D4 |
| Kernel Defines | D5 |
| <i>Master Permuted Index</i> | |
| Permuted index of all manual pages | All |

Retitled Reference Manuals

Background Four reference manuals for this release have been restructured and/or retitled to more accurately describe their contents. The following table shows these changes.

| Previous Titles | Current Titles | Current Sections |
|--|--|--|
| <i>User's Reference Manual/ System Administrator's Reference Manual (Commands a - l) (Commands m - z)</i> | <i>Commands Reference Manual (Volume 1, a - l) (Volume 2, m - z)</i> | 1, 1C, 1F, 1M, 1N, 5 |
| <i>Programmer's Reference Manual: Operating System API Part 1: Programming Commands and System Calls Part 2: Functions</i> | <i>System Calls and Library Functions Reference Manual</i> | 2, 3, 3C, 3E, 3G, 3M, 3N, 3S, 3X, 5 |
| <i>System Files and Devices Reference Manual</i> | <i>System Files and Devices Reference Manual (section 5 removed)</i> | 4, 7 |
| <i>Permuted Index</i> | <i>Master Permuted Index</i> | All |

Manual Page Format

Main headings used

All UNIX manual pages have a common format. The following main headings are used:

| Heading | Section Contents |
|--------------------|--|
| NAME | Name of the component and brief statement of its purpose |
| SYNOPSIS | Syntax of the component |
| DESCRIPTION | General discussion of functionality |
| EXAMPLE | Example(s) of usage |
| FILES | File names built into the component |
| SEE ALSO | Cross-references to related components |

Note: Not all manual pages use all headings.

Typographical Conventions

Style and conventions used

The following typographical and formatting conventions are used.

| Convention | Indicates ... |
|---|---|
| Constant width | a literal that should be entered just as it appears |
| <i>Italic</i> | a substitutable argument |
| Square brackets around an argument [] | an optional argument |
| <i>name or file</i> | a file name |
| Ellipses ... | previous argument may be repeated |
| Argument beginning with - minus + plus = equal | a flag argument |

Permuted Index

Definition

A permuted index is an alphabetical listing of all the keywords in the **NAME** line of a manual page.

Certain common words are not considered keywords and are not recognized. In the example below, the common words *of*, *to*, and *the* are not recognized.

Example

The **NAME** line of the `adjtime(2)` manual page appears below.

| | |
|--|-------------------|
| adjtime(2) | adjtime(2) |
| NAME | |
| adjtime- correct the time to allow synchronization of the system clock | |

The `adjtime(2)` entries from the permuted index are shown below. These entries appear in the a, c, and s sections of the permuted index respectively.

| Remainder of NAME line | Keyword and NAME line | Manual Page |
|--|--|-------------|
| synchronization of the system/ clock | adjtime correct the time to allow. | adjtime(2) |
| adjtime correct the time to allow synchronization of the system | allow synchronization of the system . . . | adjtime(2) |
| synchronization of the/ | clock adjtime correct the time to . . . | adjtime(2) |
| adjtime correct the time to allow | correct the time to allow | adjtime(2) |
| to allow synchronization of the | synchronization of the system clock . . . | adjtime(2) |
| | system clock / correct the time | adjtime(2) |

Continued on next page

Permuted Index, Continued

How a permuted index is constructed

The center column lists each keyword followed by all or a portion of the **NAME** line, as space permits. The left column lists the remainder of the **NAME** line. The right column indicates the manual page being referenced.

Omitted words are indicated with a slash (/).

Identification of entries

Manual page entries are identified with their section suffixes shown in parentheses.

Example: man(1) and man(5)

Section suffixes eliminate confusion caused by duplication of names among the sections.

Master Permuted Index

Each reference manual has a permuted index for the manual pages contained in that book.

The *Master Permuted Index* covers all the manual pages of this documentation library.

Request for Comment

Description A Request for Comment (RFC) is a document that describes some aspect of networking technology. The RFCs cited in the **SEE ALSO** section of these manual pages are available in hard copy for a small fee from:

Network Information System Center
SRI International
333 Ravenswood Avenue
Menlo Park, CA 94025
415-859-6387 fax: 415-859-6028
email:nisc@nisc.sri.com

Online versions of RFCs

Online versions of the RFCs are available by ftp from nic.ddn.mil. To retrieve an on-line RFC, do the following:

| Step | Action |
|------|--|
| 1 | Connect to the RFC host by entering: ftp nic.ddn.mil user name: anonymous password: guest |
| 2 | Retrieve the RFC by entering: get rfc/rfcnum where <i>num</i> is the number of the RFC <u>Example:</u> get rfc:rfc1171.txt |
| 3 | End the ftp session by entering: quit |

NAME

intro - introduction to system calls and error numbers

SYNOPSIS

```
#include <errno.h>
```

DESCRIPTION

This section describes all of the system calls. Most of these calls have one or more error returns. An error condition is indicated by an otherwise impossible returned value. This is almost always -1 or the `NULL` pointer; the individual descriptions specify the details. An error number is also made available in the external variable `errno`. `errno` is not cleared on successful calls, so it should be tested only after an error has been indicated.

Each system call description attempts to list all possible error numbers. The following is a complete list of the error numbers and their names as defined in `<errno.h>`.

- 1 `EPERM` Not super-user
Typically this error indicates an attempt to modify a file in some way forbidden except to its owner or the super-user. It is also returned for attempts by ordinary users to do things allowed only to the super-user.
- 2 `ENOENT` No such file or directory
A file-name is specified and the file should exist but doesn't, or one of the directories in a path-name does not exist.
- 3 `ESRCH` No such process
No process can be found corresponding to that specified by PID in the `kill` or `ptrace` routine.
- 4 `EINTR` Interrupted system call
An asynchronous signal (such as interrupt or quit), which the user has elected to catch, occurred during a system service routine. If execution is resumed after processing the signal, it will appear as if the interrupted routine call returned this error condition.
- 5 `EIO` I/O error
Some physical I/O error has occurred. This error may in some cases occur on a call following the one to which it actually applies.
- 6 `ENXIO` No such device or address
I/O on a special file refers to a subdevice which does not exist, or exists beyond the limit of the device. It may also occur when, for example, a tape drive is not on-line or no disk pack is loaded on a drive.
- 7 `E2BIG` Arg list too long
An argument list longer than `ARG_MAX` bytes is presented to a member of the `exec` family of routines. The argument list limit is the sum of the size of the argument list plus the size of the environment's exported shell variables.
- 8 `ENOEXEC` Exec format error
A request is made to execute a file which, although it has the appropriate permissions, does not start with a valid format.

- 9 **EBADF** Bad file number
Either a file descriptor refers to no open file, or a `read` [respectively, `write`] request is made to a file that is open only for writing (respectively, reading).
- 10 **ECHILD** No child processes
A `wait` routine was executed by a process that had no existing or unwaited-for child processes.
- 11 **EAGAIN** No more processes
For example, the `fork` routine failed because the system's process table is full or the user is not allowed to create any more processes, or a system call failed because of insufficient memory or swap space.
- 12 **ENOMEM** Not enough space
During execution of an `exec`, `brk`, or `sbrk` routine, a program asks for more space than the system is able to supply. This is not a temporary condition; the maximum size is a system parameter. The error may also occur if the arrangement of text, data, and stack segments requires too many segmentation registers, or if there is not enough swap space during the `fork` routine. If this error occurs on a resource associated with Remote File Sharing (RFS), it indicates a memory depletion which may be temporary, dependent on system activity at the time the call was invoked.
- 13 **EACCES** Permission denied
An attempt was made to access a file in a way forbidden by the protection system.
- 14 **EFAULT** Bad address
The system encountered a hardware fault in attempting to use an argument of a routine. For example, `errno` potentially may be set to **EFAULT** any time a routine that takes a pointer argument is passed an invalid address, if the system can detect the condition. Because systems will differ in their ability to reliably detect a bad address, on some implementations passing a bad address to a routine will result in undefined behavior.
- 15 **ENOTBLK** Block device required
A non-block file was mentioned where a block device was required (for example, in a call to the `mount` routine).
- 16 **EBUSY** Device busy
An attempt was made to mount a device that was already mounted or an attempt was made to unmount a device on which there is an active file (open file, current directory, mounted-on file, active text segment). It will also occur if an attempt is made to enable accounting when it is already enabled. The device or resource is currently unavailable.
- 17 **EEXIST** File exists
An existing file was mentioned in an inappropriate context (for example, call to the `link` routine).
- 18 **EXDEV** Cross-device link
A link to a file on another device was attempted.

- 19 `ENODEV` No such device
An attempt was made to apply an inappropriate operation to a device (for example, read a write-only device).
- 20 `ENOTDIR` Not a directory
A non-directory was specified where a directory is required (for example, in a path prefix or as an argument to the `chdir` routine).
- 21 `EISDIR` Is a directory
An attempt was made to write on a directory.
- 22 `EINVAL` Invalid argument
An invalid argument was specified (for example, unmounting a non-mounted device), mentioning an undefined signal in a call to the `signal` or `kill` routine.
- 23 `ENFILE` File table overflow
The system file table is full (that is, `SYS_OPEN` files are open, and temporarily no more files can be opened).
- 24 `EMFILE` Too many open files
No process may have more than `OPEN_MAX` file descriptors open at a time.
- 25 `ENOTTY` Not a typewriter
A call was made to the `ioctl` routine specifying a file that is not a special character device.
- 26 `ETXTBSY` Text file busy
An attempt was made to execute a pure-procedure program that is currently open for writing. Also an attempt to open for writing or to remove a pure-procedure program that is being executed.
- 27 `EFBIG` File too large
The size of a file exceeded the maximum file size, `FCHR_MAX` [see `getrlimit`].
- 28 `ENOSPC` No space left on device
While writing an ordinary file or creating a directory entry, there is no free space left on the device. In the `fcntl` routine, the setting or removing of record locks on a file cannot be accomplished because there are no more record entries left on the system.
- 29 `ESPIPE` Illegal seek
A call to the `lseek` routine was issued to a pipe.
- 30 `EROFS` Read-only file system
An attempt to modify a file or directory was made on a device mounted read-only.
- 31 `EMLINK` Too many links
An attempt to make more than the maximum number of links, `LINK_MAX`, to a file.
- 32 `EPIPE` Broken pipe
A write on a pipe for which there is no process to read the data. This condition normally generates a signal; the error is returned if the signal is ignored.

- 33 **EDOM** Math argument out of domain of func
The argument of a function in the math package (3M) is out of the domain of the function.
- 34 **ERANGE** Math result not representable
The value of a function in the math package (3M) is not representable within machine precision.
- 35 **ENOMSG** No message of desired type
An attempt was made to receive a message of a type that does not exist on the specified message queue [see `msgop(2)`].
- 36 **EIDRM** Identifier removed
This error is returned to processes that resume execution due to the removal of an identifier from the file system's name space [see `msgctl(2)`, `semctl(2)`, and `shmctl(2)`].
- 37 **ECHRNG** Channel number out of range
- 38 **EL2NSYNC** Level 2 not synchronized
- 39 **EL3HLT** Level 3 halted
- 40 **EL3RST** Level 3 reset
- 41 **ELNRNG** Link number out of range
- 42 **EUNATCH** Protocol driver not attached
- 43 **ENOCSI** No CSI structure available
- 44 **EL2HLT** Level 2 halted
- 45 **EDEADLK** Deadlock condition
A deadlock situation was detected and avoided. This error pertains to file and record locking.
- 46 **ENOLCK** No record locks available
There are no more locks available. The system lock table is full [see `fcntl(2)`].
- 47-49 Reserved
- 58-59 Reserved
- 60 **ENOSTR** Device not a stream
A `putmsg` or `getmsg` system call was attempted on a file descriptor that is not a STREAMS device.
- 61 **ENODATA** No data available
- 62 **ETIME** Timer expired
The timer set for a STREAMS `ioctl` call has expired. The cause of this error is device specific and could indicate either a hardware or software failure, or perhaps a timeout value that is too short for the specific operation. The status of the `ioctl` operation is indeterminate.
- 63 **ENOSR** Out of stream resources
During a STREAMS `open`, either no STREAMS queues or no STREAMS head data structures were available. This is a temporary condition; one may recover from it if other processes release resources.

- 64 `ENONET` Machine is not on the network
This error is Remote File Sharing (RFS) specific. It occurs when users try to advertise, unadvertise, mount, or unmount remote resources while the machine has not done the proper startup to connect to the network.
- 65 `ENOPKG` Package not installed
This error occurs when users attempt to use a system call from a package which has not been installed.
- 66 `EREMOTE` Object is remote
This error is RFS specific. It occurs when users try to advertise a resource which is not on the local machine, or try to mount/unmount a device (or path-name) that is on a remote machine.
- 67 `ENOLINK` Link has been severed
This error is RFS specific. It occurs when the link (virtual circuit) connecting to a remote machine is gone.
- 68 `EADV` Advertise error
This error is RFS specific. It occurs when users try to advertise a resource which has been advertised already, or try to stop RFS while there are resources still advertised, or try to force unmount a resource when it is still advertised.
- 69 `ESRMNT` Srmount error
This error is RFS specific. It occurs when an attempt is made to stop RFS while resources are still mounted by remote machines, or when a resource is readadvertised with a client list that does not include a remote machine that currently has the resource mounted.
- 70 `ECOMM` Communication error on send
This error is RFS specific. It occurs when the current process is waiting for a message from a remote machine, and the virtual circuit fails.
- 71 `EPROTO` Protocol error
Some protocol error occurred. This error is device specific, but is generally not related to a hardware failure.
- 74 `EMULTIHOP` Multihop attempted
This error is RFS specific. It occurs when users try to access remote resources which are not directly accessible.
- 76 `EDOTDOT` Error 76
This error is RFS specific. A way for the server to tell the client that a process has transferred back from mount point.
- 77 `EBADMSG` Not a data message
During a read, `getmsg`, or `ioctl I_RECVFD` system call to a STREAMS device, something has come to the head of the queue that can't be processed. That something depends on the system call:
- `read`: control information or a passed file descriptor.
 - `getmsg`: passed file descriptor.
 - `ioctl`: control or data information.

- 78 ENAMETOOLONG File name too long
The length of the path argument exceeds PATH_MAX, or the length of a path component exceeds NAME_MAX while _POSIX_NO_TRUNC is in effect; see limits(4).
- 79 EOVERFLOW Value too large for defined data type.
- 80 ENOTUNIQ Name not unique on network
Given log name not unique.
- 81 EBADF File descriptor in bad state
Either a file descriptor refers to no open file or a read request was made to a file that is open only for writing.
- 82 EREMCHG Remote address changed
- 83 ELIBACC Cannot access a needed shared library
Trying to exec an a.out that requires a static shared library and the static shared library doesn't exist or the user doesn't have permission to use it.
- 84 ELIBBAD Accessing a corrupted shared library
Trying to exec an a.out that requires a static shared library (to be linked in) and exec could not load the static shared library. The static shared library is probably corrupted.
- 85 ELIBSCN .lib section in a.out corrupted
Trying to exec an a.out that requires a static shared library (to be linked in) and there was erroneous data in the .lib section of the a.out. The .lib section tells exec what static shared libraries are needed. The a.out is probably corrupted.
- 86 ELIBMAX Attempting to link in more shared libraries than system limit
Trying to exec an a.out that requires more static shared libraries than is allowed on the current configuration of the system.
- 87 ELIBEXEC Cannot exec a shared library directly
Attempting to exec a shared library directly.
- 88 EILSEQ Error 88
Illegal byte sequence. Handle multiple characters as a single character.
- 89 ENOSYS Operation not applicable
- 90 ELOOP Number of symbolic links encountered during path-name traversal exceeds MAXSYMLINKS
- 91 ESTART Error 91
Interrupted system call should be restarted.
- 92 ESTRPIPE Error 92
Streams pipe error (not externally visible).
- 158 ENOTEMPTY Directory not empty
- 160 EUSERS Too many users
Too many users.

- 130 ENOTSOCK Socket operation on non-socket
Self-explanatory.
- 131 EDESTADDRREQ Destination address required
A required address was omitted from an operation on a transport endpoint.
Destination address required.
- 132 EMSGSIZE Message too long
A message sent on a transport provider was larger than the internal message buffer or some other network limit.
- 133 EPROTOTYPE Protocol wrong type for socket
A protocol was specified that does not support the semantics of the socket type requested.
- 134 ENOPROTOOPT Protocol not available
A bad option or level was specified when getting or setting options for a protocol.
- 135 EPROTONOSUPPORT Protocol not supported
The protocol has not been configured into the system or no implementation for it exists.
- 136 ESOCKTNOSUPPORT Socket type not supported
The support for the socket type has not been configured into the system or no implementation for it exists.
- 137 EOPNOTSUPP Operation not supported on transport endpoint
For example, trying to accept a connection on a datagram transport endpoint.
- 138 EPFNOSUPPORT Protocol family not supported
The protocol family has not been configured into the system or no implementation for it exists. Used for the Internet protocols.
- 139 EAFNOSUPPORT Address family not supported by protocol family
An address incompatible with the requested protocol was used.
- 140 EADDRINUSE Address already in use
User attempted to use an address already in use, and the protocol does not allow this.
- 141 EADDRNOTAVAIL Cannot assign requested address
Results from an attempt to create a transport endpoint with an address not on the current machine.
- 142 ENETDOWN Network is down
Operation encountered a dead network.
- 143 ENETUNREACH Network is unreachable
Operation was attempted to an unreachable network.
- 144 ENETRESET Network dropped connection because of reset
The host you were connected to crashed and rebooted.

- 145 `ECONNABORTED` Software caused connection abort
A connection abort was caused internal to your host machine.
- 146 `ECONNRESET` Connection reset by peer
A connection was forcibly closed by a peer. This normally results from a loss of the connection on the remote host due to a timeout or a reboot.
- 147 `ENOBUFS` No buffer space available
An operation on a transport endpoint or pipe was not performed because the system lacked sufficient buffer space or because a queue was full.
- 148 `EISCONN` Transport endpoint is already connected
A connect request was made on an already connected transport endpoint; or, a `sendto` or `sendmsg` request on a connected transport endpoint specified a destination when already connected.
- 149 `ENOTCONN` Transport endpoint is not connected
A request to send or receive data was disallowed because the transport endpoint is not connected and (when sending a datagram) no address was supplied.
- 150 `ESHUTDOWN` Cannot send after transport endpoint shutdown
A request to send data was disallowed because the transport endpoint has already been shut down.
- 151 `ETOOMANYREFS` Too many references: cannot splice
- 152 `ETIMEDOUT` Connection timed out
A connect or send request failed because the connected party did not properly respond after a period of time. (The timeout period is dependent on the communication protocol.)
- 153 `ECONNREFUSED` Connection refused
No connection could be made because the target machine actively refused it. This usually results from trying to connect to a service that is inactive on the remote host.
- 156 `EHOSTDOWN` Host is down
A transport provider operation failed because the destination host was down.
- 157 `EHOSTUNREACH` No route to host
A transport provider operation was attempted to an unreachable host.
- 129 `EALREADY` Operation already in progress
An operation was attempted on a non-blocking object that already had an operation in progress.
- 128 `EINPROGRESS` Operation now in progress
An operation that takes a long time to complete (such as a `connect`) was attempted on a non-blocking object.
- 162 `ESTALE` Stale NFS file handle

DEFINITIONS**Background Process Group**

Any process group that is not the foreground process group of a session that has established a connection with a controlling terminal.

Controlling Process

A session leader that established a connection to a controlling terminal.

Controlling Terminal

A terminal that is associated with a session. Each session may have, at most, one controlling terminal associated with it and a controlling terminal may be associated with only one session. Certain input sequences from the controlling terminal cause signals to be sent to process groups in the session associated with the controlling terminal; see `termio(7)`.

Directory

Directories organize files into a hierarchical system where directories are the nodes in the hierarchy. A directory is a file that catalogues the list of files, including directories (sub-directories), that are directly beneath it in the hierarchy. Entries in a directory file are called links. A link associates a file identifier with a file-name. By convention, a directory contains at least two links, `.` (dot) and `..` (dot-dot). The link called dot refers to the directory itself while dot-dot refers to its parent directory. The root directory, which is the top-most node of the hierarchy, has itself as its parent directory. The path-name of the root directory is `/` and the parent directory of the root directory is `/.`

Downstream

In a stream, the direction from stream head to driver.

Driver

In a stream, the driver provides the interface between peripheral hardware and the stream. A driver can also be a pseudo-driver, such as a multiplexor or log driver [see `log(7)`], which is not associated with a hardware device.

Effective User ID and Effective Group ID

An active process has an effective user ID and an effective group ID that are used to determine file access permissions (see below). The effective user ID and effective group ID are equal to the process's real user ID and real group ID respectively, unless the process or one of its ancestors evolved from a file that had the set-user-ID bit or set-group ID bit set [see `exec(2)`].

File Access Permissions

Read, write, and execute/search permissions on a file are granted to a process if one or more of the following are true:

The effective user ID of the process is super-user.

The effective user ID of the process matches the user ID of the owner of the file and the appropriate access bit of the "owner" portion (0700) of the file mode is set.

The effective user ID of the process does not match the user ID of the owner of the file, but either the effective group ID or one of the supplementary group IDs of the process match the group ID of the file and the appropriate access bit of the "group" portion (0070) of the file mode is set.

The effective user ID of the process does not match the user ID of the owner of the file, and neither the effective group ID nor any of the supplementary group IDs of the process match the group ID of the file, but the appropriate access bit of the "other" portion (0007) of the file mode is set.

Otherwise, the corresponding permissions are denied.

File Descriptor

A file descriptor is a small integer used to do I/O on a file. The value of a file descriptor is from 0 to (NOFILES-1). A process may have no more than NOFILES file descriptors open simultaneously. A file descriptor is returned by system calls such as `open`, or `pipe`. The file descriptor is used as an argument by calls such as `read`, `write`, `ioctl`, and `close`.

File-Name

Names consisting of 1 to NAME_MAX characters may be used to name an ordinary file, special file or directory.

These characters may be selected from the set of all character values excluding `\0` (null) and the ASCII code for `/` (slash).

Note that it is generally unwise to use `*`, `?`, `[`, or `]` as part of file-names because of the special meaning attached to these characters by the shell [see `sh(1)`]. Although permitted, the use of unprintable characters in file-names should be avoided.

A file-name is sometimes referred to as a path-name component. The interpretation of a path-name component is dependent on the values of NAME_MAX and _POSIX_NO_TRUNC associated with the path prefix of that component. If any path-name component is longer than NAME_MAX and _POSIX_NO_TRUNC is in effect for the path prefix of that component [see `fpathconf(2)` and `limits(4)`], it shall be considered an error condition in that implementation. Otherwise, the implementation shall use the first NAME_MAX bytes of the path-name component.

Foreground Process Group

Each session that has established a connection with a controlling terminal will distinguish one process group of the session as the foreground process group of the controlling terminal. This group has certain privileges when accessing its controlling terminal that are denied to background process groups.

Message

In a stream, one or more blocks of data or information, with associated STREAMS control structures. Messages can be of several defined types, which identify the message contents. Messages are the only means of transferring data and communicating within a stream.

Message Queue

In a stream, a linked list of messages awaiting processing by a module or driver.

Message Queue Identifier

A message queue identifier (`msqid`) is a unique positive integer created by a `msgget` system call. Each `msqid` has a message queue and a data structure associated with it. The data structure is referred to as `msqid_ds` and contains the following members:

```

struct ipc_perm msg_perm;
struct msg *msg_first;
struct msg *msg_last;
ulong      msg_cbytes;
ulong      msg_qnum;
ulong      msg_qbytes;
pid_t      msg_lspid;
pid_t      msg_lrpid;
time_t     msg_stime;
long       msg_susec;
time_t     msg_rtime;
long       msg_rusec;
time_t     msg_ctime;
long       msg_cusec;

```

Here are descriptions of the fields of the `msgid_ds` structure:

`msg_perm` is an `ipc_perm` structure that specifies the message operation permission (see below). This structure includes the following members:

```

uid_t      cuid; /* creator user id */
gid_t      cgid; /* creator group id */
uid_t      uid; /* user id */
gid_t      gid; /* group id */
mode_t     mode; /* r/w permission */
ushort     seq; /* slot usage sequence # */
key_t      key; /* key */

```

`*msg_first` is a pointer to the first message on the queue.

`*msg_last` is a pointer to the last message on the queue.

`msg_cbytes` is the current number of bytes on the queue.

`msg_qnum` is the number of messages currently on the queue.

`msg_qbytes` is the maximum number of bytes allowed on the queue.

`msg_lspid` is the process ID of the last process that performed a `msgsnd` operation.

`msg_lrpid` is the process id of the last process that performed a `msgrcv` operation.

`msg_stime` and `msg_susec` are the seconds and microseconds respectively, of the time of the last `msgsnd` operation.

`msg_rtime` and `msg_rusec` are the seconds and microseconds respectively, of the time of the last `msgrcv` operation.

`msg_ctime` and `msg_cusec` are the seconds and microseconds respectively, of the time of the last `msgctl` operation that changed a member of the above structure.

Message Operation Permissions

In the `msgop` and `msgctl` system call descriptions, the permission required for an operation is given as `{token}`, where `token` is the type of permission needed, interpreted as follows:

```

00400  READ by user
00200  WRITE by user
00040  READ by group
00020  WRITE by group
00004  READ by others
00002  WRITE by others

```

Read and write permissions on a `msgid` are granted to a process if one or more of the following are true:

The effective user ID of the process is super-user.

The effective user ID of the process matches `msg_perm.cuid` or `msg_perm.uid` in the data structure associated with `msgid` and the appropriate bit of the "user" portion (0600) of `msg_perm.mode` is set.

The effective group ID of the process matches `msg_perm.cgid` or `msg_perm.gid` and the appropriate bit of the "group" portion (060) of `msg_perm.mode` is set.

The appropriate bit of the "other" portion (006) of `msg_perm.mode` is set.

Otherwise, the corresponding permissions are denied.

Module

A module is an entity containing processing routines for input and output data. It always exists in the middle of a stream, between the stream's head and a driver. A module is the STREAMS counterpart to the commands in a shell pipeline except that a module contains a pair of functions which allow independent bidirectional (downstream and upstream) data flow and processing.

Multiplexor

A multiplexor is a driver that allows streams associated with several user processes to be connected to a single driver, or several drivers to be connected to a single user process. STREAMS does not provide a general multiplexing driver, but does provide the facilities for constructing them and for connecting multiplexed configurations of streams.

Orphaned Process Group

A process group in which the parent of every member in the group is either itself a member of the group, or is not a member of the process group's session.

Path-Name

A path-name is a null-terminated character string starting with an optional slash (/), followed by zero or more directory names separated by slashes, optionally followed by a file-name.

If a path-name begins with a slash, the path search begins at the root directory. Otherwise, the search begins from the current working directory.

A slash by itself names the root directory.

Unless specifically stated otherwise, the null path-name is treated as if it named a non-existent file.

Process ID

Each process in the system is uniquely identified during its lifetime by a positive integer called a process ID. A process ID may not be reused by the system until the process lifetime, process group lifetime and session lifetime ends for any process ID, process group ID and session ID equal to that process ID.

Parent Process ID

A new process is created by a currently active process [see `fork(2)`]. The parent process ID of a process is the process ID of its creator.

Privilege

Having appropriate privilege means having the capability to override system restrictions.

Process Group

Each process in the system is a member of a process group that is identified by a process group ID. Any process that is not a process group leader may create a new process group and become its leader. Any process that is not a process group leader may join an existing process group that shares the same session as the process. A newly created process joins the process group of its parent.

Process Group Leader

A process group leader is a process whose process ID is the same as its process group ID.

Process Group ID

Each active process is a member of a process group and is identified by a positive integer called the process group ID. This ID is the process ID of the group leader. This grouping permits the signaling of related processes [see `kill(2)`].

Process Lifetime

A process lifetime begins when the process is forked and ends after it exits, when its termination has been acknowledged by its parent process. See `wait(2)`.

Process Group Lifetime

A process group lifetime begins when the process group is created by its process group leader, and ends when the lifetime of the last process in the group ends or when the last process in the group leaves the group.

Read Queue

In a stream, the message queue in a module or driver containing messages moving upstream.

Real User ID and Real Group ID

Each user allowed on the system is identified by a positive integer (0 to `MAXUID`) called a real user ID.

Each user is also a member of a group. The group is identified by a positive integer called the real group ID.

An active process has a real user ID and real group ID that are set to the real user ID and real group ID, respectively, of the user responsible for the creation of the process.

Root Directory and Current Working Directory

Each process has associated with it a concept of a root directory and a current working directory for the purpose of resolving path-name searches. The root directory of a process need not be the root directory of the root file system.

Saved User ID and Saved Group ID

The saved user ID and saved group ID are the values of the effective user ID and effective group ID prior to an exec of a file whose set user or set group file mode bit has been set [see exec(2)].

Semaphore Identifier

A semaphore identifier (`semid`) is a unique positive integer created by a `semget` system call. Each `semid` has a set of semaphores and a data structure associated with it. The data structure is referred to as `semid_ds` and contains the following members:

```
struct ipc_perm sem_perm; /* operation permission struct */
struct sem      *sem_base; /* ptr to first semaphore in set */
char           sem_pad[2];
ushort        sem_nsems; /* # of sems in set */
time_t        sem_otime; /* last semop time */
long          sem_ousec; /* in secs and microseconds. */
time_t        sem_ctime; /* last change time */
long          sem_cusec  /* in secs and microseconds. */
```

Here are descriptions of the fields of the `semid_ds` structure:

`sem_perm` is an `ipc_perm` structure that specifies the semaphore operation permission (see below). This structure includes the following members:

```
uid_t  uid; /* user id */
gid_t  gid; /* group id */
uid_t  cuid; /* creator user id */
gid_t  cgid; /* creator group id */
mode_t mode; /* r/a permission */
ushort seq; /* slot usage sequence number */
key_t  key; /* key */
```

`sem_nsems` is equal to the number of semaphores in the set. Each semaphore in the set is referenced by a nonnegative integer referred to as a `sem_num`. `sem_num` values run sequentially from 0 to the value of `sem_nsems` minus 1.

`sem_otime` and `sem_ousec` are the seconds and microseconds respectively, of the time of the last `semop` operation.

`sem_ctime` and `sem_cusec` are the seconds and microseconds respectively, of the time of the last `semctl` operation that changed a member of the above structure.

A semaphore is a data structure called `sem` that contains the following members:

```

ushort semval; /* semaphore value */
pid_t  sempid; /* pid of last operation */
ushort semncnt; /* # awaiting semval > cval */
ushort semzcnt; /* # awaiting semval = 0 */

```

`semval` is a non-negative integer that is the actual value of the semaphore.

`sempid` is equal to the process ID of the last process that performed a semaphore operation on this semaphore.

`semncnt` is a count of the number of processes that are currently suspended awaiting this semaphore's `semval` to become greater than its current value.

`semzcnt` is a count of the number of processes that are currently suspended awaiting this semaphore's `semval` to become 0.

Semaphore Operation Permissions

In the `semop` and `semctl` system call descriptions, the permission required for an operation is given as `{token}`, where `token` is the type of permission needed interpreted as follows:

```

00400  READ by user
00200  ALTER by user
00040  READ by group
00020  ALTER by group
00004  READ by others
00002  ALTER by others

```

Read and alter permissions on a `semid` are granted to a process if one or more of the following are true:

The effective user ID of the process is super-user.

The effective user ID of the process matches `sem_perm.cuid` or `sem_perm.uid` in the data structure associated with `semid` and the appropriate bit of the "user" portion (0600) of `sem_perm.mode` is set.

The effective group ID of the process matches `sem_perm.cgid` or `sem_perm.gid` and the appropriate bit of the "group" portion (060) of `sem_perm.mode` is set.

The appropriate bit of the "other" portion (06) of `sem_perm.mode` is set.

Otherwise, the corresponding permissions are denied.

Session

A session is a group of processes identified by a common ID called a session ID, capable of establishing a connection with a controlling terminal. Any process that is not a process group leader may create a new session and process group, becoming the session leader of the session and process group leader of the process group. A newly created process joins the session of its creator.

Session ID

Each session in the system is uniquely identified during its lifetime by a positive integer called a session ID, the process ID of its session leader.

Session Leader

A session leader is a process whose session ID is the same as its process and process group ID.

Session Lifetime

A session lifetime begins when the session is created by its session leader, and ends when the lifetime of the last process that is a member of the session ends, or when the last process that is a member in the session leaves the session.

Shared Memory Identifier

A shared memory identifier (`shmid`) is a unique positive integer created by a `shmget` system call. Each `shmid` has a segment of memory (referred to as a shared memory segment) and a data structure associated with it. (Note that these shared memory segments must be explicitly removed by the user after the last reference to them is removed.) The data structure is referred to as `shmid_ds` and contains the following members:

```

struct ipc_perm  shm_perm;    /* operation permission struct */
int              shm_segsz;   /* size of segment in bytes */
struct anon_map *shm_amp;    /* segment anon_map pointer*/
pid_t           shm_lpid;    /* pid of last operation */
pid_t           shm_cpid;    /* pid of creator */
ulong           shm_nattch;  /* used only for shminfo */
ulong           shm_cnattch; /* used only for shminfo */
time_t          shm_atime;   /* last shmat time */
long            shm_ausec;   /* in secs and microsecs.*/
time_t          shm_dtime;   /* last shmdt time */
long            shm_cusec;   /* in secs and microsecs. */
time_t          shm_ctime;   /* last change time */
long            shm_cusec    /* in secs and microsecs. */

```

Here are descriptions of the fields of the `shmid_ds` structure:

`shm_perm` is an `ipc_perm` structure that specifies the shared memory operation permission (see below). This structure includes the following members:

```

uid_t   cuid; /* creator user id */
gid_t   cgid; /* creator group id */
uid_t   uid;  /* user id */
gid_t   gid;  /* group id */
mode_t  mode; /* r/w permission */
ushort  seq;  /* slot usage sequence # */
key_t   key;  /* key */

```

`shm_segsz` specifies the size of the shared memory segment in bytes.

`shm_cpid` is the process ID of the process that created the shared memory identifier.

`shm_lpid` is the process ID of the last process that performed a `shmop` operation.

`shm_nattch` is the number of processes that currently have this segment attached.

`shm_otime` and `shm_ausec` are the seconds and microseconds respectively, of the time of the last `shmat` operation [see `shmop(2)`].

`shm_dtime` and `shm_dusec` are the seconds and microseconds respectively, of the time of the last `shmdt` operation [see `shmop(2)`].

`shm_ctime` and `shm_cusec` are the seconds and microseconds respectively, of the time of the last `shmctl` operation that changed members of the above structure.

Shared Memory Operation Permissions

In the `shmop` and `shmctl` system call descriptions, the permission required for an operation is given as `{token}`, where `token` is the type of permission needed interpreted as follows:

```
00400  READ by user
00200  WRITE by user
00040  READ by group
00020  WRITE by group
00004  READ by others
00002  WRITE by others
```

Read and write permissions on a `shmid` are granted to a process if one or more of the following are true:

The effective user ID of the process is super-user.

The effective user ID of the process matches `shm_perm.cuid` or `shm_perm.uid` in the data structure associated with `shmid` and the appropriate bit of the “user” portion (0600) of `shm_perm.mode` is set.

The effective group ID of the process matches `shm_perm.cgid` or `shm_perm.gid` and the appropriate bit of the “group” portion (060) of `shm_perm.mode` is set.

The appropriate bit of the “other” portion (06) of `shm_perm.mode` is set.

Otherwise, the corresponding permissions are denied.

Special Processes

The process with ID 0 and the process with ID 1 are special processes referred to as `proc0` and `proc1`; see `kill(2)`. `proc0` is the process scheduler. `proc1` is the initialization process (`init`); `proc1` is the ancestor of every other process in the system and is used to control the process structure.

STREAMS

A set of kernel mechanisms that support the development of network services and data communication drivers. It defines interface standards for character input/output within the kernel and between the kernel and user level processes. The STREAMS mechanism is composed of utility routines, kernel facilities and a set of data structures.

Stream

A stream is a full-duplex data path within the kernel between a user process and driver routines. The primary components are a stream head, a driver and zero or more modules between the stream head and driver. A stream is analogous to a shell pipeline except that data flow and processing are bidirectional.

Stream Head

In a stream, the stream head is the end of the stream that provides the interface between the stream and a user process. The principal functions of the stream head are processing STREAMS-related system calls, and passing data and information between a user process and the stream.

Super-user

A process is recognized as a super-user process and is granted special privileges, such as immunity from file permissions, if its effective user ID is 0.

Upstream

In a stream, the direction from driver to stream head.

Write Queue

In a stream, the message queue in a module or driver containing messages moving downstream.

NAME

intro - introduction to functions and libraries

DESCRIPTION

This section describes functions found in various libraries, other than those functions that directly invoke UNIX system primitives, which are described in Section 2 of this volume. Function declarations can be obtained from the `#include` files indicated on each page. Certain major collections are identified by a letter after the section number:

- (3C) These functions, together with those of Section 2 and those marked (3S), constitute the standard C library, `libc`, which is automatically linked by the C compilation system. The standard C library is implemented as a shared object, `libc.so`, and an archive, `libc.a`. C programs are linked with the shared object version of the standard C library by default. Specify `-dn` on the `cc` command line to link with the archive version. See `cc(1)` for other overrides.
- (3E) These functions constitute the ELF access library, `libelf`. This library is not implemented as a shared object, and is not automatically linked by the C compilation system. Specify `-lelf` on the `cc` command line to link with this library.
- (3G) These functions constitute the general-purpose library, `libgen`. This library is not implemented as a shared object, and is not automatically linked by the C compilation system. Specify `-lgen` on the `cc` command line to link with this library.
- (3M) These functions constitute the math library, `libm`. Declarations for these functions may be obtained from the `#include` file `math.h`. [See `math(5)`.]
`libm` is not automatically loaded by the C compilation system; use the `-l` option to `cc` to access the library.
`libm` contains the full set of double-precision routines plus some single-precision routines (designated by the suffix `f`) that give better performance with less precision. Selected routines are hand-optimized for performance. The optimized routines include `sin`, `cos`, `tan`, `atan`, `atan2`, `exp`, `log`, `log10`, `pow`, and `sqrt` and their single-precision equivalents.
This library is not implemented as a shared object, and is not automatically linked by the C compilation system. Specify `-lm` on the `cc` command line to link with this library.
- (3N) These functions are contained in three libraries: the Network Services library, `libnsl`; the Sockets Interface library, `libsocket`; and the Internet Domain Name Server library, `libresolv`.

The following functions constitute the `libnsl` library:

| | |
|------------------|-------------------------------------|
| <code>cr1</code> | cr1 authentication library |
| <code>cs</code> | Connection Server library interface |
| <code>des</code> | Data Encryption Standards library |

| | |
|-----------|--|
| netdir | Network Directory functions. This contains look-up functions and the access point to network directory libraries for various network transports. |
| netselect | Network Selection routines. These functions manipulate the <code>/etc/netconfig</code> file and return entries. |
| nsl | Transport Library Interface (TLI). These functions contain the implementation of X/OPEN's Transport Level Interface. |
| rexec | REXEC library interface |
| rpc | User-level Remote Procedure Call library |
| saf | Service Access Facility library |
| yp | Network Information Service functions |

The `libsocket` library has two components: `inet`, containing the Internet library routines, and `socket`, containing the Socket Interface routines. The `libresolv` library contains the resolver routines.

The standard networking libraries are implemented as a shared object (`libnsl.so` and `libsocket.so`) or archive file (`libresolv.a`). To link with these libraries, specify the `cc` command line with `-lnsl`, `-lsocket`, or `-lresolv`, respectively.

- (3S) These functions constitute the "standard I/O package" [see `stdio(3S)`].
- (3X) Specialized libraries. The files in which these libraries are found are given on the appropriate pages.

DEFINITIONS

A character is any bit pattern able to fit into a byte on the machine. The null character is a character with value 0, conventionally represented in the C language as `\0`. A character array is a sequence of characters. A null-terminated character array (a *string*) is a sequence of characters, the last of which is the null character. The null string is a character array containing only the terminating null character. A `NULL` pointer is the value that is obtained by casting 0 into a pointer. C guarantees that this value will not match that of any legitimate pointer, so many functions that return pointers return `NULL` to indicate an error. The macro `NULL` is defined in `stdio.h`. Types of the form `size_t` are defined in the appropriate header files.

In the Network Services library, `netbuf` is a structure used in various TLI functions to send and receive data and information. `netbuf` is defined in `sys/tiuser.h`, and includes the following members:

```
struct netbuf {
    unsigned int maxlen; /* The physical size of the buffer */
    unsigned int len; /* The number of bytes in the buffer */
    char *buf; /* Points to user input and/or output buffer */
};
```

If `netbuf` is used for output, the function will set the user value of `len` on return. `maxlen` generally has significance only when `buf` is used to receive output from the TLI function. In this case, it specifies the maximum value of `len` that can be set by the function. If `maxlen` is not large enough to hold the returned information, an

TBUFOVFLW error will generally result. However, certain functions may return part of the data and not generate an error.

FILES

INCDIR usually /usr/include
LIBDIR usually /usr/ccs/lib
LIBDIR/libc.so
LIBDIR/libc.a
LIBDIR/libgen.a
LIBDIR/libm.a
LIBDIR/libnsl.so
LIBDIR/libresolv.a
LIBDIR/libsfm.sa
LIBDIR/libsocket.so
 /usr/lib/libc.so.1

SEE ALSO

ar(1), cc(1), ld(1), lint(1), nm(1), intro(2), stdio(3S), math(5),

DIAGNOSTICS

Math Library (libm) Only

For functions that return floating-point values, error handling varies according to compilation mode. Under the `-xt` (default) option to `cc`, these functions return the conventional values 0, \pm HUGE, or NaN when the function is undefined for the given arguments or when the value is not representable. In the `-Xa` and `-Xc` compilation modes, `±HUGE_VAL` is returned instead of \pm HUGE. (`HUGE_VAL` and `HUGE` are defined in `math.h` to be infinity and the largest-magnitude single-precision number, respectively.) In every case, the external variable `errno` [see `intro(2)`] is set to the value `EDOM` or `ERANGE`, although the value may vary for a given error depending on compilation mode.

NOTES

None of the functions, external variables, or macros should be redefined in the user's programs. Any other name may be redefined without affecting the behavior of other library functions, but such redefinition may conflict with a declaration in an included header file.

The header files in *INCDIR* provide function prototypes (function declarations including the types of arguments) for most of the functions listed in this manual. Function prototypes allow the compiler to check for correct usage of these functions in the user's program. The `lint` program checker may also be used and will report discrepancies even if the header files are not included with `#include` statements. Definitions for Sections 2, 3C, and 3S are checked automatically. Other definitions can be included by using the `-l` option to `lint`. (For example, `-lm` includes definitions for `libm`.) Use of `lint` is highly recommended.

Users should carefully note the difference between `STREAMS` and *stream*. `STREAMS` is a set of kernel mechanisms that support the development of network services and data communication drivers. It is composed of utility routines, kernel facilities, and a set of data structures. A *stream* is a file with its associated buffering. It is declared to be a pointer to a type `FILE` defined in `stdio.h`.

In detailed definitions of components, it is sometimes necessary to refer to symbolic names that are implementation-specific, but which are not necessarily expected to

be accessible to an application program. Many of these symbolic names describe boundary conditions and system limits.

In this section, for readability, these implementation-specific values are given symbolic names. These names always appear enclosed in curly brackets to distinguish them from symbolic names of other implementation-specific constants that are accessible to application programs by header files. These names are not necessarily accessible to an application program through a header file, although they may be defined in the documentation for a particular system.

In general, a portable application program should not refer to these symbolic names in its code. For example, an application program would not be expected to test the length of an argument list given to a routine to determine if it was greater than `{ARG_MAX}`.

NAME

intro - introduction to math libraries

SYNOPSIS

```
cc [flag ...] file ... -lm [library ...]
cc -O -Ksd [flag ...] file ... -J sfm [library ...]
#include <math.h>
```

DESCRIPTION

This section describes the functions in the math libraries, `libm` and `libsfm`. Declarations for these functions may be obtained from the `#include` file `math.h`. Several generally useful mathematical constants are also defined there [see `intro(3)` and `math(5)`].

The reference manual pages are divided as follows: *Commands Reference Manual*, Volumes 1: Section 1 and all Section 1 subsections, and Section 5 manual pages related to commands.

System Calls and Library Functions Reference Manual: Sections 2, 3, and all Section 3 subsections, and Section 5 manual pages related to programming.

System Files and Devices Reference Manual: Sections 4 and 7.

The math libraries are not automatically loaded by the C compilation system; use the `-l` or `-J` options to `cc` to access the libraries as follows:

- `-lm` Search the regular math library, `libm`.
- `-J sfm` Do in-line expansion of functions from the fast single-precision assembly source math library, `libsfm`. Specify `-O -Ksd` to optimize for speed.
- `libm` Contains the full set of double-precision routines plus some single-precision routines (designated by the suffix `f`) that give better performance with less precision. Selected routines are hand-optimized for performance. The optimized routines include `sin`, `cos`, `tan`, `atan`, `atan2`, `exp`, `log`, `log10`, `pow`, and `sqrt` and their single-precision equivalents.
- `libsfm` Contains the functions `sinf`, `cosf`, `tanf`, `asinf`, `acosf`, `atanf`, `expf`, `logf`, `log10f`, `powf`, and `sqrtf`. The source library routines are in-line expanded by the optimizer to provide faster execution by reducing the overhead of argument passing, function calling and returning, and return value passing. The source library is designed for applications that desire an increase in speed at the potential cost of size.

`libsfm` should be used only when necessary and with extreme caution. It is a special purpose library that does not do error checking or domain reduction. In other words, these functions never call `matherr`, and arguments aren't reduced to be within a finite range.

Inputs to `sinf` and `cosf` must be in the range

$$-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$$

Inputs to `tanf` must be in the range

$$-\frac{\pi}{2} < x < \frac{\pi}{2}$$

Inputs to `sqrtf`, `logf`, and `log10f` must be greater than 0.

DEFINITIONS

See `intro(3)` for C language definitions.

FILES

LIBDIR usually `/usr/ccs/lib`
LIBDIR/libm.a

SEE ALSO

`cc(1)`, `intro(2)`, `intro(3)`, `math(5)`

DIAGNOSTICS

Error handling varies according to compilation mode. Under the `-xt` (default) option to `cc`, these functions return the conventional values 0, `±HUGE`, or NaN when the function is undefined for the given arguments or when the value is not representable. In the `-xa` and `-xc` compilation modes, `±HUGE_VAL` is returned instead of `±HUGE`. (`HUGE_VAL` and `HUGE` are defined in `math.h` to be infinity and the largest-magnitude single-precision number, respectively.) In every case, the external variable `errno` [see `intro(2)`] is set to the value `EDOM` or `ERANGE`, although the value may vary for a given error depending on compilation mode. See the table under `matherr(3M)` below.

intro (5)

intro (5)

NAME

`intro` - introduction to miscellany

DESCRIPTION

This section describes miscellaneous facilities related to programming.

NAME

intro

Errnos

This section describes all the system calls. Many of these calls have one or more error returns. An error condition is indicated by an otherwise impossible returned value which is almost always -1 or the `NULL` pointer. The individual descriptions specify the details. The following is a complete list of the error names and their descriptions.

| | |
|--------------|---|
| EACCES | Search permission is denied for a component of the path prefix. |
| EDEADLK | A process' attempt to lock a file region would cause a deadlock between processes vying for control of that region. |
| EEXIST | The named file exists. |
| EFAULT | <i>buf</i> or <i>path</i> points to an invalid address. |
| EFAULT | <i>path</i> points outside the allocated address space of the process. |
| EINVAL | An invalid argument was specified mentioning an undefined signal in a call to the <code>signal</code> or <code>kill</code> routine. Also set by the functions described in the <code>math</code> package (3M). |
| EINTR | A signal was caught during the system call. |
| EISNAM | A XENIX name file (semaphore, shared data, and so on) was specified when not expected. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines. |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds <code>{PATH_MAX}</code> , or the length of a <i>path</i> component exceeds <code>{NAME_MAX}</code> while <code>(_POSIX_NO_TRUNC)</code> is in effect. |
| ENAVAIL | An <code>opensem(2)</code> , <code>waitsem(2)</code> or <code>sigsem(2)</code> was issued to a XENIX semaphore that has not been initialized by a call to <code>creatsem(2)</code> . A <code>sigsem</code> was issued to a XENIX semaphore out of sequence; that is, before the process has issued the corresponding <code>waitsem</code> to the semaphore. An <code>nbwaitsem</code> was issued to a semaphore guarding a resource that is currently in use by another process. The semaphore that a process was waiting on has been left in an inconsistent state when the process controlling the semaphore exited without relinquishing control properly; that is, without issuing a <code>waitsem</code> on the semaphore. |
| ENOENT | The named file does not exist or is the null pathname. |

| | |
|------------|---|
| ENOENT | A component of the path prefix does not exist or is a null pathname. |
| ENOLCK | Cannot allocate a record lock for <code>fcntl</code> or locking. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| ENOSPC | No space is available. |
| ENOTDIR | A component of the path prefix is not a directory. |
| ENOTNAM | Not available. A <code>creatsem</code> , <code>opensem(2)</code> , <code>waitsem(2)</code> , or <code>sigsem(2)</code> was issued using an invalid XENIX semaphore identifier. Or, a process attempted a <code>sdget(2)</code> on a file that exists but is not shared data type. |
| E_OVERFLOW | A component is too large to store in the structure pointed to by <i>buf</i> . does not exist or is a null pathname. |
| EPERM | The effective user ID of the process is not super-user. |
| EROFS | The directory in which the file is to be created is located on a read-only file system. |

NAME

a64l, l64a - convert between long integer and base-64 ASCII string

SYNOPSIS

```
#include <stdlib.h>
long a64l (const char *s);
char *l64a (long l);
```

DESCRIPTION

These functions are used to maintain numbers stored in base-64 ASCII characters. These characters define a notation by which long integers can be represented by up to six characters; each character represents a “digit” in a radix-64 notation.

The characters used to represent “digits” are . for 0, / for 1, 0 through 9 for 2-11, A through Z for 12-37, and a through z for 38-63.

a64l takes a pointer to a null-terminated base-64 representation and returns a corresponding long value. If the string pointed to by s contains more than six characters, a64l will use the first six.

a64l scans the character string from left to right with the least significant digit on the left, decoding each character as a 6-bit radix-64 number.

l64a takes a long argument and returns a pointer to the corresponding base-64 representation. If the argument is 0, l64a returns a pointer to a null string.

NOTES

The value returned by l64a is a pointer into a static buffer, the contents of which are overwritten by each call.

NAME

`abort` - generate an abnormal termination signal

SYNOPSIS

```
#include <stdlib.h>
void abort (void);
```

DESCRIPTION

`abort` first closes all open files, `stdio(3S)` streams, directory streams and message catalogue descriptors, if possible, then causes the signal `SIGABRT` to be sent to the calling process.

SEE ALSO

`tbx(1)`, `exit(2)`, `kill(2)`, `signal(2)`, `catopen(3C)`, `stdio(3S)`.

DIAGNOSTICS

If `SIGABRT` is neither caught nor ignored, and the current directory is writable, a core dump is produced and the message `abort - core dumped` is written by the shell [see `sh(1)`].

NAME

abs, labs - return integer absolute value

SYNOPSIS

```
#include <stdlib.h>
int abs (int val);
long labs (long lval);
```

DESCRIPTION

abs returns the absolute value of its int operand. labs returns the absolute value of its long operand.

SEE ALSO

floor(3M)

NOTES

In 2's-complement representation, the absolute value of the largest magnitude negative integral value is undefined.

accept (3N)

accept (3N)

NAME

accept - accept a connection on a socket

SYNOPSIS

```
#include <sys/types.h>
int accept(int s, caddr_t addr, int *addrlen);
```

DESCRIPTION

The argument *s* is a socket that has been created with `socket` and bound to an address with `bind`, and that is listening for connections after a call to `listen`. `accept` extracts the first connection on the queue of pending connections, creates a new socket with the properties of *s*, and allocates a new file descriptor, *ns*, for the socket. If no pending connections are present on the queue and the socket is not marked as non-blocking, `accept` blocks the caller until a connection is present. If the socket is marked as non-blocking and no pending connections are present on the queue, `accept` returns an error as described below. `accept` uses the `netconfig` file to determine the STREAMS device file name associated with *s*. This is the device on which the connect indication will be accepted. The accepted socket, *ns*, is used to read and write data to and from the socket that connected to *ns*; it is not used to accept more connections. The original socket (*s*) remains open for accepting further connections.

The argument *addr* is a result parameter that is filled in with the address of the connecting entity as it is known to the communications layer. The exact format of the *addr* parameter is determined by the domain in which the communication occurs.

addrlen is a value-result parameter. Initially, it contains the amount of space pointed to by *addr*; on return it contains the length in bytes of the address returned.

`accept` is used with connection-based socket types, currently with `SOCK_STREAM`.

It is possible to select a socket for the purpose of an `accept` by selecting it for read. However, this will only indicate when a connect indication is pending; it is still necessary to call `accept`.

RETURN VALUE

`accept` returns -1 on error. If it succeeds, it returns a non-negative integer that is a descriptor for the accepted socket.

ERRORS

`accept` will fail if:

| | |
|-------------|---|
| EBADF | The descriptor is invalid. |
| ENOTSOCK | The descriptor does not reference a socket. |
| EOPNOTSUPP | The referenced socket is not of type <code>SOCK_STREAM</code> . |
| EWOULDBLOCK | The socket is marked as non-blocking and no connections are present to be accepted. |
| EPROTO | A protocol error has occurred; for example, the STREAMS protocol stack has not been initialized. |
| ENODEV | The protocol family and type corresponding to <i>s</i> could not be found in the <code>netconfig</code> file. |

accept (3N)

accept (3N)

| | |
|--------|--|
| ENOMEM | There was insufficient user memory available to complete the operation. |
| ENOSR | There were insufficient STREAMS resources available to complete the operation. |

SEE ALSO

`bind(3N)`, `connect(3N)`, `listen(3N)`, `socket(3N)`, `netconfig(4)`

NOTES

The type of address structure passed to `accept` depends on the address family. UNIX domain sockets (address family `AF_UNIX`) require a `socketaddr_un` structure as defined in `sys/un.h`; Internet domain sockets (address family `AF_INET`) require a `sockaddr_in` structure as defined in `netinet/in.h`. Other address families may require other structures. Use the structure appropriate to the address family; cast the structure address to a generic `caddr_t` in the call to `accept` and pass the size of the structure in the `addrlen` argument.

access(2)

access(2)

NAME

access - determine accessibility of a file

SYNOPSIS

```
#include <unistd.h>

int access(const char *path, int amode);
```

DESCRIPTION

path points to a path name naming a file. `access` checks the named file for accessibility according to the bit pattern contained in *amode*, using the real user ID in place of the effective user ID and the real group ID in place of the effective group ID. The bit pattern contained in *amode* is constructed by an OR of the following constants (defined in `<unistd.h>`):

```
R_OK  read
W_OK  write
X_OK  execute (search)
F_OK  check existence of file
```

Access to the file is denied if one or more of the following are true:

| | |
|--------------|--|
| EACCES | Search permission is denied on a component of the path prefix. |
| EACCES | Permission bits of the file mode do not permit the requested access. |
| EFAULT | <i>path</i> points outside the allocated address space for the process. |
| EINTR | A signal was caught during the <code>access</code> system call. |
| EINVAL | Argument is invalid. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines. |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds <code>{PATH_MAX}</code> , or the length of a <i>path</i> component exceeds <code>{NAME_MAX}</code> while <code>_POSIX_NO_TRUNC</code> is in effect. |
| ENOTDIR | A component of the path prefix is not a directory. |
| ENOENT | Read, write, or execute (search) permission is requested for a null path name. |
| ENOENT | The named file does not exist. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| EROFS | Write access is requested for a file on a read-only file system. |

SEE ALSO

`chmod(2)`, `stat(2)`
"File Access Permission" in `intro(2)`.

access(2)

access(2)

DIAGNOSTICS

If the requested access is permitted, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

acct - enable or disable process accounting

SYNOPSIS

```
#include <unistd.h>
int acct(const char *path);
```

DESCRIPTION

acct enables or disables the system process accounting routine. If the routine is enabled, an accounting record will be written in an accounting file for each process that terminates. The termination of a process can be caused by one of two things: an `exit` call or a signal [see `exit(2)` and `signal(2)`]. The effective user ID of the process calling `acct` must be superuser.

path points to a pathname naming the accounting file. The accounting file format is given in `acct(4)`.

The accounting routine is enabled if *path* is non-zero and no errors occur during the system call. It is disabled if *path* is `(char *)NULL` and no errors occur during the system call.

acct will fail if one or more of the following are true:

| | |
|--------------|--|
| EACCES | The file named by <i>path</i> is not an ordinary file. |
| EBUSY | An attempt is being made to enable accounting using the same file that is currently being used. |
| EFAULT | <i>path</i> points to an illegal address. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds <code>{PATH_MAX}</code> , or the length of a <i>path</i> component exceeds <code>{NAME_MAX}</code> while <code>_POSIX_NO_TRUNC</code> is in effect. |
| ENOTDIR | A component of the path prefix is not a directory. |
| ENOENT | One or more components of the accounting file pathname do not exist. |
| EPERM | The effective user of the calling process is not superuser. |
| EROFS | The named file resides on a read-only file system. |

SEE ALSO

`exit(2)`, `signal(2)`, `acct(4)`.

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

addsev - define additional severities

SYNOPSIS

```
int addsev(int int_val, const char *string);
```

DESCRIPTION

The function `addsev()` defines additional severities for use in subsequent calls to `pfmt()` or `lfmt()`. `addsev()` associates an integer value *int_val* in the range [5-255] with a character *string*. It overwrites any previous string association with *int_val* and *string*.

If *int_val* is ORed with the *flags* passed to subsequent calls `pfmt()` or `lfmt()`, *string* will be used as severity.

Passing a NULL *string* removes the severity.

Add-on severities are only effective within the applications defining them.

RETURN VALUE

`addsev()` returns 0 in case of success, -1 otherwise.

USAGE

Only the standard severities are automatically displayed per the locale in effect at runtime. An application must provide the means for displaying locale-specific versions of add-on severities.

EXAMPLE

```
#define Panic 5
setlabel("APPL");
setcat("my_appl");
addsev(Panic, gettxt(":26", "PANIC"));
/* ... */
lfmt(stderr, MM_SOFT|MM_APPL| Panic, ":12:Cannot locate database\n");
```

will display the message to *stderr* and forward to the logging service:

```
APPL: PANIC: Cannot locate database
```

SEE ALSO

`gettext(3C)`, `lfmt(3C)`, `pfmt(3C)`.

NAME

addseverity - build a list of severity levels for an application for use with `fmtmsg`

SYNOPSIS

```
#include <fmtmsg.h>

int addseverity(int severity, const char *string);
```

DESCRIPTION

The `addseverity` function builds a list of severity levels for an application to be used with the message formatting facility, `fmtmsg`. *severity* is an integer value indicating the seriousness of the condition, and *string* is a pointer to a string describing the condition (*string* is not limited to a specific size).

If `addseverity` is called with an integer value that has not been previously defined, the function adds that new severity value and print string to the existing set of standard severity levels.

If `addseverity` is called with an integer value that has been previously defined, the function redefines that value with the new print string. Previously defined severity levels may be removed by supplying the `NULL` string. If `addseverity` is called with a negative number or an integer value of 0, 1, 2, 3, or 4, the function fails and returns -1. The values 0-4 are reserved for the standard severity levels and cannot be modified. Identifiers for the standard levels of severity are:

| | |
|-------------------------|---|
| <code>MM_HALT</code> | indicates that the application has encountered a severe fault and is halting. Produces the print string <code>HALT</code> . |
| <code>MM_ERROR</code> | indicates that the application has detected a fault. Produces the print string <code>ERROR</code> . |
| <code>MM_WARNING</code> | indicates a condition that is out of the ordinary, that might be a problem, and should be watched. Produces the print string <code>WARNING</code> . |
| <code>MM_INFO</code> | provides information about a condition that is not in error. Produces the print string <code>INFO</code> . |
| <code>MM_NOSEV</code> | indicates that no severity level is supplied for the message. |

Severity levels may also be defined at run time using the `SEV_LEVEL` environment variable [see `fmtmsg(3C)`].

EXAMPLES

When the function `addseverity` is used as follows:

```
addseverity(7, "ALERT")
```

the following call to `fmtmsg`:

```
fmtmsg(MM_PRINT, "UX:cat", 7, "invalid syntax", "refer to manual", "UX:cat:001")
```

produces:

```
UX:cat: ALERT: invalid syntax
TO FIX: refer to manual UX:cat:001
```

SEE ALSO

`fmtmsg(1M)`, `fmtmsg(3C)`, `gettext(3C)`, `printf(3S)`

addseverity (3C)

(Essential Utilities)

addseverity (3C)

DIAGNOSTICS

addseverity returns MM_OK on success or MM_NOTOK on failure.

NAME

adjtime - correct the time to allow synchronization of the system clock

SYNOPSIS

```
#include <sys/time.h>

int adjtime(struct timeval *delta, struct timeval *olddelta);
```

DESCRIPTION

adjtime adjusts the system's notion of the current time, as returned by `gettimeofday(3C)`, advancing or retarding it by the amount of time specified in the `struct timeval` pointed to by *delta*.

The adjustment is effected by speeding up (if that amount of time is positive) or slowing down (if that amount of time is negative) the system's clock by some small percentage, 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 *delta* is 0, then *olddelta* returns the status of the effects of the previous `adjtime` call and there is no effect on the time correction as a result of this call. If *olddelta* is not a NULL pointer, then the structure it points to will contain, upon return, the number of seconds and/or microseconds still to be corrected from the earlier call. If *olddelta* is a NULL pointer, the corresponding information will not be returned.

This call may be used in 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.

Only the super-user may adjust the time of day.

The adjustment value will be silently rounded to the resolution of the system clock.

RETURN

A 0 return value indicates that the call succeeded. A -1 return value indicates an error occurred, and in this case an error code is stored into the global variable `errno`.

ERRORS

The following error codes may be set in `errno`:

EFAULT *delta* or *olddelta* points outside the process's allocated address space, or *olddelta* points to a region of the process' allocated address space that is not writable.

EPERM The process's effective user ID is not that of the super-user.

SEE ALSO

`date(1)`, `gettimeofday(3C)`.

alarm(2)

alarm(2)

NAME

alarm - set a process alarm clock

SYNOPSIS

```
#include <unistd.h>
unsigned alarm(unsigned sec);
```

DESCRIPTION

alarm instructs the alarm clock of the calling process to send the signal `SIGALRM` to the calling process after the number of real time seconds specified by *sec* have elapsed [see `signal(2)`].

Alarm requests are not stacked; successive calls reset the alarm clock of the calling process.

If *sec* is 0, any previously made alarm request is canceled.

`fork` sets the alarm clock of a new process to 0 [see `fork(2)`]. A process created by the `exec` family of routines inherits the time left on the old process's alarm clock.

SEE ALSO

`fork(2)`, `exec(2)`, `pause(2)`, `signal(2)`, `sigset(2)`

DIAGNOSTICS

alarm returns the amount of time previously remaining in the alarm clock of the calling process.

NAME

alloca - memory allocator

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...  
#include <alloca.h>  
char *alloca(size)  
int size;
```

DESCRIPTION

alloca allocates *size* bytes of space in the stack frame of the caller, and returns a pointer to the allocated block. This temporary space is automatically freed when the caller returns. Note: if the allocated block is beyond the current stack limit, the resulting behavior is undefined.

NOTES

alloca is machine-, compiler-, and most of all, system-dependent. Its use is strongly discouraged. Within the M88 family of processors, the programmer is responsible for freeing the allocated block because the M88 family of processors does not set up and free stack frames upon entry and exit from a function. Also, local variables on the stack may be improperly accessed after allocation. Therefore, its use on the M88 family of processors is discouraged.

SEE ALSO

csh(1), ld(1), brk(2), getrlimit(2), calloc(3), sigstack(3), sigvec(3), malloc(3).

Stephenson, C.J., *Fast Fits*, in *Proceedings of the ACM 9th Symposium on Operating Systems*, SIGOPS Operating Systems Review, vol. 17, no. 5, October 1983.

Core Wars, in *Scientific American*, May 1984.

assert (3X)

assert (3X)

NAME

assert - verify program assertion

SYNOPSIS

```
#include <assert.h>
void assert (int expression);
```

DESCRIPTION

This macro is useful for putting diagnostics into programs. When it is executed, if *expression* is false (zero), `assert` prints

```
Assertion failed: expression, file xyz, line nnn
```

on the standard error output and aborts. In the error message, *xyz* is the name of the source file and *nnn* the source line number of the `assert` statement. The latter are respectively the values of the preprocessor macros `__FILE__` and `__LINE__`.

Compiling with the preprocessor option `-DNDEBUG` [see `cc(1)`], or with the preprocessor control statement `#define NDEBUG` ahead of the `#include assert.h` statement, will stop assertions from being compiled into the program.

SEE ALSO

`cc(1)`, `abort(3C)`

NOTES

Since `assert` is implemented as a macro, the *expression* may not contain any string literals.

NAME

atexit - add program termination routine

SYNOPSIS

```
#include <stdlib.h>
int atexit (void (*func)(void));
```

DESCRIPTION

atexit adds the function *func* to a list of functions to be called without arguments on normal termination of the program. Normal termination occurs by either a call to the `exit` system call or a return from `main`. At most 32 functions may be registered by `atexit`; the functions will be called in the reverse order of their registration.

atexit returns 0 if the registration succeeds, nonzero if it fails.

SEE ALSO

exit(2)

basename(3G)

basename(3G)

NAME

basename - return the last element of a path name

SYNOPSIS

```
cc [flag . . .] file . . . -lgen [library . . .]
#include <libgen.h>
char *basename (char *path);
```

DESCRIPTION

Given a pointer to a null-terminated character string that contains a path name, `basename` returns a pointer to the last element of *path*. Trailing “/” characters are deleted.

If *path* or **path* is zero, pointer to a static constant “.” is returned.

EXAMPLES

| <u>Input string</u> | <u>Output pointer</u> |
|---------------------|-----------------------|
| /usr/lib | lib |
| /usr/ | usr |
| / | / |

SEE ALSO

basename(1), dirname(3G).

NAME

bessel: $j_0, j_1, j_n, y_0, y_1, y_n$ - Bessel functions

SYNOPSIS

```
cc [flag ...] file ... -lm [library ...]
#include <math.h>
double j0 (double x);
double j1 (double x);
double jn (int n, double x);
double y0 (double x);
double y1 (double x);
double yn (int n, double x);
```

DESCRIPTION

j_0 and j_1 return Bessel functions of x of the first kind of orders 0 and 1, respectively. j_n returns the Bessel function of x of the first kind of order n .

y_0 and y_1 return Bessel functions of x of the second kind of orders 0 and 1, respectively. y_n returns the Bessel function of x of the second kind of order n . The value of x must be positive.

SEE ALSO

matherr(3M)

DIAGNOSTICS

Non-positive arguments cause y_0, y_1 , and y_n to return the value `-HUGE` and to set `errno` to `EDOM`. In addition, a message indicating `DOMAIN` error is printed on the standard error output.

Arguments too large in magnitude cause j_0, j_1, y_0 , and y_1 to return 0 and to set `errno` to `ERANGE`. In addition, a message indicating `TLOSS` error is printed on the standard error output.

Except when the `-Xc` compilation option is used, these error-handling procedures may be changed with the function `matherr`. When the `-Xa` or `-Xc` compilation options are used, `HUGE_VAL` is returned instead of `HUGE` and no error messages are printed.

NAME

bgets - read stream up to next delimiter

SYNOPSIS

```
cc [flag ...]file ... -lgen [library ...]
#include <libgen.h>
char *bgets (char *buffer, size_t *count, FILE *stream,
             const char *breakstring);
```

DESCRIPTION

bgets reads characters from *stream* into *buffer* until either *count* is exhausted or one of the characters in *breakstring* is encountered in the stream. The read data is terminated with a null byte ('\0') and a pointer to the trailing null is returned. If a *breakstring* character is encountered, the last non-null is the delimiter character that terminated the scan.

Note that, except for the fact that the returned value points to the end of the read string rather than to the beginning, the call

```
bgets (buffer, sizeof buffer, stream, "\n");
```

is identical to

```
fgets (buffer, sizeof buffer, stream);
```

There is always enough room reserved in the buffer for the trailing null.

If *breakstring* is a null pointer, the value of *breakstring* from the previous call is used. If *breakstring* is null at the first call, no characters will be used to delimit the string.

EXAMPLES

```
#include <libgen.h>

char buffer[8];
/* read in first user name from /etc/passwd */
fp = fopen("/etc/passwd", "r");
bgets(buffer, 8, fp, ":");
```

DIAGNOSTICS

NULL is returned on error or end-of-file. Reporting the condition is delayed to the next call if any characters were read but not yet returned.

SEE ALSO

gets(3S)

bind(3N)

bind(3N)

NAME

bind - bind a name to a socket

SYNOPSIS

```
#include <sys/types.h>
int bind(int s, caddr_t name, int namelen);
```

DESCRIPTION

bind assigns a name to an unnamed socket. When a socket is created with `socket`, it exists in a name space (address family) but has no name assigned. `bind` requests that the name pointed to by `name` be assigned to the socket.

RETURN VALUE

If the bind is successful, a 0 value is returned. A return value of -1 indicates an error, which is further specified in the global `errno`.

ERRORS

The `bind` call will fail if:

| | |
|---------------|---|
| EBADF | <code>s</code> is not a valid descriptor. |
| ENOTSOCK | <code>s</code> is a descriptor for a file, not a socket. |
| EADDRNOTAVAIL | The specified address is not available on the local machine. |
| EADDRINUSE | The specified address is already in use. |
| EINVAL | <code>namelen</code> is not the size of a valid address for the specified address family. |
| EINVAL | The socket is already bound to an address. |
| EACCES | The requested address is protected and the current user has inadequate permission to access it. |
| ENOSR | There were insufficient STREAMS resources for the operation to complete. |

The following errors are specific to binding names in the UNIX domain:

| | |
|---------|---|
| ENOTDIR | A component of the path prefix of the pathname in <code>name</code> is not a directory. |
| ENOENT | A component of the path prefix of the pathname in <code>name</code> does not exist. |
| EACCES | Search permission is denied for a component of the path prefix of the pathname in <code>name</code> . |
| ELOOP | Too many symbolic links were encountered in translating the pathname in <code>name</code> . |
| EIO | An I/O error occurred while making the directory entry or allocating the inode. |
| EROFS | The inode would reside on a read-only file system. |
| EISDIR | A null pathname was specified. |

SEE ALSO

`unlink(2)` in the *Programmer's Reference Manual*

bind (3N)

bind (3N)

NOTES

Binding a name in the UNIX domain creates a socket in the file system that must be deleted by the caller when it is no longer needed [see `unlink(2)`].

The rules used in name binding vary between communication domains.

The type of address structure passed to `bind` depends on the address family. UNIX domain sockets (address family `AF_UNIX`) require a `socketaddr_un` structure as defined in `sys/un.h`; Internet domain sockets (address family `AF_INET`) require a `sockaddr_in` structure as defined in `netinet/in.h`. Other address families may require other structures. Use the structure appropriate to the address family; cast the structure address to a generic `caddr_t` in the call to `bind` and pass the size of the structure in the *namelen* argument.

NAME

`brk`, `sbrk` - change data segment space allocation

SYNOPSIS

```
#include <unistd.h>
int brk(void *endds);
void *sbrk(int incr);
```

DESCRIPTION

`brk` and `sbrk` are used to change dynamically the amount of space allocated for the calling process's data segment [see `exec(2)`]. The change is made by resetting the process's break value and allocating the appropriate amount of space. The break value is the address of the first location beyond the end of the data segment. The amount of allocated space increases as the break value increases. Newly allocated space is set to zero. If, however, the same memory space is reallocated to the same process its contents are undefined.

`brk` sets the break value to `endds` and changes the allocated space accordingly.

`sbrk` adds `incr` bytes to the break value and changes the allocated space accordingly. `incr` can be negative, in which case the amount of allocated space is decreased.

`brk` and `sbrk` will fail without making any change in the allocated space if one or more of the following are true:

- | | |
|--------|--|
| ENOMEM | Such a change would result in more space being allocated than is allowed by the system-imposed maximum process size [see <code>ulimit(2)</code>]. |
| EAGAIN | Returned when the system is out of swap space. |

SEE ALSO

`exec(2)`, `shmop(2)`, `ulimit(2)`, `end(3C)`.

DIAGNOSTICS

Upon successful completion, `brk` returns a value of 0 and `sbrk` returns the old break value. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

bsearch - binary search a sorted table

SYNOPSIS

```
#include <stdlib.h>

void *bsearch (const void *key, const void *base, size_t nel,
              size_t size, int (*compar)(const void *, const void *));
```

DESCRIPTION

bsearch is a binary search routine generalized from Knuth (6.2.1) Algorithm B. It returns a pointer into a table (an array) indicating where a datum may be found or a null pointer if the datum cannot be found. The table must be previously sorted in increasing order according to a comparison function pointed to by *compar*. *key* points to a datum instance to be sought in the table. *base* points to the element at the base of the table. *nel* is the number of elements in the table. *size* is the number of bytes in each element. The function pointed to by *compar* is called with two arguments that point to the elements being compared. The function must return an integer less than, equal to, or greater than 0 as accordingly the first argument is to be considered less than, equal to, or greater than the second.

EXAMPLE

The example below searches a table containing pointers to nodes consisting of a string and its length. The table is ordered alphabetically on the string in the node pointed to by each entry.

This program reads in strings and either finds the corresponding node and prints out the string and its length, or prints an error message.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

struct node {
    char *string;
    int length;
};
static struct node table[] = /* table to be searched */
{
    { "asparagus", 10 },
    { "beans", 6 },
    { "tomato", 7 },
    { "watermelon", 11 },
};

main()
{
    struct node *node_ptr, node;
    /* routine to compare 2 nodes */
    static int node_compare(const void *, const void *);
    char str_space[20]; /* space to read string into */

    node.string = str_space;
    while (scanf("%20s", node.string) != EOF) {
```

```

node_ptr = bsearch( &node,
                    table, sizeof(table)/sizeof(struct node),
                    sizeof(struct node), node_compare);
if (node_ptr != NULL) {
    (void) printf("string = %20s, length = %d\n",
                 node_ptr->string, node_ptr->length);
} else {
    (void)printf("not found: %20s\n", node.string);
}
}
return(0);
}

/* routine to compare two nodes based on an */
/* alphabetical ordering of the string field */
static int
node_compare(const void *node1, const void *node2)
{
    return (strcmp(
                ((const struct node *)node1)->string,
                ((const struct node *)node2)->string));
}

```

SEE ALSO

hsearch(3C), lsearch(3C), qsort(3C), tsearch(3C)

DIAGNOSTICS

A null pointer is returned if the key cannot be found in the table.

NOTES

The pointers to the key and the element at the base of the table should be of type *pointer-to-element*.

The comparison function need not compare every byte, so arbitrary data may be contained in the elements in addition to the values being compared.

If the number of elements in the table is less than the size reserved for the table, *nel* should be the lower number.

NAME

bstring: bcopy, bcmp, bzero, - bit and byte string operations

SYNOPSIS

```
/usr/ucb/cc [flag...] file...
```

```
bcopy(b1, b2, length)
char *b1, *b2;
int length;

int bcmp(b1, b2, length)
char *b1, *b2;
int length;

bzero(b, length)
char *b;
int length;
```

DESCRIPTION

The functions `bcopy`, `bcmp`, and `bzero` operate on variable length strings of bytes. They do not check for null bytes as the routines in `string(3)` do.

`bcopy` copies *length* bytes from string *b1* to the string *b2*. Overlapping strings are handled correctly.

`bcmp` compares byte string *b1* against byte string *b2*, returning zero if they are identical, 1 otherwise. Both strings are assumed to be *length* bytes long. `bcmp` of length zero bytes always returns zero.

`bzero` places *length* 0 bytes in the string *b*.

NOTES

The `bcmp` and `bcopy` routines take parameters backwards from `strcmp` and `strcpy`.

SEE ALSO

`ffs(3C)`, `string(3C)`.

NAME

bufsplit - split buffer into fields

SYNOPSIS

```
cc [flag ...] file ... -lgen [library ...]
#include <libgen.h>
size_t bupsplit (char *buf, size_t n, char **a);
```

DESCRIPTION

bufsplit examines the buffer, *buf*, and assigns values to the pointer array, *a*, so that the pointers point to the first *n* fields in *buf* that are delimited by tabs or new-lines.

To change the characters used to separate fields, call bupsplit with *buf* pointing to the string of characters, and *n* and *a* set to zero. For example, to use ':', '.', and ',' as separators along with tab and new-line:

```
bufsplit (":.,\t\n", 0, (char**)0 );
```

RETURN VALUE

The number of fields assigned in the array *a*. If *buf* is zero, the return value is zero and the array is unchanged. Otherwise the value is at least one. The remainder of the elements in the array are assigned the address of the null byte at the end of the buffer.

EXAMPLES

```
/*
 * set a[0] = "This", a[1] = "is", a[2] = "a",
 * a[3] = "test"
 */
bufsplit("This\tis\ta\ttest\n", 4, a);
```

NOTES

bufsplit changes the delimiters to null bytes in *buf*.

byteorder(3N)

byteorder(3N)

NAME

byteorder, htonl, htons, ntohl, ntohs - convert values between host and network byte order

SYNOPSIS

```
#include <sys/types.h>
#include <netinet/in.h>

u_long htonl(u_long hostlong);
u_short htons(u_short hostshort);
u_long ntohl(u_long netlong);
u_short ntohs(u_short netshort);
```

DESCRIPTION

These routines convert 16 and 32 bit quantities between network byte order and host byte order. On some architectures these routines are defined as `NULL` macros in the include file `netinet/in.h`. On other architectures, if their host byte order is different from network byte order, these routines are functional.

These routines are most often used in conjunction with Internet addresses and ports as returned by `gethostent(3N)` and `getservent(3N)`.

SEE ALSO

`gethostent(3N)`, `getservent(3N)`

catgets(3C)

catgets(3C)

NAME

catgets - read a program message

SYNOPSIS

```
#include <nl_types.h>
char *catgets (nl_catd catd, int set_num, int msg_num, char *s);
```

DESCRIPTION

catgets attempts to read message *msg_num*, in set *set_num*, from the message catalogue identified by *catd*. *catd* is a catalogue descriptor returned from an earlier call to `catopen`. *s* points to a default message string which will be returned by `catgets` if the identified message catalogue is not currently available.

SEE ALSO

`catopen(3C)`

DIAGNOSTICS

If the identified message is retrieved successfully, `catgets` returns a pointer to an internal buffer area containing the null terminated message string. If the call is unsuccessful because the message catalogue identified by *catd* is not currently available, a pointer to *s* is returned.

NAME

catopen, catclose - open/close a message catalog

SYNOPSIS

```
#include <nl_types.h>
nl_catd catopen (char *name, int oflag);
int catclose (nl_catd catd);
```

DESCRIPTION

catopen opens a message catalog and returns a catalog descriptor. *name* specifies the name of the message catalog to be opened. If *name* contains a "/" then *name* specifies a pathname for the message catalog. Otherwise, the environment variable NLSPATH is used. If NLSPATH does not exist in the environment, or if a message catalog cannot be opened in any of the paths specified by NLSPATH, then the default path is used [see nl_types(5)].

The names of message catalogs, and their location in the filestore, can vary from one system to another. Individual applications can choose to name or locate message catalogs according to their own special needs. A mechanism is therefore required to specify where the catalog resides.

The NLSPATH variable provides both the location of message catalogs, in the form of a search path, and the naming conventions associated with message catalog files. For example:

```
NLSPATH=/nlslib/%L/%N.cat:/nlslib/%N/%L
```

The metacharacter % introduces a substitution field, where %L substitutes the current setting of the LANG environment variable (see following section), and %N substitutes the value of the *name* parameter passed to catopen. Thus, in the above example, catopen will search in /nlslib/\$LANG/*name*.cat, then in /nlslib/*name*/\$LANG, for the required message catalog.

NLSPATH will normally be set up on a system wide basis (for example, in /etc/profile) and thus makes the location and naming conventions associated with message catalogs transparent to both programs and users.

The full set of metacharacters is:

- %N The value of the name parameter passed to catopen.
- %L The value of LANG.
- %l The value of the language element of LANG.
- %t The value of the territory element of LANG.
- %c The value of the codeset element of LANG.
- %% A single %.

The LANG environment variable provides the ability to specify the user's requirements for native languages, local customs and character set, as an ASCII string in the form

```
LANG=language[_territory[.codeset]]
```

catopen(3C)

catopen(3C)

A user who speaks German as it is spoken in Austria and has a terminal which operates in ISO 8859/1 codeset, would want the setting of the `LANG` variable to be

```
LANG=De_A.88591
```

With this setting it should be possible for that user to find any relevant catalogs should they exist.

Should the `LANG` variable not be set then the value of `LC_MESSAGES` as returned by `setlocale` is used. If this is `NULL` then the default path as defined in `nl_types` is used.

oflag is reserved for future use and should be set to 0. The results of setting this field to any other value are undefined.

`catclose` closes the message catalog identified by *catd*.

SEE ALSO

`catgets(3C)`, `setlocale(3C)`, `environ(5)`, `nl_types(5)`

DIAGNOSTICS

If successful, `catopen` returns a message catalog descriptor for use on subsequent calls to `catgets` and `catclose`. Otherwise `catopen` returns `(nl_catd) -1`.

`catclose` returns 0 if successful, otherwise -1.

NAME

chdir, fchdir - change working directory

SYNOPSIS

```
#include <unistd.h>
int chdir(const char *path);
int fchdir(int fildes);
```

DESCRIPTION

chdir and fchdir cause a directory pointed to by *path* or *fildes* to become the current working directory, the starting point for path searches for path names not beginning with /. *path* points to the path name of a directory. The *fildes* argument to fchdir is an open file descriptor of a directory.

In order for a directory to become the current directory, a process must have execute (search) access to the directory.

chdir will fail and the current working directory will be unchanged if one or more of the following are true:

| | |
|--------------|--|
| EACCES | Search permission is denied for any component of the path name. |
| EFAULT | <i>path</i> points outside the allocated address space of the process. |
| EINTR | A signal was caught during the execution of the chdir system call. |
| EIO | An I/O error occurred while reading from or writing to the file system. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds {PATH_MAX}, or the length of a <i>path</i> component exceeds {NAME_MAX} while _POSIX_NO_TRUNC is in effect. |
| ENOTDIR | A component of the path name is not a directory. |
| ENOENT | Either a component of the path prefix or the directory named by <i>path</i> does not exist or is a null pathname. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and file system type does not allow it. |

fchdir will fail and the current working directory will be unchanged if one or more of the following are true:

| | |
|--------|---|
| EACCES | Search permission is denied for <i>fildes</i> . |
| EBADF | <i>fildes</i> is not an open file descriptor. |

chdir(2)

chdir(2)

| | |
|---------|--|
| EINTR | A signal was caught during the execution of the <code>chdir</code> system call. |
| EIO | An I/O error occurred while reading from or writing to the file system. |
| ENOLINK | <i>fildev</i> points to a remote machine and the link to that machine is no longer active. |
| ENOTDIR | The open file descriptor <i>fildev</i> does not refer to a directory. |

SEE ALSO

`chroot(2)`

DIAGNOSTICS

Upon successful completion, a value of zero is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

chmod, fchmod - change mode of file

SYNOPSIS

```
#include <sys/types.h>
#include <sys/stat.h>

int chmod(const char *path, mode_t mode);
int fchmod(int fildes, mode_t mode);
```

DESCRIPTION

chmod and fchmod set the access permission portion of the mode of the file whose name is given by *path* or referenced by the descriptor *fildes* to the bit pattern contained in *mode*. If *path* or *fildes* are symbolic links, the access permissions of the target of the symbolic links are set. Access permission bits are interpreted as follows:

| | | |
|---------|-------|---|
| S_ISUID | 0400 | Set user ID on execution. |
| S_ISGID | 020#0 | Set group ID on execution if # is 7, 5, 3, or 1 Enable mandatory file/record locking if # is 6, 4, 2, or 0 |
| S_ISVTX | 01000 | Save text image after execution. |
| S_IRWXU | 00700 | Read, write, execute by owner. |
| S_IRUSR | 00400 | Read by owner. |
| S_IWUSR | 00200 | Write by owner. |
| S_IXUSR | 00100 | Execute (search if a directory) by owner. |
| S_IRWXG | 00070 | Read, write, execute by group. |
| S_IRGRP | 00040 | Read by group. |
| S_IWGRP | 00020 | Write by group. |
| S_IXGRP | 00010 | Execute by group. |
| S_IRWXO | 00007 | Read, write, execute (search) by others. |
| S_IROTH | 00004 | Read by others. |
| S_IWOTH | 00002 | Write by others |
| S_IXOTH | 00001 | Execute by others. |

Modes are constructed by OR'ing the access permission bits.

The effective user ID of the process must match the owner of the file or the process must have the appropriate privilege to change the mode of a file.

If the process is not a privileged process and the file is not a directory, mode bit 01000 (save text image on execution) is cleared.

If neither the process nor a member of the supplementary group list is privileged, and the effective group ID of the process does not match the group ID of the file, mode bit 02000 (set group ID on execution) is cleared.

If a 0410 executable file has the sticky bit (mode bit 01000) set, the operating system will not delete the program text from the swap area when the last user process terminates. If a 0413 or ELF executable file has the sticky bit set, the operating system will not delete the program text from memory when the last user process terminates. In either case, if the sticky bit is set the text will already be available (either in a swap area or in memory) when the next user of the file executes it, thus making execution faster.

chmod(2)

chmod(2)

If a directory is writable and has the sticky bit set, files within that directory can be removed or renamed only if one or more of the following is true [see `unlink(2)` and `rename(2)`]:

- the user owns the file
- the user owns the directory
- the file is writable by the user
- the user is a privileged user

If the mode bit 02000 (set group ID on execution) is set and the mode bit 00010 (execute or search by group) is not set, mandatory file/record locking will exist on a regular file. This may affect future calls to `open(2)`, `creat(2)`, `read(2)`, and `write(2)` on this file.

Upon successful completion, `chmod` and `fchmod` mark for update the `st_ctime` field of the file.

`chmod` will fail and the file mode will be unchanged if one or more of the following are true:

| | |
|--------------|--|
| EACCES | Search permission is denied on a component of the path prefix of <i>path</i> . |
| EFAULT | <i>path</i> points outside the allocated address space of the process. |
| EINTR | A signal was caught during execution of the system call. |
| EIO | An I/O error occurred while reading from or writing to the file system. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and file system type does not allow it. |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds {PATH_MAX}, or the length of a <i>path</i> component exceeds {NAME_MAX} while _POSIX_NO_TRUNC is in effect. |
| ENOTDIR | A component of the prefix of <i>path</i> is not a directory. |
| ENOENT | Either a component of the path prefix, or the file referred to by <i>path</i> does not exist or is a null pathname. |
| ENOLINK | <i>fildev</i> points to a remote machine and the link to that machine is no longer active. |
| EPERM | The effective user ID does not match the owner of the file and the process does not have appropriate privilege. |
| EROFS | The file referred to by <i>path</i> resides on a read-only file system. |

`fchmod` will fail and the file mode will be unchanged if:

| | |
|-------|---|
| EBADF | <i>fildev</i> is not an open file descriptor |
| EIO | An I/O error occurred while reading from or writing to the file system. |

chmod(2)

chmod(2)

| | |
|---------|---|
| EINTR | A signal was caught during execution of the <code>fchmod</code> system call. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| EPERM | The effective user ID does not match the owner of the file and the process does not have appropriate privilege. |
| EROFS | The file referred to by <i>files</i> resides on a read-only file system. |

SEE ALSO

`chmod(1)`, `chown(2)`, `creat(2)`, `fcntl(2)`, `mknod(2)`, `open(2)`, `read(2)`, `stat(2)`, `write(2)`, `mkfifo(3C)`, `stat(5)`

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

chown, lchown, fchown - change owner and group of a file

SYNOPSIS

```
#include <unistd.h>
#include <sys/stat.h>

int chown(const char *path, uid_t owner, gid_t group);
int lchown(const char *path, uid_t owner, gid_t group);
int fchown(int fildes, uid_t owner, gid_t group);
```

DESCRIPTION

The owner ID and group ID of the file specified by *path* or referenced by the descriptor *fildes*, are set to *owner* and *group* respectively. If *owner* or *group* is specified as -1, the corresponding ID of the file is not changed.

The function `lchown` sets the owner ID and group ID of the named file just as `chown` does, except in the case where the named file is a symbolic link. In this case `lchown` changes the ownership of the symbolic link file itself, while `chown` changes the ownership of the file or directory to which the symbolic link refers.

If `chown`, `lchown`, or `fchown` is invoked by a process other than super-user, the set-user-ID and set-group-ID bits of the file mode, `S_ISUID` and `S_ISGID` respectively, are cleared [see `chmod(2)`].

The operating system has a configuration option, `{_POSIX_CHOWN_RESTRICTED}`, to restrict ownership changes for the `chown`, `lchown`, and `fchown` system calls. When `{_POSIX_CHOWN_RESTRICTED}` is not in effect, the effective user ID of the process must match the owner of the file or the process must be the super-user to change the ownership of a file. When `{_POSIX_CHOWN_RESTRICTED}` is in effect, the `chown`, `lchown`, and `fchown` system calls, for users other than super-user, prevent the owner of the file from changing the owner ID of the file and restrict the change of the group of the file to the list of supplementary group IDs.

Upon successful completion, `chown`, `fchown` and `lchown` mark for update the `st_ctime` field of the file.

`chown` and `lchown` fail and the owner and group of the named file remain unchanged if one or more of the following are true:

| | |
|--------|--|
| EACCES | Search permission is denied on a component of the path prefix of <i>path</i> . |
| EFAULT | <i>path</i> points outside the allocated address space of the process. |
| EINTR | A signal was caught during the <code>chown</code> or <code>lchown</code> system calls. |
| EINVAL | <i>group</i> or <i>owner</i> is out of range. |
| EIO | An I/O error occurred while reading from or writing to the file system. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |

chown(2)

chown(2)

| | |
|--------------|---|
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and file system type does not allow it. Too many symbolic links were encountered in translating <i>path</i> . |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds {PATH_MAX}, or the length of a <i>path</i> component exceeds {NAME_MAX} while _POSIX_NO_TRUNC is in effect. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| ENOTDIR | A component of the path prefix of <i>path</i> is not a directory. |
| ENOENT | Either a component of the path prefix or the file referred to by <i>path</i> does not exist or is a null pathname. |
| EPERM | The effective user ID does not match the owner of the file or the process is not the super-user and {_POSIX_CHOWN_RESTRICTED} indicates that such privilege is required. |
| EROFS | The named file resides on a read-only file system. |

fchown fails and the owner and group of the named file remain unchanged if one or more of the following are true:

| | |
|---------|--|
| EBADF | <i>fdes</i> is not an open file descriptor. |
| EINVAL | <i>group</i> or <i>owner</i> is out of range. |
| EPERM | The effective user ID does not match the owner of the file or the process is not the super-user and {_POSIX_CHOWN_RESTRICTED} indicates that such privilege is required. |
| EROFS | The named file referred to by <i>fdes</i> resides on a read-only file system. |
| EINTR | A signal was caught during execution of the system call. |
| EIO | An I/O error occurred while reading from or writing to the file system. |
| ENOLINK | <i>fdes</i> points to a remote machine and the link to that machine is no longer active. |

SEE ALSO

chgrp(1), chown(1), chmod(2).

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and *errno* is set to indicate the error.

NAME

chroot - change root directory

SYNOPSIS

```
#include <unistd.h>

int chroot(const char *path);
```

DESCRIPTION

path points to a path name naming a directory. `chroot` causes the named directory to become the root directory, the starting point for path searches for path names beginning with `/`. The user's working directory is unaffected by the `chroot` system call.

The effective user ID of the process must be super-user to change the root directory.

The `..` entry in the root directory is interpreted to mean the root directory itself. Thus, `..` cannot be used to access files outside the subtree rooted at the root directory.

`chroot` will fail and the root directory will remain unchanged if one or more of the following are true:

| | |
|--------------|--|
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds <code>{PATH_MAX}</code> , or the length of a <i>path</i> component exceeds <code>{NAME_MAX}</code> while <code>_POSIX_NO_TRUNC</code> is in effect. |
| EFAULT | <i>path</i> points outside the allocated address space of the process. |
| EINTR | A signal was caught during the <code>chroot</code> system call. |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and file system type does not allow it. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| ENOTDIR | Any component of the path name is not a directory. |
| ENOENT | The named directory does not exist or is a null pathname. |
| EPERM | The effective user ID is not super-user. |

SEE ALSO

`chdir(2)`

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

chsize - change the size of a file

SYNOPSIS

```
cc [flag ...] file ... -lx
int chsize (int fildes, long size);
```

DESCRIPTION

fildes is a file descriptor obtained from a `create`, `open`, `dup`, `fcntl`, or `pipe` system call. `chsize` changes the size of the file associated with the file descriptor *fildes* to be exactly *size* bytes in length. The routine either truncates the file, or pads it with an appropriate number of bytes. If *size* is less than the initial size of the file, then all allocated disk blocks between *size* and the initial file size are freed.

The maximum file size as set by `ulimit(2)` is enforced when `chsize` is called, rather than on subsequent writes. Thus `chsize` fails, and the file size remains unchanged if the new changed file size would exceed the `ulimit`.

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, the value -1 is returned and `errno` is set to indicate the error.

SEE ALSO

`creat(2)`, `dup(2)`, `lseek(2)`, `open(2)`, `pipe(2)`, `ulimit(2)`

NOTES

In general if `chsize` is used to expand the size of a file, when data is written to the end of the file, intervening blocks are filled with zeros. In some cases, reducing the file size may not remove the data beyond the new end-of-file.

NAME

clock - report CPU time used

SYNOPSIS

```
#include <time.h>
clock_t clock (void);
```

DESCRIPTION

clock returns the amount of CPU time (in microseconds) used since the first call to clock in the calling process. The time reported is the sum of the user and system times of the calling process and its terminated child processes for which it has executed the wait system call, the pclose function, or the system function.

Dividing the value returned by clock by the constant CLOCKS_PER_SEC, defined in the time.h header file, will give the time in seconds.

The resolution of the clock is defined by CLK_TCK in limits.h, and is typically 1/100 or 1/60 of a second.

SEE ALSO

times(2), wait(2), popen(3S), system(3S)

NOTES

The value returned by clock is defined in microseconds for compatibility with systems that have CPU clocks with much higher resolution. Because of this, the value returned will wrap around after accumulating only 2147 seconds of CPU time (about 36 minutes). If the process time used is not available or cannot be represented, clock returns the value (clock_t)-1.

close(2)

close(2)

NAME

close - close a file descriptor

SYNOPSIS

```
#include <unistd.h>
int close(int fildes);
```

DESCRIPTION

fildes is a file descriptor obtained from a `creat`, `open`, `dup`, `fcntl`, `pipe`, or `ioctl` system call. `close` closes the file descriptor indicated by *fildes*. All outstanding record locks owned by the process (on the file indicated by *fildes*) are removed.

When all file descriptors associated with the open file description have been closed, the open file description is freed.

If the link count of the file is zero, when all file descriptors associated with the file have been closed, the space occupied by the file is freed and the file is no longer accessible.

If a STREAMS-based [see `intro(2)`] *fildes* is closed, and the calling process had previously registered to receive a SIGPOLL signal [see `signal(2)`] for events associated with that stream [see `I_SETSIG` in `streamio(7)`], the calling process will be unregistered for events associated with the stream. The last `close` for a stream causes the stream associated with *fildes* to be dismantled. If `O_NDELAY` and `O_NONBLOCK` are clear and there have been no signals posted for the stream, and if there are data on the module's write queue, `close` waits up to 15 seconds (for each module and driver) for any output to drain before dismantling the stream. The time delay can be changed via an `I_SETCLTIME` `ioctl` request [see `streamio(7)`]. If `O_NDELAY` or `O_NONBLOCK` is set, or if there are any pending signals, `close` does not wait for output to drain, and dismantles the stream immediately.

If *fildes* is associated with one end of a pipe, the last `close` causes a hangup to occur on the other end of the pipe. In addition, if the other end of the pipe has been named [see `fattach(3C)`], the last `close` forces the named end to be detached [see `fdetach(3C)`]. If the named end has no open processes associated with it and becomes detached, the stream associated with that end is also dismantled.

The named file is closed unless one or more of the following are true:

| | |
|---------|--|
| EBADF | <i>fildes</i> is not a valid open file descriptor. |
| EINTR | A signal was caught during the <code>close</code> system call. |
| ENOLINK | <i>fildes</i> is on a remote machine and the link to that machine is no longer active. |

SEE ALSO

`creat(2)`, `dup(2)`, `exec(2)`, `fcntl(2)`, `intro(2)`, `open(2)`, `pipe(2)`, `signal(2)`, `fattach(3C)`, `fdetach(3C)`, `signal(5)`, `streamio(7)`.

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

connect(3N)

connect(3N)

NAME

`connect` - initiate a connection on a socket

SYNOPSIS

```
#include <sys/types.h>

int connect(int s, addr_t name, int namelen);
```

DESCRIPTION

The parameter `s` is a socket. If it is of type `SOCK_DGRAM`, `connect` specifies the peer with which the socket is to be associated; this address is the address to which datagrams are to be sent if a receiver is not explicitly designated; it is the only address from which datagrams are to be received. If the socket `s` is of type `SOCK_STREAM`, `connect` attempts to make a connection to another socket. The other socket is specified by `name`. `name` is an address in the communications space of the socket. Each communications space interprets the `name` parameter in its own way. If `s` is not bound, then it will be bound to an address selected by the underlying transport provider. Generally, stream sockets may successfully connect only once; datagram sockets may use `connect` multiple times to change their association. Datagram sockets may dissolve the association by connecting to a null address.

RETURN VALUE

If the connection or binding succeeds, then 0 is returned. Otherwise a -1 is returned and a more specific error code is stored in `errno`.

ERRORS

The call fails if:

| | |
|----------------------------|---|
| <code>EBADF</code> | <code>s</code> is not a valid descriptor. |
| <code>ENOTSOCK</code> | <code>s</code> is a descriptor for a file, not a socket. |
| <code>EINVAL</code> | <code>namelen</code> is not the size of a valid address for the specified address family. |
| <code>EADDRNOTAVAIL</code> | The specified address is not available on the remote machine. |
| <code>EAFNOSUPPORT</code> | Addresses in the specified address family cannot be used with this socket. |
| <code>EAGAIN</code> | The socket is non-blocking and the connection cannot be completed immediately. It is possible to select for completion by selecting the socket for writing. However, this is only possible if the socket STREAMS module is the topmost module on the protocol stack with a write service procedure. This will be the normal case. |
| <code>EISCONN</code> | The socket is already connected. |
| <code>ETIMEDOUT</code> | Connection establishment timed out without establishing a connection. |
| <code>ECONNREFUSED</code> | The attempt to connect was forcefully rejected. The calling program should close the socket descriptor, and issue another socket call to obtain a new descriptor before attempting another connect call. |

connect(3N)

connect(3N)

| | |
|-------------|--|
| ENETUNREACH | The network is not reachable from this host. |
| EADDRINUSE | The address is already in use. |
| EALREADY | The socket is non-blocking and a previous connection attempt has not yet been completed. |
| EINTR | The connection attempt was interrupted before any data arrived by the delivery of a signal. |
| EINTR | System call returned due to interrupt. |
| ENOTSOCK | The file referred to by <i>name</i> is not a socket. |
| EOPNOTSUPP | The socket is in the listen state. |
| EPROTOTYPE | The file referred to by <i>name</i> is a socket of a type other than type <i>s</i> (for example, <i>s</i> is a SOCK_DGRAM socket, while <i>name</i> refers to a SOCK_STREAM socket). |
| ENOSR | There were insufficient STREAMS resources available to complete the operation. |

The following errors are specific to connecting names in the UNIX domain. These errors may not apply in future versions of the UNIX IPC domain.

| | |
|---------|---|
| ENOTDIR | A component of the path prefix of the pathname in <i>name</i> is not a directory. |
| ENOENT | A component of the path prefix of the pathname in <i>name</i> does not exist. |
| ENOENT | The socket referred to by the pathname in <i>name</i> does not exist. |
| EACCES | Search permission is denied for a component of the path prefix of the pathname in <i>name</i> . |
| ELOOP | Too many symbolic links were encountered in translating the pathname in <i>name</i> . |
| EIO | An I/O error occurred while reading from or writing to the file system. |

SEE ALSO

close(2), accept(3N), connect(3N), getsockname(3N), socket(3N).

NOTES

The type of address structure passed to `connect` depends on the address family. UNIX domain sockets (address family `AF_UNIX`) require a `socketaddr_un` structure as defined in `sys/un.h`; Internet domain sockets (address family `AF_INET`) require a `sockaddr_in` structure as defined in `netinet/in.h`. Other address families may require other structures. Use the structure appropriate to the address family; cast the structure address to a generic `caddr_t` in the call to `connect` and pass the size of the structure in the `namelen` argument.

NAME

conv: toupper, tolower, _toupper, _tolower, toascii - translate characters

SYNOPSIS

```
#include <ctype.h>
int toupper (int c);
int tolower (int c);
int _toupper (int c);
int _tolower (int c);
int toascii (int c);
```

DESCRIPTION

`toupper` and `tolower` have as their domain the range of the function `getc`: all values represented in an unsigned `char` and the value of the macro `EOF` as defined in `stdio.h`. If the argument of `toupper` represents a lower-case letter, the result is the corresponding upper-case letter. If the argument of `tolower` represents an upper-case letter, the result is the corresponding lower-case letter. All other arguments in the domain are returned unchanged.

The macros `_toupper` and `_tolower` accomplish the same things as `toupper` and `tolower`, respectively, but have restricted domains and are faster. `_toupper` requires a lower-case letter as its argument; its result is the corresponding upper-case letter. `_tolower` requires an upper-case letter as its argument; its result is the corresponding lower-case letter. Arguments outside the domain cause undefined results.

`toascii` yields its argument with all bits turned off that are not part of a standard 7-bit ASCII character; it is intended for compatibility with other systems.

`toupper`, `tolower`, `_toupper`, and `_tolower` are affected by `LC_CTYPE`. In the C locale, or in a locale where shift information is not defined, these functions determine the case of characters according to the rules of the ASCII-coded character set. Characters outside the ASCII range of characters are returned unchanged.

SEE ALSO

`ctype(3C)`, `getc(3S)`, `setlocale(3C)`, `environ(5)`

copylist(3G)

copylist(3G)

NAME

copylist - copy a file into memory

SYNOPSIS

```
cc [flag ...]file ... -lgen [library ...]
#include <libgen.h>
char *copylist (const char *filenm, off_t *szptr);
```

DESCRIPTION

copylist copies a list of items from a file into freshly allocated memory, replacing new-lines with null characters. It expects two arguments: a pointer *filenm* to the name of the file to be copied, and a pointer *szptr* to a variable where the size of the file will be stored.

Upon success, copylist returns a pointer to the memory allocated. Otherwise it returns NULL if it has trouble finding the file, calling malloc, or opening the file.

EXAMPLES

```
/* read "file" into buf */
off_t size;
char *buf;
buf = copylist("file", &size);
for (i = 0; i < size; i++)
    if(buf[i])
        putchar(buf[i]);
    else
        putchar('\n');
```

SEE ALSO

malloc(3C)

creat (2)

creat (2)

NAME

creat - create a new file or rewrite an existing one

SYNOPSIS

```
#include <sys/types.h>
#include <sys/stat.h>
#include <fcntl.h>

int creat(const char *path, mode_t mode);
```

DESCRIPTION

creat creates a new ordinary file or prepares to rewrite an existing file named by the path name pointed to by *path*.

If the file exists, the length is truncated to 0 and the mode and owner are unchanged.

If the file does not exist the file's owner ID is set to the effective user ID of the process. The group ID of the file is set to the effective group ID of the process, or if the `S_ISGID` bit is set in the parent directory then the group ID of the file is inherited from the parent directory. The access permission bits of the file mode are set to the value of *mode* modified as follows:

If the group ID of the new file does not match the effective group ID or one of the supplementary group IDs, the `S_ISGID` bit is cleared.

All bits set in the process's file mode creation mask are cleared [see `umask(2)`].

The "save text image after execution bit" of the mode is cleared [see `chmod(2)` for the values of mode].

Upon successful completion, a write-only file descriptor is returned and the file is open for writing, even if the mode does not permit writing. The file pointer is set to the beginning of the file. The file descriptor is set to remain open across `exec` system calls [see `fcntl(2)`]. A new file may be created with a mode that forbids writing.

The call `creat(path, mode)` is equivalent to:

```
open(path, O_WRONLY | O_CREAT | O_TRUNC, mode)
```

creat fails if one or more of the following are true:

| | |
|--------|---|
| EACCES | Search permission is denied on a component of the path prefix. |
| EACCES | The file does not exist and the directory in which the file is to be created does not permit writing. |
| EACCES | The file exists and write permission is denied. |
| EAGAIN | The file exists, mandatory file/record locking is set, and there are outstanding record locks on the file [see <code>chmod(2)</code>]. |
| EFAULT | <i>path</i> points outside the allocated address space of the process. |

creat (2)

creat (2)

| | |
|--------------|--|
| EISDIR | The named file is an existing directory. |
| EINTR | A signal was caught during the <code>creat</code> system call. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMFILE | The process has too many open files [see <code>getrlimit(2)</code>]. |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds <code>{PATH_MAX}</code> , or the length of a <i>path</i> component exceeds <code>{NAME_MAX}</code> while <code>_POSIX_NO_TRUNC</code> is in effect. |
| ENOTDIR | A component of the path prefix is not a directory. |
| ENOENT | A component of the path prefix does not exist. |
| ENOENT | The path name is null. |
| EROFS | The named file resides or would reside on a read-only file system. |
| ETXTBSY | The file is a pure procedure (shared text) file that is being executed. |
| ENFILE | The system file table is full. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines. |
| ENOSPC | The file system is out of inodes. |

SEE ALSO

`chmod(2)`, `close(2)`, `dup(2)`, `fcntl(2)`, `getrlimit(2)`, `lseek(2)`, `open(2)`, `read(2)`, `umask(2)`, `write(2)`, `stat(5)`

DIAGNOSTICS

Upon successful completion a non-negative integer, namely the lowest numbered unused file descriptor, is returned. Otherwise, a value of -1 is returned, no files are created or modified, and `errno` is set to indicate the error.

NAME

creatsem - create an instance of a binary semaphore

SYNOPSIS

```
cc [flag ...] file ... -lx
int creatsem(char *sem_name, int mode);
```

DESCRIPTION

creatsem defines a binary semaphore named by *sem_name* to be used by `waitsem` and `sigsem` to manage mutually exclusive access to a resource, shared variable, or critical section of a program. `creatsem` returns a unique semaphore number, *sem_num*, which may then be used as the parameter in `waitsem` and `sigsem` calls. Semaphores are special files of 0 length. The filename space is used to provide unique identifiers for semaphores. *mode* sets the accessibility of the semaphore using the same format as file access bits. Access to a semaphore is granted only on the basis of the read access bit; the write and execute bits are ignored.

A semaphore can be operated on only by a synchronizing primitive, such as `waitsem` or `sigsem`, by `creatsem` which initializes it to some value, or by `opensem` which opens the semaphore for use by a process. Synchronizing primitives are guaranteed to be executed without interruption once started. These primitives are used by associating a semaphore with each resource (including critical code sections) to be protected.

The process controlling the semaphore should issue:

```
sem_num = creatsem("semaphore", mode);
```

to create, initialize, and open the semaphore for that process. All other processes using the semaphore should issue:

```
sem_num = opensem("semaphore");
```

to access the semaphore's identification value. Note that a process cannot open and use a semaphore that has not been initialized by a call to `creatsem`, nor should a process open a semaphore more than once in one period of execution. Both the creating and opening processes use `waitsem` and `sigsem` to use the semaphore *sem_num*.

DIAGNOSTICS

`creatsem` returns the value -1 if an error occurs. If the semaphore named by *sem_name* is already open for use by other processes, `errno` is set to `EEXIST`. If the file specified exists but is not a semaphore type, `errno` is set to `ENOTNAM`. If the semaphore has not been initialized by a call to `creatsem`, `errno` is set to `EINVAL`.

SEE ALSO

`opensem(2)`, `sigsem(2)`, `waitsem(2)`

NOTES

After a `creatsem`, you must do a `waitsem` to gain control of a given resource.

NAME

crypt, setkey, encrypt - generate encryption

SYNOPSIS

```
#include <crypt.h>
char *crypt (const char *key, const char *salt);
void setkey (const char *key);
void encrypt (char *block, int edflag);
```

DESCRIPTION

crypt is the password encryption function. It is based on a one-way encryption algorithm with variations intended (among other things) to frustrate use of hardware implementations of a key search.

key is the input string to encrypt, for instance, a user's typed password. Only the first eight characters are used; the rest are ignored. *salt* is a two-character string chosen from the set a-zA-Z0-9./; this string is used to perturb the hashing algorithm in one of 4096 different ways, after which the input string is used as the key to encrypt repeatedly a constant string. The returned value points to the encrypted input string. The first two characters of the return value are the *salt* itself.

The *setkey* and *encrypt* functions provide (rather primitive) access to the actual hashing algorithm. The argument of *setkey* is a character array of length 64 containing only the characters with numerical value 0 and 1. This string is divided into groups of 8, the low-order bit in each group is ignored; this gives a 56-bit key that is set into the machine. This is the key that will be used with the hashing algorithm to encrypt the string *block* with the *encrypt* function.

The *block* argument of *encrypt* is a character array of length 64 containing only the characters with numerical value 0 and 1. The argument array is modified in place to a similar array representing the bits of the argument after having been subjected to the hashing algorithm using the key set by *setkey*. The argument *edflag*, indicating decryption rather than encryption, is ignored; use *encrypt* in *libcrypt* [see *crypt(3X)*] for decryption.

SEE ALSO

login(1), passwd(1), crypt(3X), getpass(3C), passwd(4).

DIAGNOSTICS

If *edflag* is set to anything other than zero, *errno* will be set to ENOSYS.

NOTES

The return value for *crypt* points to static data that are overwritten by each call.

NAME

crypt - password and file encryption functions

SYNOPSIS

```
cc [flag ...] file ... -lcrypt [library ...]
#include <crypt.h>
char *crypt (const char *key, const char *salt);
void setkey (const char *key);
void encrypt (char *block, int flag);
char *des_crypt (const char *key, const char *salt);
void des_setkey (const char *key);
void des_encrypt (char *block, int flag);
int run_setkey (int *connection, const char *key);
int run_crypt (long offset, char *buffer, unsigned int count,
              int *connection);
int crypt_close(int *connection);
```

DESCRIPTION

`des_crypt` is the password encryption function. It is based on a one-way hashing encryption algorithm with variations intended (among other things) to frustrate use of hardware implementations of a key search.

key is a user's typed password. *salt* is a two-character string chosen from the set [a-zA-Z0-9./]; this string is used to perturb the hashing algorithm in one of 4096 different ways, after which the password is used as the key to encrypt repeatedly a constant string. The returned value points to the encrypted password. The first two characters are the salt itself.

The `des_setkey` and `des_encrypt` entries provide (rather primitive) access to the actual hashing algorithm. The argument of `des_setkey` is a character array of length 64 containing only the characters with numerical value 0 and 1. If this string is divided into groups of 8, the low-order bit in each group is ignored, thereby creating a 56-bit key that is set into the machine. This key is the key that will be used with the hashing algorithm to encrypt the string *block* with the function `des_encrypt`.

The argument to the `des_encrypt` entry is a character array of length 64 containing only the characters with numerical value 0 and 1. The argument array is modified in place to a similar array representing the bits of the argument after having been subjected to the hashing algorithm using the key set by `des_setkey`. If *flag* is zero, the argument is encrypted; if non-zero, it is decrypted.

Note that decryption is not provided in the international version of `crypt`. The international version is part of the C Development Set, and the domestic version is part of the Encryption Utilities. If decryption is attempted with the international version of `des_encrypt`, an error message is printed.

`crypt`, `setkey`, and `encrypt` are front-end routines that invoke `des_crypt`, `des_setkey`, and `des_encrypt` respectively.

The routines `run_setkey` and `run_crypt` are designed for use by applications that need cryptographic capabilities [such as `ed(1)` and `vi(1)`] that must be compatible with the `crypt(1)` user-level utility. `run_setkey` establishes a two-way pipe connection with the `crypt` utility, using `key` as the password argument. `run_crypt` takes a block of characters and transforms the cleartext or ciphertext into their ciphertext or cleartext using the `crypt` utility. `offset` is the relative byte position from the beginning of the file that the block of text provided in `buffer` is coming from. `count` is the number of characters in `buffer`, and `connection` is an array containing indices to a table of input and output file streams. When encryption is finished, `crypt_close` is used to terminate the connection with the `crypt` utility.

`run_setkey` returns -1 if a connection with the `crypt` utility cannot be established. This result will occur in international versions of the UNIX system in which the `crypt` utility is not available. If a null key is passed to `run_setkey`, 0 is returned. Otherwise, 1 is returned. `run_crypt` returns -1 if it cannot write output or read input from the pipe attached to `crypt`. Otherwise it returns 0.

The program must be linked with the object file access routine library `libcrypt.a`.

SEE ALSO

`crypt(1)`, `login(1)`, `passwd(1)`, `getpass(3C)`, `passwd(4)`.

DIAGNOSTICS

In the international version of `crypt(3X)`, a flag argument of 1 to `encrypt` or `des_encrypt` is not accepted, and `errno` is set to `ENOSYS` to indicate that the functionality is not available.

NOTES

The return value in `crypt` points to static data that are overwritten by each call.

NAME

`csync` - designate portions of memory safe for execution

SYNOPSIS

```
#include <sys/types.h>
int csync(caddr_t base, unsigned length);
```

DESCRIPTION

`csync` designates portions of memory as safe for execution in all executable mappings of the memory. On systems with hardware caches, this notification has the effect of synchronizing the contents of memory with that of the caches.

The values of *base* and *length* designate an area of the calling process's address space: if *length* is zero, all addresses (locations 0x0000 0000 through 0xffff ffff, inclusive) are designated; otherwise, *base* gives the base address and *length* the length (in bytes) of the area. If *length* is not zero, the sum of *base* and *length* shall exceed the value of *base*. The memory associated with the designated area of the calling process's address space is made safe for execution in all executable mappings of the memory.

Under the following conditions, the function `csync` fails and sets `errno` to:

`EINVAL` *base* plus *length* does not exceed *base*.

DIAGNOSTICS

Upon successful completion a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

SEE ALSO

`mencntl(2)`, `mmap(2)`, `mprotect(2)`, `stkprotect(2)`

NAME

ctermid - generate file name for terminal

SYNOPSIS

```
#include <stdio.h>
char *ctermid (char *s);
```

DESCRIPTION

ctermid generates the path name of the controlling terminal for the current process, and stores it in a string.

If *s* is a NULL pointer, the string is stored in an internal static area, the contents of which are overwritten at the next call to ctermid, and the address of which is returned. Otherwise, *s* is assumed to point to a character array of at least `L_ctermid` elements; the path name is placed in this array and the value of *s* is returned. The constant `L_ctermid` is defined in the `stdio.h` header file.

SEE ALSO

ttynname(3C)

NOTES

The difference between `ctermid` and `ttynname(3C)` is that `ttynname` must be handed a file descriptor and returns the actual name of the terminal associated with that file descriptor, while `ctermid` returns a string (`/dev/tty`) that will refer to the terminal if used as a file name. Thus `ttynname` is useful only if the process already has at least one file open to a terminal.

NAME

ctime, localtime, gmtime, asctime, tzset - convert date and time to string

SYNOPSIS

```
#include <time.h>

char *ctime (const time_t *clock);

struct tm *localtime (const time_t *clock);

struct tm *gmtime (const time_t *clock);

char *asctime (const struct tm *tm);

extern time_t timezone, altzone;

extern int daylight;

extern char *tzname[2];

void tzset (void);
```

DESCRIPTION

ctime, localtime, and gmtime accept arguments of type time_t, pointed to by clock, representing the time in seconds since 00:00:00 UTC, January 1, 1970. ctime returns a pointer to a 26-character string as shown below. Time zone and daylight savings corrections are made before the string is generated. The fields are constant in width:

```
Fri Sep 13 00:00:00 1986\n\0
```

localtime and gmtime return pointers to tm structures, described below. localtime corrects for the main time zone and possible alternate ("daylight savings") time zone; gmtime converts directly to Coordinated Universal Time (UTC), which is the time the UNIX system uses internally.

asctime converts a tm structure to a 26-character string, as shown in the above example, and returns a pointer to the string.

Declarations of all the functions and externals, and the tm structure, are in the time.h header file. The structure declaration is:

```
struct    tm {
    int    tm_sec;    /* seconds after the minute - [0, 61] */
                    /* for leap seconds */
    int    tm_min;    /* minutes after the hour - [0, 59] */
    int    tm_hour;   /* hour since midnight - [0, 23] */
    int    tm_mday;   /* day of the month - [1, 31] */
    int    tm_mon;    /* months since January - [0, 11] */
    int    tm_year;   /* years since 1900 */
    int    tm_wday;   /* days since Sunday - [0, 6] */
    int    tm_yday;   /* days since January 1 - [0, 365] */
    int    tm_isdst;  /* flag for alternate daylight */
                    /* savings time */
};
```

The value of tm_isdst is positive if daylight savings time is in effect, zero if daylight savings time is not in effect, and negative if the information is not available. (Previously, the value of tm_isdst was defined as non-zero if daylight savings time was in effect.)

The external `time_t` variable `altzone` contains the difference, in seconds, between Coordinated Universal Time and the alternate time zone. The external variable `timezone` contains the difference, in seconds, between UTC and local standard time. The external variable `daylight` indicates whether time should reflect daylight savings time. Both `timezone` and `altzone` default to 0 (UTC). The external variable `daylight` is non-zero if an alternate time zone exists. The time zone names are contained in the external variable `tzname`, which by default is set to:

```
char *tzname[2] = { "GMT", " " };
```

These functions know about the peculiarities of this conversion for various time periods for the U.S.A. (specifically, the years 1974, 1975, and 1987). They will handle the new daylight savings time starting with the first Sunday in April, 1987.

`tzset` uses the contents of the environment variable `TZ` to override the value of the different external variables. The function `tzset` is called by `asctime` and may also be called by the user. See `environ(5)` for a description of the `TZ` environment variable.

`tzset` scans the contents of the environment variable and assigns the different fields to the respective variable. For example, the most complete setting for New Jersey in 1986 could be

```
EST5EDT4,116/2:00:00,298/2:00:00
```

or simply

```
EST5EDT
```

An example of a southern hemisphere setting such as the Cook Islands could be

```
KDT9:30KST10:00,63/5:00,302/20:00
```

In the longer version of the New Jersey example of `TZ`, `tzname[0]` is `EST`, `timezone` will be set to `5*60*60`, `tzname[1]` is `EDT`, `altzone` will be set to `4*60*60`, the starting date of the alternate time zone is the 117th day at 2 AM, the ending date of the alternate time zone is the 299th day at 2 AM (using zero-based Julian days), and `daylight` will be set positive. Starting and ending times are relative to the alternate time zone. If the alternate time zone start and end dates and the time are not provided, the days for the United States that year will be used and the time will be 2 AM. If the start and end dates are provided but the time is not provided, the time will be 2 AM. The effects of `tzset` are thus to change the values of the external variables `timezone`, `altzone`, `daylight`, and `tzname`. `ctime`, `localtime`, `mktime`, and `strftime` will also update these external variables as if they had called `tzset` at the time specified by the `time_t` or `struct tm` value that they are converting.

Note that in most installations, `TZ` is set to the correct value by default when the user logs on, via the local `/etc/profile` file [see `profile(4)` and `timezone(4)`].

FILES

`/usr/lib/locale/language/LC_TIME` - file containing locale specific date and time information

SEE ALSO

`time(2)`, `getenv(3C)`, `mktime(3C)`, `putenv(3C)`, `printf(3S)`, `setlocale(3C)`, `strftime(3C)`, `cftime(4)`, `profile(4)`, `timezone(4)`, `environ(5)`

NOTES

The return values for `ctime`, `localtime`, and `gmtime` point to static data whose content is overwritten by each call.

Setting the time during the interval of change from `timezone` to `altzone` or vice versa can produce unpredictable results. The system administrator must change the Julian start and end days annually.

NAME

ctype: isdigit, isxdigit, islower, isupper, isalpha, isalnum, isspace, iscntrl, ispunct, isprint, isgraph, isascii - character handling

SYNOPSIS

```
#include <ctype.h>

int isalpha(int c);
int isupper(int c);
int islower(int c);
int isdigit(int c);
int isxdigit(int c);
int isalnum(int c);
int isspace(int c);
int ispunct(int c);
int isprint(int c);
int isgraph(int c);
int iscntrl(int c);
int isascii(int c);
```

DESCRIPTION

These macros classify character-coded integer values. Each is a predicate returning non-zero for true, zero for false. The behavior of these macros, except `isascii`, is affected by the current locale [see `setlocale(3C)`]. To modify the behavior, change the `LC_TYPE` category in `setlocale`, that is, `setlocale(LC_TYPE, newlocale)`. In the C locale, or in a locale where character type information is not defined, characters are classified according to the rules of the US-ASCII 7-bit coded character set.

The macro `isascii` is defined on all integer values; the rest are defined only where the argument is an `int`, the value of which is representable as an unsigned `char`, or `EOF`, which is defined by the `stdio.h` header file and represents end-of-file.

`isalpha` tests for any character for which `isupper` or `islower` is true, or any character that is one of an implementation-defined set of characters for which none of `iscntrl`, `isdigit`, `ispunct`, or `isspace` is true. In the C locale, `isalpha` returns true only for the characters for which `isupper` or `islower` is true.

`isupper` tests for any character that is an upper-case letter or is one of an implementation-defined set of characters for which none of `iscntrl`, `isdigit`, `ispunct`, `isspace`, or `islower` is true. In the C locale, `isupper` returns true only for the characters defined as upper-case ASCII characters.

`islower` tests for any character that is a lower-case letter or is one of an implementation-defined set of characters for which none of `iscntrl`, `isdigit`, `ispunct`, `isspace`, or `isupper` is true. In the C locale, `islower` returns true only for the characters defined as lower-case ASCII characters.

| | |
|-----------------------|---|
| <code>isdigit</code> | tests for any decimal-digit character. |
| <code>isxdigit</code> | tests for any hexadecimal-digit character ([0-9], [A-F] or [a-f]). |
| <code>isalnum</code> | tests for any character for which <code>isalpha</code> or <code>isdigit</code> is true (letter or digit). |
| <code>isspace</code> | tests for any space, tab, carriage-return, newline, vertical-tab or form-feed (standard white-space characters) or for one of an implementation-defined set of characters for which <code>isalnum</code> is false. In the C locale, <code>isspace</code> returns true only for the standard white-space characters. |
| <code>ispunct</code> | tests for any printing character which is neither a space nor a character for which <code>isalnum</code> is true. |
| <code>isprint</code> | tests for any printing character, including space (" "). |
| <code>isgraph</code> | tests for any printing character, except space. |
| <code>iscntrl</code> | tests for any "control character" as defined by the character set. |
| <code>isascii</code> | tests for any ASCII character, code between 0 and 0177 inclusive. |

All the character classification macros and the conversion functions and macros use a table lookup.

Functions exist for all the above defined macros. To get the function form, the macro name must be undefined (for example, `#undef isdigit`).

FILES

`/usr/lib/locale/locale/LC_CTYPE`

SEE ALSO

`chrtbl(1M)`, `setlocale(3C)`, `stdio(3S)`, `ascii(5)`, `environ(5)`

DIAGNOSTICS

If the argument to any of the character handling macros is not in the domain of the function, the result is undefined.

NAME

`curs_addchstr`: `addchstr`, `addchnstr`, `waddchstr`, `waddchnstr`, `mvaddchstr`, `mvaddchnstr`, `mvwaddchstr`, `mvwaddchnstr` - add string of characters (and attributes) to a curses window

SYNOPSIS

```
#include <curses.h>

int addchstr(chtype *chstr);
int addchnstr(chtype *chstr, int n);
int waddchstr(WINDOW *win, chtype *chstr);
int waddchnstr(WINDOW *win, chtype *chstr, int n);
int mvaddchstr(int y, int x, chtype *chstr);
int mvaddchnstr(int y, int x, chtype *chstr, int n);
int mvwaddchstr(WINDOW *win, int y, int x, chtype *chstr);
int mvwaddchnstr(WINDOW *win, int y, int x,
                 chtype *chstr, int n);
```

DESCRIPTION

All of these routines copy *chstr* directly into the window image structure starting at the current cursor position. The four routines with *n* as the last argument copy at most *n* elements, but no more than will fit on the line. If *n*=-1 then the whole string is copied, to the maximum number that fit on the line.

The position of the window cursor is not advanced. These routines works faster than `waddnstr` because they merely copy *chstr* into the window image structure. On the other hand, care must be taken when using these functions because they don't perform any kind of checking (such as for the newline character), they don't advance the current cursor position, and they truncate the string, rather than wrapping it around to the new line.

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion, unless otherwise noted in the preceding routine descriptions.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that all routines except `waddchnstr` may be macros.

SEE ALSO

`curses(3X)`

NAME

`curs_addch`: `addch`, `waddch`, `mvaddch`, `mvwaddch`, `echochar`, `wechochar` - add a character (with attributes) to a curses window and advance cursor

SYNOPSIS

```
#include <curses.h>

addch(chtype ch);
waddch(WINDOW *win, chtype ch);
mvaddch(int y, int x, chtype ch);
mvwaddch(WINDOW *win, int y, int x, chtype ch);
echochar(chtype ch);
wechochar(WINDOW *win, chtype ch);
```

DESCRIPTION

With the `addch`, `waddch`, `mvaddch` and `mvwaddch` routines, the character `ch` is put into the window at the current cursor position of the window and the position of the window cursor is advanced. Its function is similar to that of `putchar`. At the right margin, an automatic newline is performed. At the bottom of the scrolling region, if `scrollok` is enabled, the scrolling region is scrolled up one line.

If `ch` is a tab, newline, or backspace, the cursor is moved appropriately within the window. A newline also does a `clrtoeol` before moving. Tabs are considered to be at every eighth column. If `ch` is another control character, it is drawn in the `^X` notation. Calling `winch` after adding a control character does not return the control character, but instead returns the representation of the control character.

Video attributes can be combined with a character by ORing them into the parameter. This results in these attributes also being set. (The intent here is that text, including attributes, can be copied from one place to another using `inch` and `addch`.) [see `standout`, predefined video attribute constants, on the `curs_attr(3X)` page].

The `echochar` and `wechochar` routines are functionally equivalent to a call to `addch` followed by a call to `refresh`, or a call to `waddch` followed by a call to `wrefresh`. The knowledge that only a single character is being output is taken into consideration and, for non-control characters, a considerable performance gain might be seen by using these routines instead of their equivalents.

Line Graphics

The following variables may be used to add line drawing characters to the screen with routines of the `addch` family. When variables are defined for the terminal, the `A_ALTCHARSET` bit is turned on [see `curs_attr(3X)`]. Otherwise, the default character listed below is stored in the variable. The names chosen are consistent with the VT100 nomenclature.

| Name | Default | Glyph Description |
|--------------|---------|-------------------------|
| ACS_ULCORNER | + | upper left-hand corner |
| ACS_LLCORNER | + | lower left-hand corner |
| ACS_URCORNER | + | upper right-hand corner |
| ACS_LRCORNER | + | lower right-hand corner |
| ACS_RTEE | + | right tee (┘) |
| ACS_LTEE | + | left tee (└) |
| ACS_BTEE | + | bottom tee (┘) |
| ACS_TTEE | + | top tee (└) |
| ACS_HLINE | - | horizontal line |
| ACS_VLINE | \| | vertical line |
| ACS_PLUS | + | plus |
| ACS_S1 | - | scan line 1 |
| ACS_S9 | - | scan line 9 |
| ACS_DIAMOND | + | diamond |
| ACS_CKBOARD | : | checker board (stipple) |
| ACS_DEGREE | ' | degree symbol |
| ACS_PLMINUS | # | plus/minus |
| ACS_BULLET | o | bullet |
| ACS_LARROW | < | arrow pointing left |
| ACS_RARROW | > | arrow pointing right |
| ACS_DARROW | v | arrow pointing down |
| ACS_UARROW | ^ | arrow pointing up |
| ACS_BOARD | # | board of squares |
| ACS_LANTERN | # | lantern symbol |
| ACS_BLOCK | # | solid square block |

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion, unless otherwise noted in the preceding routine descriptions.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `addch`, `mvaddch`, `mvwaddch`, and `echochar` may be macros.

SEE ALSO

`curses(3X)`, `curs_attr(3X)`, `curs_clear(3X)`, `curs_inch(3X)`, `curs_outopts(3X)`, `curs_refresh(3X)` `putc(3S)`

curs_addstr(3X)

curs_addstr(3X)

NAME

`curs_addstr`: `addstr`, `addnstr`, `waddstr`, `waddnstr`, `mvaddstr`, `mvaddnstr`, `mvwaddstr`, `mvwaddnstr` - add a string of characters to a curses window and advance cursor

SYNOPSIS

```
#include <curses.h>

int addstr(char *str);
int addnstr(char *str, int n);
int waddstr(WINDOW *win, char *str);
int waddnstr(WINDOW *win, char *str, int n);
int mvaddstr(y, int x, char *str);
int mvaddnstr(y, int x, char *str, int n);
int mvwaddstr(WINDOW *win, int y, int x, char *str);
int mvwaddnstr(WINDOW *win, int y, int x, char *str,
               int n);
```

DESCRIPTION

All of these routines write all the characters of the null terminated character string *str* on the given window. It is similar to calling `waddch` once for each character in the string. The four routines with *n* as the last argument write at most *n* characters. If *n* is negative, then the entire string will be added.

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that all of these routines except `waddstr` and `waddnstr` may be macros.

SEE ALSO

`curses(3X)`, `curs_addch(3X)`

NAME

`curs_addwch`: `addwch`, `waddwch`, `mvaddwch`, `mvwaddwch`, `echowchar`, `wechowchar`
- add a `wchar_t` character (with attributes) to a curses window and advance cursor

SYNOPSIS

```
#include <curses.h>

int addwch(chtype wch);
int waddwch(WINDOW *win, chtype wch);
int mvaddwch(int y, int x, chtype wch);
int mvwaddwch(WINDOW *win, int y, int x, chtype wch);
int echowchar(chtype wch);
int wechowchar(WINDOW *win, chtype wch);
```

DESCRIPTION

With the `addwch`, `waddwch`, `mvaddwch` and `mvwaddwch` routines, the character `wch` which is holding a `wchar_t` character is put into the window at the current cursor position of the window and the position of the window cursor is advanced. Its function is similar to that of `putwchar` in the C multibyte library. At the right margin, an automatic newline is performed. At the bottom of the scrolling region, if `scrollok` is enabled, the scrolling region is scrolled up one line.

If `wch` is a tab, newline, or backspace, the cursor is moved appropriately within the window. A newline also does a `clrtoeol` before moving. Tabs are considered to be at every eighth column. If `wch` is another control character, it is drawn in the `^X` notation. Calling `winwch` after adding a control character does not return the control character, but instead returns the representation of the control character.

Video attributes can be combined with a `wchar_t` character by OR-ing them into the parameter. This results in these attributes also being set. (The intent here is that text, including attributes, can be copied from one place to another using `inwch` and `addwch`.) [see `standout`, predefined video attribute constants, on the `curs_attr(3X)` page].

The `echowchar` and `wechowchar` routines are functionally equivalent to a call to `addwch` followed by a call to `refresh`, or a call to `waddwch` followed by a call to `wrefresh`. The knowledge that only a single character is being output is taken into consideration and, for non-control characters, a considerable performance gain might be seen by using these routines instead of their equivalents.

Line Graphics

The following variables may be used to add line drawing characters to the screen with routines of the `addwch` family. When variables are defined for the terminal, the `A_ALTCHARSET` bit is turned on [see `curs_attr(3X)`]. Otherwise, the default character listed below is stored in the variable. The names chosen are consistent with the VT100 nomenclature.

| <i>Name</i> | <i>Default</i> | <i>Glyph Description</i> |
|--------------|----------------|--------------------------|
| ACS_ULCORNER | + | upper left-hand corner |
| ACS_LLCORNER | + | lower left-hand corner |
| ACS_URCORNER | + | upper right-hand corner |
| ACS_LRCORNER | + | lower right-hand corner |
| ACS_RTEE | + | right tee (┘) |
| ACS_LTEE | + | left tee (└) |
| ACS_BTEE | + | bottom tee (┘) |
| ACS_TTEE | + | top tee (└) |
| ACS_HLINE | - | horizontal line |
| ACS_VLINE | \| | vertical line |
| ACS_PLUS | + | plus |
| ACS_S1 | - | scan line 1 |
| ACS_S9 | - | scan line 9 |
| ACS_DIAMOND | + | diamond |
| ACS_CKBOARD | : | checker board (stipple) |
| ACS_DEGREE | ' | degree symbol |
| ACS_PLMINUS | # | plus/minus |
| ACS_BULLET | o | bullet |
| ACS_LARROW | < | arrow pointing left |
| ACS_RARROW | > | arrow pointing right |
| ACS_DARROW | v | arrow pointing down |
| ACS_UARROW | ^ | arrow pointing up |
| ACS_BOARD | # | board of squares |
| ACS_LANTERN | # | lantern symbol |
| ACS_BLOCK | # | solid square block |

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion, unless otherwise noted in the preceding routine descriptions.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

Note that `addwch`, `mvaddwch`, `mvwaddwch`, and `echowchar` may be macros.

SEE ALSO

`curses(3X)`, `curs_attr(3X)`, `curs_clear(3X)`, `curs_inwch(3X)`, `curs_outopts(3X)`, `curs_refresh(3X)` `putwc(3W)`.

NAME

`curs_addwstr`: `addwstr`, `addnwstr`, `waddwstr`, `waddnwstr`, `mvaddwstr`, `mvaddnwstr`, `mvwaddwstr`, `mvwaddnwstr` - add a string of `wchar_t` characters to a curses window and advance cursor

SYNOPSIS

```
#include <curses.h>

int addwstr(wchar_t *wstr);
int addnwstr(wchar_t *wstr, int n);
int waddwstr(WINDOW *win, wchar_t *wstr);
int waddnwstr(WINDOW *win, wchar_t *wstr, int n);
int mvaddwstr(y, int x, wchar_t *wstr);
int mvaddnwstr(y, int x, wchar_t *wstr, int n);
int mvwaddwstr(WINDOW *win, int y, int x, wchar_t *wstr);
int mvwaddnwstr(WINDOW *win, int y, int x, wchar_t *wstr,
                int n);
```

DESCRIPTION

All of these routines write all the characters of the null terminated `wchar_t` character string `str` on the given window. It is similar to calling `waddwch` once for each `wchar_t` character in the string. The four routines with `n` as the last argument write at most `n` `wchar_t` characters. If `n` is negative, then the entire string will be added.

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

Note that all of these routines except `waddwstr` and `waddnwstr` may be macros.

SEE ALSO

`curses(3X)`, `curs_addwch(3X)`.

NAME

`curs_addwchstr`: `addwchstr`, `addwchnstr`, `waddwchstr`, `waddwchnstr`, `mvaddwchstr`, `mvaddwchnstr`, `mvwaddwchstr`, `mvwaddwchnstr` - add string of `wchar_t` characters (and attributes) to a curses window

SYNOPSIS

```
#include <curses.h>

int addwchstr(chtype *wchstr);
int addwchnstr(chtype *wchstr, int n);
int waddwchstr(WINDOW *win, chtype *wchstr);
int waddwchnstr(WINDOW *win, chtype *wchstr, int n);
int mvaddwchstr(int y, int x, chtype *wchstr);
int mvaddwchnstr(int y, int x, chtype *wchstr, int n);
int mvwaddwchstr(WINDOW *win, int y, int x, chtype *wchstr);
int mvwaddwchnstr(WINDOW *win, int y, int x,
                  chtype *wchstr, int n);
```

DESCRIPTION

All of these routines copy *wchstr* which points to the string of `wchar_t` characters directly into the window image structure starting at the current cursor position. The four routines with *n* as the last argument copy at most *n* elements, but no more than will fit on the line. If *n*=-1 then the whole string is copied, to the maximum number that fit on the line.

The position of the window cursor is **NOT** advanced. These routines works faster than `waddnwstr` because they merely copy *wchstr* into the window image structure. On the other hand, care must be taken when using these functions because they don't perform any kind of checking (such as for the newline character), they don't advance the current cursor position, and they truncate the string, rather than wrapping it around to the new line.

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion, unless otherwise noted in the preceding routine descriptions.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

Note that all routines except `waddwchnstr` may be macros.

SEE ALSO

`curses(3X)`.

NAME

curs_attr: attroff, wattroff, attron, wattron, attrset, wattrset, standend, wstandend, standout, wstandout - curses character and window attribute control routines

SYNOPSIS

```
#include <curses.h>

int attroff(int attrs);
int wattroff(WINDOW *win, int attrs);
int attron(int attrs);
int wattron(WINDOW *win, int attrs);
int attrset(int attrs);
int wattrset(WINDOW *win, int attrs);
int standend(void);
int wstandend(WINDOW *win);
int standout(void);
int wstandout(WINDOW *win);
```

DESCRIPTION

All of these routines manipulate the current attributes of the named window. The current attributes of a window are applied to all characters that are written into the window with `waddch`, `waddstr` and `wprintw`. Attributes are a property of the character, and move with the character through any scrolling and insert/delete line/character operations. To the extent possible on the particular terminal, they are displayed as the graphic rendition of characters put on the screen.

The routine `attrset` sets the current attributes of the given window to *attrs*. The routine `attroff` turns off the named attributes without turning any other attributes on or off. The routine `attron` turns on the named attributes without affecting any others. The routine `standout` is the same as `attron(A_STANDOUT)`. The routine `standend` is the same as `attrset(0)`, that is, it turns off all attributes.

Attributes

The following video attributes, defined in `curses.h`, can be passed to the routines `attron`, `attroff`, and `attrset`, or ORed with the characters passed to `addch`.

| | |
|----------------------------|---|
| <code>A_STANDOUT</code> | Best highlighting mode of the terminal. |
| <code>A_UNDERLINE</code> | Underlining |
| <code>A_REVERSE</code> | Reverse video |
| <code>A_BLINK</code> | Blinking |
| <code>A_DIM</code> | Half bright |
| <code>A_BOLD</code> | Extra bright or bold |
| <code>A_ALTCHARSET</code> | Alternate character set |
| <code>A_CHARTEXT</code> | Bit-mask to extract a character |
| <code>COLOR_PAIR(n)</code> | Color-pair number <i>n</i> |

The following macro is the reverse of `COLOR_PAIR(n)`:

| | |
|---------------------------------|---|
| <code>PAIR_NUMBER(attrs)</code> | Returns the pair number associated with the <code>COLOR_PAIR(n)</code> attribute. |
|---------------------------------|---|

curs_attr(3X)

curs_attr(3X)

RETURN VALUE

These routines always return 1.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `attroff`, `wattroff`, `attron`, `wattron`, `attrset`, `wattrset`, `standend` and `standout` may be macros.

SEE ALSO

`curses(3X)`, `curs_addch(3X)`, `curs_addstr(3X)`, `curs_printw(3X)`

curs_beep(3X)

curs_beep(3X)

NAME

`curs_beep`: `beep`, `flash` - curses bell and screen flash routines

SYNOPSIS

```
#include <curses.h>
```

```
int beep(void);
```

```
int flash(void);
```

DESCRIPTION

The `beep` and `flash` routines are used to signal the terminal user. The routine `beep` sounds the audible alarm on the terminal, if possible; if that is not possible, it flashes the screen (visible bell), if that is possible. The routine `flash` flashes the screen, and if that is not possible, sounds the audible signal. If neither signal is possible, nothing happens. Nearly all terminals have an audible signal (bell or beep), but only some can flash the screen.

RETURN VALUE

These routines always return OK.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

SEE ALSO

`curses(3X)`

NAME

`curs_bkgd`: `bkgdset`, `wbkgdset`, `bkgd`, `wbkgd` - curses window background manipulation routines

SYNOPSIS

```
#include <curses.h>

void bkgdset(chtype ch);
void wbkgdset(WINDOW *win, chtype ch);
int bkgd(chtype ch);
int wbkgd(WINDOW *win, chtype ch);
```

DESCRIPTION

The `bkgdset` and `wbkgdset` routines manipulate the background of the named window. Background is a `chtype` consisting of any combination of attributes and a character. The attribute part of the background is combined (ORed) with all non-blank characters that are written into the window with `waddch`. Both the character and attribute parts of the background are combined with the blank characters. The background becomes a property of the character and moves with the character through any scrolling and insert/delete line/character operations. To the extent possible on a particular terminal, the attribute part of the background is displayed as the graphic rendition of the character put on the screen.

The `bkgd` and `wbkgd` routines combine the new background with every position in the window. Background is any combination of attributes and a character. Only the attribute part is used to set the background of non-blank characters, while both character and attributes are used for blank positions. To the extent possible on a particular terminal, the attribute part of the background is displayed as the graphic rendition of the character put on the screen.

RETURN VALUE

`bkgd` and `wbkgd` return the integer `OK`, or a non-negative integer, if `immedok` is set.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `bkgdset` and `bkgd` may be macros.

SEE ALSO

`curses(3X)`, `curs_addch(3X)`, `curs_outopts(3X)`

NAME

`curs_border`: `border`, `wborder`, `box`, `hline`, `whline`, `vline`, `wvline` - create curses borders, horizontal and vertical lines

SYNOPSIS

```
#include <curses.h>

int border(chtype ls, chtype rs, chtype ts, chtype bs,
           chtype tl, chtype tr, chtype bl, chtype br);
int wborder(WINDOW *win, chtype ls, chtype rs,
           chtype ts, chtype bs, chtype tl, chtype tr,
           chtype bl, chtype br);
int box(WINDOW *win, chtype verch, chtype horch);
int hline(chtype ch, int n);
int whline(WINDOW *win, chtype ch, int n);
int vline(chtype ch, int n);
int wvline(WINDOW *win, chtype ch, int n);
```

DESCRIPTION

With the `border`, `wborder` and `box` routines, a border is drawn around the edges of the window. The argument `ls` is a character and attributes used for the left side of the border, `rs` - right side, `ts` - top side, `bs` - bottom side, `tl` - top left-hand corner, `tr` - top right-hand corner, `bl` - bottom left-hand corner, and `br` - bottom right-hand corner. If any of these arguments is zero, then the following default values (defined in `curses.h`) are used instead: `ACS_VLINE`, `ACS_VLINE`, `ACS_HLINE`, `ACS_HLINE`, `ACS_ULCORNER`, `ACS_URCORNER`, `ACS_BLCORNER`, `ACS_BRCORNER`.

`box(win, verch, horch)` is a shorthand for the following call: `wborder(win, verch, verch, horch, horch, 0, 0, 0, 0)`.

`hline` and `whline` draw a horizontal (left to right) line using `ch` starting at the current cursor position in the window. The current cursor position is not changed. The line is at most `n` characters long, or as many as fit into the window.

`vline` and `wvline` draw a vertical (top to bottom) line using `ch` starting at the current cursor position in the window. The current cursor position is not changed. The line is at most `n` characters long, or as many as fit into the window.

RETURN VALUE

All routines return the integer `OK`, or a non-negative integer if `immedok` is set.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `border` and `box` may be macros.

SEE ALSO

`curses(3X)`, `curs_outopts(3X)`

curs_clear(3X)

curs_clear(3X)

NAME

`curs_clear`: `erase`, `werase`, `clear`, `wclear`, `clrrobot`, `wclrrobot`, `clrtoeol`, `wclrtoeol` - clear all or part of a curses window

SYNOPSIS

```
# include <curses.h>

int erase(void);
int werase(WINDOW *win);
int clear(void);
int wclear(WINDOW *win);
int clrrobot(void);
int wclrrobot(WINDOW *win);
int clrtoeol(void);
int wclrtoeol(WINDOW *win);
```

DESCRIPTION

The `erase` and `werase` routines copy blanks to every position in the window.

The `clear` and `wclear` routines are like `erase` and `werase`, but they also call `clearok`, so that the screen is cleared completely on the next call to `wrefresh` for that window and repainted from scratch.

The `clrrobot` and `wclrrobot` routines erase all lines below the cursor in the window. Also, the current line to the right of the cursor, inclusive, is erased.

The `clrtoeol` and `wclrtoeol` routines erase the current line to the right of the cursor, inclusive.

RETURN VALUE

All routines return the integer `OK`, or a non-negative integer if `immedok` is set.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `erase`, `werase`, `clear`, `wclear`, `clrrobot`, and `clrtoeol` may be macros.

SEE ALSO

`curses(3X)`, `curs_outopts(3X)`, `curs_refresh(3X)`

NAME

`curs_color`: `start_color`, `init_pair`, `init_color`, `has_colors`, `can_change_color`, `color_content`, `pair_content` - curses color manipulation routines

SYNOPSIS

```
# include <curses.h>

int start_color(void);
int init_pair(short pair, short f, short b);
int init_color(short color, short r, short g, short b);
bool has_colors(void);
bool can_change_color(void);
int color_content(short color, short *r, short *g, short *b);
int pair_content(short pair, short *f, short *b);
```

DESCRIPTION**Overview**

`curses` provides routines that manipulate color on color alphanumeric terminals. To use these routines `start_color` must be called, usually right after `initscr`. Colors are always used in pairs (referred to as color-pairs). A color-pair consists of a foreground color (for characters) and a background color (for the field on which the characters are displayed). A programmer initializes a color-pair with the routine `init_pair`. After it has been initialized, `COLOR_PAIR(n)`, a macro defined in `curses.h`, can be used in the same ways other video attributes can be used. If a terminal is capable of redefining colors, the programmer can use the routine `init_color` to change the definition of a color. The routines `has_colors` and `can_change_color` return `TRUE` or `FALSE`, depending on whether the terminal has color capabilities and whether the programmer can change the colors. The routine `color_content` allows a programmer to identify the amounts of red, green, and blue components in an initialized color. The routine `pair_content` allows a programmer to find out how a given color-pair is currently defined.

Routine Descriptions

The `start_color` routine requires no arguments. It must be called if the programmer wants to use colors, and before any other color manipulation routine is called. It is good practice to call this routine right after `initscr`. `start_color` initializes eight basic colors (black, red, green, yellow, blue, magenta, cyan, and white), and two global variables, `COLORS` and `COLOR_PAIRS` (respectively defining the maximum number of colors and color-pairs the terminal can support). It also restores the colors on the terminal to the values they had when the terminal was just turned on.

The `init_pair` routine changes the definition of a color-pair. It takes three arguments: the number of the color-pair to be changed, the foreground color number, and the background color number. The value of the first argument must be between 1 and `COLOR_PAIRS-1`. The value of the second and third arguments must be between 0 and `COLORS`. If the color-pair was previously initialized, the screen is refreshed and all occurrences of that color-pair is changed to the new definition.

The `init_color` routine changes the definition of a color. It takes four arguments: the number of the color to be changed followed by three RGB values (for the amounts of red, green, and blue components). The value of the first argument must be between 0 and `COLORS`. (See the section **Colors** for the default color index.) Each of the last three arguments must be a value between 0 and 1000. When `init_color` is used, all occurrences of that color on the screen immediately change to the new definition.

The `has_colors` routine requires no arguments. It returns `TRUE` if the terminal can manipulate colors; otherwise, it returns `FALSE`. This routine facilitates writing terminal-independent programs. For example, a programmer can use it to decide whether to use color or some other video attribute.

The `can_change_color` routine requires no arguments. It returns `TRUE` if the terminal supports colors and can change their definitions; other, it returns `FALSE`. This routine facilitates writing terminal-independent programs.

The `color_content` routine gives users a way to find the intensity of the red, green, and blue (RGB) components in a color. It requires four arguments: the color number, and three addresses of `shorts` for storing the information about the amounts of red, green, and blue components in the given color. The value of the first argument must be between 0 and `COLORS`. The values that are stored at the addresses pointed to by the last three arguments are between 0 (no component) and 1000 (maximum amount of component).

The `pair_content` routine allows users to find out what colors a given color-pair consists of. It requires three arguments: the color-pair number, and two addresses of `shorts` for storing the foreground and the background color numbers. The value of the first argument must be between 1 and `COLOR_PAIRS-1`. The values that are stored at the addresses pointed to by the second and third arguments are between 0 and `COLORS`.

Colors

In `curses.h` the following macros are defined. These are the default colors. `curses` also assumes that `COLOR_BLACK` is the default background color for all terminals.

```
COLOR_BLACK
COLOR_RED
COLOR_GREEN
COLOR_YELLOW
COLOR_BLUE
COLOR_MAGENTA
COLOR_CYAN
COLOR_WHITE
```

RETURN VALUE

All routines that return an integer return `ERR` upon failure and `OK` upon successful completion.

curs_color(3X)

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NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

SEE ALSO

`curses(3X)`, `curs_initscr(3X)`, `curs_attr(3X)`

NAME

`curs_delch`: `delch`, `wdelch`, `mvdelch`, `mvwdelch` - delete character under cursor in a curses window

SYNOPSIS

```
#include <curses.h>

int delch(void);
int wdelch(WINDOW *win);
int mvdelch(int y, int x);
int mvwdelch(WINDOW *win, int y, int x);
```

DESCRIPTION

With these routines the character under the cursor in the window is deleted; all characters to the right of the cursor on the same line are moved to the left one position and the last character on the line is filled with a blank. The cursor position does not change (after moving to *y*, *x*, if specified). (This does not imply use of the hardware delete character feature.)

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `delch`, `mvdelch`, and `mvwdelch` may be macros.

SEE ALSO

`curses(3X)`

NAME

`curs_deleteln`: `deleteln`, `wdeleteln`, `insdelln`, `winsdelln`, `insertln`, `winsertln` - delete and insert lines in a curses window

SYNOPSIS

```
#include <curses.h>

int deleteln(void);
int wdeleteln(WINDOW *win);
int insdelln(int n);
int winsdelln(WINDOW *win, int n);
int insertln(void);
int winsertln(WINDOW *win);
```

DESCRIPTION

With the `deleteln` and `wdeleteln` routines, the line under the cursor in the window is deleted; all lines below the current line are moved up one line. The bottom line of the window is cleared. The cursor position does not change. (This does not imply use of a hardware delete line feature.)

With the `insdelln` and `winsdelln` routines, for positive n , insert n lines into the specified window above the current line. The n bottom lines are lost. For negative n , delete n lines (starting with the one under the cursor), and move the remaining lines up. The bottom n lines are cleared. The current cursor position remains the same.

With the `insertln` and `winsertln` routines, a blank line is inserted above the current line and the bottom line is lost. (This does not imply use of a hardware insert line feature.)

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that all but `winsdelln` may be a macros.

SEE ALSO

`curses(3X)`

NAME

`curs_getch`: `getch`, `wgetch`, `mvgetch`, `mvwgetch`, `ungetch` - get (or push back) characters from curses terminal keyboard

SYNOPSIS

```
#include <curses.h>

int getch(void);
int wgetch(WINDOW *win);
int mvgetch(int y, int x);
int mvwgetch(WINDOW *win, int y, int x);
int ungetch(int ch);
```

DESCRIPTION

With the `getch`, `wgetch`, `mvgetch` and `mvwgetch`, routines a character is read from the terminal associated with the window. In no-delay mode, if no input is waiting, the value `ERR` is returned. In delay mode, the program waits until the system passes text through to the program. Depending on the setting of `cbreak`, this is after one character (`cbreak` mode), or after the first newline (`nocbreak` mode). In half-delay mode, the program waits until a character is typed or the specified timeout has been reached. Unless `noecho` has been set, the character will also be echoed into the designated window.

If the window is not a pad, and it has been moved or modified since the last call to `wrefresh`, `wrefresh` will be called before another character is read.

If `keypad` is `TRUE`, and a function key is pressed, the token for that function key is returned instead of the raw characters. Possible function keys are defined in `curses.h` with integers beginning with `0401`, whose names begin with `KEY_`. If a character that could be the beginning of a function key (such as escape) is received, `curses` sets a timer. If the remainder of the sequence does not come in within the designated time, the character is passed through; otherwise, the function key value is returned. For this reason, many terminals experience a delay between the time a user presses the escape key and the escape is returned to the program. Since tokens returned by these routines are outside the ASCII range, they are not printable.

The `ungetch` routine places `ch` back onto the input queue to be returned by the next call to `wgetch`.

Function Keys

The following function keys, defined in `curses.h`, might be returned by `getch` if `keypad` has been enabled. Note that not all of these may be supported on a particular terminal if the terminal does not transmit a unique code when the key is pressed or if the definition for the key is not present in the `terminfo` database.

| Name | Key name |
|-------------------|--|
| KEY_BREAK | Break key |
| KEY_DOWN | The four arrow keys ... |
| KEY_UP | |
| KEY_LEFT | |
| KEY_RIGHT | |
| KEY_HOME | Home key (upward+left arrow) |
| KEY_BACKSPACE | Backspace |
| KEY_F0 | Function keys; space for 64 keys is reserved. |
| KEY_F(<i>n</i>) | For $0 \leq n \leq 63$ |
| KEY_DL | Delete line |
| KEY_IL | Insert line |
| KEY_DC | Delete character |
| KEY_IC | Insert char or enter insert mode |
| KEY_EIC | Exit insert char mode |
| KEY_CLEAR | Clear screen |
| KEY_EOS | Clear to end of screen |
| KEY_EOL | Clear to end of line |
| KEY_SF | Scroll 1 line forward |
| KEY_SR | Scroll 1 line backward (reverse) |
| KEY_NPAGE | Next page |
| KEY_PPAGE | Previous page |
| KEY_STAB | Set tab |
| KEY_CTAB | Clear tab |
| KEY_CATAB | Clear all tabs |
| KEY_ENTER | Enter or send |
| KEY_SRESET | Soft (partial) reset |
| KEY_RESET | Reset or hard reset |
| KEY_PRINT | Print or copy |
| KEY_LL | Home down or bottom (lower left). Keypad is arranged like this: |
| | A1 up A3 |
| | left B2 right |
| | C1 down C3 |
| KEY_A1 | Upper left of keypad |
| KEY_A3 | Upper right of keypad |
| KEY_B2 | Center of keypad |
| KEY_C1 | Lower left of keypad |
| KEY_C3 | Lower right of keypad |
| KEY_BTAB | Back tab key |
| KEY_BEG | Beg(inning) key |
| KEY_CANCEL | Cancel key |
| KEY_CLOSE | Close key |
| KEY_COMMAND | Cmd (command) key |
| KEY_COPY | Copy key |

| Name | Key name |
|---------------|-------------------------|
| KEY_CREATE | Create key |
| KEY_END | End key |
| KEY_EXIT | Exit key |
| KEY_FIND | Find key |
| KEY_HELP | Help key |
| KEY_MARK | Mark key |
| KEY_MESSAGE | Message key |
| KEY_MOVE | Move key |
| KEY_NEXT | Next object key |
| KEY_OPEN | Open key |
| KEY_OPTIONS | Options key |
| KEY_PREVIOUS | Previous object key |
| KEY_REDO | Redo key |
| KEY_REFERENCE | Ref(erence) key |
| KEY_REFRESH | Refresh key |
| KEY_REPLACE | Replace key |
| KEY_RESTART | Restart key |
| KEY_RESUME | Resume key |
| KEY_SAVE | Save key |
| KEY_SBEG | Shifted beginning key |
| KEY_SCANCEL | Shifted cancel key |
| KEY_SCOMMAND | Shifted command key |
| KEY_SCOPY | Shifted copy key |
| KEY_SCREATE | Shifted create key |
| KEY_SDC | Shifted delete char key |
| KEY_SDL | Shifted delete line key |
| KEY_SELECT | Select key |
| KEY_SEND | Shifted end key |
| KEY_SEOL | Shifted clear line key |
| KEY_SEXIT | Shifted exit key |
| KEY_SFIND | Shifted find key |
| KEY_SHELP | Shifted help key |
| KEY_SHOME | Shifted home key |
| KEY_SIC | Shifted input key |
| KEY_SLEFT | Shifted left arrow key |
| KEY_SMESSAGE | Shifted message key |
| KEY_SMOVE | Shifted move key |
| KEY_SNEXT | Shifted next key |
| KEY_SOPTIONS | Shifted options key |
| KEY_SPREVIOUS | Shifted prev key |
| KEY_SPRINT | Shifted print key |
| KEY_SREDO | Shifted redo key |
| KEY_SREPLACE | Shifted replace key |
| KEY_SRIGHT | Shifted right arrow |
| KEY_SRSUME | Shifted resume key |

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| Name | Key name |
|--------------|---------------------|
| KEY_SSAVE | Shifted save key |
| KEY_SSUSPEND | Shifted suspend key |
| KEY_SUNDO | Shifted undo key |
| KEY_SUSPEND | Suspend key |
| KEY_UNDO | Undo key |

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Use of the escape key by a programmer for a single character function is discouraged.

When using `getch`, `wgetch`, `mvgetch`, or `mvwgetch`, `nocbreak` mode (`nocbreak`) and `echo` mode (`echo`) should not be used at the same time. Depending on the state of the tty driver when each character is typed, the program may produce undesirable results.

Note that `getch`, `mvgetch`, and `mvwgetch` may be macros.

SEE ALSO

`curses(3X)`, `curs_inopts(3X)`, `curs_move(3X)`, `curs_refresh(3X)`

NAME

`curs_getstr`: `getstr`, `getnstr`, `wgetstr`, `wgetnstr`, `mvgetstr`, `mvgetnstr`, `mvwgetstr`, `mvwgetnstr` - **get character strings from curses terminal keyboard**

SYNOPSIS

```
#include <curses.h>

int getstr(char *str);
int getnstr(char *str, int n);
int wgetstr(WINDOW *win, char *str);
int wgetnstr(WINDOW *win, char *str, int n);
int mvgetstr(int y, int x, char *str);
int mvgetnstr(int y, int x, char *str, int n);
int mvwgetstr(WINDOW *win, int y, int x, char *str);
int mvwgetnstr(WINDOW *win, int y, int x, char *str, int n);
```

DESCRIPTION

The effect of `getstr` is as though a series of calls to `getch` were made, until a new-line and carriage return is received. The resulting value is placed in the area pointed to by the character pointer `str`. `getnstr` reads at most `n` characters, thus preventing a possible overflow of the input buffer. The user's erase and kill characters are interpreted, as well as any special keys (such as function keys, "home" key, "clear" key, *etc.*).

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

Note that all routines except `wgetnstr` may be macros.

SEE ALSO

`curses(3X)`, `curs_getch(3X)`.

NAME

`curs_getwch`: `getwch`, `wgetwch`, `mvgetwch`, `mvwgetwch`, `ungetwch` - get (or push back) `wchar_t` characters from curses terminal keyboard

SYNOPSIS

```
#include <curses.h>

int getwch(void);
int wgetwch(WINDOW *win);
int mvgetwch(int y, int x);
int mvwgetwch(WINDOW *win, int y, int x);
int ungetwch(wchar_t wch);
```

DESCRIPTION

With the `getwch`, `wgetwch`, `mvgetwch` and `mvwgetwch` routines, a *EUC* character is read from the terminal associated with the window, it is transformed into a `wchar_t` character, and a `wchar_t` character is returned. In no-delay mode, if no input is waiting, the value `ERR` is returned. In delay mode, the program waits until the system passes text through to the program. Depending on the setting of `cbreak`, this is after one character (`cbreak` mode), or after the first newline (`nocbreak` mode). In half-delay mode, the program waits until a character is typed or the specified timeout has been reached. Unless `noecho` has been set, the character will also be echoed into the designated window.

If the window is not a pad, and it has been moved or modified since the last call to `wrefresh`, `wrefresh` will be called before another character is read.

If `keypad` is `TRUE`, and a function key is pressed, the token for that function key is returned instead of the raw characters. Possible function keys are defined in `<curses.h>` with integers beginning with `0401`, whose names begin with `KEY_`. If a character that could be the beginning of a function key (such as escape) is received, `curses` sets a timer. If the remainder of the sequence does not come in within the designated time, the character is passed through; otherwise, the function key value is returned. For this reason, many terminals experience a delay between the time a user presses the escape key and the escape is returned to the program.

The `ungetwch` routine places `wch` back onto the input queue to be returned by the next call to `wgetwch`.

Function Keys

The following function keys, defined in `<curses.h>`, might be returned by `getwch` if `keypad` has been enabled. Note that not all of these may be supported on a particular terminal if the terminal does not transmit a unique code when the key is pressed or if the definition for the key is not present in the *terminfo* database.

| <i>Name</i> | <i>Key name</i> |
|-------------------|---|
| KEY_BREAK | Break key |
| KEY_DOWN | The four arrow keys ... |
| KEY_UP | |
| KEY_LEFT | |
| KEY_RIGHT | |
| KEY_HOME | Home key (upward+left arrow) |
| KEY_BACKSPACE | Backspace |
| KEY_F0 | Function keys; space for 64 keys is reserved. |
| KEY_F(<i>n</i>) | For $0 \leq n \leq 63$ |
| KEY_DL | Delete line |
| KEY_IL | Insert line |
| KEY_DC | Delete character |
| KEY_IC | Insert char or enter insert mode |
| KEY_EIC | Exit insert char mode |
| KEY_CLEAR | Clear screen |
| KEY_EOS | Clear to end of screen |
| KEY_EOL | Clear to end of line |
| KEY_SF | Scroll 1 line forward |
| KEY_SR | Scroll 1 line backward (reverse) |
| KEY_NPAGE | Next page |
| KEY_PPAGE | Previous page |
| KEY_STAB | Set tab |
| KEY_CTAB | Clear tab |
| KEY_CATAB | Clear all tabs |
| KEY_ENTER | Enter or send |
| KEY_SRESET | Soft (partial) reset |
| KEY_RESET | Reset or hard reset |
| KEY_PRINT | Print or copy |
| KEY_LL | Home down or bottom (lower left). Keypad is arranged like this: <div style="margin-left: 40px;"> A1 up A3 left B2 right C1 down C3 </div> |
| KEY_A1 | Upper left of keypad |
| KEY_A3 | Upper right of keypad |
| KEY_B2 | Center of keypad |
| KEY_C1 | Lower left of keypad |
| KEY_C3 | Lower right of keypad |
| KEY_BTAB | Back tab key |
| KEY_BEG | Beg(inning) key |
| KEY_CANCEL | Cancel key |
| KEY_CLOSE | Close key |
| KEY_COMMAND | Cmd (command) key |
| KEY_COPY | Copy key |

| <i>Name</i> | <i>Key name</i> |
|---------------|-------------------------|
| KEY_CREATE | Create key |
| KEY_END | End key |
| KEY_EXIT | Exit key |
| KEY_FIND | Find key |
| KEY_HELP | Help key |
| KEY_MARK | Mark key |
| KEY_MESSAGE | Message key |
| KEY_MOVE | Move key |
| KEY_NEXT | Next object key |
| KEY_OPEN | Open key |
| KEY_OPTIONS | Options key |
| KEY_PREVIOUS | Previous object key |
| KEY_REDO | Redo key |
| KEY_REFERENCE | Ref(erence) key |
| KEY_REFRESH | Refresh key |
| KEY_REPLACE | Replace key |
| KEY_RESTART | Restart key |
| KEY_RESUME | Resume key |
| KEY_SAVE | Save key |
| KEY_SBEG | Shifted beginning key |
| KEY_SCANCEL | Shifted cancel key |
| KEY_SCOMMAND | Shifted command key |
| KEY_SCOPY | Shifted copy key |
| KEY_SCREATE | Shifted create key |
| KEY_SDC | Shifted delete char key |
| KEY_SDL | Shifted delete line key |
| KEY_SELECT | Select key |
| KEY_SEND | Shifted end key |
| KEY_SEOL | Shifted clear line key |
| KEY_SEXIT | Shifted exit key |
| KEY_SFIND | Shifted find key |
| KEY_SHELP | Shifted help key |
| KEY_SHOME | Shifted home key |
| KEY_SIC | Shifted input key |
| KEY_SLEFT | Shifted left arrow key |
| KEY_SMESSAGE | Shifted message key |
| KEY_SMOVE | Shifted move key |
| KEY_SNEXT | Shifted next key |
| KEY_SOPTIONS | Shifted options key |
| KEY_SPREVIOUS | Shifted prev key |
| KEY_SPRINT | Shifted print key |
| KEY_SREDO | Shifted redo key |
| KEY_SREPLACE | Shifted replace key |
| KEY_SRIGHT | Shifted right arrow |
| KEY_SRSUME | Shifted resume key |

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| <i>Name</i> | <i>Key name</i> |
|--------------|---------------------|
| KEY_SSAVE | Shifted save key |
| KEY_SSUSPEND | Shifted suspend key |
| KEY_SUNDO | Shifted undo key |
| KEY_SUSPEND | Suspend key |
| KEY_UNDO | Undo key |

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

Use of the escape key by a programmer for a single character function is discouraged.

When using `getwch`, `wgetwch`, `mvgetwch`, or `mvwgetwch`, `nocbreak` mode (`nocbreak`) and `echo` mode (`echo`) should not be used at the same time. Depending on the state of the tty driver when each character is typed, the program may produce undesirable results.

Note that `getwch`, `mvgetwch`, and `mvwgetwch` may be macros.

SEE ALSO

`curses(3X)`, `curs_inopts(3X)`, `curs_move(3X)`, `curs_refresh(3X)`.

NAME

`curs_getwstr`: `getwstr`, `getnwstr`, `wgetwstr`, `wgetnwstr`, `mvgetwstr`, `mvgetnwstr`, `mvwgetwstr`, `mvwgetnwstr` - get `wchar_t` character strings from curses terminal keyboard

SYNOPSIS

```
#include <curses.h>

int getwstr(wchar_t *wstr);
int getnwstr(wchar_t *wstr, int n);
int mvgetwstr(int y, int x, wchar_t *wstr);
int mvgetnwstr(int y, int x, wchar_t *wstr, int n);
int mvwgetwstr(WINDOW *win, int y, int x, wchar_t *wstr);
int mvwgetnwstr(WINDOW *win, int y, int x, wchar_t *wstr, int n);
int wgetwstr(WINDOW *win, wchar_t *wstr);
int wgetnwstr(WINDOW *win, wchar_t *wstr, int n);
```

DESCRIPTION

The effect of `getwstr` is as though a series of calls to `getwch` were made, until a newline and carriage return is received. The resulting value is placed in the area pointed to by the `wchar_t` pointer `str`. `getnwstr` reads at most `n` `wchar_t` characters, thus preventing a possible overflow of the input buffer. The user's erase and kill characters are interpreted, as well as any special keys (such as function keys, "home" key, "clear" key, *etc.*).

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

Note that all routines except `wgetnwstr` may be macros.

SEE ALSO

`curses(3X)`, `curs_getwch(3X)`.

NAME

`curs_getyx`: `getyx`, `getparyx`, `getbegyx`, `getmaxyx` - get curses cursor and window coordinates

SYNOPSIS

```
#include <curses.h>

void getyx(WINDOW *win, int y, int x);
void getparyx(WINDOW *win, int y, int x);
void getbegyx(WINDOW *win, int y, int x);
void getmaxyx(WINDOW *win, int y, int x);
```

DESCRIPTION

With the `getyx` macro, the cursor position of the window is placed in the two integer variables *y* and *x*.

With the `getparyx` macro, if *win* is a subwindow, the beginning coordinates of the subwindow relative to the parent window are placed into two integer variables, *y* and *x*. Otherwise, `-1` is placed into *y* and *x*.

Like `getyx`, the `getbegyx` and `getmaxyx` macros store the current beginning coordinates and size of the specified window.

RETURN VALUE

The return values of these macros are undefined (that is, they should not be used as the right-hand side of assignment statements).

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that all of these interfaces are macros and that "&" is not necessary before the variables *y* and *x*.

SEE ALSO

`curses(3X)`

curs_inch(3X)

curs_inch(3X)

NAME

`curs_inch`: `inch`, `winch`, `mvinch`, `mvwinch` - get a character and its attributes from a curses window

SYNOPSIS

```
#include <curses.h>
```

```
chtype inch(void);
```

```
chtype winch(WINDOW *win);
```

```
chtype mvinch(int y, int x);
```

```
chtype mvwinch(WINDOW *win, int y, int x);
```

DESCRIPTION

With these routines, the character, of type `chtype`, at the current position in the named window is returned. If any attributes are set for that position, their values are ORed into the value returned. Constants defined in `<curses.h>` can be used with the `&` (logical AND) operator to extract the character or attributes alone.

Attributes

The following bit-masks may be ANDed with characters returned by `winch`.

| | |
|---------------------------|--|
| <code>A_CHARTEXT</code> | Bit-mask to extract character |
| <code>A_ATTRIBUTES</code> | Bit-mask to extract attributes |
| <code>A_COLOR</code> | Bit-mask to extract color-pair field information |

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that all of these routines may be macros.

SEE ALSO

`curses(3X)`

NAME

`curs_inchstr`: `inchstr`, `inchnstr`, `winchstr`, `winchnstr`, `mvinchstr`, `mvinchnstr`, `mvwinchstr`, `mvwinchnstr` - get a string of characters (and attributes) from a curses window

SYNOPSIS

```
#include <curses.h>

int inchstr(chtype *chstr);
int inchnstr(chtype *chstr, int n);
int winchstr(WINDOW *win, chtype *chstr);
int winchnstr(WINDOW *win, chtype *chstr, int n);
int mvinchstr(int y, int x, chtype *chstr);
int mvinchnstr(int y, int x, chtype *chstr, int n);
int mvwinchstr(WINDOW *win, int y, int x, chtype *chstr);
int mvwinchnstr(WINDOW *win, int y, int x, chtype *chstr, int n);
```

DESCRIPTION

With these routines, a string of type `chtype`, starting at the current cursor position in the named window and ending at the right margin of the window, is returned. The four functions with *n* as the last argument, return the string at most *n* characters long. Constants defined in `curses.h` can be used with the `&` (logical AND) operator to extract the character or the attribute alone from any position in the *chstr* [see `curs_inch(3X)`].

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that all routines except `winchnstr` may be macros.

SEE ALSO

`curses(3X)`, `curs_inch(3X)`

NAME

curs_initscr: initscr, newterm, endwin, isendwin, set_term, delscreen - curses screen initialization and manipulation routines

SYNOPSIS

```
#include <curses.h>

WINDOW *initscr(void);

int endwin(void);

int isendwin(void);

SCREEN *newterm(char *type, FILE *outfd, FILE *infd);

SCREEN *set_term(SCREEN *new);

void delscreen(SCREEN* sp);
```

DESCRIPTION

`initscr` is almost always the first routine that should be called (the exceptions are `slk_init`, `filter`, `ripoffline`, `use_env` and, for multiple-terminal applications, `newterm`.) This determines the terminal type and initializes all curses data structures. `initscr` also causes the first call to `refresh` to clear the screen. If errors occur, `initscr` writes an appropriate error message to standard error and exits; otherwise, a pointer is returned to `stdscr`. If the program needs an indication of error conditions, `newterm()` should be used instead of `initscr`; `initscr` should only be called once per application.

A program that outputs to more than one terminal should use the `newterm` routine for each terminal instead of `initscr`. A program that needs an indication of error conditions, so it can continue to run in a line-oriented mode if the terminal cannot support a screen-oriented program, would also use this routine. The routine `newterm` should be called once for each terminal. It returns a variable of type `SCREEN *` which should be saved as a reference to that terminal. The arguments are the *type* of the terminal to be used in place of `$TERM`, a file pointer for output to the terminal, and another file pointer for input from the terminal (if *type* is `NULL`, `$TERM` will be used). The program must also call `endwin` for each terminal being used before exiting from curses. If `newterm` is called more than once for the same terminal, the first terminal referred to must be the last one for which `endwin` is called.

A program should always call `endwin` before exiting or escaping from curses mode temporarily. This routine restores tty modes, moves the cursor to the lower left-hand corner of the screen and resets the terminal into the proper non-visual mode. Calling `refresh` or `doupdate` after a temporary escape causes the program to resume visual mode.

The `isendwin` routine returns `TRUE` if `endwin` has been called without any subsequent calls to `wrefresh`, and `FALSE` otherwise.

The `set_term` routine is used to switch between different terminals. The screen reference `new` becomes the new current terminal. The previous terminal is returned by the routine. This is the only routine which manipulates `SCREEN` pointers; all other routines affect only the current terminal.

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The `delscreen` routine frees storage associated with the `SCREEN` data structure. The `endwin` routine does not do this, so `delscreen` should be called after `endwin` if a particular `SCREEN` is no longer needed.

RETURN VALUE

`endwin` returns the integer `ERR` upon failure and `OK` upon successful completion.

Routines that return pointers always return `NULL` on error.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `initscr` and `newterm` may be macros.

SEE ALSO

`curses(3X)`, `curs_kernel(3X)`, `curs_refresh(3X)`, `curs_slk(3X)`, `curs_util(3X)`

NAME

`curs_inopts`: `cbreak`, `nocbreak`, `echo`, `noecho`, `halfdelay`, `intrflush`, `keypad`, `meta`, `nodelay`, `notimeout`, `raw`, `noraw`, `noqiflush`, `qiflush`, `timeout`, `wtimeout`, `typeahead` - `curses` terminal input option control routines

SYNOPSIS

```
#include <curses.h>

int cbreak(void);
int nocbreak(void);
int echo(void);
int noecho(void);
int halfdelay(int tenths);
int intrflush(WINDOW *win, bool bf);
int keypad(WINDOW *win, bool bf);
int meta(WINDOW *win, bool bf);
int nodelay(WINDOW *win, bool bf);
int notimeout(WINDOW *win, bool bf);
int raw(void);
int noraw(void);
void noqiflush(void);
void qiflush(void);
void timeout(int delay);
void wtimeout(WINDOW *win, int delay);
int typeahead(int fd);
```

DESCRIPTION

The `cbreak` and `nocbreak` routines put the terminal into and out of `cbreak` mode, respectively. In this mode, characters typed by the user are immediately available to the program, and erase/kill character-processing is not performed. When out of this mode, the tty driver buffers the typed characters until a newline or carriage return is typed. Interrupt and flow control characters are unaffected by this mode. Initially the terminal may or may not be in `cbreak` mode, as the mode is inherited; therefore, a program should call `cbreak` or `nocbreak` explicitly. Most interactive programs using `curses` set the `cbreak` mode.

Note that `cbreak` overrides `raw`. [See `curs_getch(3X)` for a discussion of how these routines interact with `echo` and `noecho`.]

The `echo` and `noecho` routines control whether characters typed by the user are echoed by `getch` as they are typed. Echoing by the tty driver is always disabled, but initially `getch` is in `echo` mode, so characters typed are echoed. Authors of most interactive programs prefer to do their own echoing in a controlled area of the screen, or not to echo at all, so they disable echoing by calling `noecho`. [See `curs_getch(3X)` for a discussion of how these routines interact with `cbreak` and

nocbreak.]

The `halfdelay` routine is used for half-delay mode, which is similar to `cbreak` mode in that characters typed by the user are immediately available to the program. However, after blocking for *tenths* tenths of seconds, `ERR` is returned if nothing has been typed. The value of *tenths* must be a number between 1 and 255. Use `nocbreak` to leave half-delay mode.

If the `intrflush` option is enabled, (*bf* is `TRUE`), when an interrupt key is pressed on the keyboard (interrupt, break, quit) all output in the tty driver queue will be flushed, giving the effect of faster response to the interrupt, but causing `curses` to have the wrong idea of what is on the screen. Disabling (*bf* is `FALSE`), the option prevents the flush. The default for the option is inherited from the tty driver settings. The window argument is ignored.

The `keypad` option enables the keypad of the user's terminal. If enabled (*bf* is `TRUE`), the user can press a function key (such as an arrow key) and `wgetch` returns a single value representing the function key, as in `KEY_LEFT`. If disabled (*bf* is `FALSE`), `curses` does not treat function keys specially and the program has to interpret the escape sequences itself. If the keypad in the terminal can be turned on (made to transmit) and off (made to work locally), turning on this option causes the terminal keypad to be turned on when `wgetch` is called. The default value for `keypad` is false.

Initially, whether the terminal returns 7 or 8 significant bits on input depends on the control mode of the tty driver [see `termio(7)`]. To force 8 bits to be returned, invoke `meta(win, TRUE)`. To force 7 bits to be returned, invoke `meta(win, FALSE)`. The window argument, *win*, is always ignored. If the terminfo capabilities `smm` (`meta_on`) and `rmm` (`meta_off`) are defined for the terminal, `smm` is sent to the terminal when `meta(win, TRUE)` is called and `rmm` is sent when `meta(win, FALSE)` is called.

The `nodelay` option causes `getch` to be a non-blocking call. If no input is ready, `getch` returns `ERR`. If disabled (*bf* is `FALSE`), `getch` waits until a key is pressed.

While interpreting an input escape sequence, `wgetch` sets a timer while waiting for the next character. If `notimeout(win, TRUE)` is called, then `wgetch` does not set a timer. The purpose of the timeout is to differentiate between sequences received from a function key and those typed by a user.

With the `raw` and `noraw` routines, the terminal is placed into or out of raw mode. Raw mode is similar to `cbreak` mode, in that characters typed are immediately passed through to the user program. The differences are that in raw mode, the interrupt, quit, suspend, and flow control characters are all passed through uninterpreted, instead of generating a signal. The behavior of the `BREAK` key depends on other bits in the tty driver that are not set by `curses`.

When the `noqiflush` routine is used, normal flush of input and output queues associated with the `INTR`, `QUIT` and `SUSP` characters will not be done [see `termio(7)`]. When `qiflush` is called, the queues will be flushed when these control characters are read.

The `timeout` and `wtimeout` routines set blocking or non-blocking read for a given window. If *delay* is negative, blocking read is used (that is, waits indefinitely for input). If *delay* is zero, then non-blocking read is used (that is, read returns `ERR` if no input is waiting). If *delay* is positive, then read blocks for *delay* milliseconds, and returns `ERR` if there is still no input. Hence, these routines provide the same

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functionality as `nodelay`, plus the additional capability of being able to block for only *delay* milliseconds (where *delay* is positive).

`curses` does “line-breakout optimization” by looking for typeahead periodically while updating the screen. If input is found, and it is coming from a tty, the current update is postponed until `refresh` or `doupdate` is called again. This allows faster response to commands typed in advance. Normally, the input FILE pointer passed to `newterm`, or `stdin` in the case that `initscr` was used, will be used to do this typeahead checking. The `typeahead` routine specifies that the file descriptor *fd* is to be used to check for typeahead instead. If *fd* is -1, then no typeahead checking is done.

RETURN VALUE

All routines that return an integer return `ERR` upon failure and an integer value other than `ERR` upon successful completion, unless otherwise noted in the preceding routine descriptions.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `echo`, `noecho`, `halfdelay`, `intrflush`, `meta`, `nodelay`, `notimeout`, `noqiflush`, `qiflush`, `timeout`, and `wtimeout` may be macros.

SEE ALSO

`curses(3X)`, `curs_getch(3X)`, `curs_initscr(3X)`, `termio(7)`

NAME

`curs_insch`: `insch`, `winsch`, `mvinsch`, `mwinsch` - insert a character before the character under the cursor in a curses window

SYNOPSIS

```
#include <curses.h>

int insch(chtype ch);
int winsch(WINDOW *win, chtype ch);
int mvinsch(int y, int x, chtype ch);
int mwinsch(WINDOW *win, int y, int x, chtype ch);
```

DESCRIPTION

With these routines, the character *ch* is inserted before the character under the cursor. All characters to the right of the cursor are moved one space to the right, with the possibility of the rightmost character on the line being lost. The cursor position does not change (after moving to *y*, *x*, if specified). (This does not imply use of the hardware insert character feature.)

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `insch`, `mvinsch`, and `mwinsch` may be macros.

SEE ALSO

`curses(3X)`

NAME

`curs_instr`: `insstr`, `insnstr`, `winsstr`, `winsnstr`, `mvinsstr`, `mvinsnstr`, `mwinsstr`, `mwinsnstr` - insert string before character under the cursor in a curses window

SYNOPSIS

```
#include <curses.h>

int insstr(char *str);
int insnstr(char *str, int n);
int winsstr(WINDOW *win, char *str);
int winsnstr(WINDOW *win, char *str, int n);
int mvinsstr(int y, int x, char *str);
int mvinsnstr(int y, int x, char *str, int n);
int mwinsstr(WINDOW *win, int y, int x, char *str);
int mwinsnstr(WINDOW *win, int y, int x, char *str, int n);
```

DESCRIPTION

With these routines, a character string (as many characters as will fit on the line) is inserted before the character under the cursor. All characters to the right of the cursor are moved to the right, with the possibility of the rightmost characters on the line being lost. The cursor position does not change (after moving to *y*, *x*, if specified). (This does not imply use of the hardware insert character feature.) The four routines with *n* as the last argument insert at most *n* characters. If *n* ≤ 0, then the entire string is inserted.

If a character in *str* is a tab, newline, carriage return or backspace, the cursor is moved appropriately within the window. A newline also does a `clrtoeol` before moving. Tabs are considered to be at every eighth column. If a character in *str* is another control character, it is drawn in the `^X` notation. Calling `winch` after adding a control character (and moving to it, if necessary) does not return the control character, but instead returns the representation of the control character.

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that all but `winsnstr` may be macros.

SEE ALSO

`curses(3X)`, `curs_clear(3X)`, `curs_inch(3X)`

NAME

`curs_instr`: `instr`, `innstr`, `winstr`, `winnstr`, `mvinstr`, `mvinnstr`, `mvwinstr`, `mvwinnstr` - get a string of characters from a curses window

SYNOPSIS

```
#include <curses.h>

int instr(char *str);
int innstr(char *str, int n);
int winstr(WINDOW *win, char *str);
int winnstr(WINDOW *win, char *str, int n);
int mvinstr(int y, int x, char *str);
int mvinnstr(int y, int x, char *str, int n);
int mvwinstr(WINDOW *win, int y, int x, char *str);
int mvwinnstr(WINDOW *win, int y, int x, char *str, int n);
```

DESCRIPTION

These routines return a string of characters in *str*, starting at the current cursor position in the named window and ending at the right margin of the window. Attributes are stripped from the characters. The four functions with *n* as the last argument return the string at most *n* characters long.

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that all routines except `winnstr` may be macros.

SEE ALSO

`curses(3X)`

NAME

`curs_inswch`: `inswch`, `winswch`, `mvinswch`, `mvwinswch` - insert a `wchar_t` character before the character under the cursor in a curses window

SYNOPSIS

```
#include <curses.h>

int inswch(chtype wch);
int winswch(WINDOW *win, chtype wch);
int mvinswch(int y, int x, chtype wch);
int mvwinswch(WINDOW *win, int y, int x, chtype wch);
```

DESCRIPTION

With these routines, the character *wch* holding a `wchar_t` character is inserted before the character under the cursor. All characters to the right of the cursor are moved one space to the right, with the possibility of the rightmost character on the line being lost. The cursor position does not change (after moving to *y*, *x*, if specified). (This does not imply use of the hardware insert character feature.)

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

Note that `inswch`, `mvinswch`, and `mvwinswch` may be macros.

SEE ALSO

`curses(3X)`.

NAME

`curl_instr`: `inswstr`, `insnwstr`, `winswstr`, `winsnwstr`, `mvinswstr`, `mvinsnwstr`, `mvwinswstr`, `mvwinsnwstr` - insert `wchar_t` string before character under the cursor in a `curses` window

SYNOPSIS

```
#include <curses.h>

int inswstr(wchar_t *wstr);
int insnwstr(wchar_t *wstr, int n);
int winswstr(WINDOW *win, wchar_t *wstr);
int winsnwstr(WINDOW *win, wchar_t *wstr, int n);
int mvinswstr(int y, int x, wchar_t *wstr);
int mvinsnwstr(int y, int x, wchar_t *wstr, int n);
int mvwinswstr(WINDOW *win, int y, int x, wchar_t *wstr);
int mvwinsnwstr(WINDOW *win, int y, int x, wchar_t *wstr, int n);
```

DESCRIPTION

With these routines, a `wchar_t` character string (as many `wchar_t` characters as will fit on the line) is inserted before the character under the cursor. All characters to the right of the cursor are moved to the right, with the possibility of the right-most characters on the line being lost. The cursor position does not change (after moving to `y, x`, if specified). (This does not imply use of the hardware insert character feature.) The four routines with `n` as the last argument insert at most `n` `wchar_t` characters. If `n<=0`, then the entire string is inserted.

If a character in `wstr` is a tab, newline, carriage return or backspace, the cursor is moved appropriately within the window. A newline also does a `clrtoeol` before moving. Tabs are considered to be at every eighth column. If a character in `wstr` is another control character, it is drawn in the `^X` notation. Calling `winch` after adding a control character (and moving to it, if necessary) does not return the control character, but instead returns the representation of the control character.

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

Note that all but `winsnwstr` may be macros.

SEE ALSO

`curses(3X)`, `curl_clear(3X)`, `curl_inwch(3X)`.

NAME

`curs_inwch`: `inwch`, `winwch`, `mvinwch`, `mvwinwch` - get a `wchar_t` character and its attributes from a curses window

SYNOPSIS

```
#include <curses.h>
```

```
chtype inwch(void);
```

```
chtype winwch(WINDOW *win);
```

```
chtype mvinwch(int y, int x);
```

```
chtype mvwinwch(WINDOW *win, int y, int x);
```

DESCRIPTION

With these routines, the `wchar_t` character, of type `chtype`, at the current position in the named window is returned. If any attributes are set for that position, their values are OR-ed into the value returned. Constants defined in `<curses.h>` can be used with the `&` (logical AND) operator to extract the character or attributes alone.

Attributes

The following bit-masks may be AND-ed with characters returned by `winwch`.

| | |
|---------------------------|--|
| <code>A_CHARTEXT</code> | Bit-mask to extract character |
| <code>A_ATTRIBUTES</code> | Bit-mask to extract attributes |
| <code>A_COLOR</code> | Bit-mask to extract color-pair field information |

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

Note that all of these routines may be macros.

SEE ALSO

`curses(3X)`.

NAME

`curs_inwchstr`: `inwchstr`, `inwchnstr`, `winwchstr`, `winwchnstr`, `mvinwchstr`, `mvinwchnstr`, `mvwinwchstr`, `mvwinwchnstr` - **get a string of `wchar_t` characters (and attributes) from a curses window**

SYNOPSIS

```
#include <curses.h>

int inwchstr(chtype *wchstr);
int inwchnstr(chtype *wchstr, int n);
int winwchstr(WINDOW *win, chtype *wchstr);
int winwchnstr(WINDOW *win, chtype *wchstr, int n);
int mvinwchstr(int y, int x, chtype *wchstr);
int mvinwchnstr(int y, int x, chtype *wchstr, int n);
int mvwinwchstr(WINDOW *win, int y, int x, chtype *wchstr);
int mvwinwchnstr(WINDOW *win, int y, int x, chtype *wchstr, int n);
```

DESCRIPTION

With these routines, a string of type `chtype` holding `wchar_t` characters, starting at the current cursor position in the named window and ending at the right margin of the window, is returned. The four functions with `n` as the last argument, return the string at most `n` `wchar_t` characters long. Constants defined in `<curses.h>` can be used with the `&` (logical AND) operator to extract the `wchar_t` character or the attribute alone from any position in the `chstr` [see `curs_inch(3X)`].

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

Note that all routines except `winwchnstr` may be macros.

SEE ALSO

`curses(3X)`, `curs_inwch(3X)`.

NAME

`curs_inwstr`: `inwstr`, `innwstr`, `winwstr`, `winnwstr`, `mvinwstr`, `mvinnwstr`, `mvwinwstr`, `mvwinnwstr` - get a string of `wchar_t` characters from a curses window

SYNOPSIS

```
#include <curses.h>

int inwstr(wchar_t *str);
int innwstr(wchar_t *str, int n);
int winwstr(WINDOW *win, wchar_t *str);
int winnwstr(WINDOW *win, wchar_t *str, int n);
int mvinwstr(int y, int x, wchar_t *str);
int mvinnwstr(int y, int x, wchar_t *str, int n);
int mvwinwstr(WINDOW *win, int y, int x, wchar_t *str);
int mvwinnwstr(WINDOW *win, int y, int x, wchar_t *str, int n);
```

DESCRIPTION

These routines return a string of `wchar_t` characters in `str`, starting at the current cursor position in the named window and ending at the right margin of the window. Attributes are stripped from the characters. The four functions with `n` as the last argument return the string at most `n` `wchar_t` characters long.

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

Note that all routines except `winnwstr` may be macros.

SEE ALSO

`curses(3X)`.

NAME

curs_kernel: def_prog_mode, def_shell_mode, reset_prog_mode, reset_shell_mode, resetty, savetty, getsyx, setsyx, ripoffline, curs_set, napms - low-level curses routines

SYNOPSIS

```
#include <curses.h>

int def_prog_mode(void);
int def_shell_mode(void);
int reset_prog_mode(void);
int reset_shell_mode(void);
int resetty(void);
int savetty(void);
int getsyx(int y, int x);
int setsyx(int y, int x);
int ripoffline(int line, int (*init)(WINDOW *, int));
int curs_set(int visibility);
int napms(int ms);
```

DESCRIPTION

The following routines give low-level access to various curses functionality. These routines typically are used inside library routines.

The `def_prog_mode` and `def_shell_mode` routines save the current terminal modes as the "program" (in curses) or "shell" (not in curses) state for use by the `reset_prog_mode` and `reset_shell_mode` routines. This is done automatically by `initscr`.

The `reset_prog_mode` and `reset_shell_mode` routines restore the terminal to "program" (in curses) or "shell" (out of curses) state. These are done automatically by `endwin` and, after an `endwin`, by `doupdate`, so they normally are not called.

The `resetty` and `savetty` routines save and restore the state of the terminal modes. `savetty` saves the current state in a buffer and `resetty` restores the state to what it was at the last call to `savetty`.

With the `getsyx` routine, the current coordinates of the virtual screen cursor are returned in `y` and `x`. If `leaveok` is currently `TRUE`, then `-1,-1` is returned. If lines have been removed from the top of the screen, using `ripoffline`, `y` and `x` include these lines; therefore, `y` and `x` should be used only as arguments for `setsyx`.

With the `setsyx` routine, the virtual screen cursor is set to `y, x`. If `y` and `x` are both `-1`, then `leaveok` is set. The two routines `getsyx` and `setsyx` are designed to be used by a library routine, which manipulates curses windows but does not want to change the current position of the program's cursor. The library routine would call `getsyx` at the beginning, do its manipulation of its own windows, do a `wnoutrefresh` on its windows, call `setsyx`, and then call `doupdate`.

The `ripoffline` routine provides access to the same facility that `slk_init` [see `curs_slk(3X)`] uses to reduce the size of the screen. `ripoffline` must be called before `initscr` or `newterm` is called. If *line* is positive, a line is removed from the top of `stdscr`; if *line* is negative, a line is removed from the bottom. When this is done inside `initscr`, the routine `init` (supplied by the user) is called with two arguments: a window pointer to the one-line window that has been allocated and an integer with the number of columns in the window. Inside this initialization routine, the integer variables `LINES` and `COLS` (defined in `curses.h`) are not guaranteed to be accurate and `wrefresh` or `doupdate` must not be called. It is allowable to call `wnoutrefresh` during the initialization routine.

`ripoffline` can be called up to five times before calling `initscr` or `newterm`.

With the `curs_set` routine, the cursor state is set to invisible, normal, or very visible for *visibility* equal to 0, 1, or 2 respectively. If the terminal supports the *visibility* requested, the previous *cursor* state is returned; otherwise, `ERR` is returned.

The `napms` routine is used to sleep for *ms* milliseconds.

RETURN VALUE

Except for `curs_set`, these routines always return `OK`. `curs_set` returns the previous cursor state, or `ERR` if the requested *visibility* is not supported.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `getsyx` is a macro, so `&` is not necessary before the variables *y* and *x*.

SEE ALSO

`curses(3X)`, `curs_initscr(3X)`, `curs_outopts(3X)`, `curs_refresh(3X)`,
`curs_scr_dump(3X)`, `curs_slk(3X)`

NAME

curs_move: move, wmove - move curses window cursor

SYNOPSIS

```
#include <curses.h>

int move(int y, int x);
int wmove(WINDOW *win, int y, int x);
```

DESCRIPTION

With these routines, the cursor associated with the window is moved to line *y* and column *x*. This routine does not move the physical cursor of the terminal until `refresh` is called. The position specified is relative to the upper left-hand corner of the window, which is (0,0).

RETURN VALUE

These routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `move` may be a macro.

SEE ALSO

`curses(3X)`, `curs_refresh(3X)`

NAME

curs_ouptops: clearok, idlok, idcok immedok, leaveok, setscreg, wsetscreg, scrollok, nl, nonl - curses **terminal output option control routines**

SYNOPSIS

```
#include <curses.h>

int clearok(WINDOW *win, bool bf);
int idlok(WINDOW *win, bool bf);
void idcok(WINDOW *win, bool bf);
void immedok(WINDOW *win, bool bf);
int leaveok(WINDOW *win, bool bf);
int setscreg(int top, int bot);
int wsetscreg(WINDOW *win, int top, int bot);
int scrollok(WINDOW *win, bool bf);
int nl(void);
int nonl(void);
```

DESCRIPTION

These routines set options that deal with output within curses. All options are initially FALSE, unless otherwise stated. It is not necessary to turn these options off before calling `endwin`.

With the `clearok` routine, if enabled (*bf* is TRUE), the next call to `wrefresh` with this window will clear the screen completely and redraw the entire screen from scratch. This is useful when the contents of the screen are uncertain, or in some cases for a more pleasing visual effect. If the *win* argument to `clearok` is the global variable `curscr`, the next call to `wrefresh` with any window causes the screen to be cleared and repainted from scratch.

With the `idlok` routine, if enabled (*bf* is TRUE), curses considers using the hardware insert/delete line feature of terminals so equipped. If disabled (*bf* is FALSE), curses very seldom uses this feature. (The insert/delete character feature is always considered.) This option should be enabled only if the application needs insert/delete line, for example, for a screen editor. It is disabled by default because insert/delete line tends to be visually annoying when used in applications where it isn't really needed. If insert/delete line cannot be used, curses redraws the changed portions of all lines.

With the `idcok` routine, if enabled (*bf* is TRUE), curses considers using the hardware insert/delete character feature of terminals so equipped. This is enabled by default.

With the `immedok` routine, if enabled (*bf* is TRUE), any change in the window image, such as the ones caused by `waddch`, `wclrtoeol`, `wscrl`, and so on, automatically cause a call to `wrefresh`. However, it may degrade the performance considerably, due to repeated calls to `wrefresh`. It is disabled by default.

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Normally, the hardware cursor is left at the location of the window cursor being refreshed. The `leaveok` option allows the cursor to be left wherever the update happens to leave it. It is useful for applications where the cursor is not used, since it reduces the need for cursor motions. If possible, the cursor is made invisible when this option is enabled.

The `setscreg` and `wsetscreg` routines allow the application programmer to set a software scrolling region in a window. `top` and `bot` are the line numbers of the top and bottom margin of the scrolling region. (Line 0 is the top line of the window.) If this option and `scrollok` are enabled, an attempt to move off the bottom margin line causes all lines in the scrolling region to scroll up one line. Only the text of the window is scrolled. (Note that this has nothing to do with the use of a physical scrolling region capability in the terminal, like that in the VT100. If `idlok` is enabled and the terminal has either a scrolling region or insert/delete line capability, they will probably be used by the output routines.)

The `scrollok` option controls what happens when the cursor of a window is moved off the edge of the window or scrolling region, either as a result of a newline action on the bottom line, or typing the last character of the last line. If disabled, (*bf* is FALSE), the cursor is left on the bottom line. If enabled, (*bf* is TRUE), `wrefresh` is called on the window, and the physical terminal and window are scrolled up one line. [Note that in order to get the physical scrolling effect on the terminal, it is also necessary to call `idlok`.]

The `nl` and `nonl` routines control whether newline is translated into carriage return and linefeed on output, and whether return is translated into newline on input. Initially, the translations do occur. By disabling these translations using `nonl`, `curses` is able to make better use of the linefeed capability, resulting in faster cursor motion.

RETURN VALUE

`setscreg` and `wsetscreg` return OK upon success and ERR upon failure. All other routines that return an integer always return OK.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `clearok`, `leaveok`, `scrollok`, `idcok`, `nl`, `nonl` and `setscreg` may be macros.

The `immedok` routine is useful for windows that are used as terminal emulators.

SEE ALSO

`curses(3X)`, `curs_addch(3X)`, `curs_clear(3X)`, `curs_initscr(3X)`,
`curs_scroll(3X)`, `curs_refresh(3X)`

NAME

`curs_overlay`: `overlay`, `overwrite`, `copywin` - overlap and manipulate overlapped curses windows

SYNOPSIS

```
#include <curses.h>

int overlay(WINDOW *srcwin, WINDOW *dstwin);
int overwrite(WINDOW *srcwin, WINDOW *dstwin);
int copywin(WINDOW *srcwin, WINDOW *dstwin, int sminrow,
            int smincol, int dminrow, int dmincol, int dmaxrow,
            int dmaxcol, int overlay);
```

DESCRIPTION

The `overlay` and `overwrite` routines `overlay` *srcwin* on top of *dstwin*. *srcwin* and *dstwin* are not required to be the same size; only text where the two windows overlap is copied. The difference is that `overlay` is non-destructive (blanks are not copied) whereas `overwrite` is destructive.

The `copywin` routine provides a finer granularity of control over the `overlay` and `overwrite` routines. Like in the `prefresh` routine, a rectangle is specified in the destination window, (*dminrow*, *dmincol*) and (*dmaxrow*, *dmaxcol*), and the upper-left-corner coordinates of the source window, (*sminrow*, *smincol*). If the argument *overlay* is true, then copying is non-destructive, as in `overlay`.

RETURN VALUE

Routines that return an integer return `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `overlay` and `overwrite` may be macros.

SEE ALSO

`curses(3X)`, `curs_pad(3X)`, `curs_refresh(3X)`

NAME

curs_pad: newpad, subpad, prefresh, pnoutrefresh, pechochar, pechowchar - create and display curses pads

SYNOPSIS

```
#include <curses.h>

WINDOW *newpad(int nlines, int ncols);

WINDOW *subpad(WINDOW *orig, int nlines, int ncols,
               int begin_y, int begin_x);

int prefresh(WINDOW *pad, int pminrow, int pmincol,
             int sminrow, int smincol, int smaxrow, int smaxcol);

int pnoutrefresh(WINDOW *pad, int pminrow, int pmincol,
                int sminrow, int smincol, int smaxrow, int smaxcol);

int pechochar(WINDOW *pad, chtype ch);

int pechowchar(WINDOW *pad, chtype wch);
```

DESCRIPTION

The `newpad` routine creates and returns a pointer to a new pad data structure with the given number of lines, *nlines*, and columns, *ncols*. A pad is like a window, except that it is not restricted by the screen size, and is not necessarily associated with a particular part of the screen. Pads can be used when a large window is needed, and only a part of the window will be on the screen at one time. Automatic refreshes of pads (*e.g.*, from scrolling or echoing of input) do not occur. It is not legal to call `wrefresh` with a *pad* as an argument; the routines `prefresh` or `pnoutrefresh` should be called instead. Note that these routines require additional parameters to specify the part of the pad to be displayed and the location on the screen to be used for the display.

The `subpad` routine creates and returns a pointer to a subwindow within a pad with the given number of lines, *nlines*, and columns, *ncols*. Unlike `subwin`, which uses screen coordinates, the window is at position (*begin_x*, *begin_y*) on the pad. The window is made in the middle of the window *orig*, so that changes made to one window affect both windows. During the use of this routine, it will often be necessary to call `touchwin` or `touchline` on *orig* before calling `prefresh`.

The `prefresh` and `pnoutrefresh` routines are analogous to `wrefresh` and `wnoutrefresh` except that they relate to pads instead of windows. The additional parameters are needed to indicate what part of the pad and screen are involved. *pminrow* and *pmincol* specify the upper left-hand corner of the rectangle to be displayed in the pad. *sminrow*, *smincol*, *smaxrow*, and *smaxcol* specify the edges of the rectangle to be displayed on the screen. The lower right-hand corner of the rectangle to be displayed in the pad is calculated from the screen coordinates, since the rectangles must be the same size. Both rectangles must be entirely contained within their respective structures. Negative values of *pminrow*, *pmincol*, *sminrow*, or *smincol* are treated as if they were zero.

The `pechochar` routine is functionally equivalent to a call to `addch` followed by a call to `refresh`, a call to `waddch` followed by a call to `wrefresh`, or a call to `waddch` followed by a call to `prefresh`. The knowledge that only a single character is being output is taken into consideration and, for non-control characters, a

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considerable performance gain might be seen by using these routines instead of their equivalents. In the case of `pechochar`, the last location of the pad on the screen is reused for the arguments to `prefresh`.

The `pechowchar` routine is functionally equivalent to a call to `addwch` followed by a call to `refresh`, a call to `waddwch` followed by a call to `wrefresh`, or a call to `waddwch` followed by a call to `prefresh`.

RETURN VALUE

Routines that return an integer return `ERR` upon failure and an integer value other than `ERR` upon successful completion.

Routines that return pointers return `NULL` on error.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

Note that `pechochar` may be a macro.

SEE ALSO

`curses(3X)`, `curs_refresh(3X)`, `curs_touch(3X)`, `curs_addch(3X)`,
`curs_addwch(3X)`.

NAME

`curs_printw`: `printw`, `wprintw`, `mvprintw`, `mvwprintw`, `vwprintw` - print formatted output in curses windows

SYNOPSIS

```
#include <curses.h>

int printw(char *fmt [, arg] ...);
int wprintw(WINDOW *win, char *fmt [, arg] ...);
int mvprintw(int y, int x, char *fmt [, arg] ...);
int mvwprintw(WINDOW *win, int y, int x,
              char *fmt [, arg] ...);

#include <stdarg.h>
int vwprintw(WINDOW *win, char *fmt, va_list varglist);
```

DESCRIPTION

The `printw`, `wprintw`, `mvprintw` and `mvwprintw` routines are analogous to `printf` [see `printf(3S)`]. In effect, the string that would be output by `printf` is output instead as though `waddstr` were used on the given window.

The `vwprintw` routine is analogous to `vprintf` [see `vprintf(3S)`] and performs a `wprintw` using a variable argument list. The third argument is a `va_list`, a pointer to a list of arguments, as defined in `<stdarg.h>`.

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

SEE ALSO

`curses(3X)`, `printf(3S)`, `printf(3W)`, `vprintf(3S)`.

NAME

`curs_refresh`: `refresh`, `wrefresh`, `wnoutrefresh`, `doupdate`, `redrawwin`, `wredrawln` - refresh curses windows and lines

SYNOPSIS

```
#include <curses.h>

int refresh(void);
int wrefresh(WINDOW *win);
int wnoutrefresh(WINDOW *win);
int doupdate(void);
int redrawwin(WINDOW *win);
int wredrawln(WINDOW *win, int beg_line, int num_lines);
```

DESCRIPTION

The `refresh` and `wrefresh` routines (or `wnoutrefresh` and `doupdate`) must be called to get any output on the terminal, as other routines merely manipulate data structures. The routine `wrefresh` copies the named window to the physical terminal screen, taking into account what is already there in order to do optimizations. The `refresh` routine is the same, using `stdscr` as the default window. Unless `leaveok` has been enabled, the physical cursor of the terminal is left at the location of the cursor for that window.

The `wnoutrefresh` and `doupdate` routines allow multiple updates with more efficiency than `wrefresh` alone. In addition to all the window structures, `curses` keeps two data structures representing the terminal screen: a physical screen, describing what is actually on the screen, and a virtual screen, describing what the programmer wants to have on the screen.

The routine `wrefresh` works by first calling `wnoutrefresh`, which copies the named window to the virtual screen, and then calling `doupdate`, which compares the virtual screen to the physical screen and does the actual update. If the programmer wishes to output several windows at once, a series of calls to `wrefresh` results in alternating calls to `wnoutrefresh` and `doupdate`, causing several bursts of output to the screen. By first calling `wnoutrefresh` for each window, it is then possible to call `doupdate` once, resulting in only one burst of output, with fewer total characters transmitted and less CPU time used. If the `win` argument to `wrefresh` is the global variable `curscr`, the screen is immediately cleared and repainted from scratch.

The `redrawwin` routine indicates to `curses` that some screen lines are corrupted and should be thrown away before anything is written over them. These routines could be used for programs such as editors, which want a command to redraw some part of the screen or the entire screen. The routine `wredrawln` is preferred over `redrawwin` where a noisy communication line exists and redrawing the entire window could be subject to even more communication noise. Just redrawing several lines offers the possibility that they would show up unblemished.

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RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `refresh` and `redrawwin` may be macros.

SEE ALSO

`curses(3X)`, `curs_outopts(3X)`

curs_scanw(3X)

curs_scanw(3X)

NAME

curs_scanw: scanw, wscanw, mvscanw, mvwscanw, vwscanw - convert formatted input from a curses window

SYNOPSIS

```
#include <curses.h>

int scanw(char *fmt [, arg] ...);
int wscanw(WINDOW *win, char *fmt [, arg] ...);
int mvscanw(int y, int x, char *fmt [, arg] ...);
int mvwscanw(WINDOW *win, int y, int x,
             char *fmt [, arg] ...);

#include <stdarg.h>
int vwscanw(WINDOW *win, char *fmt, va_list varglist);
```

DESCRIPTION

The `scanw`, `wscanw` and `mvscanw` routines correspond to `scanf` [see `scanf(3S)`]. The effect of these routines is as though `wgetstr` were called on the window, and the resulting line used as input for the scan. Fields which do not map to a variable in the *fmt* field are lost.

The `vwscanw` routine is similar to `vwprintw` in that it performs a `wscanw` using a variable argument list. The third argument is a *va_list*, a pointer to a list of arguments, as defined in `<stdarg.h>`.

RETURN VALUE

`vwscanw` returns `ERR` on failure and an integer equal to the number of fields scanned on success.

Applications may interrogate the return value from the `scanw`, `wscanw`, `mvscanw` and `mvwscanw` routines to determine the number of fields which were mapped in the call.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

SEE ALSO

`curses(3X)`, `curs_getstr(3X)`, `curs_printw(3X)`, `scanf(3S)`, `scanf(3W)`.

curs_scr_dump(3X)

curs_scr_dump(3X)

NAME

`curs_scr_dump`: `scr_dump`, `scr_restore`, `scr_init`, `scr_set` - read (write) a curses screen from (to) a file

SYNOPSIS

```
#include <curses.h>

int scr_dump(char *filename);
int scr_restore(char *filename);
int scr_init(char *filename);
int scr_set(char *filename);
```

DESCRIPTION

With the `scr_dump` routine, the current contents of the virtual screen are written to the file *filename*.

With the `scr_restore` routine, the virtual screen is set to the contents of *filename*, which must have been written using `scr_dump`. The next call to `doupdate` restores the screen to the way it looked in the dump file.

With the `scr_init` routine, the contents of *filename* are read in and used to initialize the curses data structures about what the terminal currently has on its screen. If the data is determined to be valid, curses bases its next update of the screen on this information rather than clearing the screen and starting from scratch. `scr_init` is used after `initscr` or a `system` [see `system(BA_LIB)`] call to share the screen with another process which has done a `scr_dump` after its `endwin` call. The data is declared invalid if the time-stamp of the tty is old or the terminfo capabilities `rncup` and `nrrmc` exist.

The `scr_set` routine is a combination of `scr_restore` and `scr_init`. It tells the program that the information in *filename* is what is currently on the screen, and also what the program wants on the screen. This can be thought of as a screen inheritance function.

To read (write) a window from (to) a file, use the `getwin` and `putwin` routines [see `curs_util(3X)`].

RETURN VALUE

All routines return the integer `ERR` upon failure and `OK` upon success.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `scr_init`, `scr_set`, and `scr_restore` may be macros.

SEE ALSO

`curses(3X)`, `curs_initscr(3X)`, `curs_refresh(3X)`, `curs_util(3X)`, `system(3S)`

NAME

curs_scroll: scroll, srcl, wscr1 - scroll a curses window

SYNOPSIS

```
#include <curses.h>

int scroll(WINDOW *win);
int srcl(int n);
int wscr1(WINDOW *win, int n);
```

DESCRIPTION

With the `scroll` routine, the window is scrolled up one line. This involves moving the lines in the window data structure. As an optimization, if the scrolling region of the window is the entire screen, the physical screen is scrolled at the same time.

With the `srcl` and `wscr1` routines, for positive n scroll the window up n lines (line $i+n$ becomes i); otherwise scroll the window down n lines. This involves moving the lines in the window character image structure. The current cursor position is not changed.

For these functions to work, scrolling must be enabled via `scrollok`.

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `srcl` and `scroll` may be macros.

SEE ALSO

`curses(3X)`, `curs_outopts(3X)`

NAME

curs_slk: slk_init, slk_set, slk_refresh, slk_noutrefresh, slk_label, slk_clear, slk_restore, slk_touch, slk_attron, slk_attrset, slk_attroff - curses soft label routines

SYNOPSIS

```
#include <curses.h>

int slk_init(int fmt);
int slk_set(int labnum, char *label, int fmt);
int slk_refresh(void);
int slk_noutrefresh(void);
char *slk_label(int labnum);
int slk_clear(void);
int slk_restore(void);
int slk_touch(void);
int slk_attron(chtype attrs);
int slk_attrset(chtype attrs);
int slk_attroff(chtype attrs);
```

DESCRIPTION

curses manipulates the set of soft function-key labels that exist on many terminals. For those terminals that do not have soft labels, curses takes over the bottom line of `stdscr`, reducing the size of `stdscr` and the variable `LINES`. curses standardizes on eight labels of up to eight characters each.

To use soft labels, the `slk_init` routine must be called before `initscr` or `newterm` is called. If `initscr` eventually uses a line from `stdscr` to emulate the soft labels, then `fmt` determines how the labels are arranged on the screen. Setting `fmt` to 0 indicates a 3-2-3 arrangement of the labels; 1 indicates a 4-4 arrangement.

With the `slk_set` routine, `labnum` is the label number, from 1 to 8. `label` is the string to be put on the label, up to eight characters in length. A null string or a null pointer sets up a blank label. `fmt` is either 0, 1, or 2, indicating whether the label is to be left-justified, centered, or right-justified, respectively, within the label.

The `slk_refresh` and `slk_noutrefresh` routines correspond to the `wrefresh` and `wnoutrefresh` routines.

With the `slk_label` routine, the current label for label number `labnum` is returned with leading and trailing blanks stripped.

With the `slk_clear` routine, the soft labels are cleared from the screen.

With the `slk_restore` routine, the soft labels are restored to the screen after a `slk_clear` is performed.

With the `slk_touch` routine, all the soft labels are forced to be output the next time a `slk_noutrefresh` is performed.

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The `slk_attron`, `slk_attrset` and `slk_attroff` routines correspond to `attron`, `attrset`, and `attroff`. They have an effect only if soft labels are simulated on the bottom line of the screen.

RETURN VALUE

Routines that return an integer return `ERR` upon failure and an integer value other than `ERR` upon successful completion.

`slk_label` returns `NULL` on error.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Most applications would use `slk_noutrefresh` because a `wrefresh` is likely to follow soon.

SEE ALSO

`curses(3X)`, `curs_attr(3X)`, `curs_initscr(3X)`, `curs_refresh(3X)`

NAME

`curs_termattrs`: `baudrate`, `erasechar`, `has_ic`, `has_il`, `killchar`, `longname`, `termattrs`, `termname` - curses environment query routines

SYNOPSIS

```
#include <curses.h>

int baudrate(void);
char erasechar(void);
int has_ic(void);
int has_il(void);
char killchar(void);
char *longname(void);
chtype termattrs(void);
char *termname(void);
```

DESCRIPTION

The `baudrate` routine returns the output speed of the terminal. The number returned is in bits per second, for example 9600, and is an integer.

With the `erasechar` routine, the user's current erase character is returned.

The `has_ic` routine is true if the terminal has insert- and delete-character capabilities.

The `has_il` routine is true if the terminal has insert- and delete-line capabilities, or can simulate them using scrolling regions. This might be used to determine if it would be appropriate to turn on physical scrolling using `scrollok`.

With the `killchar` routine, the user's current line kill character is returned.

The `longname` routine returns a pointer to a static area containing a verbose description of the current terminal. The maximum length of a verbose description is 128 characters. It is defined only after the call to `initscr` or `newterm`. The area is overwritten by each call to `newterm` and is not restored by `set_term`, so the value should be saved between calls to `newterm` if `longname` is going to be used with multiple terminals.

If a given terminal doesn't support a video attribute that an application program is trying to use, `curses` may substitute a different video attribute for it. The `termattrs` function returns a logical OR of all video attributes supported by the terminal. This information is useful when a `curses` program needs complete control over the appearance of the screen.

The `termname` routine returns the value of the environmental variable `TERM` (truncated to 14 characters).

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RETURN VALUE

`longname` and `termname` return `NULL` on error.

Routines that return an integer return `ERR` upon failure and an integer value other than `ERR` upon successful completion.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `termattrs` may be a macro.

SEE ALSO

`curses(3X)`, `curs_initscr(3X)`, `curs_outopts(3X)`

NAME

`curs_termcap`: `tgetent`, `tgetflag`, `tgetnum`, `tgetstr`, `tgoto`, `tputs` - curses interfaces (emulated) to the termcap library

SYNOPSIS

```
#include <curses.h>
#include <term.h>

int tgetent(char *bp, char *name);
int tgetflag(char id[2]);
int tgetnum(char id[2]);
char *tgetstr(char id[2], char **area);
char *tgoto(char *cap, int col, int row);
int tputs(char *str, int affcnt, int (*putc)(void));
```

DESCRIPTION

These routines are included as a conversion aid for programs that use the *termcap* library. Their parameters are the same and the routines are emulated using the *terminfo* database. These routines are supported at Level 2 and should not be used in new applications.

The `tgetent` routine looks up the termcap entry for *name*. The emulation ignores the buffer pointer *bp*.

The `tgetflag` routine gets the boolean entry for *id*.

The `tgetnum` routine gets the numeric entry for *id*.

The `tgetstr` routine returns the string entry for *id*. Use `tputs` to output the returned string.

The `tgoto` routine instantiates the parameters into the given capability. The output from this routine is to be passed to `tputs`.

The `tputs` routine is described on the `curs_terminfo(4)` manual page.

RETURN VALUE

Routines that return an integer return `ERR` upon failure and an integer value other than `ERR` upon successful completion.

Routines that return pointers return `NULL` on error.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

SEE ALSO

`curses(3X)`, `curs_terminfo(4)`, `putc(3S)`

NAME

curs_terminfo: `setupterm`, `setterm`, `set_curterm`, `del_curterm`, `restartterm`, `tparam`, `tputs`, `putp`, `vidputs`, `vidattr`, `mvcur`, `tigetflag`, `tigetnum`, `tigetstr` - curses interfaces to terminfo database

SYNOPSIS

```
#include <curses.h>
#include <term.h>

int setupterm(char *term, int fildes, int *errret);
int setterm(char *term);
int set_curterm(TERMINAL *nterm);
int del_curterm(TERMINAL *oterm);
int restartterm(char *term, int fildes, int *errret);
char *tparam(char *str, long int p1, long int p2, long int p3,
             long int p4, long int p5, long int p6, long int p7,
             long int p8, long int p9);
int tputs(char *str, int affcnt, int (*putc)(char));
int putp(char *str);
int vidputs(chtype attrs, int (*putc)(char));
int vidattr(chtype attrs);
int mvcur(int oldrow, int oldcol, int newrow, int newcol);
int tigetflag(char *capname);
int tigetnum(char *capname);
int tigetstr(char *capname);
```

DESCRIPTION

These low-level routines must be called by programs that have to deal directly with the terminfo database to handle certain terminal capabilities, such as programming function keys. For all other functionality, `curses` routines are more suitable and their use is recommended.

Initially, `setupterm` should be called. Note that `setupterm` is automatically called by `initscr` and `newterm`. This defines the set of terminal-dependent variables [listed in `terminfo(4)`]. The terminfo variables `lines` and `columns` are initialized by `setupterm` as follows: If `use_env(FALSE)` has been called, values for `lines` and `columns` specified in `terminfo` are used. Otherwise, if the environment variables `LINES` and `COLUMNS` exist, their values are used. If these environment variables do not exist and the program is running in a window, the current window size is used. Otherwise, if the environment variables do not exist, the values for `lines` and `columns` specified in the terminfo database are used.

The header files `curses.h` and `term.h` should be included (in this order) to get the definitions for these strings, numbers, and flags. Parameterized strings should be passed through `tparam` to instantiate them. All terminfo strings [including the output of `tparam`] should be printed with `tputs` or `putp`. Call the

`reset_shell_mode` to restore the tty modes before exiting [see `curs_kernel(3X)`]. Programs which use cursor addressing should output `enter_ca_mode` upon startup and should output `exit_ca_mode` before exiting. Programs desiring shell escapes should call `reset_shell_mode` and output `exit_ca_mode` before the shell is called and should output `enter_ca_mode` and call `reset_prog_mode` after returning from the shell.

The `setupterm` routine reads in the `terminfo` database, initializing the `terminfo` structures, but does not set up the output virtualization structures used by `curses`. The terminal type is the character string *term*; if *term* is null, the environment variable `TERM` is used. All output is to file descriptor `filides` which is initialized for output. If *errret* is not null, then `setupterm` returns `OK` or `ERR` and stores a status value in the integer pointed to by *errret*. A status of 1 in *errret* is normal, 0 means that the terminal could not be found, and -1 means that the `terminfo` database could not be found. If *errret* is null, `setupterm` prints an error message upon finding an error and exits. Thus, the simplest call is:

```
setupterm((char *)0, 1, (int *)0);,
```

which uses all the defaults and sends the output to `stdout`.

The `setterm` routine is being replaced by `setupterm`. The call:

```
setupterm(term, 1, (int *)0)
```

provides the same functionality as `setterm(term)`. The `setterm` routine is included here for compatibility and is supported at Level 2.

The `set_curterm` routine sets the variable `cur_term` to *nterm*, and makes all of the `terminfo` boolean, numeric, and string variables use the values from *nterm*.

The `del_curterm` routine frees the space pointed to by *oterm* and makes it available for further use. If *oterm* is the same as `cur_term`, references to any of the `terminfo` boolean, numeric, and string variables thereafter may refer to invalid memory locations until another `setupterm` has been called.

The `restartterm` routine is similar to `setupterm` and `initscr`, except that it is called after restoring memory to a previous state. It assumes that the windows and the input and output options are the same as when memory was saved, but the terminal type and baud rate may be different.

The `tparm` routine instantiates the string *str* with parameters *pi*. A pointer is returned to the result of *str* with the parameters applied.

The `tputs` routine applies padding information to the string *str* and outputs it. The *str* must be a `terminfo` string variable or the return value from `tparm`, `tgetstr`, or `tgoto`. *affcnt* is the number of lines affected, or 1 if not applicable. *putc* is a `putchar`-like routine to which the characters are passed, one at a time.

The `putp` routine calls `tputs(str, 1, putchar)`. Note that the output of `putp` always goes to `stdout`, not to the *fildes* specified in `setupterm`.

The `vidputs` routine displays the string on the terminal in the video attribute mode *attrs*, which is any combination of the attributes listed in `curses(3X)`. The characters are passed to the `putchar`-like routine *putc*.

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The `vidattr` routine is like the `vidputs` routine, except that it outputs through `putchar`.

The `mvcur` routine provides low-level cursor motion.

The `tigetflag`, `tigetnum` and `tigetstr` routines return the value of the capability corresponding to the `terminfo` *capname* passed to them, such as `xenl`.

With the `tigetflag` routine, the value `-1` is returned if *capname* is not a boolean capability.

With the `tigetnum` routine, the value `-2` is returned if *capname* is not a numeric capability.

With the `tigetstr` routine, the value `(char *)-1` is returned if *capname* is not a string capability.

The *capname* for each capability is given in the table column entitled *capname* code in the capabilities section of `terminfo(4)`.

```
char *boolnames, *boolcodes, *boolfnames
```

```
char *numnames, *numcodes, *numfnames
```

```
char *strnames, *strcodes, *strfnames
```

These null-terminated arrays contain the *capnames*, the `termcap` codes, and the full C names, for each of the `terminfo` variables.

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion, unless otherwise noted in the preceding routine descriptions.

Routines that return pointers always return `NULL` on error.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

The `setupterm` routine should be used in place of `setterm`.

Note that `vidattr` and `vidputs` may be macros.

SEE ALSO

`curses(3X)`, `curs_initscr(3X)`, `curs_kernel(3X)`, `curs_termcap(3X)`, `putc(3S)`, `terminfo(4)`

NAME

`curs_touch`: `touchwin`, `touchline`, `untouchwin`, `wtouchln`, `is_linetouched`, `is_wintouched` - curses **refresh control routines**

SYNOPSIS

```
#include <curses.h>

int touchwin(WINDOW *win);
int touchline(WINDOW *win, int start, int count);
int untouchwin(WINDOW *win);
int wtouchln(WINDOW *win, int y, int n, int changed);
int is_linetouched(WINDOW *win, int line);
int is_wintouched(WINDOW *win);
```

DESCRIPTION

The `touchwin` and `touchline` routines throw away all optimization information about which parts of the window have been touched, by pretending that the entire window has been drawn on. This is sometimes necessary when using overlapping windows, since a change to one window affects the other window, but the records of which lines have been changed in the other window do not reflect the change. The routine `touchline` only pretends that *count* lines have been changed, beginning with line *start*.

The `untouchwin` routine marks all lines in the window as unchanged since the last call to `wrefresh`.

The `wtouchln` routine makes *n* lines in the window, starting at line *y*, look as if they have (*changed*=1) or have not (*changed*=0) been changed since the last call to `wrefresh`.

The `is_linetouched` and `is_wintouched` routines return `TRUE` if the specified line/window was modified since the last call to `wrefresh`; otherwise they return `FALSE`. In addition, `is_linetouched` returns `ERR` if *line* is not valid for the given window.

RETURN VALUE

All routines return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion, unless otherwise noted in the preceding routine descriptions.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that all routines except `wtouchln` may be macros.

SEE ALSO

`curses(3X)`, `curs_refresh(3X)`

NAME

`curs_util`: `unctrl`, `keyname`, `filter`, `use_env`, `putwin`, `getwin`, `delay_output`, `flushinp` - miscellaneous curses utility routines

SYNOPSIS

```
#include <curses.h>

char *unctrl(chtype c);
char *keyname(int c);
int filter(void);
void use_env(char bool);
int putwin(WINDOW *win, FILE *filep);
WINDOW *getwin(FILE *filep);
int delay_output(int ms);
int flushinp(void);
```

DESCRIPTION

The `unctrl` macro expands to a character string which is a printable representation of the character `c`. Control characters are displayed in the `^X` notation. Printing characters are displayed as is.

With the `keyname` routine, a character string corresponding to the key `c` is returned.

The `filter` routine, if used, is called before `initscr` or `newterm` are called. It makes `curses` think that there is a one-line screen. `curses` does not use any terminal capabilities that assume that they know on what line of the screen the cursor is positioned.

The `use_env` routine, if used, is called before `initscr` or `newterm` are called. When called with `FALSE` as an argument, the values of `lines` and `columns` specified in the `terminfo` database will be used, even if environment variables `LINES` and `COLUMNS` (used by default) are set, or if `curses` is running in a window (in which case default behavior would be to use the window size if `LINES` and `COLUMNS` are not set).

With the `putwin` routine, all data associated with window `win` is written into the file to which `filep` points. This information can be later retrieved using the `getwin` function.

The `getwin` routine reads window related data stored in the file by `putwin`. The routine then creates and initializes a new window using that data. It returns a pointer to the new window.

The `delay_output` routine inserts an `ms` millisecond pause in output. This routine should not be used extensively because padding characters are used rather than a CPU pause.

The `flushinp` routine throws away any typeahead that has been typed by the user and has not yet been read by the program.

RETURN VALUE

Except for `flushinp`, routines that return an integer return `ERR` upon failure and an integer value other than `ERR` upon successful completion.

`flushinp` always returns `OK`.

Routines that return pointers return `NULL` on error.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

Note that `unctrl` is a macro, which is defined in `unctrl.h`.

SEE ALSO

`curses(3X)`, `curs_initscr(3X)`, `curs_scr_dump(3X)`

NAME

`curs_window`: `newwin`, `delwin`, `mvwin`, `subwin`, `derwin`, `mvderwin`, `dupwin`, `wsyncup`, `syncok`, `wcursyncup`, `wsyncdown` - create curses windows

SYNOPSIS

```
#include <curses.h>

WINDOW *newwin(int nlines, int ncols, int begin_y,
               int begin_x);

int delwin(WINDOW *win);

int mvwin(WINDOW *win, int y, int x);

WINDOW *subwin(WINDOW *orig, int nlines, int ncols,
              int begin_y, int begin_x);

WINDOW *derwin(WINDOW *orig, int nlines, int ncols,
              int begin_y, int begin_x);

int mvderwin(WINDOW *win, int par_y, int par_x);

WINDOW *dupwin(WINDOW *win);

void wsyncup(WINDOW *win);

int syncok(WINDOW *win, bool bf);

void wcursyncup(WINDOW *win);

void wsyncdown(WINDOW *win);
```

DESCRIPTION

The `newwin` routine creates and returns a pointer to a new window with the given number of lines, *nlines*, and columns, *ncols*. The upper left-hand corner of the window is at line *begin_y*, column *begin_x*. If either *nlines* or *ncols* is zero, they default to `LINES - begin_y` and `COLS - begin_x`. A new full-screen window is created by calling `newwin(0, 0, 0, 0)`.

The `delwin` routine deletes the named window, freeing all memory associated with it. Subwindows must be deleted before the main window can be deleted.

The `mvwin` routine moves the window so that the upper left-hand corner is at position (*x*, *y*). If the move would cause the window to be off the screen, it is an error and the window is not moved. Moving subwindows is allowed, but should be avoided.

The `subwin` routine creates and returns a pointer to a new window with the given number of lines, *nlines*, and columns, *ncols*. The window is at position (*begin_y*, *begin_x*) on the screen. (This position is relative to the screen, and not to the window *orig*.) The window is made in the middle of the window *orig*, so that changes made to one window will affect both windows. The subwindow shares memory with the window *orig*. When using this routine, it is necessary to call `touchwin` or `touchline` on *orig* before calling `wrefresh` on the subwindow.

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The `derwin` routine is the same as `subwin`, except that `begin_y` and `begin_x` are relative to the origin of the window `orig` rather than the screen. There is no difference between the subwindows and the derived windows.

The `mvderwin` routine moves a derived window (or subwindow) inside its parent window. The screen-relative parameters of the window are not changed. This routine is used to display different parts of the parent window at the same physical position on the screen.

The `dupwin` routine creates an exact duplicate of the window `win`.

Each `curses` window maintains two data structures: the character image structure and the status structure. The character image structure is shared among all windows in the window hierarchy (that is, the window with all subwindows). The status structure, which contains information about individual line changes in the window, is private to each window. The routine `wrefresh` uses the status data structure when performing screen updating. Since status structures are not shared, changes made to one window in the hierarchy may not be properly reflected on the screen.

The routine `wsyncup` causes the changes in the status structure of a window to be reflected in the status structures of its ancestors. If `syncok` is called with second argument `TRUE` then `wsyncup` is called automatically whenever there is a change in the window.

The routine `wcursyncup` updates the current cursor position of all the ancestors of the window to reflect the current cursor position of the window.

The routine `wsyncdown` updates the status structure of the window to reflect the changes in the status structures of its ancestors. Applications seldom call this routine because it is called automatically by `wrefresh`.

RETURN VALUE

Routines that return an integer return the integer `ERR` upon failure and an integer value other than `ERR` upon successful completion.

`delwin` returns the integer `ERR` upon failure and `OK` upon successful completion.

Routines that return pointers return `NULL` on error.

NOTES

The header file `curses.h` automatically includes the header files `stdio.h` and `unctrl.h`.

If many small changes are made to the window, the `wsyncup` option could degrade performance.

Note that `syncok` may be a macro.

SEE ALSO

`curses(3X)`, `curs_refresh(3X)`, `curs_touch(3X)`

NAME

curses - CRT screen handling and optimization package

SYNOPSIS

```
#include <curses.h>
```

DESCRIPTION

The `curses` library routines give the user a terminal-independent method of updating character screens with reasonable optimization. A program using these routines must be compiled with the `-lcurses` option of `cc`.

The `curses` package allows: overall screen, window and pad manipulation; output to windows and pads; reading terminal input; control over terminal and `curses` input and output options; environment query routines; color manipulation; use of soft label keys; terminfo access; and access to low-level `curses` routines.

To initialize the routines, the routine `initscr` or `newterm` must be called before any of the other routines that deal with windows and screens are used. The routine `endwin` must be called before exiting. To get character-at-a-time input without echoing (most interactive, screen oriented programs want this), the following sequence should be used:

```
initscr,cbreak,noecho;
```

Most programs would additionally use the sequence:

```
nonl,intrflush(stdscr,FALSE),keypad(stdscr,TRUE);
```

Before a `curses` program is run, the tab stops of the terminal should be set and its initialization strings, if defined, must be output. This can be done by executing the `tput init` command after the shell environment variable `TERM` has been exported. [See `terminfo(4)` for further details.]

The `curses` library permits manipulation of data structures, called *windows*, which can be thought of as two-dimensional arrays of characters representing all or part of a CRT screen. A default window called `stdscr`, which is the size of the terminal screen, is supplied. Others may be created with `newwin`.

Windows are referred to by variables declared as `WINDOW *`. These data structures are manipulated with routines described on 3X pages (whose names begin "curs_"). Among which the most basic routines are `move` and `addch`. More general versions of these routines are included with names beginning with `w`, allowing the user to specify a window. The routines not beginning with `w` affect `stdscr`.)

After using routines to manipulate a window, `refresh` is called, telling `curses` to make the user's CRT screen look like `stdscr`. The characters in a window are actually of type `chtype`, (character and attribute data) so that other information about the character may also be stored with each character.

Special windows called *pads* may also be manipulated. These are windows which are not constrained to the size of the screen and whose contents need not be completely displayed. See `curs_pad(3X)` for more information.

In addition to drawing characters on the screen, video attributes and colors may be included, causing the characters to show up in such modes as underlined, in reverse video, or in color on terminals that support such display enhancements. Line drawing characters may be specified to be output. On input, `curses` is also able to translate arrow and function keys that transmit escape sequences into single values. The video attributes, line drawing characters, and input values use names,

defined in `<curses.h>`, such as `A_REVERSE`, `ACS_HLINE`, and `KEY_LEFT`.

If the environment variables `LINES` and `COLUMNS` are set, or if the program is executing in a window environment, line and column information in the environment will override information read by *terminfo*.

If the environment variable `TERMINFO` is defined, any program using `curses` checks for a local terminal definition before checking in the standard place. For example, if `TERM` is set to `att4424`, then the compiled terminal definition is found in

```
/usr/share/lib/terminfo/a/att4424.
```

(The `a` is copied from the first letter of `att4424` to avoid creation of huge directories.) However, if `TERMINFO` is set to `$HOME/myterms`, `curses` first checks

```
$HOME/myterms/a/att4424,
```

and if that fails, it then checks

```
/usr/share/lib/terminfo/a/att4424.
```

This is useful for developing experimental definitions or when write permission in `/usr/share/lib/terminfo` is not available.

The integer variables `LINES` and `COLS` are defined in `<curses.h>` and will be filled in by `initscr` with the size of the screen. The constants `TRUE` and `FALSE` have the values 1 and 0, respectively.

The `curses` routines also define the `WINDOW *` variable `curscr` which is used for certain low-level operations like clearing and redrawing a screen containing garbage. The `curscr` can be used in only a few routines.

International Functions

The number of byte and the number of columns to hold a character from the supplementary character set is locale-specific (locale category `LC_CTYPE`) and can be specified in the character class table.

For editing, operating at the character level is entirely appropriate. For screen formatting, arbitrary movement of characters on screen is not desirable.

Overwriting characters (for example, `addch`) operates on a screen level. Overwriting a character by a character which requires a different number of columns may produce *orphaned columns*. These orphaned columns are filled with background character.

Inserting characters (for example, `insch`) operates on a character level (that is, at the character boundaries). The specified character is inserted right before the character, regardless of whichever column of a character the cursor points to. Before insertion, the cursor position is adjusted to the first column of the character.

As with inserting characters, deleting characters (for example, `delch`) operates on a character level (that is, at the character boundaries). The character at the cursor is deleted whichever columns of the character the cursor points to. Before deletion, the cursor position is adjusted to the first column of the character.

Multi-column character cannot be put on the last column of the lines. When such attempts are made, the last column is set to the background character. In addition, when such operation creates orphaned columns, such columns is also be filled with the background character.

Overlapping and overwriting windows follows the operation of overwriting characters around its edge. The orphaned columns, if any, is handled in the same manner of the character operations

The cursor is allowed to be placed anywhere in a window. If the insertion or deletion are made when the cursor points to the second or later column position of a character which holds multiple columns, the cursor is adjusted to the first column of it before the insertion or deletion.

Routine and Argument Names

Many `curses` routines have two or more versions. The routines prefixed with `w` require a window argument. The routines prefixed with `p` require a pad argument. Those without a prefix generally use `stdscr`.

The routines prefixed with `mv` require an `x` and `y` coordinate to move to before performing the appropriate action. The `mv` routines imply a call to `move` before the call to the other routine. The coordinate `y` always refers to the row (of the window), and `x` always refers to the column. The upper left-hand corner is always (0,0), not (1,1).

The routines prefixed with `mvw` take both a window argument and `x` and `y` coordinates. The window argument is always specified before the coordinates.

In each case, `win` is the window affected, and `pad` is the pad affected; `win` and `pad` are always pointers to type `WINDOW`.

Option setting routines require a Boolean flag `bf` with the value `TRUE` or `FALSE`; `bf` is always of type `bool`. The variables `ch` and `attrs` below are always of type `chtype`. The types `WINDOW`, `SCREEN`, `bool`, and `chtype` are defined in `<curses.h>`. The type `TERMINAL` is defined in `<term.h>`. All other arguments are integers.

Routine Name Index

The following table lists each `curses` routine and the name of the manual page on which it is described.

| <code>curses</code> Routine Name | Manual Page Name |
|----------------------------------|---------------------------------|
| <code>addch</code> | <code>curl_addch(3X)</code> |
| <code>addchnstr</code> | <code>curl_addchstr(3X)</code> |
| <code>addchstr</code> | <code>curl_addchstr(3X)</code> |
| <code>addnstr</code> | <code>curl_addstr(3X)</code> |
| <code>addwstr</code> | <code>curl_addwstr(3X)</code> |
| <code>addstr</code> | <code>curl_addstr(3X)</code> |
| <code>addwch</code> | <code>curl_addwch(3X)</code> |
| <code>addwchnstr</code> | <code>curl_addwchstr(3X)</code> |
| <code>addwchstr</code> | <code>curl_addwchstr(3X)</code> |
| <code>addwstr</code> | <code>curl_addwstr(3X)</code> |
| <code>attroff</code> | <code>curl_attr(3X)</code> |
| <code>attron</code> | <code>curl_attr(3X)</code> |
| <code>attrset</code> | <code>curl_attr(3X)</code> |
| <code>baudrate</code> | <code>curl_termattrs(3X)</code> |

| curses Routine Name | Manual Page Name |
|---------------------|--------------------|
| beep | curs_beep(3X) |
| bkgd | curs_bkgd(3X) |
| bkgdset | curs_bkgd(3X) |
| border | curs_border(3X) |
| box | curs_border(3X) |
| can_change_color | curs_color(3X) |
| cbreak | curs_inopts(3X) |
| clear | curs_clear(3X) |
| clearok | curs_outopts(3X) |
| clrtoobot | curs_clear(3X) |
| clrtoeol | curs_clear(3X) |
| color_content | curs_color(3X) |
| copywin | curs_overlay(3X) |
| curs_set | curs_kernel(3X) |
| def_prog_mode | curs_kernel(3X) |
| def_shell_mode | curs_kernel(3X) |
| del_curterm | curs_terminfo(4) |
| delay_output | curs_util(3X) |
| delch | curs_delch(3X) |
| deleteln | curs_deleteln(3X) |
| delscreen | curs_initscr(3X) |
| delwin | curs_window(3X) |
| derwin | curs_window(3X) |
| doupdate | curs_refresh(3X) |
| dupwin | curs_window(3X) |
| echo | curs_inopts(3X) |
| echochar | curs_addch(3X) |
| echowchar | curs_addwch(3X) |
| endwin | curs_initscr(3X) |
| erase | curs_clear(3X) |
| erasechar | curs_termattrs(3X) |
| filter | curs_util(3X) |
| flash | curs_beep(3X) |
| flushinp | curs_util(3X) |
| getbegyx | curs_getyx(3X) |
| getch | curs_getch(3X) |
| getmaxyx | curs_getyx(3X) |
| getnstr | curs_getstr(3X) |
| getnwstr | curs_getwstr(3X) |
| getparyx | curs_getyx(3X) |
| getstr | curs_getstr(3X) |
| getsyx | curs_kernel(3X) |
| getwch | curs_getwch(3X) |
| getwin | curs_util(3X) |
| getwstr | curs_getwstr(3X) |

| curses Routine Name | Manual Page Name |
|---------------------|---------------------|
| getyx | curls_getyx(3X) |
| halfdelay | curls_inopts(3X) |
| has_colors | curls_color(3X) |
| has_ic | curls_termattrs(3X) |
| has_il | curls_termattrs(3X) |
| idcok | curls_outopts(3X) |
| idlok | curls_outopts(3X) |
| immedok | curls_outopts(3X) |
| inch | curls_inch(3X) |
| inchnstr | curls_inchstr(3X) |
| inchstr | curls_inchstr(3X) |
| init_color | curls_color(3X) |
| init_pair | curls_color(3X) |
| initscr | curls_initscr(3X) |
| innstr | curls_instr(3X) |
| innwstr | curls_inwstr(3X) |
| insch | curls_insch(3X) |
| insdelln | curls_deleteln(3X) |
| insertln | curls_deleteln(3X) |
| insnstr | curls_insstr(3X) |
| insnwstr | curls_inswstr(3X) |
| insstr | curls_insstr(3X) |
| instr | curls_instr(3X) |
| inwch | curls_inwch(3X) |
| inwstr | curls_inwstr(3X) |
| intrflush | curls_inopts(3X) |
| inwch | curls_inwch(3X) |
| inwchnstr | curls_inwchstr(3X) |
| inwchstr | curls_inwchstr(3X) |
| inwstr | curls_inwstr(3X) |
| is_linetouched | curls_touch(3X) |
| is_wintouched | curls_touch(3X) |
| isendwin | curls_initscr(3X) |
| keyname | curls_util(3X) |
| keypad | curls_inopts(3X) |
| killchar | curls_termattrs(3X) |
| leaveok | curls_outopts(3X) |
| longname | curls_termattrs(3X) |
| meta | curls_inopts(3X) |
| move | curls_move(3X) |
| mvaddch | curls_addch(3X) |
| mvaddchnstr | curls_addchstr(3X) |
| mvaddchstr | curls_addchstr(3X) |
| mvaddnstr | curls_addstr(3X) |
| mvaddnwstr | curls_addwstr(3X) |

| curses Routine Name | Manual Page Name |
|---------------------|--------------------|
| mvaddstr | curs_addstr(3X) |
| mvaddwch | curs_addwch(3X) |
| mvaddwchnstr | curs_addwchstr(3X) |
| mvaddwchstr | curs_addwchstr(3X) |
| mvaddwstr | curs_addwstr(3X) |
| mvcur | curs_terminfo(4) |
| mvdelch | curs_delch(3X) |
| mvderwin | curs_window(3X) |
| mvgetch | curs_getch(3X) |
| mvgetnstr | curs_getstr(3X) |
| mvgetnwstr | curs_getwstr(3X) |
| mvgetstr | curs_getstr(3X) |
| mvgetwch | curs_getwch(3X) |
| mvgetwstr | curs_getwstr(3X) |
| mvinch | curs_inch(3X) |
| mvinchnstr | curs_inchstr(3X) |
| mvinchstr | curs_inchstr(3X) |
| mvinnstr | curs_instr(3X) |
| mvinnwstr | curs_inwstr(3X) |
| mvinsch | curs_insch(3X) |
| mvinsnstr | curs_insstr(3X) |
| mvinsnwstr | curs_inswstr(3X) |
| mvinsstr | curs_insstr(3X) |
| mvinstr | curs_instr(3X) |
| mvinswch | curs_inswch(3X) |
| mvinswstr | curs_inswstr(3X) |
| mvinwch | curs_inwch(3X) |
| mvinwchnstr | curs_inwchstr(3X) |
| mvinwchstr | curs_inwchstr(3X) |
| mvinwstr | curs_inwstr(3X) |
| mvprintw | curs_printw(3X) |
| mvscanw | curs_scanw(3X) |
| mwaddch | curs_addch(3X) |
| mwaddchnstr | curs_addchstr(3X) |
| mwaddchstr | curs_addchstr(3X) |
| mwaddnstr | curs_addstr(3X) |
| mwaddnwstr | curs_addwstr(3X) |
| mwaddstr | curs_addstr(3X) |
| mwaddwch | curs_addwch(3X) |
| mwaddwchnstr | curs_addwchstr(3X) |
| mwaddwchstr | curs_addwchstr(3X) |
| mwaddwstr | curs_addwstr(3X) |
| mwdelch | curs_delch(3X) |
| mwgetch | curs_getch(3X) |
| mwgetnstr | curs_getstr(3X) |

| curses | Routine Name | Manual Page Name |
|--------|---------------------|-------------------------|
| | mvwgetnwstr | curs_getwstr(3X) |
| | mvwgetstr | curs_getstr(3X) |
| | mvwgetwch | curs_getwch(3X) |
| | mvwgetwstr | curs_getwstr(3X) |
| | mvwin | curs_window(3X) |
| | mvwinch | curs_inch(3X) |
| | mvwinchnstr | curs_inchstr(3X) |
| | mvwinchstr | curs_inchstr(3X) |
| | mvwinnstr | curs_instr(3X) |
| | mvwinnwstr | curs_inwstr(3X) |
| | mvwinsch | curs_insch(3X) |
| | mvwinsnstr | curs_insstr(3X) |
| | mvwinsnwstr | curs_inswstr(3X) |
| | mvwinsstr | curs_insstr(3X) |
| | mvwinstr | curs_instr(3X) |
| | mvwinswch | curs_inswch(3X) |
| | mvwinswstr | curs_inswstr(3X) |
| | mvwinwch | curs_inwch(3X) |
| | mvwinwchnstr | curs_inwchstr(3X) |
| | mvwinwchstr | curs_inwchstr(3X) |
| | mvwinwstr | curs_inwstr(3X) |
| | mvwprintw | curs_printw(3X) |
| | mvwscanw | curs_scanw(3X) |
| | napms | curs_kernel(3X) |
| | newpad | curs_pad(3X) |
| | newterm | curs_initscr(3X) |
| | newwin | curs_window(3X) |
| | nl | curs_outopts(3X) |
| | nocbreak | curs_inopts(3X) |
| | nodelay | curs_inopts(3X) |
| | noecho | curs_inopts(3X) |
| | nonl | curs_outopts(3X) |
| | noqiflush | curs_inopts(3X) |
| | noraw | curs_inopts(3X) |
| | notimeout | curs_inopts(3X) |
| | overlay | curs_overlay(3X) |
| | overwrite | curs_overlay(3X) |
| | pair_content | curs_color(3X) |
| | pechochar | curs_pad(3X) |
| | pechowchar | curs_pad(3X) |
| | pnoutrefresh | curs_pad(3X) |
| | prefresh | curs_pad(3X) |
| | printw | curs_printw(3X) |
| | putp | curs_terminfo(4) |
| | putwin | curs_util(3X) |

| curses | Routine Name | Manual Page Name |
|--------|------------------|---------------------|
| | qiflush | curls_inopts(3X) |
| | raw | curls_inopts(3X) |
| | redrawwin | curls_refresh(3X) |
| | refresh | curls_refresh(3X) |
| | reset_prog_mode | curls_kernel(3X) |
| | reset_shell_mode | curls_kernel(3X) |
| | resetty | curls_kernel(3X) |
| | restartterm | curls_terminfo(4) |
| | ripline | curls_kernel(3X) |
| | savetty | curls_kernel(3X) |
| | scanw | curls_scanw(3X) |
| | scr_dump | curls_scr_dump(3X) |
| | scr_init | curls_scr_dump(3X) |
| | scr_restore | curls_scr_dump(3X) |
| | scr_set | curls_scr_dump(3X) |
| | scroll | curls_scroll(3X) |
| | scrollok | curls_outopts(3X) |
| | set_curterm | curls_terminfo(4) |
| | set_term | curls_initscr(3X) |
| | setscreg | curls_outopts(3X) |
| | setyx | curls_kernel(3X) |
| | setterm | curls_terminfo(4) |
| | setupterm | curls_terminfo(4) |
| | slk_atroff | curls_slk(3X) |
| | slk_attron | curls_slk(3X) |
| | slk_attrset | curls_slk(3X) |
| | slk_clear | curls_slk(3X) |
| | slk_init | curls_slk(3X) |
| | slk_label | curls_slk(3X) |
| | slk_noutrefresh | curls_slk(3X) |
| | slk_refresh | curls_slk(3X) |
| | slk_restore | curls_slk(3X) |
| | slk_set | curls_slk(3X) |
| | slk_touch | curls_slk(3X) |
| | srcl | curls_scroll(3X) |
| | standend | curls_attr(3X) |
| | standout | curls_attr(3X) |
| | start_color | curls_color(3X) |
| | subpad | curls_pad(3X) |
| | subwin | curls_window(3X) |
| | syncok | curls_window(3X) |
| | termattrs | curls_termattrs(3X) |
| | termname | curls_termattrs(3X) |
| | tgetent | curls_termcap(3X) |
| | tgetflag | curls_termcap(3X) |

| curses | Routine Name | Manual Page Name |
|--------|--------------|--------------------|
| | tgetnum | curs_termcap(3X) |
| | tgetstr | curs_termcap(3X) |
| | tgoto | curs_termcap(3X) |
| | tigetflag | curs_terminfo(4) |
| | tigetnum | curs_terminfo(4) |
| | tigetstr | curs_terminfo(4) |
| | timeout | curs_inopts(3X) |
| | touchline | curs_touch(3X) |
| | touchwin | curs_touch(3X) |
| | tparm | curs_terminfo(4) |
| | tputs | curs_termcap(3X) |
| | tputs | curs_terminfo(4) |
| | typeahead | curs_inopts(3X) |
| | unctrl | curs_util(3X) |
| | ungetch | curs_getch(3X) |
| | ungetwch | curs_getwch(3X) |
| | untouchwin | curs_touch(3X) |
| | use_env | curs_util(3X) |
| | vidattr | curs_terminfo(4) |
| | vidputs | curs_terminfo(4) |
| | vwprintw | curs_printw(3X) |
| | vwscanw | curs_scanw(3X) |
| | waddch | curs_addch(3X) |
| | waddchnstr | curs_addchstr(3X) |
| | waddchstr | curs_addchstr(3X) |
| | waddnstr | curs_addstr(3X) |
| | waddnwstr | curs_addwstr(3X) |
| | waddstr | curs_addstr(3X) |
| | waddwch | curs_addwch(3X) |
| | waddwchnstr | curs_addwchstr(3X) |
| | waddwchstr | curs_addwchstr(3X) |
| | waddwstr | curs_addwstr(3X) |
| | wattroff | curs_attr(3X) |
| | wattron | curs_attr(3X) |
| | wattrset | curs_attr(3X) |
| | wbkgd | curs_bkgd(3X) |
| | wbkgdset | curs_bkgd(3X) |
| | wborder | curs_border(3X) |
| | wclear | curs_clear(3X) |
| | wclrtoobot | curs_clear(3X) |
| | wclrtoeol | curs_clear(3X) |
| | wcursyncup | curs_window(3X) |
| | wdelch | curs_delch(3X) |
| | wdeleteln | curs_deleteln(3X) |
| | wechochar | curs_addch(3X) |

| curses | Routine Name | Manual Page Name |
|--------|--------------|-------------------|
| | wechownchar | curs_addwch(3X) |
| | werase | curs_clear(3X) |
| | wgetch | curs_getch(3X) |
| | wgetnstr | curs_getstr(3X) |
| | wgetnwstr | curs_getwstr(3X) |
| | wgetstr | curs_getstr(3X) |
| | wgetwch | curs_getwch(3X) |
| | wgetwstr | curs_getwstr(3X) |
| | whline | curs_border(3X) |
| | winch | curs_inch(3X) |
| | winchnstr | curs_inchstr(3X) |
| | winchstr | curs_inchstr(3X) |
| | winnstr | curs_instr(3X) |
| | winnwstr | curs_inwstr(3X) |
| | winsch | curs_insch(3X) |
| | winsdelln | curs_deleteln(3X) |
| | winsertln | curs_deleteln(3X) |
| | winsnstr | curs_insstr(3X) |
| | winsnwstr | curs_inswstr(3X) |
| | winsstr | curs_insstr(3X) |
| | winstr | curs_instr(3X) |
| | winswch | curs_inswch(3X) |
| | winswstr | curs_inswstr(3X) |
| | winwch | curs_inwch(3X) |
| | winwnstr | curs_inwchstr(3X) |
| | winwchstr | curs_inwchstr(3X) |
| | winwstr | curs_inwstr(3X) |
| | wmove | curs_move(3X) |
| | wnoutrefresh | curs_refresh(3X) |
| | wprintw | curs_printw(3X) |
| | wredrawln | curs_refresh(3X) |
| | wrefresh | curs_refresh(3X) |
| | wscanw | curs_scanw(3X) |
| | wscrl | curs_scroll(3X) |
| | wsetscreg | curs_outopts(3X) |
| | wstandend | curs_attr(3X) |
| | wstandout | curs_attr(3X) |
| | wsyncdown | curs_window(3X) |
| | wsyncup | curs_window(3X) |
| | wtimeout | curs_inopts(3X) |
| | wtouchln | curs_touch(3X) |
| | wvline | curs_border(3X) |

RETURN VALUE

Routines that return an integer return `ERR` upon failure and an integer value other than `ERR` upon successful completion, unless otherwise noted in the routine descriptions.

All macros return the value of the `w` version, except `setscrreg`, `wsetscrreg`, `getyx`, `getbegyx`, `getmaxyx`. The return values of `setscrreg`, `wsetscrreg`, `getyx`, `getbegyx`, and `getmaxyx` are undefined (that is, these should not be used as the right-hand side of assignment statements).

Routines that return pointers return `NULL` on error.

SEE ALSO

`terminfo(4)` and 3X pages whose names begin "curs_" for detailed routine descriptions.

`curs_addch(3X)`, `curs_addchstr(3X)`, `curs_addstr(3X)`, `curs_attr(3X)`, `curs_beep(3X)`, `curs_bkgd(3X)`, `curs_border(3X)`, `curs_clear(3X)`, `curs_color(3X)`, `curs_delch(3X)`, `curs_deleteln(3X)`, `curs_getch(3X)`, `curs_getyx(3X)`, `curs_inch(3X)`, `curs_inchstr(3X)`, `curs_initscr(3X)`, `curs_inopts(3X)`, `curs_insch(3X)`, `curs_insstr(3X)`, `curs_instr(3X)`, `curs_kernel(3X)`, `curs_move(3X)`, `curs_outopts(3X)`, `curs_overlay(3X)`, `curs_refresh(3X)`, `curs_scr_dmp(3X)`, `curs_scroll(3X)`, `curs_slk(3X)`, `curs_termattr(3X)`, `curs_termcap(3X)`, `curs_terminfo(3X)`, `curs_touch(3X)`, `curs_util(3X)`, `curs_window(3X)` in the *Programmer's Guide: Character User Interface*.

NOTES

The header file `<curses.h>` automatically includes the header files `<stdio.h>` and `<unctrl.h>`.

The following internal data objects once existed in the `libcurses` library but have since been removed in order to avoid namespace conflicts with valid application defined data objects:

`BC`, `Def_term`, `Mouse_status`, `Oldcolors`, `PC`, `SP`, `UP`, `acs32map`, `bit_attributes`, `curs_err_strings`, `curs_errno`, `curs_parm_err`, `curses_version`, `ospeed`, `outchcount`, `term_err_strings`, `term_errno`, `term_parm_err`, `ttytype`

These objects have been renamed by prepending an underscore to their old names. These renamed objects refer to undocumented `curses` interfaces which may be changed or removed in the future.

NAME

cuserid - get character login name of the user

SYNOPSIS

```
#include <stdio.h>
char *cuserid (char *s);
```

DESCRIPTION

cuserid generates a character-string representation of the login name that the owner of the current process is logged in under. If *s* is a `NULL` pointer, this representation is generated in an internal static area, the address of which is returned. Otherwise, *s* is assumed to point to an array of at least `L_cuserid` characters; the representation is left in this array. The constant `L_cuserid` is defined in the `stdio.h` header file.

SEE ALSO

getlogin(3C), getpwent(3C)

DIAGNOSTICS

If the login name cannot be found, cuserid returns a `NULL` pointer; if *s* is not a `NULL` pointer, a null character ``\0'` will be placed at *s*[0].

NAME

dbm, dbminit, dbmclose, fetch, store, delete, firstkey, nextkey - database subroutines

SYNOPSIS

```
#include <dbm.h>
typedef struct {
    char *dptr;
    int dsize;
} datum;
int dbminit(char *file);
int dbmclose(void);
datum fetch(datum key);
int store(datum key, datum content);
int delete(datum key);
datum firstkey(void);
datum nextkey(datum key);
```

DESCRIPTION

These functions maintain key/content pairs in a database. The functions will handle very large (a billion blocks) databases and will access a keyed item in one or two file system accesses. The functions are obtained with the loader option `-lnsl`.

keys and *contents* are described by the `datum` typedef. A `datum` specifies a string of *dsize* bytes pointed to by *dptr*. Arbitrary binary data, as well as normal ASCII strings, are allowed. The database is stored in two files. One file is a directory containing a bit map and has `.dir` as its suffix. The second file contains all data and has `.pag` as its suffix.

Before a database can be accessed, it must be opened by `dbminit`. At the time of this call, the files `file.dir` and `file.pag` must exist. An empty database is created by creating zero-length `.dir` and `.pag` files.

A database may be closed by calling `dbmclose`. You must close a database before opening a new one.

Once open, the data stored under a key is accessed by `fetch` and data is placed under a key by `store`. A key (and its associated contents) is deleted by `delete`. A linear pass through all keys in a database may be made, in an (apparently) random order, by use of `firstkey` and `nextkey`. `firstkey` will return the first key in the database. With any key `nextkey` will return the next key in the database. This code will traverse the database:

```
for (key = firstkey(); key.dptr != NULL; key = nextkey(key))
```

RETURN VALUE

All functions that return an `int` indicate errors with negative values. A zero return indicates no error. Routines that return a `datum` indicate errors with a `NULL (0) dptr`.

NOTES

The `.pag` file will contain holes so that its apparent size is about four times its actual content. Older versions of the UNIX operating system may create real file blocks for these holes when touched. These files cannot be copied by normal means [that is, `cp(1)`, `cat(1)`, `tar(1)`, `ar(1)`] without filling in the holes.

dptr pointers returned by these subroutines point into static storage that is changed by subsequent calls.

The sum of the sizes of a key/content pair must not exceed the internal block size (currently 1024 bytes). Moreover all key/content pairs that hash together must fit on a single block. `store` will return an error in the event that a disk block fills with inseparable data.

`delete` does not physically reclaim file space, although it does make it available for reuse.

The order of keys presented by `firstkey` and `nextkey` depends on a hashing function, not on anything interesting.

There are no interlocks and no reliable cache flushing; thus concurrent updating and reading is risky.

FILES

`/usr/lib/libnsl.a`

NAME

dbm: dbm_{init}, dbm_{close}, fetch, store, delete, firstkey, nextkey - data base subroutines

SYNOPSIS

```
cc [flag...]file...-ldbm
#include <dbm.h>
typedef struct {
    char *dptr;
    int dsize;
} datum;
dbminit(char *file);
dbmclose();
datum fetch(datum key);
store(datum key, datum content);
delete(datum key);
datum firstkey();
datum nextkey(datum key);
```

DESCRIPTION

Note: the dbm library has been superseded by ndbm(3), and is now implemented using ndbm.

These functions maintain key/content pairs in a data base. The functions will handle very large (a billion blocks) databases and will access a keyed item in one or two file system accesses. The functions are obtained with the loader option -ldb_m.

keys and *contents* are described by the datum typedef. A datum specifies a string of *dsize* bytes pointed to by *dptr*. Arbitrary binary data, as well as normal ASCII strings, are allowed. The data base is stored in two files. One file is a directory containing a bit map and has .dir as its suffix. The second file contains all data and has .pag as its suffix.

Before a database can be accessed, it must be opened by dbm_{init}. At the time of this call, the files *file.dir* and *file.pag* must exist. An empty database is created by creating zero-length .dir and .pag files.

A database may be closed by calling dbm_{close}. You must close a database before opening a new one.

Once open, the data stored under a key is accessed by fetch and data is placed under a key by store. A key (and its associated contents) is deleted by delete. A linear pass through all keys in a database may be made, in an (apparently) random order, by use of firstkey and nextkey. firstkey will return the first key in the database. With any key nextkey will return the next key in the database. This code will traverse the data base:

```
for (key = firstkey; key.dptr != NULL; key = nextkey(key))
```

SEE ALSO

ndbm(3)

RETURN VALUE

All functions that return an `int` indicate errors with negative values. A zero return indicates no error. Routines that return a `datum` indicate errors with a `NULL (0)` *dptr*.

NOTES

The `.pag` file will contain holes so that its apparent size is about four times its actual content. Older versions of the UNIX operating system may create real file blocks for these holes when touched. These files cannot be copied by normal means [that is, `cp(1)`, `cat(1)`, `tar(1)`, `ar(1)`] without filling in the holes.

dptr pointers returned by these subroutines point into static storage that is changed by subsequent calls.

The sum of the sizes of a key/content pair must not exceed the internal block size (currently 1024 bytes). Moreover all key/content pairs that hash together must fit on a single block. `store` will return an error in the event that a disk block fills with inseparable data.

`delete` does not physically reclaim file space, although it does make it available for reuse.

The order of keys presented by `firstkey` and `nextkey` depends on a hashing function, not on anything interesting.

There are no interlocks and no reliable cache flushing; thus concurrent updating and reading is risky.

decimal_to_floating(3) (BSD Compatibility Package) decimal_to_floating(3)

NAME

decimal_to_floating: decimal_to_single, decimal_to_double, decimal_to_extended - convert decimal record to floating-point value

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
#include <floatingpoint.h>

void decimal_to_single(px, pm, pd, ps)
single *px ;
decimal_mode *pm;
decimal_record *pd;
fp_exception_field_type *ps;

void decimal_to_double(px, pm, pd, ps)
double *px ;
decimal_mode *pm;
decimal_record *pd;
fp_exception_field_type *ps;

void decimal_to_extended(px, pm, pd, ps)
extended *px ;
decimal_mode *pm;
decimal_record *pd;
fp_exception_field_type *ps;
```

DESCRIPTION

The `decimal_to_floating` functions convert the decimal record at **pd* into a floating-point value at **px*, observing the modes specified in **pm* and setting exceptions in **ps*. If there are no IEEE exceptions, **ps* will be zero.

pd->sign and *pd->fpclass* are always taken into account. *pd->exponent* and *pd->ds* are used when *pd->fpclass* is *fp_normal* or *fp_subnormal*. In these cases *pd->ds* must contain one or more ASCII digits followed by a NULL. **px* is set to a correctly rounded approximation to

$$(pd->sign) * (pd->ds) * 10^{(pd->exponent)}$$

Thus if *pd->exponent* == -2 and *pd->ds* == "1234", **px* will get 12.34 rounded to storage precision. *pd->ds* cannot have more than `DECIMAL_STRING_LENGTH-1` significant digits because one character is used to terminate the string with a NULL. If *pd->more* != 0 on input then additional nonzero digits follow those in *pd->ds*; *fp_inexact* is set accordingly on output in **ps*.

**px* is correctly rounded according to the IEEE rounding modes in *pm->rd*. **ps* is set to contain *fp_inexact*, *fp_underflow*, or *fp_overflow* if any of these arise.

pd->ndigits, *pm->df*, and *pm->ndigits* are not used.

`strtod(3C)`, `scanf(3S)`, `fscanf()`, and `sscanf()` all use `decimal_to_double`.

SEE ALSO

`scanf(3S)`, `strtod(3C)`.

NAME

dial - establish an outgoing terminal line connection

SYNOPSIS

```
#include <dial.h>
int dial(CALL call);
void undial(int fd);
```

DESCRIPTION

dial returns a file-descriptor for a terminal line open for read/write. The argument to dial is a CALL structure (defined in the dial.h header file).

When finished with the terminal line, the calling program must invoke undial to release the semaphore that has been set during the allocation of the terminal device.

The definition of CALL in the dial.h header file is:

```
typedef struct {
    struct termio *attr;    /* pointer to termio attribute struct */
    int      baud;        /* transmission data rate */
    int      speed;       /* 212A modem: low=300, high=1200 */
    char     *line;       /* device name for out-going line */
    char     *telno;      /* pointer to tel-no digits string */
    int      modem;       /* specify modem control for direct lines */
    char     *device;     /* unused */
    int      dev_len;     /* unused */
} CALL;
```

The CALL element speed is intended only for use with an outgoing dialed call, in which case its value should be either 300 or 1200 to identify the 113A modem, or the high- or low-speed setting on the 212A modem. Note that the 113A modem or the low-speed setting of the 212A modem will transmit at any rate between 0 and 300 bits per second. However, the high-speed setting of the 212A modem transmits and receives at 1200 bits per second only. The CALL element baud is for the desired transmission baud rate. For example, one might set baud to 110 and speed to 300 (or 1200). However, if speed is set to 1200, baud must be set to high (1200).

If the desired terminal line is a direct line, a string pointer to its device-name should be placed in the line element in the CALL structure. Legal values for such terminal device names are kept in the Devices file. In this case, the value of the baud element should be set to -1. This value will cause dial to determine the correct value from the Devices file.

The telno element is for a pointer to a character string representing the telephone number to be dialed. Such numbers may consist only of these characters:

| | |
|-----|-----------------------------------|
| 0-9 | dial 0-9 |
| * | dial * |
| # | dial # |
| = | wait for secondary dial tone |
| - | delay for approximately 4 seconds |

The `CALL` element `modem` is used to specify modem control for direct lines. This element should be non-zero if modem control is required. The `CALL` element `attr` is a pointer to a `termio` structure, as defined in the `termio.h` header file. A `NULL` value for this pointer element may be passed to the `dial` function, but if such a structure is included, the elements specified in it will be set for the outgoing terminal line before the connection is established. This setting is often important for certain attributes such as parity and baud-rate.

The `CALL` elements `device` and `dev_len` are no longer used. They are retained in the `CALL` structure for compatibility reasons.

FILES

```
/etc/uucp/Devices
/etc/uucp/Systems
/var/spool/uucp/LCK..tty-device
```

SEE ALSO

`alarm(2)`, `read(2)`, `write(2)`.
`termio(7)` in the *System Administrator's Reference Manual*.
`uucp(1C)` in the *User's Reference Manual*.

DIAGNOSTICS

On failure, a negative value indicating the reason for the failure will be returned. Mnemonics for these negative indices as listed here are defined in the `dial.h` header file.

| | | |
|----------------------|-----|--|
| <code>INTRPT</code> | -1 | <code>/* interrupt occurred */</code> |
| <code>D_HUNG</code> | -2 | <code>/* dialer hung (no return from write) */</code> |
| <code>NO_ANS</code> | -3 | <code>/* no answer within 10 seconds */</code> |
| <code>ILL_BD</code> | -4 | <code>/* illegal baud-rate */</code> |
| <code>A_PROB</code> | -5 | <code>/* acu problem (open() failure) */</code> |
| <code>L_PROB</code> | -6 | <code>/* line problem (open() failure) */</code> |
| <code>NO_Ldv</code> | -7 | <code>/* can't open Devices file */</code> |
| <code>DV_NT_A</code> | -8 | <code>/* requested device not available */</code> |
| <code>DV_NT_K</code> | -9 | <code>/* requested device not known */</code> |
| <code>NO_BD_A</code> | -10 | <code>/* no device available at requested baud */</code> |
| <code>NO_BD_K</code> | -11 | <code>/* no device known at requested baud */</code> |
| <code>DV_NT_E</code> | -12 | <code>/* requested speed does not match */</code> |
| <code>BAD_SYS</code> | -13 | <code>/* system not in Systems file*/</code> |

NOTES

Including the `dial.h` header file automatically includes the `termio.h` header file.

An `alarm(2)` system call for 3600 seconds is made (and caught) within the `dial` module for the purpose of "touching" the `LCK..` file and constitutes the device allocation semaphore for the terminal device. Otherwise, `uucp(1C)` may simply delete the `LCK..` entry on its 90-minute clean-up rounds. The alarm may go off while the user program is in a `read(2)` or `write(2)` system call, causing an apparent error return. If the user program expects to be around for an hour or more, error returns from reads should be checked for (`errno==EINTR`), and the read possibly reissued.

NAME

`difftime` - computes the difference between two calendar times

SYNOPSIS

```
#include <time.h>

double difftime (time_t time1, time_t time0);
```

DESCRIPTION

`difftime` computes the difference between two calendar times. `f4difftime` returns the difference (*time1-time0*) expressed in seconds as a double. This function is provided because there are no general arithmetic properties defined for type `time_t`.

SEE ALSO

`ctime(3C)`

NAME

opendir, readdir, telldir, seekdir, rewinddir, closedir - directory operations

SYNOPSIS

```
#include <sys/types.h>
#include <sys/dir.h>

DIR *opendir(filename)
char *filename;

struct direct *readdir(dirp)
DIR *dirp;

long telldir(dirp)
DIR *dirp;

seekdir(dirp, loc)
DIR *dirp;
long loc;

rewinddir(dirp)
DIR *dirp;

closedir(dirp)
DIR *dirp;
```

DESCRIPTION

`opendir` opens the directory named by *filename* and associates a directory stream with it. `opendir` returns a pointer to be used to identify the directory stream in subsequent operations. The pointer `NULL` is returned if *filename* cannot be accessed, or if it cannot allocate enough memory with `malloc` to hold the whole thing.

`readdir` returns a pointer to the next directory entry. It returns `NULL` upon reaching the end of the directory or detecting an invalid `seekdir` operation.

`telldir` returns the current location associated with the named directory stream.

`seekdir` sets the position of the next `readdir` operation on the directory stream. The new position reverts to the one associated with the directory stream when the `telldir` operation was performed. Values returned by `telldir` are good only for the lifetime of the `DIR` pointer from which they are derived. If the directory is closed and then reopened, the `telldir` value may be invalidated due to undetected directory compaction. It is safe to use a previous `telldir` value immediately after a call to `opendir` and before any calls to `readdir`.

`rewinddir` resets the position of the named directory stream to the beginning of the directory.

`closedir` closes the named directory stream and frees the structure associated with the `DIR` pointer.

Sample code which searches a directory for the entry name is:

```
len = strlen(name);
dirp = opendir(".");
for (dp = readdir(dirp); dp != NULL; dp = readdir(dirp))
    if (dp->d_namlen == len && !strcmp(dp->d_name, name)) {
        closedir(dirp);
        return FOUND;
    }
closedir(dirp);
return NOT_FOUND;
```

SEE ALSO

open(2), close(2), read(2), lseek(2),

NAME

directory: opendir, readdir, telldir, seekdir, rewinddir, closedir - directory operations

SYNOPSIS

```
#include <dirent.h>

DIR *opendir (const char *filename);
struct dirent *readdir (DIR *dirp);
long telldir (DIR *dirp);
void seekdir (DIR *dirp, long loc);
void rewinddir (DIR *dirp);
int closedir (DIR *dirp);
```

DESCRIPTION

`opendir` opens the directory named by *filename* and associates a directory stream with it. `opendir` returns a pointer to be used to identify the directory stream in subsequent operations. The directory stream is positioned at the first entry. The `NULL` pointer is returned if *filename* cannot be accessed or is not a directory, or if it cannot `malloc(3C)` enough memory to hold a `DIR` structure or a buffer for the directory entries.

`readdir` returns a pointer to the next active directory entry and positions the directory stream at the next entry. No inactive entries are returned. It returns `NULL` upon reaching the end of the directory or upon detecting an invalid location in the directory. `readdir` buffers several directory entries per actual read operation; `readdir` marks for update the `st_atime` field of the directory each time the directory is actually read.

`telldir` returns the current location associated with the named directory stream.

`seekdir` sets the position of the next `readdir` operation on the directory stream. The new position reverts to the position associated with directory stream at the time the `telldir` operation that provides *loc* was performed. Values returned by `telldir` are valid only if the directory has not changed because of compaction or expansion. This situation is not a problem with System V, but it may be a problem with some file system types.

`rewinddir` resets the position of the named directory stream to the beginning of the directory. It also causes the directory stream to refer to the current state of the corresponding directory, as a call to `opendir` would.

`closedir` closes the named directory stream and frees the `DIR` structure.

The following errors can occur as a result of these operations.

`opendir` returns `NULL` on failure and sets `errno` to one of the following values:

| | |
|----------------------|--|
| <code>ENOTDIR</code> | A component of <i>filename</i> is not a directory. |
| <code>EACCES</code> | A component of <i>filename</i> denies search permission. |
| <code>EACCES</code> | Read permission is denied on the specified directory. |

directory (3C)

| | |
|--|--|
| EMFILE | The maximum number of file descriptors are currently open. |
| ENFILE | The system file table is full. |
| EFAULT | <i>filename</i> points outside the allocated address space. |
| ELOOP | Too many symbolic links were encountered in translating <i>filename</i> . |
| ENAMETOOLONG | The length of the <i>filename</i> argument exceeds {PATH_MAX}, or the length of a <i>filename</i> component exceeds {NAME_MAX} while {_POSIX_NO_TRUNC} is in effect. |
| ENOENT | A component of <i>filename</i> does not exist or is a null pathname. |
| readdir returns NULL | on failure and sets <i>errno</i> to one of the following values: |
| ENOENT | The current file pointer for the directory is not located at a valid entry. |
| EBADF | The file descriptor determined by the DIR stream is no longer valid. This result occurs if the DIR stream has been closed. |
| telldir, seekdir, and closedir return -1 | on failure and set <i>errno</i> to the following value: |
| EBADF | The file descriptor determined by the DIR stream is no longer valid. This results if the DIR stream has been closed. |

EXAMPLE

Here is a sample program that prints the names of all the files in the current directory:

```
#include <stdio.h>
#include <dirent.h>

main()
{
    DIR *dirp;
    struct dirent *direntp;

    dirp = opendir( "." );
    while ( (direntp = readdir( dirp )) != NULL )
        (void)printf( "%s\n", direntp->d_name );
    closedir( dirp );
    return (0);
}
```

SEE ALSO

getdents(2), dirent(4)

NOTES

rewinddir is implemented as a macro, so its function address cannot be taken.

directory (3C)

dirname(3G)

dirname(3G)

NAME

dirname - report the parent directory name of a file path name

SYNOPSIS

```
cc [flag ...] file ... -lgen [library ...]
#include <libgen.h>
char *dirname (char *path);
```

DESCRIPTION

Given a pointer to a null-terminated character string that contains a file system path name, `dirname` returns a pointer to a static constant string that is the parent directory of that file. In doing this, it sometimes places a null byte in the path name after the next to last element, so the content of *path* must be disposable. Trailing `"/` characters in the path are not counted as part of the path.

If *path* or **path* is zero, a pointer to a static constant `“.”` is returned.

`dirname` and `basename` together yield a complete path name. `dirname (path)` is the directory where `basename (path)` is found.

EXAMPLES

A simple file name and the strings `“.”` and `“..”` all have `“.”` as their return value.

| <u>Input string</u> | <u>Output pointer</u> |
|---------------------|-----------------------|
| /usr/lib | /usr |
| /usr/ | / |
| usr | . |
| / | / |
| . | . |
| .. | . |

The following code reads a path name, changes directory to the appropriate directory [see `chdir(2)`], and opens the file.

```
char path[100], *pathcopy;
int fd;
gets (path);
pathcopy = strdup (path);
chdir (dirname (pathcopy) );
fd = open (basename (path), O_RDONLY);
```

SEE ALSO

`basename(1)`, `chdir(2)`, `basename(3G)`.

NAME

div, ldiv - compute the quotient and remainder

SYNOPSIS

```
#include <stdlib.h>
div_t div (int numer, int denom);
ldiv_t ldiv (long int numer, long int denom);
```

DESCRIPTION

div computes the quotient and remainder of the division of the numerator *numer* by the denominator *denom*. This function provides a well-defined semantics for the signed integral division and remainder operations, unlike the implementation-defined semantics of the built-in operations. The sign of the resulting quotient is that of the algebraic quotient, and, if the division is inexact, the magnitude of the resulting quotient is the largest integer less than the magnitude of the algebraic quotient. If the result cannot be represented, the behavior is undefined; otherwise, *quotient * denom + remainder* will equal *numer*.

div returns a structure of type `div_t`, comprising both the quotient and remainder:

```
typedef struct div_t {
    int    quot; /*quotient*/
    int    rem;  /*remainder*/
} div_t;
```

ldiv is similar to div, except that the arguments and the members of the returned structure (which has type `ldiv_t`) all have type `long int`.

NAME

dlclose - close a shared object

SYNOPSIS

```
cc [flag ...] file ... -ldl [library ...]  
#include <dlfcn.h>  
int dlclose(void *handle);
```

DESCRIPTION

dlclose disassociates a shared object previously opened by dlopen from the current process. Once an object has been closed using dlclose, its symbols are no longer available to dlsym. All objects loaded automatically as a result of invoking dlopen on the referenced object [see dlopen(3X)] are also closed. *handle* is the value returned by a previous invocation of dlopen.

This routine is available in a library that is loaded if the option -ldl is used with cc or ld. The -ldl library (and the routines it contains) may not be used when a program is to be statically linked.

SEE ALSO

dlderror(3X), dlopen(3X), dlsym(3X)

DIAGNOSTICS

If the referenced object was successfully closed, dlclose returns 0. If the object could not be closed, or if *handle* does not refer to an open object, dlclose returns a non-0 value. More detailed diagnostic information is available through dlderror.

NOTES

A successful invocation of dlclose does not guarantee that the objects associated with *handle* have actually been removed from the address space of the process. Objects loaded by one invocation of dlopen may also be loaded by another invocation of dlopen. The same object may also be opened multiple times. An object is not removed from the address space until all references to that object through an explicit dlopen invocation have been closed and all other objects implicitly referencing that object have also been closed.

Once an object has been closed by dlclose, referencing symbols contained in that object can cause undefined behavior.

NAME

dlerror - get diagnostic information

SYNOPSIS

```
cc [flag ...] file ... -ldl [library ...]  
#include <dlfcn.h>  
char *dlerror(void);
```

DESCRIPTION

dlerror returns a null-terminated character string (with no trailing newline) that describes the last error that occurred during dynamic linking processing. If no dynamic linking errors have occurred since the last invocation of dlerror, dlerror returns NULL. Thus, invoking dlerror a second time, immediately following a prior invocation, results in NULL being returned.

This routine is available in a library that is loaded if the option -ldl is used with cc or ld. The -ldl library (and the routines it contains) may not be used when a program is to be statically linked.

SEE ALSO

dlclose(3X), dlopen(3X), dlsym(3X)

NOTES

The messages returned by dlerror may reside in a static buffer that is overwritten on each call to dlerror. Application code should not write to this buffer. Programs wishing to preserve an error message should make their own copies of that message.

NAME

dlopen - open a shared object

SYNOPSIS

```
cc [flag ...] file ... -ldl [library ...]
#include <dlfcn.h>
void *dlopen(char *pathname, int mode);
```

DESCRIPTION

dlopen is one of a family of routines that give the user direct access to the dynamic linking facilities. These routines are available in a library that is loaded if the option `-ldl` is used with `cc` or `ld`. The `-ldl` library (and the routines it contains) may not be used when a program is to be statically linked.

dlopen makes a shared object available to a running process. dlopen returns to the process a *handle* the process may use on subsequent calls to `dlsym` and `dlclose`. This value should not be interpreted in any way by the process. *pathname* is the path name of the object to be opened; it may be an absolute path or relative to the current directory. If the value of *pathname* is 0, dlopen makes the symbols contained in the original `a.out`, and all of the objects that were loaded at program startup with the `a.out`, available through `dlsym`.

When a shared object is brought into the address space of a process, it may contain references to symbols whose addresses are not known until the object is loaded. These references must be relocated before the symbols can be accessed. The *mode* parameter governs when these relocations take place and may have the following values:

RTLD_LAZY

Under this *mode*, only references to data symbols are relocated when the object is loaded. References to functions are not relocated until a given function is invoked for the first time. This *mode* should result in better performance, since a process may not reference all of the functions in any given shared object.

RTLD_NOW

Under this *mode*, all necessary relocations are performed when the object is first loaded. This may result in some wasted effort, if relocations are performed for functions that are never referenced, but is useful for applications that need to know as soon as an object is loaded that all symbols referenced during execution will be available.

DIAGNOSTICS

If *pathname* cannot be found, cannot be opened for reading, is not a shared object, or if an error occurs during the process of loading *pathname* or relocating its symbolic references, dlopen returns `NULL`. More detailed diagnostic information is available through `dlerror`.

NOTES

If other shared objects were link edited with *pathname* when *pathname* was built, those objects are automatically loaded by dlopen. The directory search path to be used to find both *pathname* and the other *needed* objects may be specified by setting the environment variable `LD_LIBRARY_PATH`. This environment variable should contain a colon-separated list of directories, in the same format as the `PATH` variable

[see `sh(1)`]. `LD_LIBRARY_PATH` is ignored if the process is running `setuid` or `setgid` [see `exec(2)`] or if the name specified is not a simple file name (that is, contains a `/` character). Objects whose names resolve to the same absolute or relative path name may be opened any number of times using `dlopen`, however, the object referenced is loaded only once into the address space of the current process. The same object referenced by two different path names, however, may be loaded multiple times. For example, given the object `/usr/home/me/mylibs/mylib.so`, and assuming the current working directory is `/usr/home/me/workdir`,

```
. . .
void *handle1;
void *handle2;

handle1 = dlopen("../mylibs/mylib.so", RTLD_LAZY);
handle2 = dlopen("/usr/home/me/mylibs/mylib.so", RTLD_LAZY);
. . .
```

results in `mylibs.so` being loaded twice for the current process. On the other hand, given the same object and current working directory, if `LD_LIBRARY_PATH=/usr/home/me/mylibs`, then

```
. . .
void *handle1;
void *handle2;

handle1 = dlopen("mylib.so", RTLD_LAZY);
handle2 = dlopen("/usr/home/me/mylibs/mylib.so", RTLD_LAZY);
. . .
```

results in `mylibs.so` being loaded only once.

Objects loaded by a single invocation of `dlopen` may import symbols from one another or from any object loaded automatically during program startup, but objects loaded by one `dlopen` invocation may not directly reference symbols from objects loaded by a different `dlopen` invocation. Those symbols may, however, be referenced indirectly using `dlsym`.

Users who wish to gain access to the symbol table of the `a.out` itself using `dlsym(0, mode)` should be aware that some symbols defined in the `a.out` may not be available to the dynamic linker. The symbol table created by `ld` for use by the dynamic linker might contain only a subset of the symbols defined in the `a.out`: specifically those referenced by the shared objects with which the `a.out` is linked.

Any symbols in the executable that may be referenced from a shared object accessed via `dlopen` must also be referenced in a shared library that is linked in at link time.

SEE ALSO

`cc(1)`, `ld(1)`, `sh(1)`, `exec(2)`, `dlopen(3X)`, `dlopen(3X)`, `dlsym(3X)`.

NAME

dlsym - get the address of a symbol in shared object

SYNOPSIS

```
cc [flag ...] file ... -ldl [library ...]  
#include <dlfcn.h>  
void *dlsym(void *handle, char *name);
```

DESCRIPTION

dlsym allows a process to obtain the address of a symbol defined within a shared object previously opened by dlopen. *handle* is a value returned by a call to dlopen; the corresponding shared object must not have been closed using dlclose. *name* is the symbol's name as a character string. dlsym searches for the named symbol in all shared objects loaded automatically as a result of loading the object referenced by *handle* [see dlopen(3X)].

This routine is available in a library that is loaded if the option -ldl is used with cc or ld. The -ldl library (and the routines it contains) may not be used when a program is to be statically linked.

EXAMPLES

The following example shows how one can use dlopen and dlsym to access either function or data objects. For simplicity, error checking has been omitted.

```
void *handle;  
int i, *iptr;  
int (*fptr)(int);  
  
/* open the needed object */  
handle = dlopen("/usr/mydir/libx.so", RTLD_LAZY);  
  
/* find address of function and data objects */  
fptr = (int (*)(int))dlsym(handle, "some_function");  
  
iptr = (int *)dlsym(handle, "int_object");  
  
/* invoke function, passing value of integer as a parameter */  
i = (*fptr)(*iptr);
```

SEE ALSO

dlclose(3X), dlerror(3X), dlopen(3X)

DIAGNOSTICS

If *handle* does not refer to a valid object opened by dlopen, or if the named symbol cannot be found within any of the objects associated with *handle*, dlsym returns NULL. More detailed diagnostic information is available through dlerror.

NAME

doconfig - execute a configuration script

SYNOPSIS

```
# include <sac.h>
```

```
int doconfig(int fd, char *script, long rflag);
```

DESCRIPTION

doconfig is a Service Access Facility library function that interprets the configuration scripts contained in the files `/etc/saf/pmtag/_config`, `/etc/saf/_sysconfig`, and `/etc/saf/pmtag/svctag`.

`script` is the name of the configuration script; `fd` is a file descriptor that designates the stream to which stream manipulation operations are to be applied; `rflag` is a bit-mask that indicates the mode in which `script` is to be interpreted. `rflag` may take two values, `NORUN` and `NOASSIGN`, which may be or'd. If `rflag` is zero, all commands in the configuration script are eligible to be interpreted. If `rflag` has the `NOASSIGN` bit set, the `assign` command is considered illegal and will generate an error return. If `rflag` has the `NORUN` bit set, the `run` and `runwait` commands are considered illegal and will generate error returns.

The configuration language in which `script` is written consists of a sequence of commands, each of which is interpreted separately. The following reserved keywords are defined: `assign`, `push`, `pop`, `runwait`, and `run`. The comment character is `#`; when a `#` occurs on a line, everything from that point to the end of the line is ignored. Blank lines are not significant. No line in a command script may exceed 1024 characters.

`assign` *variable=value*

Used to define environment variables. *variable* is the name of the environment variable and *value* is the value to be assigned to it. The value assigned must be a string constant; no form of parameter substitution is available. *value* may be quoted. The quoting rules are those used by the shell for defining environment variables. `assign` will fail if space cannot be allocated for the new variable or if any part of the specification is invalid.

`push` *module1[, module2, module3, . . .]*

Used to push STREAMS modules onto the stream designated by *fd*. *module1* is the name of the first module to be pushed, *module2* is the name of the second module to be pushed, etc. The command will fail if any of the named modules cannot be pushed. If a module cannot be pushed, the subsequent modules on the same command line will be ignored and modules that have already been pushed will be popped.

`pop` [*module*]

Used to pop STREAMS modules off the designated stream. If `pop` is invoked with no arguments, the top module on the stream is popped. If an argument is given, modules will be popped one at a time until the named module is at the top of the stream. If the named module is not on the designated stream, the stream is left as it was and the command fails. If *module* is the special keyword `ALL`, then all modules on the

stream will be popped. Note that only modules above the topmost driver are affected.

`runwait command`

The `runwait` command runs a command and waits for it to complete. *command* is the pathname of the command to be run. The command is run with `/usr/bin/sh -c` prepended to it; shell scripts may thus be executed from configuration scripts. The `runwait` command will fail if *command* cannot be found or cannot be executed, or if *command* exits with a non-zero status.

`run command`

The `run` command is identical to `runwait` except that it does not wait for *command* to complete. *command* is the pathname of the command to be run. `run` will not fail unless it is unable to create a child process to execute the command.

Although they are syntactically indistinguishable, some of the commands available to `run` and `runwait` are interpreter built-in commands. Interpreter built-ins are used when it is necessary to alter the state of a process within the context of that process. The `doconfig` interpreter built-in commands are similar to the shell special commands and, like these, they do not spawn another process for execution. See `sh(1)`. The initial set of built-in commands is:

```
cd
ulimit
umask
```

DIAGNOSTICS

`doconfig` returns 0 if the script was interpreted successfully. If a command in the script fails, the interpretation of the script ceases at that point and a positive number is returned; this number indicates which line in the script failed. If a system error occurs, a value of -1 is returned. When a script fails, the process whose environment was being established should not be started.

SEE ALSO

`pmadm(1M)`, `sacadm(1M)`, `sh(1)`.

NAME

drand48, erand48, lrand48, nrand48, mrand48, jrand48, srand48, seed48, lcong48 - generate uniformly distributed pseudo-random numbers

SYNOPSIS

```
#include <stdlib.h>
double drand48 (void);
double erand48 (unsigned short xsubi[3]);
long lrand48 (void);
long nrand48 (unsigned short xsubi[3]);
long mrand48 (void);
long jrand48 (unsigned short xsubi[3]);
void srand48 (long seedval);
unsigned short *seed48 (unsigned short seed16v[3]);
void lcong48 (unsigned short param[7]);
```

DESCRIPTION

This family of functions generates pseudo-random numbers using the well-known linear congruential algorithm and 48-bit integer arithmetic.

Functions `drand48` and `erand48` return non-negative double-precision floating-point values uniformly distributed over the interval $[0.0, 1.0)$.

Functions `lrand48` and `nrand48` return non-negative long integers uniformly distributed over the interval $[0, 2^{31})$.

Functions `mrnd48` and `jrnd48` return signed long integers uniformly distributed over the interval $[-2^{31}, 2^{31})$.

Functions `srand48`, `seed48`, and `lcong48` are initialization entry points, one of which should be invoked before either `drand48`, `lrand48`, or `mrnd48` is called. (Although it is not recommended practice, constant default initializer values will be supplied automatically if `drand48`, `lrand48`, or `mrnd48` is called without a prior call to an initialization entry point.) Functions `erand48`, `nrand48`, and `jrnd48` do not require an initialization entry point to be called first.

All the routines work by generating a sequence of 48-bit integer values, $X_{sub\ i}$, according to the linear congruential formula

$$X_{n+1} = (aX_n + c)_{\text{mod } m} \quad n \geq 0.$$

The parameter $m = 2^{48}$; hence 48-bit integer arithmetic is performed. Unless `lcong48` has been invoked, the multiplier value a and the addend value c are given by

$$\begin{aligned} a &= 5DEECE66D_{16} = 273673163155_8 \\ c &= B_{16} = 13_8. \end{aligned}$$

The value returned by any of the functions `drand48`, `erand48`, `lrand48`, `nrand48`, `mrnd48`, or `jrnd48` is computed by first generating the next 48-bit $X_{sub\ i}$ in the sequence. Then the appropriate number of bits, according to the type of

data item to be returned, are copied from the high-order (leftmost) bits of $\$X$ sub $i\$$ and transformed into the returned value.

The functions `drand48`, `lrand48`, and `mrand48` store the last 48-bit $\$X$ sub $i\$$ generated in an internal buffer. $\$X$ sub $i\$$ must be initialized prior to being invoked. The functions `erand48`, `nrand48`, and `jrand48` require the calling program to provide storage for the successive $\$X$ sub $i\$$ values in the array specified as an argument when the functions are invoked. These routines do not have to be initialized; the calling program must place the desired initial value of $\$X$ sub $i\$$ into the array and pass it as an argument. By using different arguments, functions `erand48`, `nrand48`, and `jrand48` allow separate modules of a large program to generate several independent streams of pseudo-random numbers, that is, the sequence of numbers in each stream will not depend upon how many times the routines have been called to generate numbers for the other streams.

The initializer function `srand48` sets the high-order 32 bits of $\$X$ sub $i\$$ to the 32 bits contained in its argument. The low-order 16 bits of $\$X$ sub $i\$$ are set to the arbitrary value `$roman 330E sub 16 .`

The initializer function `seed48` sets the value of $\$X$ sub $i\$$ to the 48-bit value specified in the argument array. In addition, the previous value of $\$X$ sub $i\$$ is copied into a 48-bit internal buffer, used only by `seed48`, and a pointer to this buffer is the value returned by `seed48`. This returned pointer, which can just be ignored if not needed, is useful if a program is to be restarted from a given point at some future time — use the pointer to get at and store the last $\$X$ sub $i\$$ value, and then use this value to reinitialize via `seed48` when the program is restarted.

The initialization function `lcong48` allows the user to specify the initial $\$X$ sub i , $\$$ the multiplier value $\$a$, $\$$ and the addend value $\$c$. $\$$ Argument array elements *param*[0-2] specify $\$X$ sub i , $\$$ *param*[3-5] specify the multiplier $\$a$, $\$$ and *param*[6] specifies the 16-bit addend $\$c$. $\$$ After `lcong48` has been called, a subsequent call to either `srand48` or `seed48` will restore the “standard” multiplier and addend values, $\$a$ and $\$c$, $\$$ specified on the previous page.

SEE ALSO

`rand(3C)`

NAME

dup - duplicate an open file descriptor

SYNOPSIS

```
#include <unistd.h>
int dup(int fildes);
```

DESCRIPTION

fildes is a file descriptor obtained from a `creat`, `open`, `dup`, `fcntl`, `pipe`, or `ioctl` system call. `dup` returns a new file descriptor having the following in common with the original:

Same open file (or pipe).

Same file pointer (that is, both file descriptors share one file pointer).

Same access mode (read, write or read/write).

The new file descriptor is set to remain open across `exec` system calls [see `fcntl(2)`].

The file descriptor returned is the lowest one available.

`dup` will fail if one or more of the following are true:

`EBADF` *fildes* is not a valid open file descriptor.

`EINTR` A signal was caught during the `dup` system call.

`EMFILE` The process has too many open files [see `getrlimit(2)`].

`ENOLINK` *fildes* is on a remote machine and the link to that machine is no longer active.

SEE ALSO

`close(2)`, `creat(2)`, `exec(2)`, `fcntl(2)`, `getrlimit(2)`, `open(2)`, `pipe(2)`, `dup2(3C)`, `lockf(3C)`

DIAGNOSTICS

Upon successful completion a non-negative integer, namely the file descriptor, is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

dup2 - duplicate an open file descriptor

SYNOPSIS

```
#include <unistd.h>

int dup2 (int fildes, int fildes2);
```

DESCRIPTION

fildes is a file descriptor referring to an open file, and *fildes2* is a non-negative integer less than {OPEN_MAX} (the maximum number of open files). dup2 causes *fildes2* to refer to the same file as *fildes*. If *fildes2* already referred to an open file, not *fildes*, it is closed first. If *fildes2* refers to *fildes*, or if *fildes* is not a valid open file descriptor, *fildes2* will not be closed first.

dup2 will fail if one or more of the following are true:

| | |
|--------|--|
| EBADF | <i>fildes</i> is not a valid open file descriptor. |
| EBADF | <i>fildes2</i> is negative or greater than or equal to {OPEN_MAX}. |
| EINTR | a signal was caught during the dup2 call. |
| EMFILE | {OPEN_MAX} file descriptors are currently open. |

SEE ALSO

creat(2), close(2), exec(2), fcntl(2), open(2), pipe(2), lockf(3C), limits(4)

DIAGNOSTICS

Upon successful completion a non-negative integer, namely, the file descriptor, is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

econvert, fconvert, gconvert, seconvert, sfconvert, sgconvert - output conversion

SYNOPSIS

```

/usr/ucb/cc [flag...]file...
#include <floatingpoint.h>
char *econvert(value, ndigit, decpt, sign, buf)
double value;
int ndigit, *decpt, *sign;
char *buf;

char *fconvert(value, ndigit, decpt, sign, buf)
double value;
int ndigit, *decpt, *sign;
char *buf;

char *gconvert(value, ndigit, trailing, buf)
double value;
int ndigit;
int trailing;
char *buf;

char *seconvert(value, ndigit, decpt, sign, buf)
single *value;
int ndigit, *decpt, *sign;
char *buf;

char *sfconvert(value, ndigit, decpt, sign, buf)
single *value;
int ndigit, *decpt, *sign;
char *buf;

char *sgconvert(value, ndigit, trailing, buf)
single *value;
int ndigit;
int trailing;
char *buf;

```

DESCRIPTION

econvert converts the *value* to a NULL-terminated string of *ndigit* ASCII digits in *buf* and returns a pointer to *buf*. *buf* should contain at least *ndigit*+1 characters. The position of the decimal point relative to the beginning of the string is stored indirectly through *decpt*. Thus *buf* == "314" and **decpt* == 1 corresponds to the numerical value 3.14, while *buf* == "314" and **decpt* == -1 corresponds to the numerical value .0314. If the sign of the result is negative, the word pointed to by *sign* is nonzero; otherwise it is zero. The least significant digit is rounded.

fconvert works much like econvert, except that the correct digit has been rounded as if for `sprintf(%w.nf)` output with *n=ndigit* digits to the right of the decimal point. *ndigit* can be negative to indicate rounding to the left of the decimal point. The return value is a pointer to *buf*. *buf* should contain at least `310+max(0,ndigit)` characters to accommodate any double-precision *value*.

`gconvert` converts the *value* to a NULL-terminated ASCII string in *buf* and returns a pointer to *buf*. It produces *ndigit* significant digits in fixed-decimal format, like `printf(%w.nf)`, if possible, and otherwise in floating-decimal format, like `printf(%w.ne)`; in either case *buf* is ready for printing, with sign and exponent. The result corresponds to that obtained by

```
(void) printf(buf, '%w.ng', value) ;
```

If *trailing* = 0, trailing zeros and a trailing point are suppressed, as in `printf(%g)`. If *trailing* != 0, trailing zeros and a trailing point are retained, as in `printf(%#g)`.

`seconvert`, `sfconvert`, and `sgconvert` are single-precision versions of these functions, and are more efficient than the corresponding double-precision versions. A pointer rather than the value itself is passed to avoid C's usual conversion of single-precision arguments to double.

IEEE Infinities and NaNs are treated similarly by these functions. "NaN" is returned for NaN, and "Inf" or "Infinity" for Infinity. The longer form is produced when *ndigit* ≥ 8.

SEE ALSO

`printf(3S)`.

NAME

ecvt, fcvt, gcvt - convert floating-point number to string

SYNOPSIS

```
#include <stdlib.h>
char *ecvt (double value, int ndigit, int *decpt, int *sign);
char *fcvt (double value, int ndigit, int *decpt, int *sign);
char *gcvt (double value, int ndigit, char *buf);
```

DESCRIPTION

ecvt converts *value* to a null-terminated string of *ndigit* digits and returns a pointer thereto. The high-order digit is non-zero, unless the value is zero. The low-order digit is rounded. The position of the decimal point relative to the beginning of the string is stored indirectly through *decpt* (negative means to the left of the returned digits). The decimal point is not included in the returned string. If the sign of the result is negative, the word pointed to by *sign* is non-zero, otherwise it is zero.

fcvt is identical to ecvt, except that the correct digit has been rounded for printf %f output of the number of digits specified by *ndigit*.

gcvt converts the *value* to a null-terminated string in the array pointed to by *buf* and returns *buf*. It attempts to produce *ndigit* significant digits in %F format if possible, otherwise %e format (scientific notation), ready for printing. A minus sign, if there is one, or a decimal point will be included as part of the returned string. Trailing zeros are suppressed.

SEE ALSO

printf(3S)

NOTES

The values returned by ecvt and fcvt point to a single static data array whose content is overwritten by each call.

NAME

elf - object file access library

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>
```

DESCRIPTION

Functions in the ELF access library let a program manipulate ELF (Executable and Linking Format) object files, archive files, and archive members. The header file provides type and function declarations for all library services.

Programs communicate with many of the higher-level routines using an *ELF descriptor*. That is, when the program starts working with a file, `elf_begin` creates an ELF descriptor through which the program manipulates the structures and information in the file. These ELF descriptors can be used both to read and to write files. After the program establishes an ELF descriptor for a file, it may then obtain *section descriptors* to manipulate the sections of the file [see `elf_getscn(3E)`]. Sections hold the bulk of an object file's real information, such as text, data, the symbol table, and so on. A section descriptor "belongs" to a particular ELF descriptor, just as a section belongs to a file. Finally, *data descriptors* are available through section descriptors, allowing the program to manipulate the information associated with a section. A data descriptor "belongs" to a section descriptor.

Descriptors provide private handles to a file and its pieces. In other words, a data descriptor is associated with one section descriptor, which is associated with one ELF descriptor, which is associated with one file. Although descriptors are private, they give access to data that may be shared. Consider programs that combine input files, using incoming data to create or update another file. Such a program might get data descriptors for an input and an output section. It then could update the output descriptor to reuse the input descriptor's data. That is, the descriptors are distinct, but they could share the associated data bytes. This sharing avoids the space overhead for duplicate buffers and the performance overhead for copying data unnecessarily.

FILE CLASSES

ELF provides a framework in which to define a family of object files, supporting multiple processors and architectures. An important distinction among object files is the *class*, or capacity, of the file. The 32-bit class supports architectures in which a 32-bit object can represent addresses, file sizes, etc., as in the following.

| Name | Purpose |
|----------------------------|-------------------------|
| <code>Elf32_Addr</code> | Unsigned address |
| <code>Elf32_Half</code> | Unsigned medium integer |
| <code>Elf32_Off</code> | Unsigned file offset |
| <code>Elf32_Sword</code> | Signed large integer |
| <code>Elf32_Word</code> | Unsigned large integer |
| <code>unsigned char</code> | Unsigned small integer |

Other classes will be defined as necessary, to support larger (or smaller) machines. Some library services deal only with data objects for a specific class, while others are class-independent. To make this distinction clear, library function names reflect their status, as described below.

DATA REPRESENTATIONS

Conceptually, two parallel sets of objects support cross compilation environments. One set corresponds to file contents, while the other set corresponds to the native memory image of the program manipulating the file. Type definitions supplied by the header files work on the native machine, which may have different data encodings (size, byte order, etc.) than the target machine. Although native memory objects should be at least as big as the file objects (to avoid information loss), they may be bigger if that is more natural for the host machine.

Translation facilities exist to convert between file and memory representations. Some library routines convert data automatically, while others leave conversion as the program's responsibility. Either way, programs that create object files must write file-typed objects to those files; programs that read object files must take a similar view. See `elf_xlate(3E)` and `elf_fsize(3E)` for more information.

Programs may translate data explicitly, taking full control over the object file layout and semantics. If the program prefers not to have and exercise complete control, the library provides a higher-level interface that hides many object file details. `elf_begin` and related functions let a program deal with the native memory types, converting between memory objects and their file equivalents automatically when reading or writing an object file.

ELF VERSIONS

Object file versions allow ELF to adapt to new requirements. Three— independent—versions can be important to a program. First, an application program knows about a particular version by virtue of being compiled with certain header files. Second, the access library similarly is compiled with header files that control what versions it understands. Third, an ELF object file holds a value identifying its version, determined by the ELF version known by the file's creator. Ideally, all three versions would be the same, but they may differ.

If a program's version is newer than the access library, the program might use information unknown to the library. Translation routines might not work properly, leading to undefined behavior. This condition merits installing a new library.

The library's version might be newer than the program's and the file's. The library understands old versions, thus avoiding compatibility problems in this case.

Finally, a file's version might be newer than either the program or the library understands. The program might or might not be able to process the file properly, depending on whether the file has extra information and whether that information can be safely ignored. Again, the safe alternative is to install a new library that understands the file's version.

To accommodate these differences, a program must use `elf_version` to pass its version to the library, thus establishing the *working version* for the process. Using this, the library accepts data from and presents data to the program in the proper representations. When the library reads object files, it uses each file's version to interpret the data. When writing files or converting memory types to the file equivalents, the library uses the program's working version for the file data.

SYSTEM SERVICES

As mentioned above, `elf_begin` and related routines provide a higher-level interface to ELF files, performing input and output on behalf of the application program. These routines assume a program can hold entire files in memory, without explicitly using temporary files. When reading a file, the library routines bring the data into memory and perform subsequent operations on the memory copy. Programs that wish to read or write large object files with this model must execute on a machine with a large process virtual address space. If the underlying operating system limits the number of open files, a program can use `elf_cntl` to retrieve all necessary data from the file, allowing the program to close the file descriptor and reuse it.

Although the `elf_begin` interfaces are convenient and efficient for many programs, they might be inappropriate for some. In those cases, an application may invoke the `elf_xlate` data translation routines directly. These routines perform no input or output, leaving that as the application's responsibility. By assuming a larger share of the job, an application controls its input and output model.

LIBRARY NAMES

Names associated with the library take several forms.

| | |
|-----------------------------|--|
| <code>elf_name</code> | These class-independent names perform some service, <i>name</i> , for the program. |
| <code>elf32_name</code> | Service names with an embedded class, <code>32</code> here, indicate they work only for the designated class of files. |
| <code>Elf_Type</code> | Data types can be class-independent as well, distinguished by <i>Type</i> . |
| <code>Elf32_Type</code> | Class-dependent data types have an embedded class name, <code>32</code> here. |
| <code>ELF_C_CMD</code> | Several functions take commands that control their actions. These values are members of the <code>Elf_Cmd</code> enumeration; they range from zero through <code>ELF_C_NUM-1</code> . |
| <code>ELF_F_FLAG</code> | Several functions take flags that control library status and/or actions. Flags are bits that may be combined. |
| <code>ELF32_FSZ_TYPE</code> | These constants give the file sizes in bytes of the basic ELF types for the 32-bit class of files. See <code>elf_fsize</code> for more information. |
| <code>ELF_K_KIND</code> | The function <code>elf_kind</code> identifies the <i>KIND</i> of file associated with an ELF descriptor. These values are members of the <code>Elf_Kind</code> enumeration; they range from zero through <code>ELF_K_NUM-1</code> . |
| <code>ELF_T_TYPE</code> | When a service function, such as <code>elf_xlate</code> , deals with multiple types, names of this form specify the desired <i>TYPE</i> . Thus, for example, <code>ELF_T_EHDR</code> is directly related to <code>Elf32_Ehdr</code> . These values are members of the <code>Elf_Type</code> enumeration; they range from zero through <code>ELF_T_NUM-1</code> . |

SEE ALSO

cof2elf(1), elf_begin(3E), elf_cntl(3E), elf_end(3E), elf_error(3E), elf_fill(3E), elf_flag(3E), elf_fsize(3E), elf_getarhdr(3E), elf_getarsym(3E), elf_getbase(3E), elf_getdata(3E), elf_getehdr(3E), elf_getident(3E), elf_getphdr(3E), elf_getscn(3E), elf_getshdr(3E), elf_hash(3E), elf_kind(3E), elf_next(3E), elf_rand(3E), elf_rawfile(3E), elf_strptr(3E), elf_update(3E), elf_version(3E), elf_xlate(3E), a.out(4), ar(4).

NOTES

Information in the ELF header files is separated into common parts and processor-specific parts. A program can make a processor's information available by including the appropriate header file: `sys/elf_NAME.h` where *NAME* matches the processor name as used in the ELF file header.

| Symbol | Processor |
|--------|----------------|
| M32 | AT&T WE 32100 |
| SPARC | SPARC |
| 386 | Intel 80386 |
| 68K | Motorola 68000 |
| 88K | Motorola 88000 |

Other processors will be added to the table as necessary. To illustrate, a program could use the following code to "see" the processor-specific information for the 88K 32100.

```
#include <libelf.h>
#include <sys/elf_88K.h>
```

Without the `sys/elf_88K.h` definition, only the common ELF information would be visible.

NAME

elf_begin - make a file descriptor

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
```

```
#include <libelf.h>
```

```
Elf *elf_begin(int fildes, Elf_Cmd cmd, Elf *ref);
```

DESCRIPTION

elf_begin, elf_next, elf_rand, and elf_end work together to process ELF object files, either individually or as members of archives. After obtaining an ELF descriptor from elf_begin, the program may read an existing file, update an existing file, or create a new file. *fil*des is an open file descriptor that elf_begin uses for reading or writing. The initial file offset [see lseek(2)] is unconstrained, and the resulting file offset is undefined.

cmd may have the following values.

ELF_C_NULL When a program sets *cmd* to this value, elf_begin returns a null pointer, without opening a new descriptor. *ref* is ignored for this command. See elf_next(3E) and the examples below for more information.

ELF_C_READ When a program wishes to examine the contents of an existing file, it should set *cmd* to this value. Depending on the value of *ref*, this command examines archive members or entire files. Three cases can occur.

First, if *ref* is a null pointer, elf_begin allocates a new ELF descriptor and prepares to process the entire file. If the file being read is an archive, elf_begin also prepares the resulting descriptor to examine the initial archive member on the next call to elf_begin, as if the program had used elf_next or elf_rand to “move” to the initial member.

Second, if *ref* is a non-null descriptor associated with an archive file, elf_begin lets a program obtain a separate ELF descriptor associated with an individual member. The program should have used elf_next or elf_rand to position *ref* appropriately (except for the initial member, which elf_begin prepares; see the example below). In this case, *fil*des should be the same file descriptor used for the parent archive.

Finally, if *ref* is a non-null ELF descriptor that is not an archive, elf_begin increments the number of activations for the descriptor and returns *ref*, without allocating a new descriptor and without changing the descriptor’s read/write permissions. To terminate the descriptor for *ref*, the program must call elf_end once for each activation. See elf_next(3E) and the examples below for more information.

ELF_C_RDWR This command duplicates the actions of ELF_C_READ and additionally allows the program to update the file image [see elf_update(3E)]. That is, using ELF_C_READ gives a read-only view of the file, while ELF_C_RDWR lets the program read *and*

write the file. `ELF_C_RDWR` is not valid for archive members. If *ref* is non-null, it must have been created with the `ELF_C_RDWR` command.

`ELF_C_WRITE` If the program wishes to ignore previous file contents, presumably to create a new file, it should set *cmd* to this value. *ref* is ignored for this command.

`elf_begin` “works” on all files (including files with zero bytes), providing it can allocate memory for its internal structures and read any necessary information from the file. Programs reading object files thus may call `elf_kind` or `elf_getehdr` to determine the file type (only object files have an ELF header). If the file is an archive with no more members to process, or an error occurs, `elf_begin` returns a null pointer. Otherwise, the return value is a non-null ELF descriptor.

Before the first call to `elf_begin`, a program must call `elf_version` to coordinate versions.

SYSTEM SERVICES

When processing a file, the library decides when to read or write the file, depending on the program’s requests. Normally, the library assumes the file descriptor remains usable for the life of the ELF descriptor. If, however, a program must process many files simultaneously and the underlying operating system limits the number of open files, the program can use `elf_cntl` to let it reuse file descriptors. After calling `elf_cntl` with appropriate arguments, the program may close the file descriptor without interfering with the library.

All data associated with an ELF descriptor remain allocated until `elf_end` terminates the descriptor’s last activation. After the descriptors have been terminated, the storage is released; attempting to reference such data gives undefined behavior. Consequently, a program that deals with multiple input (or output) files must keep the ELF descriptors active until it finishes with them.

EXAMPLES

A prototype for reading a file appears below. If the file is a simple object file, the program executes the loop one time, receiving a null descriptor in the second iteration. In this case, both `elf` and `arf` will have the same value, the activation count will be two, and the program calls `elf_end` twice to terminate the descriptor. If the file is an archive, the loop processes each archive member in turn, ignoring those that are not object files.

```

if (elf_version(EV_CURRENT) == EV_NONE)
{
    /* library out of date */
    /* recover from error */
}
cmd = ELF_C_READ;
arf = elf_begin(fildes, cmd, (Elf *)0);
while ((elf = elf_begin(fildes, cmd, arf)) != 0)
{
    if ((ehdr = elf32_getehdr(elf)) != 0)
    {
        /* process the file ... */
    }
    cmd = elf_next(elf);
    elf_end(elf);
}
elf_end(arf);

```

Alternatively, the next example illustrates random archive processing. After identifying the file as an archive, the program repeatedly processes archive members of interest. For clarity, this example omits error checking and ignores simple object files. Additionally, this fragment preserves the ELF descriptors for all archive members, because it does not call `elf_end` to terminate them.

```

elf_version(EV_CURRENT);
arf = elf_begin(fildes, ELF_C_READ, (Elf *)0);
if (elf_kind(arf) != ELF_K_AR)
{
    /* not an archive */
}
/* initial processing */
/* set offset = ... for desired member header */
while (elf_rand(arf, offset) == offset)
{
    if ((elf = elf_begin(fildes, ELF_C_READ, arf)) == 0)
        break;
    if ((ehdr = elf32_getehdr(elf)) != 0)
    {
        /* process archive member ... */
    }
    /* set offset = ... for desired member header */
}

```

The following outline shows how one might create a new ELF file. This example is simplified to show the overall flow.

```

elf_version(EV_CURRENT);
fildes = open("path/name", O_RDWR|O_TRUNC|O_CREAT, 0666);
if ((elf = elf_begin(fildes, ELF_C_WRITE, (Elf *)0)) == 0)
    return;
ehdr = elf32_newehdr(elf);
phdr = elf32_newphdr(elf, count);
scn = elf_newscn(elf);
shdr = elf32_getshdr(scn);
data = elf_newdata(scn);
elf_update(elf, ELF_C_WRITE);
elf_end(elf);

```

Finally, the following outline shows how one might update an existing ELF file. Again, this example is simplified to show the overall flow.

```

elf_version(EV_CURRENT);
fildes = open("path/name", O_RDWR);
elf = elf_begin(fildes, ELF_C_RDWR, (Elf *)0);

/* add new or delete old information ... */

close(creat("path/name", 0666));
elf_update(elf, ELF_C_WRITE);
elf_end(elf);

```

In the example above, the call to `creat` truncates the file, thus ensuring the resulting file will have the “right” size. Without truncation, the updated file might be as big as the original, even if information were deleted. The library truncates the file, if it can, with `ftruncate` [see `truncate(2)`]. Some systems, however, do not support `ftruncate`, and the call to `creat` protects against this.

Notice that both file creation examples open the file with write *and* read permissions. On systems that support `mmap`, the library uses it to enhance performance, and `mmap` requires a readable file descriptor. Although the library can use a write-only file descriptor, the application will not obtain the performance advantages of `mmap`.

SEE ALSO

`cof2elf(1)`, `creat(2)`, `lseek(2)`, `mmap(2)`, `open(2)`, `truncate(2)`, `elf(3E)`, `elf_cntl(3E)`, `elf_end(3E)`, `elf_getarhdr(3E)`, `elf_getbase(3E)`, `elf_getdata(3E)`, `elf_getehdr(3E)`, `elf_getphdr(3E)`, `elf_getscn(3E)`, `elf_kind(3E)`, `elf_next(3E)`, `elf_rand(3E)`, `elf_rawfile(3E)`, `elf_update(3E)`, `elf_version(3E)`, `ar(4)`

NOTES

COFF is an object file format that preceded ELF. When a program calls `elf_begin` on a COFF file, the library translates COFF structures to their ELF equivalents, allowing programs to read (but not to write) a COFF file as if it were ELF. This conversion happens only to the memory image and not to the file itself. After the initial `elf_begin`, file offsets and addresses in the ELF header, the program headers, and the section headers retain the original COFF values [see `elf_getehdr`, `elf_getphdr`, and `elf_getshdr`]. A program may call `elf_update` to adjust these values (without writing the file), and the library will then present a consistent, ELF view of the file. Data obtained through `elf_getdata` are translated (the COFF

symbol table is presented as ELF , and so on). Data viewed through `elf_rawdata` undergo no conversion, allowing the program to view the bytes from the file itself.

Some COFF debugging information is not translated, though this does not affect the semantics of a running program.

Although the ELF library supports COFF , programmers are strongly encouraged to recompile their programs, obtaining ELF object files.

NAME

elf_cntl - control a file descriptor

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

int elf_cntl(Elf *elf, Elf_Cmd cmd);
```

DESCRIPTION

elf_cntl instructs the library to modify its behavior with respect to an ELF descriptor, *elf*. As elf_begin(3E) describes, an ELF descriptor can have multiple activations, and multiple ELF descriptors may share a single file descriptor. Generally, elf_cntl commands apply to all activations of *elf*. Moreover, if the ELF descriptor is associated with an archive file, descriptors for members within the archive will also be affected as described below. Unless stated otherwise, operations on archive members do not affect the descriptor for the containing archive.

The *cmd* argument tells what actions to take and may have the following values.

ELF_C_FDDONE

This value tells the library not to use the file descriptor associated with *elf*. A program should use this command when it has requested all the information it cares to use and wishes to avoid the overhead of reading the rest of the file. The memory for all completed operations remains valid, but later file operations, such as the initial elf_getdata for a section, will fail if the data are not in memory already.

ELF_C_FDREAD

This command is similar to ELF_C_FDDONE, except it forces the library to read the rest of the file. A program should use this command when it must close the file descriptor but has not yet read everything it needs from the file. After elf_cntl completes the ELF_C_FDREAD command, future operations, such as elf_getdata, will use the memory version of the file without needing to use the file descriptor.

If elf_cntl succeeds, it returns zero. Otherwise *elf* was null or an error occurred, and the function returns -1.

SEE ALSO

elf(3E), elf_begin(3E), elf_getdata(3E), elf_rawfile(3E)

NOTE

If the program wishes to use the “raw” operations [see elf_rawdata, which elf_getdata(3E) describes, and elf_rawfile(3E)] after disabling the file descriptor with ELF_C_FDDONE or ELF_C_FDREAD, it must execute the raw operations explicitly beforehand. Otherwise, the raw file operations will fail. Calling elf_rawfile makes the entire image available, thus supporting subsequent elf_rawdata calls.

NAME

elf_end - finish using an object file

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>
int elf_end(Elf *elf);
```

DESCRIPTION

A program uses `elf_end` to terminate an ELF descriptor, *elf*, and to deallocate data associated with the descriptor. Until the program terminates a descriptor, the data remain allocated. *elf* should be a value previously returned by `elf_begin`; a null pointer is allowed as an argument, to simplify error handling. If the program wishes to write data associated with the ELF descriptor to the file, it must use `elf_update` before calling `elf_end`.

As `elf_begin(3E)` explains, a descriptor can have more than one activation. Calling `elf_end` removes one activation and returns the remaining activation count. The library does not terminate the descriptor until the activation count reaches zero. Consequently, a zero return value indicates the ELF descriptor is no longer valid.

SEE ALSO

`elf(3E)`, `elf_begin(3E)`, `elf_update(3E)`

NAME

elf_errmsg, elf_errno - error handling

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

const char *elf_errmsg(int err);
int elf_errno(void);
```

DESCRIPTION

If an ELF library function fails, a program may call `elf_errno` to retrieve the library's internal error number. As a side effect, this function resets the internal error number to zero, which indicates no error.

`elf_errmsg` takes an error number, *err*, and returns a null-terminated error message (with no trailing new-line) that describes the problem. A zero *err* retrieves a message for the most recent error. If no error has occurred, the return value is a null pointer (not a pointer to the null string). Using *err* of -1 also retrieves the most recent error, except it guarantees a non-null return value, even when no error has occurred. If no message is available for the given number, `elf_errmsg` returns a pointer to an appropriate message. This function does not have the side effect of clearing the internal error number.

EXAMPLE

The following fragment clears the internal error number and checks it later for errors. Unless an error occurs after the first call to `elf_errno`, the next call will return zero.

```
(void)elf_errno();
while (more_to_do)
{
    /* processing ... */
    if ((err = elf_errno()) != 0)
    {
        msg = elf_errmsg(err);
        /* print msg */
    }
}
```

SEE ALSO

elf(3E), elf_version(3E)

NAME

elf_fill - set fill byte

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]  
#include <libelf.h>  
void elf_fill(int fill);
```

DESCRIPTION

Alignment constraints for ELF files sometimes require the presence of “holes.” For example, if the data for one section are required to begin on an eight-byte boundary, but the preceding section is too “short,” the library must fill the intervening bytes. These bytes are set to the *fill* character. The library uses zero bytes unless the application supplies a value. See `elf_getdata(3E)` for more information about these holes.

SEE ALSO

`elf(3E)`, `elf_getdata(3E)`, `elf_flag(3E)`, `elf_update(3E)`

NOTE

An application can assume control of the object file organization by setting the `ELF_F_LAYOUT` bit [see `elf_flag(3E)`]. When this is done, the library does not fill holes.

NAME

elf_flagdata, elf_flagehdr, elf_flagelf, elf_flagphdr,
elf_flagscn, elf_flagshdr - manipulate flags

SYNOPSIS

```
cc [flag ...]file ... -lelf [library ...]
#include <libelf.h>

unsigned elf_flagdata(Elf_Data *data, Elf_Cmd cmd, unsigned flags);
unsigned elf_flagehdr(Elf *elf, Elf_Cmd cmd, unsigned flags);
unsigned elf_flagelf(Elf *elf, Elf_Cmd cmd, unsigned flags);
unsigned elf_flagphdr(Elf *elf, Elf_Cmd cmd, unsigned flags);
unsigned elf_flagscn(Elf_Scn *scn, Elf_Cmd cmd, unsigned flags);
unsigned elf_flagshdr(Elf_Scn *scn, Elf_Cmd cmd, unsigned flags);
```

DESCRIPTION

These functions manipulate the flags associated with various structures of an ELF file. Given an ELF descriptor (*elf*), a data descriptor (*data*), or a section descriptor (*scn*), the functions may set or clear the associated status bits, returning the updated bits. A null descriptor is allowed, to simplify error handling; all functions return zero for this degenerate case.

cmd may have the following values.

| | |
|-----------|--|
| ELF_C_CLR | The functions clear the bits that are asserted in <i>flags</i> . Only the non-zero bits in <i>flags</i> are cleared; zero bits do not change the status of the descriptor. |
| ELF_C_SET | The functions set the bits that are asserted in <i>flags</i> . Only the non-zero bits in <i>flags</i> are set; zero bits do not change the status of the descriptor. |

Descriptions of the defined *flags* bits appear below.

| | |
|--------------|---|
| ELF_F_DIRTY | When the program intends to write an ELF file, this flag asserts the associated information needs to be written to the file. Thus, for example, a program that wished to update the ELF header of an existing file would call <code>elf_flagehdr</code> with this bit set in <i>flags</i> and <i>cmd</i> equal to <code>ELF_C_SET</code> . A later call to <code>elf_update</code> would write the marked header to the file. |
| ELF_F_LAYOUT | Normally, the library decides how to arrange an output file. That is, it automatically decides where to place sections, how to align them in the file, etc. If this bit is set for an ELF descriptor, the program assumes responsibility for determining all file positions. This bit is meaningful only for <code>elf_flagelf</code> and applies to the entire file associated with the descriptor. |

When a flag bit is set for an item, it affects all the subitems as well. Thus, for example, if the program sets the `ELF_F_DIRTY` bit with `elf_flagelf`, the entire logical file is “dirty.”

EXAMPLE

The following fragment shows how one might mark the ELF header to be written to the output file.

```
ehdr = elf32_getehdr(elf);  
/* dirty ehdr ... */  
elf_flagehdr(elf, ELF_C_SET, ELF_F_DIRTY);
```

SEE ALSO

[elf\(3E\)](#), [elf_end\(3E\)](#), [elf_getdata\(3E\)](#), [elf_getehdr\(3E\)](#), [elf_update\(3E\)](#)

NAME

elf_fsize: elf32_fsize - return the size of an object file type

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

size_t elf32_fsize(Elf_Type type, size_t count, unsigned ver);
```

DESCRIPTION

elf32_fsize gives the size in bytes of the 32-bit file representation of *count* data objects with the given *type*. The library uses version *ver* to calculate the size [see elf(3E) and elf_version(3E)].

Constant values are available for the sizes of fundamental types.

| Elf_Type | File Size | Memory Size |
|-------------|-----------------|-----------------------|
| ELF_T_ADDR | ELF32_FSZ_ADDR | sizeof(Elf32_Addr) |
| ELF_T_BYTE | 1 | sizeof(unsigned char) |
| ELF_T_HALF | ELF32_FSZ_HALF | sizeof(Elf32_Half) |
| ELT_T_OFF | ELF32_FSZ_OFF | sizeof(Elf32_Off) |
| ELF_T_SWORD | ELF32_FSZ_SWORD | sizeof(Elf32_Sword) |
| ELF_T_WORD | ELF32_FSZ_WORD | sizeof(Elf32_Word) |

elf32_fsize returns zero if the value of *type* or *ver* is unknown. See elf_xlate(3E) for a list of the *type* values.

SEE ALSO

elf(3E), elf_version(3E), elf_xlate(3E)

NAME

elf_getarhdr - retrieve archive member header

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

Elf_Arhdr *elf_getarhdr(Elf *elf);
```

DESCRIPTION

elf_getarhdr returns a pointer to an archive member header, if one is available for the ELF descriptor *elf*. Otherwise, no archive member header exists, an error occurred, or *elf* was null; elf_getarhdr then returns a null value. The header includes the following members.

| | |
|---------------|--------------|
| char | *ar_name; |
| time_t | ar_date; |
| long | ar_uid; |
| long | ar_gid; |
| unsigned long | ar_mode; |
| off_t | ar_size; |
| char | *ar_rawname; |

An archive member name, available through ar_name, is a null-terminated string, with the ar format control characters removed. The ar_rawname member holds a null-terminated string that represents the original name bytes in the file, including the terminating slash and trailing blanks as specified in the archive format.

In addition to “regular” archive members, the archive format defines some special members. All special member names begin with a slash (/), distinguishing them from regular members (whose names may not contain a slash). These special members have the names (ar_name) defined below.

- / This is the archive symbol table. If present, it will be the first archive member. A program may access the archive symbol table through elf_getarsym. The information in the symbol table is useful for random archive processing [see elf_rand(3E)].
- // This member, if present, holds a string table for long archive member names. An archive member’s header contains a 16-byte area for the name, which may be exceeded in some file systems. The library automatically retrieves long member names from the string table, setting ar_name to the appropriate value.

Under some error conditions, a member’s name might not be available. Although this causes the library to set ar_name to a null pointer, the ar_rawname member will be set as usual.

SEE ALSO

elf(3E), elf_begin(3E), elf_getarsym(3E), elf_rand(3E), ar(4)

NAME

elf_getarsym - retrieve archive symbol table

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

Elf_Arsym *elf_getarsym(Elf *elf, size_t *ptr);
```

DESCRIPTION

elf_getarsym returns a pointer to the archive symbol table, if one is available for the ELF descriptor *elf*. Otherwise, the archive doesn't have a symbol table, an error occurred, or *elf* was null; elf_getarsym then returns a null value. The symbol table is an array of structures that include the following members.

```
char          *as_name;
size_t        as_off;
unsigned long  as_hash;
```

These members have the following semantics.

as_name A pointer to a null-terminated symbol name resides here.

as_off This value is a byte offset from the beginning of the archive to the member's header. The archive member residing at the given offset defines the associated symbol. Values in *as_off* may be passed as arguments to elf_rand to access the desired archive member.

as_hash This is a hash value for the name, as computed by elf_hash.

If *ptr* is non-null, the library stores the number of table entries in the location to which *ptr* points. This value is set to zero when the return value is null. The table's last entry, which is included in the count, has a null *as_name*, a zero value for *as_off*, and ~0UL for *as_hash*.

SEE ALSO

elf(3E), elf_getarhdr(3E), elf_hash(3E), elf_rand(3E), ar(4)

NAME

elf_getbase - get the base offset for an object file

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

off_t elf_getbase(Elf *elf);
```

DESCRIPTION

elf_getbase returns the file offset of the first byte of the file or archive member associated with *elf*, if it is known or obtainable, and -1 otherwise. A null *elf* is allowed, to simplify error handling; the return value in this case is -1. The base offset of an archive member is the beginning of the member's information, not the beginning of the archive member header.

SEE ALSO

elf(3E), elf_begin(3E), ar(4)

NAME

elf_getdata, elf_newdata, elf_rawdata - get section data

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

Elf_Data *elf_getdata(Elf_Scn *scn, Elf_Data *data);
Elf_Data *elf_newdata(Elf_Scn *scn);
Elf_Data *elf_rawdata(Elf_Scn *scn, Elf_Data *data);
```

DESCRIPTION

These functions access and manipulate the data associated with a section descriptor, *scn*. When reading an existing file, a section will have a single data buffer associated with it. A program may build a new section in pieces, however, composing the new data from multiple data buffers. For this reason, “the” data for a section should be viewed as a list of buffers, each of which is available through a data descriptor.

`elf_getdata` lets a program step through a section’s data list. If the incoming data descriptor, *data*, is null, the function returns the first buffer associated with the section. Otherwise, *data* should be a data descriptor associated with *scn*, and the function gives the program access to the next data element for the section. If *scn* is null or an error occurs, `elf_getdata` returns a null pointer.

`elf_getdata` translates the data from file representations into memory representations [see `elf_xlate(3E)`] and presents objects with memory data types to the program, based on the file’s *class* [see `elf(3E)`]. The working library version [see `elf_version(3E)`] specifies what version of the memory structures the program wishes `elf_getdata` to present.

`elf_newdata` creates a new data descriptor for a section, appending it to any data elements already associated with the section. As described below, the new data descriptor appears empty, indicating the element holds no data. For convenience, the descriptor’s type (`d_type` below) is set to `ELF_T_BYTE`, and the version (`d_version` below) is set to the working version. The program is responsible for setting (or changing) the descriptor members as needed. This function implicitly sets the `ELF_F_DIRTY` bit for the section’s data [see `elf_flag(3E)`]. If *scn* is null or an error occurs, `elf_newdata` returns a null pointer.

`elf_rawdata` differs from `elf_getdata` by returning only uninterpreted bytes, regardless of the section type. This function typically should be used only to retrieve a section image from a file being read, and then only when a program must avoid the automatic data translation described below. Moreover, a program may not close or disable [see `elf_cntl(3E)`] the file descriptor associated with *elf* before the initial raw operation, because `elf_rawdata` might read the data from the file to ensure it doesn’t interfere with `elf_getdata`. See `elf_rawfile(3E)` for a related facility that applies to the entire file. When `elf_getdata` provides the right translation, its use is recommended over `elf_rawdata`. If *scn* is null or an error occurs, `elf_rawdata` returns a null pointer.

The `Elf_Data` structure includes the following members.

```
void          *d_buf;
Elf_Type     d_type;
size_t       d_size;
off_t        d_off;
size_t       d_align;
unsigned     d_version;
```

These members are available for direct manipulation by the program. Descriptions appear below.

| | |
|------------------------|---|
| <code>d_buf</code> | A pointer to the data buffer resides here. A data element with no data has a null pointer. |
| <code>d_type</code> | This member's value specifies the type of the data to which <code>d_buf</code> points. A section's type determines how to interpret the section contents, as summarized below. |
| <code>d_size</code> | This member holds the total size, in bytes, of the memory occupied by the data. This may differ from the size as represented in the file. The size will be zero if no data exist. [See the discussion of <code>SHT_NOBITS</code> below for more information.] |
| <code>d_off</code> | This member gives the offset, within the section, at which the buffer resides. This offset is relative to the file's section, not the memory object's. |
| <code>d_align</code> | This member holds the buffer's required alignment, from the beginning of the section. That is, <code>d_off</code> will be a multiple of this member's value. For example, if this member's value is four, the beginning of the buffer will be four-byte aligned within the section. Moreover, the entire section will be aligned to the maximum of its constituents, thus ensuring appropriate alignment for a buffer within the section and within the file. |
| <code>d_version</code> | This member holds the version number of the objects in the buffer. When the library originally read the data from the object file, it used the working version to control the translation to memory objects. |

DATA ALIGNMENT

As mentioned above, data buffers within a section have explicit alignment constraints. Consequently, adjacent buffers sometimes will not abut, causing "holes" within a section. Programs that create output files have two ways of dealing with these holes.

First, the program can use `elf_fill` to tell the library how to set the intervening bytes. When the library must generate gaps in the file, it uses the fill byte to initialize the data there. The library's initial fill value is zero, and `elf_fill` lets the application change that.

Second, the application can generate its own data buffers to occupy the gaps, filling the gaps with values appropriate for the section being created. A program might even use different fill values for different sections. For example, it could set text sections' bytes to no-operation instructions, while filling data section holes with zero. Using this technique, the library finds no holes to fill, because the application

eliminated them.

SECTION AND MEMORY TYPES

`elf_getdata` interprets sections' data according to the section type, as noted in the section header available through `elf_getshdr`. The following table shows the section types and how the library represents them with memory data types for the 32-bit file class. Other classes would have similar tables. By implication, the memory data types control translation by `elf_xlate`.

| Section Type | Elf_Type | 32-Bit Type |
|--------------|------------|---------------|
| SHT_DYNAMIC | ELF_T_DYN | Elf32_Dyn |
| SHT_DYNSYM | ELF_T_SYM | Elf32_Sym |
| SHT_HASH | ELF_T_WORD | Elf32_Word |
| SHT_NOBITS | ELF_T_BYTE | unsigned char |
| SHT_NOTE | ELF_T_BYTE | unsigned char |
| SHT_NULL | none | none |
| SHT_PROGBITS | ELF_T_BYTE | unsigned char |
| SHT_REL | ELF_T_REL | Elf32_Rel |
| SHT_RELA | ELF_T_RELA | Elf32_Rela |
| SHT_STRTAB | ELF_T_BYTE | unsigned char |
| SHT_SYMTAB | ELF_T_SYM | Elf32_Sym |
| <i>other</i> | ELF_T_BYTE | unsigned char |

`elf_rawdata` creates a buffer with type `ELF_T_BYTE`.

As mentioned above, the program's working version controls what structures the library creates for the application. The library similarly interprets section types according to the versions. If a section type "belongs" to a version newer than the application's working version, the library does not translate the section data. Because the application cannot know the data format in this case, the library presents an untranslated buffer of type `ELF_T_BYTE`, just as it would for an unrecognized section type.

A section with a special type, `SHT_NOBITS`, occupies no space in an object file, even when the section header indicates a non-zero size. `elf_getdata` and `elf_rawdata` "work" on such a section, setting the `data` structure to have a null buffer pointer and the type indicated above. Although no data are present, the `d_size` value is set to the size from the section header. When a program is creating a new section of type `SHT_NOBITS`, it should use `elf_newdata` to add data buffers to the section. These "empty" data buffers should have the `d_size` members set to the desired size and the `d_buf` members set to null.

EXAMPLE

The following fragment obtains the string table that holds section names (ignoring error checking). See `elf_strptr(3E)` for a variation of string table handling.

```
ehdr = elf32_getehdr(elf);
scn = elf_getscn(elf, (size_t)ehdr->e_shstrndx);
shdr = elf32_getshdr(scn);
if (shdr->sh_type != SHT_STRTAB)
{
    /* not a string table */
}
data = 0;
if ((data = elf_getdata(scn, data)) == 0 || data->d_size == 0)
{
    /* error or no data */
}
```

The `e_shstrndx` member in an ELF header holds the section table index of the string table. The program gets a section descriptor for that section, verifies it is a string table, and then retrieves the data. When this fragment finishes, `data->d_buf` points at the first byte of the string table, and `data->d_size` holds the string table's size in bytes.

SEE ALSO

elf(3E), elf_cntl(3E), elf_fill(3E), elf_flag(3E), elf_getehdr(3E),
elf_getscn(3E), elf_getshdr(3E), elf_rawfile(3E), elf_version(3E),
elf_xlate(3E)

NAME

elf_getehdr: elf32_getehdr, elf32_newehdr - retrieve class-dependent object file header

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

Elf32_Ehdr *elf32_getehdr(Elf *elf);
Elf32_Ehdr *elf32_newehdr(Elf *elf);
```

DESCRIPTION

For a 32-bit class file, `elf32_getehdr` returns a pointer to an ELF header, if one is available for the ELF descriptor `elf`. If no header exists for the descriptor, `elf32_newehdr` allocates a “clean” one, but it otherwise behaves the same as `elf32_getehdr`. It does not allocate a new header if one exists already. If no header exists (for `elf_getehdr`), one cannot be created (for `elf_newehdr`), a system error occurs, the file is not a 32-bit class file, or `elf` is null, both functions return a null pointer.

The header includes the following members.

```
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_newehdr` automatically sets the `ELF_F_DIRTY` bit [see `elf_flag(3E)`]. A program may use `elf_getident` to inspect the identification bytes from a file.

SEE ALSO

`elf(3E)`, `elf_begin(3E)`, `elf_flag(3E)`, `elf_getident(3E)`

NAME

elf_getident - retrieve file identification data

SYNOPSIS

```
cc [flag ...]file ... -lelf [library ...]
#include <libelf.h>

char *elf_getident(Elf *elf, size_t *ptr);
```

DESCRIPTION

As elf(3E) explains, ELF provides a framework for various classes of files, where basic objects may have 32 bits, 64 bits, etc. To accommodate these differences, without forcing the larger sizes on smaller machines, the initial bytes in an ELF file hold identification information common to all file classes. Every ELF header's `e_ident` has `EI_NIDENT` bytes with the following interpretation.

| e_ident Index | Value | Purpose |
|---------------|---|---------------------|
| EI_MAG0 | ELFMAG0 | File identification |
| EI_MAG1 | ELFMAG1 | |
| EI_MAG2 | ELFMAG2 | |
| EI_MAG3 | ELFMAG3 | |
| EI_CLASS | ELFCLASSNONE ELFCLASS32 ELFCLASS64 | File class |
| EI_DATA | ELFDATANONE ELFDATA2LSB ELFDATA2MSB | Data encoding |
| EI_VERSION | EV_CURRENT | File version |
| 7-15 | 0 | Unused, set to zero |

Other kinds of files [see elf_kind(3E)] also may have identification data, though they would not conform to `e_ident`.

`elf_getident` returns a pointer to the file's "initial bytes." If the library recognizes the file, a conversion from the file image to the memory image may occur. In any case, the identification bytes are guaranteed not to have been modified, though the size of the unmodified area depends on the file type. If `ptr` is non-null, the library stores the number of identification bytes in the location to which `ptr` points. If no data are present, `elf` is null, or an error occurs, the return value is a null pointer, with zero optionally stored through `ptr`.

SEE ALSO

elf(3E), elf_begin(3E), elf_getehdr(3E), elf_kind(3E), elf_rawfile(3E)

NAME

elf_getphdr: elf32_getphdr, elf32_newphdr - retrieve class-dependent program header table

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

Elf32_Phdr *elf32_getphdr(Elf *elf);
Elf32_Phdr *elf32_newphdr(Elf *elf, size_t count);
```

DESCRIPTION

For a 32-bit class file, `elf32_getphdr` returns a pointer to the program execution header table, if one is available for the ELF descriptor `elf`.

`elf32_newphdr` allocates a new table with `count` entries, regardless of whether one existed previously, and sets the `ELF_F_DIRTY` bit for the table [see `elf_flag(3E)`]. Specifying a zero `count` deletes an existing table. Note this behavior differs from that of `elf32_newehdr` [see `elf32_getehdr(3E)`], allowing a program to replace or delete the program header table, changing its size if necessary.

If no program header table exists, the file is not a 32-bit class file, an error occurs, or `elf` is null, both functions return a null pointer. Additionally, `elf32_newphdr` returns a null pointer if `count` is zero.

The table is an array of `Elf32_Phdr` structures, each of which includes the following members.

```
Elf32_Word    p_type;
Elf32_Off     p_offset;
Elf32_Addr    p_vaddr;
Elf32_Addr    p_paddr;
Elf32_Word    p_filesz;
Elf32_Word    p_memsz;
Elf32_Word    p_flags;
Elf32_Word    p_align;
```

The ELF header's `e_phnum` member tells how many entries the program header table has [see `elf_getehdr(3E)`]. A program may inspect this value to determine the size of an existing table; `elf32_newphdr` automatically sets the member's value to `count`. If the program is building a new file, it is responsible for creating the file's ELF header before creating the program header table.

SEE ALSO

`elf(3E)`, `elf_begin(3E)`, `elf_flag(3E)`, `elf_getehdr(3E)`

NAME

elf_getscn, elf_ndxscn, elf_newscn, elf_nextscn - get section information

SYNOPSIS

```
cc [flag ...]file ... -lelf [library ...]
#include <libelf.h>

Elf_Scn *elf_getscn(Elf *elf, size_t index);
size_t elf_ndxscn(Elf_Scn *scn);
Elf_Scn *elf_newscn(Elf *elf);
Elf_Scn *elf_nextscn(Elf *elf, Elf_Scn *scn);
```

DESCRIPTION

These functions provide indexed and sequential access to the sections associated with the ELF descriptor *elf*. If the program is building a new file, it is responsible for creating the file's ELF header before creating sections; see [elf_getehdr\(3E\)](#).

elf_getscn returns a section descriptor, given an *index* into the file's section header table. Note the first "real" section has index 1. Although a program can get a section descriptor for the section whose *index* is 0 (SHN_UNDEF, the undefined section), the section has no data and the section header is "empty" (though present). If the specified section does not exist, an error occurs, or *elf* is null, *elf_getscn* returns a null pointer.

elf_newscn creates a new section and appends it to the list for *elf*. Because the SHN_UNDEF section is required and not "interesting" to applications, the library creates it automatically. Thus the first call to *elf_newscn* for an ELF descriptor with no existing sections returns a descriptor for section 1. If an error occurs or *elf* is null, *elf_newscn* returns a null pointer.

After creating a new section descriptor, the program can use *elf_getshdr* to retrieve the newly created, "clean" section header. The new section descriptor will have no associated data [see [elf_getdata\(3E\)](#)]. When creating a new section in this way, the library updates the *e_shnum* member of the ELF header and sets the ELF_F_DIRTY bit for the section [see [elf_flag\(3E\)](#)]. If the program is building a new file, it is responsible for creating the file's ELF header [see [elf_getehdr\(3E\)](#)] before creating new sections.

elf_nextscn takes an existing section descriptor, *scn*, and returns a section descriptor for the next higher section. One may use a null *scn* to obtain a section descriptor for the section whose index is 1 (skipping the section whose index is SHN_UNDEF). If no further sections are present or an error occurs, *elf_nextscn* returns a null pointer.

elf_ndxscn takes an existing section descriptor, *scn*, and returns its section table index. If *scn* is null or an error occurs, *elf_ndxscn* returns SHN_UNDEF.

EXAMPLE

An example of sequential access appears below. Each pass through the loop processes the next section in the file; the loop terminates when all sections have been processed.

elf_getscn(3E)

(ELF Library)

elf_getscn(3E)

```
scn = 0;
while ((scn = elf_nextscn(elf, scn)) != 0)
{
    /* process section */
}
```

SEE ALSO

elf(3E), elf_begin(3E), elf_flag(3E), elf_getdata(3E), elf_getehdr(3E),
elf_getshdr(3E)

NAME

elf_getshdr: elf32_getshdr - retrieve class-dependent section header

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]  
#include <libelf.h>  
  
Elf32_Shdr *elf32_getshdr(Elf_Scn *scn);
```

DESCRIPTION

For a 32-bit class file, elf32_getshdr returns a pointer to a section header for the section descriptor *scn*. Otherwise, the file is not a 32-bit class file, *scn* was null, or an error occurred; elf32_getshdr then returns NULL.

The header includes the following members.

| | |
|------------|---------------|
| 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; |

If the program is building a new file, it is responsible for creating the file's ELF header before creating sections.

SEE ALSO

elf(3E), elf_flag(3E), elf_getscn(3E), elf_strptr(3E)

NAME

elf_hash - compute hash value

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

unsigned long elf_hash(const char *name);
```

DESCRIPTION

elf_hash computes a hash value, given a null terminated string, *name*. The returned hash value, *h*, can be used as a bucket index, typically after computing $h \bmod x$ to ensure appropriate bounds.

Hash tables may be built on one machine and used on another because elf_hash uses unsigned arithmetic to avoid possible differences in various machines' signed arithmetic. Although *name* is shown as char* above, elf_hash treats it as unsigned char* to avoid sign extension differences. Using char* eliminates type conflicts with expressions such as elf_hash("name").

ELF files' symbol hash tables are computed using this function [see elf_getdata(3E) and elf_xlate(3E)]. The hash value returned is guaranteed not to be the bit pattern of all ones (~0UL).

SEE ALSO

elf(3E), elf_getdata(3E), elf_xlate(3E)

NAME

elf_kind - determine file type

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]  
#include <libelf.h>  
Elf_Kind elf_kind(Elf *elf);
```

DESCRIPTION

This function returns a value identifying the kind of file associated with an ELF descriptor (*elf*). Currently defined values appear below.

| | |
|------------|--|
| ELF_K_AR | The file is an archive [see ar(4)]. An ELF descriptor may also be associated with an archive <i>member</i> , not the archive itself, and then elf_kind identifies the member's type. |
| ELF_K_COFF | The file is a COFF object file. elf_begin(3E) describes the library's handling for COFF files. |
| ELF_K_ELF | The file is an ELF file. The program may use elf_getident to determine the class. Other functions, such as elf_getehdr, are available to retrieve other file information. |
| ELF_K_NONE | This indicates a kind of file unknown to the library. |

Other values are reserved, to be assigned as needed to new kinds of files. *elf* should be a value previously returned by elf_begin. A null pointer is allowed, to simplify error handling, and causes elf_kind to return ELF_K_NONE.

SEE ALSO

elf(3E), elf_begin(3E), elf_getehdr(3E), elf_getident(3E), ar(4)

NAME

elf_next - sequential archive member access

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

Elf_Cmd elf_next(Elf *elf);
```

DESCRIPTION

elf_next, elf_rand, and elf_begin manipulate simple object files and archives. *elf* is an ELF descriptor previously returned from elf_begin.

elf_next provides sequential access to the next archive member. That is, having an ELF descriptor, *elf*, associated with an archive member, elf_next prepares the containing archive to access the following member when the program calls elf_begin. After successfully positioning an archive for the next member, elf_next returns the value ELF_C_READ. Otherwise, the open file was not an archive, *elf* was null, or an error occurred, and the return value is ELF_C_NULL. In either case, the return value may be passed as an argument to elf_begin, specifying the appropriate action.

SEE ALSO

elf(3E), elf_begin(3E), elf_getarsym(3E), elf_rand(3E), ar(4)

NAME

elf_rand - random archive member access

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

size_t elf_rand(Elf *elf, size_t offset);
```

DESCRIPTION

elf_rand, elf_next, and elf_begin manipulate simple object files and archives. *elf* is an ELF descriptor previously returned from elf_begin.

elf_rand provides random archive processing, preparing *elf* to access an arbitrary archive member. *elf* must be a descriptor for the archive itself, not a member within the archive. *offset* gives the byte offset from the beginning of the archive to the archive header of the desired member. See elf_getarsym(3E) for more information about archive member offsets. When elf_rand works, it returns *offset*. Otherwise it returns 0, because an error occurred, *elf* was null, or the file was not an archive (no archive member can have a zero offset). A program may mix random and sequential archive processing.

EXAMPLE

An archive starts with a “magic string” that has SARMAG bytes; the initial archive member follows immediately. An application could thus provide the following function to rewind an archive (the function returns -1 for errors and 0 otherwise).

```
#include <ar.h>
#include <libelf.h>

int
rewindelf(Elf *elf)
{
    if (elf_rand(elf, (size_t)SARMAG) == SARMAG)
        return 0;
    return -1;
}
```

SEE ALSO

elf(3E), elf_begin(3E), elf_getarsym(3E), elf_next(3E), ar(4)

NAME

elf_rawfile - retrieve uninterpreted file contents

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

char *elf_rawfile(Elf *elf, size_t *ptr);
```

DESCRIPTION

elf_rawfile returns a pointer to an uninterpreted byte image of the file. This function should be used only to retrieve a file being read. For example, a program might use elf_rawfile to retrieve the bytes for an archive member.

A program may not close or disable [see elf_cntl(3E)] the file descriptor associated with *elf* before the initial call to elf_rawfile, because elf_rawfile might have to read the data from the file if it does not already have the original bytes in memory. Generally, this function is more efficient for unknown file types than for object files. The library implicitly translates object files in memory, while it leaves unknown files unmodified. Thus asking for the uninterpreted image of an object file may create a duplicate copy in memory.

elf_rawdata [see elf_getdata(3E)] is a related function, providing access to sections within a file.

If *ptr* is non-null, the library also stores the file's size, in bytes, in the location to which *ptr* points. If no data are present, *elf* is null, or an error occurs, the return value is a null pointer, with zero optionally stored through *ptr*.

SEE ALSO

elf(3E), elf_begin(3E), elf_cntl(3E), elf_getdata(3E), elf_getehdr(3E), elf_getident(3E), elf_kind(3E)

NOTE

A program that uses elf_rawfile and that also interprets the same file as an object file potentially has two copies of the bytes in memory. If such a program requests the raw image first, before it asks for translated information (through such functions as elf_getehdr, elf_getdata, and so on), the library "freezes" its original memory copy for the raw image. It then uses this frozen copy as the source for creating translated objects, without reading the file again. Consequently, the application should view the raw file image returned by elf_rawfile as a read-only buffer, unless it wants to alter its own view of data subsequently translated. In any case, the application may alter the translated objects without changing bytes visible in the raw image.

Multiple calls to elf_rawfile with the same ELF descriptor return the same value; the library does not create duplicate copies of the file.

NAME

elf_strptr - make a string pointer

SYNOPSIS

```
cc [flag ...]file ... -lelf [library ...]
#include <libelf.h>

char *elf_strptr(Elf *elf, size_t section, size_t offset);
```

DESCRIPTION

This function converts a string section *offset* to a string pointer. *elf* identifies the file in which the string section resides, and *section* gives the section table index for the strings. `elf_strptr` normally returns a pointer to a string, but it returns a null pointer when *elf* is null, *section* is invalid or is not a section of type `SHT_STRTAB`, the section data cannot be obtained, *offset* is invalid, or an error occurs.

EXAMPLE

A prototype for retrieving section names appears below. The file header specifies the section name string table in the `e_shstrndx` member. The following code loops through the sections, printing their names.

```
if ((ehdr = elf32_getehdr(elf)) == 0)
{
    /* handle the error */
    return;
}
ndx = ehdr->e_shstrndx;
scn = 0;
while ((scn = elf_nextscn(elf, scn)) != 0)
{
    char *name = 0;
    if ((shdr = elf32_getshdr(scn)) != 0)
        name = elf_strptr(elf, ndx, (size_t)shdr->sh_name);
    printf("%s\n", name? name: "(null)");
}
```

SEE ALSO

elf(3E), elf_getdata(3E), elf_getshdr(3E), elf_xlate(3E)

NOTE

A program may call `elf_getdata` to retrieve an entire string table section. For some applications, that would be both more efficient and more convenient than using `elf_strptr`.

NAME

elf_update - update an ELF descriptor

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>

off_t elf_update(Elf *elf, Elf_Cmd cmd);
```

DESCRIPTION

elf_update causes the library to examine the information associated with an ELF descriptor, *elf*, and to recalculate the structural data needed to generate the file's image.

cmd may have the following values.

ELF_C_NULL This value tells elf_update to recalculate various values, updating only the ELF descriptor's memory structures. Any modified structures are flagged with the ELF_F_DIRTY bit. A program thus can update the structural information and then reexamine them without changing the file associated with the ELF descriptor. Because this does not change the file, the ELF descriptor may allow reading, writing, or both reading and writing [see elf_begin(3E)].

ELF_C_WRITE If *cmd* has this value, elf_update duplicates its ELF_C_NULL actions and also writes any "dirty" information associated with the ELF descriptor to the file. That is, when a program has used elf_getdata or the elf_flag facilities to supply new (or update existing) information for an ELF descriptor, those data will be examined, coordinated, translated if necessary [see elf_xlate(3E)], and written to the file. When portions of the file are written, any ELF_F_DIRTY bits are reset, indicating those items no longer need to be written to the file [see elf_flag(3E)]. The sections' data are written in the order of their section header entries, and the section header table is written to the end of the file.

When the ELF descriptor was created with elf_begin, it must have allowed writing the file. That is, the elf_begin command must have been either ELF_C_RDWR or ELF_C_WRITE.

If elf_update succeeds, it returns the total size of the file image (not the memory image), in bytes. Otherwise an error occurred, and the function returns -1.

When updating the internal structures, elf_update sets some members itself. Members listed below are the application's responsibility and retain the values given by the program.

| | Member | Notes |
|------------|------------------|---------------------------------------|
| ELF Header | e_ident[EI_DATA] | Library controls other e_ident values |
| | e_type | |
| | e_machine | |
| | e_version | |
| | e_entry | |
| | e_phoff | Only when ELF_F_LAYOUT asserted |
| | e_shoff | Only when ELF_F_LAYOUT asserted |
| | e_flags | |
| | e_shstrndx | |

| | Member | Notes |
|----------------|----------|---|
| Program Header | p_type | The application controls all program header entries |
| | p_offset | |
| | p_vaddr | |
| | p_paddr | |
| | p_filesz | |
| | p_memsz | |
| | p_flags | |
| | p_align | |

| | Member | Notes |
|----------------|--------------|---------------------------------|
| Section Header | sh_name | |
| | sh_type | |
| | sh_flags | |
| | sh_addr | |
| | sh_offset | Only when ELF_F_LAYOUT asserted |
| | sh_size | Only when ELF_F_LAYOUT asserted |
| | sh_link | |
| | sh_info | |
| | sh_addralign | Only when ELF_F_LAYOUT asserted |
| | sh_entsize | |

NAME

getrlimit, setrlimit - control maximum system resource consumption

SYNOPSIS

```
#include <sys/time.h>
#include <sys/resource.h>

int getrlimit(int resource, struct rlimit *rlp);
int setrlimit(int resource, const struct rlimit *rlp);
```

DESCRIPTION

Limits on the consumption of a variety of system resources by a process and each process it creates may be obtained with `getrlimit` and set with `setrlimit`.

Each call to either `getrlimit` or `setrlimit` identifies a specific resource to be operated upon as well as a resource limit. A resource limit is a pair of values: one specifying the current (soft) limit, the other a maximum (hard) limit. Soft limits may be changed by a process to any value that is less than or equal to the hard limit. A process may (irreversibly) lower its hard limit to any value that is greater than or equal to the soft limit. Only a process with an effective user ID of superuser can raise a hard limit. Both hard and soft limits can be changed in a single call to `setrlimit` subject to the constraints described above. Limits may have an infinite value of `RLIM_INFINITY`. *rlp* is a pointer to `struct rlimit` that includes the following members:

```
    rlim_t    rlim_cur;    /* current (soft) limit */
    rlim_t    rlim_max;    /* hard limit */
```

`rlim_t` is an arithmetic data type to which objects of type `int`, `size_t`, and `off_t` can be cast without loss of information.

The possible resources, their descriptions, and the actions taken when current limit is exceeded, are summarized in the following table:

| Resources | Description | Action |
|---------------------------|---|---|
| <code>RLIMIT_CORE</code> | The maximum size of a core file in bytes that may be created by a process. A limit of 0 will prevent the creation of a core file. | The writing of a core file will terminate at this size. |
| <code>RLIMIT_CPU</code> | The maximum amount of CPU time in seconds used by a process. | <code>SIGXCPU</code> is sent to the process. If the process is holding or ignoring <code>SIGXCPU</code> , the behavior is scheduling class defined. |
| <code>RLIMIT_DATA</code> | The maximum size of a process's heap in bytes. | <code>brk(2)</code> will fail with <code>errno</code> set to <code>ENOMEM</code> . |
| <code>RLIMIT_FSIZE</code> | The maximum size of a file in bytes that may be created by a process. A | <code>SIGXFSZ</code> is sent to the process. If the process is holding or ignoring |

getpwent (3C)

(C Development Set)

getpwent (3C)

SEE ALSO

getgrent(3C), getlogin(3C), passwd(4).

DIAGNOSTICS

getpwent, getpwnid, getpwnam, and fgetpwent return a null pointer on EOF or error.

NOTES

All information is contained in a static area, so it must be copied if it is to be saved.

NAME

getpwent, getpwuid, getpwnam, setpwent, endpwent, fgetpwent - manipulate password file entry

SYNOPSIS

```
#include <pwd.h>

struct passwd *getpwent (void);
struct passwd *getpwuid (uid_t uid);
struct passwd *getpwnam (const char *name);
void setpwent (void);
void endpwent (void);
struct passwd *fgetpwent (FILE *f);
```

DESCRIPTION

getpwent, getpwuid, and getpwnam each returns a pointer to an object with the following structure containing the broken-out fields of a line in the /etc/passwd file. Each line in the file contains a passwd structure, declared in the pwd.h header file:

```
struct passwd {
    char *pw_name;
    char *pw_passwd;
    uid_t pw_uid;
    gid_t pw_gid;
    char *pw_age;
    char *pw_comment;
    char *pw_gecos;
    char *pw_dir;
    char *pw_shell;
};
```

getpwent when first called returns a pointer to the first passwd structure in the file; thereafter, it returns a pointer to the next passwd structure in the file; so successive calls can be used to search the entire file. getpwuid searches from the beginning of the file until a numerical user id matching *uid* is found and returns a pointer to the particular structure in which it was found. getpwnam searches from the beginning of the file until a login name matching *name* is found, and returns a pointer to the particular structure in which it was found. If an end-of-file or an error is encountered on reading, these functions return a null pointer.

A call to setpwent has the effect of rewinding the password file to allow repeated searches. endpwent may be called to close the password file when processing is complete.

fgetpwent returns a pointer to the next passwd structure in the stream *f*, which matches the format of /etc/passwd.

FILES

/etc/passwd

NAME

getpw - get name from UID

SYNOPSIS

```
#include <stdlib.h>
int getpw (uid_t uid, char *buf);
```

DESCRIPTION

getpw searches the password file for a user id number that equals *uid*, copies the line of the password file in which *uid* was found into the array pointed to by *buf*, and returns 0. getpw returns non-zero if *uid* cannot be found.

This routine is included only for compatibility with prior systems and should not be used; see getpwent(3C) for routines to use instead.

FILES

/etc/passwd

SEE ALSO

getpwent(3C), passwd(4).

DIAGNOSTICS

getpw returns non-zero on error.

getprotoent (3N)

getprotoent (3N)

NAME

getprotoent, getprotobynumber, getprotobyname, setprotoent, endprotoent - get protocol entry

SYNOPSIS

```
#include <netdb.h>

struct protoent *getprotoent(void);
struct protoent *getprotobyname(char *name);
struct protoent *getprotobynumber(int proto);
int setprotoent(int stayopen);
int endprotoent(void);
```

DESCRIPTION

getprotoent, getprotobyname, and getprotobynumber each return a pointer to an object with the following structure containing the broken-out fields of a line in the network protocol data base, /etc/protocols.

The protoent structure include the following members:

```
char    *p_name;           /* official name of protocol */
char    **p_aliases;      /* alias list */
int     p_proto;          /* protocol number */
```

The members of this structure are:

p_name the official name of the protocol
p_aliases a zero terminated list of alternate names for the protocol
p_proto the protocol number

getprotoent reads the next line of the file, opening the file if necessary.

setprotoent opens and rewinds the file. If the *stayopen* flag is non-zero, the net data base will not be closed after each call to getprotoent (either directly, or indirectly through one of the other getproto calls).

endprotoent closes the file.

getprotobyname and getprotobynumber sequentially search from the beginning of the file until a matching protocol name or protocol number is found, or until an EOF is encountered.

FILES

/etc/protocols

SEE ALSO

protocols(4)

DIAGNOSTICS

A NULL pointer is returned on an EOF or error.

All information is contained in a static area so it must be copied if it is to be saved. Only the Internet protocols are currently understood.

getpriority(3)

(BSD Compatibility Package)

getpriority(3)

SEE ALSO

`nice(1)`, `renice(1M)`, `fork(2)`.

NOTES

It is not possible for the process executing `setpriority` to lower any other process down to its current priority, without requiring privileged user privileges.

NAME

getpriority, setpriority - get/set program scheduling priority

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
#include <sys/time.h>
#include <sys/resource.h>

int getpriority(which, who)
int which, who;

int setpriority(which, who, prio)
int which, who, prio;
```

DESCRIPTION

The scheduling priority of the process, process group, or user, as indicated by *which* and *who* is obtained with `getpriority` and set with `setpriority`. The default priority is 0; lower priorities cause more favorable scheduling.

which is one of `PRIO_PROCESS`, `PRIO_PGRP`, or `PRIO_USER`, and *who* is interpreted relative to *which* (a process identifier for `PRIO_PROCESS`, process group identifier for `PRIO_PGRP`, and a user ID for `PRIO_USER`). A zero value of *who* denotes the current process, process group, or user.

`getpriority` returns the highest priority (lowest numerical value) enjoyed by any of the specified processes. `setpriority` sets the priorities of all of the specified processes to the value specified by *prio*. If *prio* is less than -20, a value of -20 is used; if it is greater than 20, a value of 20 is used. Only the privileged user may lower priorities.

RETURN VALUE

Since `getpriority` can legitimately return the value -1, it is necessary to clear the external variable `errno` prior to the call, then check it afterward to determine if a -1 is an error or a legitimate value. The `setpriority` call returns 0 if there is no error, or -1 if there is.

ERRORS

`getpriority` and `setpriority` may return one of the following errors:

`ESRCH` No process was located using the *which* and *who* values specified.
`EINVAL` *which* was not one of `PRIO_PROCESS`, `PRIO_PGRP`, or `PRIO_USER`.

In addition to the errors indicated above, `setpriority` may fail with one of the following errors returned:

`EPERM` A process was located, but one of the following is true:

Neither its effective nor real user ID matched the effective user ID of the caller, and neither the effective nor the real user ID of the process executing the `setpriority` was the privileged user.

The call to `getpriority` would have changed a process' priority to a value lower than its current value, and the effective user ID of the process executing the call was not that of the privileged user.

NAME

getpid, getpgrp, getppid, getpgid - get process, process group, and parent process IDs

SYNOPSIS

```
#include <sys/types.h>
#include <unistd.h>

pid_t getpid(void);
pid_t getpgrp(void);
pid_t getppid(void);
pid_t getpgid(pid_t pid);
```

DESCRIPTION

getpid returns the process ID of the calling process.

getpgrp returns the process group ID of the calling process.

getppid returns the parent process ID of the calling process.

getpgid returns the process group ID of the process whose process ID is equal to *pid*, or the process group ID of the calling process, if *pid* is equal to zero.

getpgid will fail if one or more of the following is true:

| | |
|-------|---|
| EPERM | The process whose process ID is equal to <i>pid</i> is not in the same session as the calling process, and the implementation does not allow access to the process group ID of that process from the calling process. |
| ESRCH | There is no process with a process ID equal to <i>pid</i> . |

SEE ALSO

exec(2), fork(2), getpid(2), getsid(2), intro(2), setpgid(2), setsid(2), setpgrp(2), signal(2)

DIAGNOSTICS

Upon successful completion, getpgid returns a process group ID. Otherwise, a value of (pid_t) -1 is returned and `errno` is set to indicate the error.

getpeername (3N)

getpeername (3N)

NAME

getpeername - get name of connected peer

SYNOPSIS

```
int getpeername(int s, caddr_t name, int *namelen);
```

DESCRIPTION

getpeername returns the name of the peer connected to socket *s*. The *int* pointed to by the *namelen* parameter should be initialized to indicate the amount of space pointed to by *name*. On return it contains the actual size of the name returned (in bytes). The name is truncated if the buffer provided is too small.

RETURN VALUE

0 is returned if the call succeeds, -1 if it fails.

ERRORS

The call succeeds unless:

| | |
|----------|--|
| EBADF | The argument <i>s</i> is not a valid descriptor. |
| ENOTSOCK | The argument <i>s</i> is a file, not a socket. |
| ENOTCONN | The socket is not connected. |
| ENOMEM | There was insufficient user memory for the operation to complete. |
| ENOSR | There were insufficient STREAMS resources available for the operation to complete. |

SEE ALSO

accept(3N), bind(3N), getsockname(3N), socket(3N)

NOTES

The type of address structure passed to `accept` depends on the address family. UNIX domain sockets (address family `AF_UNIX`) require a `socketaddr_un` structure as defined in `sys/un.h`; Internet domain sockets (address family `AF_INET`) require a `sockaddr_in` structure as defined in `netinet/in.h`. Other address families may require other structures. Use the structure appropriate to the address family; cast the structure address to a generic `caddr_t` in the call to `getpeername` and pass the size of the structure in the *namelen* argument.

NAME

getpass - read a password

SYNOPSIS

```
#include <stdlib.h>

char *getpass (const char *prompt);
```

DESCRIPTION

getpass reads up to a newline or EOF from the file `/dev/tty`, after prompting on the standard error output with the null-terminated string *prompt* and disabling echoing. A pointer is returned to a null-terminated string of at most 8 characters. If `/dev/tty` cannot be opened, a null pointer is returned. An interrupt will terminate input and send an interrupt signal to the calling program before returning.

FILES

`/dev/tty`

NOTE

The return value points to static data whose content is overwritten by each call.

NAME

getpagesize - get system page size

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...
```

```
int getpagesize(VOID);
```

DESCRIPTION

getpagesize returns the number of bytes in a page. Page granularity is the granularity of many of the memory management calls.

The page size is a system page size and need not be the same as the underlying hardware page size.

SEE ALSO

pagesize(1), brk(2).

```
if ( iflg == 0 ) {
    infile = stdin ;
} else if ( (infile=fopen(infile,"r")) == NULL ) {
    open_err_exit(cmdname,infile,errno) ;
}
for ( ; optind<argc ; optind+=1 ) {
    if ( (outfile=fopen(ofile=argv[optind],"r+") == NULL ) {
        open_err_exit(cmdname,ofile,errno) ;
    }
    if ( (retval=do_work(aflg,bflg,infile,outfile)) != 0 ) {
        work_err_exit(cmdname,ofile,retval) ;
    }
    if ( fclose(outfile) != 0 ) {
        close_err_exit(cmdname,ofile,errno) ;
    }
}
exit(0) ;
}
```

SEE ALSO

pfmt(3C), setlabel(3C).

RETURN VALUE

The function `getopt()` returns a question mark (?) when it encounters an option letter not included in *optstring*; it also prints an error message on `stderr` if `opterr` is set to non-0 (`opterr` is initialized to 1). The message is printed in the standard error format. `getopt()` support localized output messages. If the appropriate translated system messages are installed on the system, they are selected by the latest call to `setlocale()` (using the `LC_ALL` or `LC_MESSAGES` categories).

The label defined by a call to `setlabel()` will be used if available, otherwise the name of the utility (`argv[0]`) will be used.

EXAMPLE

The following code fragment shows how one might process the options and arguments for a command that takes: mutually exclusive options `a` and `b`, exactly one of which is required; an optional option `i` which takes an option-argument; and at least two arguments.

```
main(int argc, char *argv[] /*, char envp[]*/)
    /* envp is unused in this example */
{
    int          opt, aflag=0, bflag=0, iflag=0, errflag=0, retval ;
    char         *cmdname, *infile, *outfile ;
    FILE         *infile, *outfile ;
    extern int   optind, opterr, errno ;
    extern char  *optarg ;

    setlabel("UX:example");
    cmdname = argv[0] ;
    opterr = 0 ; /* inhibit getopt err msg */
    while ( (opt=getopt(argc,argv,"abi:")) != EOF ) {
        switch ( opt ) {
            case 'a' :
                aflag += 1 ; break ;
            case 'b' :
                bflag += 1 ; break ;
            case 'i' :
                iflag += 1 ; ifile = optarg ; break ;
            default : /* includes '?' case */
                errflag += 1 ; break ;
        }
    }
    if ( errflag>0 || aflag+bflag!=1 || iflag>1 || argc-optind<2 ) {
        usage_err_exit(cmdname) ;
    }
}
```

(continues)

NAME

getopt - get option letter from argument vector

SYNOPSIS

```
#include <stdio.h>

int getopt(int argc, char *const *argv, const char *optstring);

extern char *optarg;
extern int optind, opterr;
```

DESCRIPTION

The function `getopt()` is a command-line parser. It returns the next option letter in *argv* that matches a letter in *optstring*.

The function `getopt()` places in `optind` the *argv* index of the next argument to be processed. The external variable `optind` is initialized to 1 before the first call to the function `getopt()`.

The argument *optstring* is a string of recognized option letters; if a letter is followed by a colon, the option is expected to have an argument that may be separated from it by white space.

The variable `optarg` is set to point to the start of the option argument on return from `getopt()`.

When all options have been processed (*i.e.*, up to the first non-option argument), the function `getopt()` returns EOF. The special option `--` may be used to delimit the end of the options; EOF will be returned and `--` will be skipped.

The following rules comprise the System V standard for command-line syntax:

- RULE 1: Command names must be between two and nine characters.
- RULE 2: Command names must include lower-case letters and digits only.
- RULE 3: Option names must be a single character in length.
- RULE 4: All options must be delimited by the `-` character.
- RULE 5: Options with no arguments may be grouped behind one delimiter.
- RULE 6: The first option-argument following an option may be preceded by white space.
- RULE 7: Option arguments cannot be optional.
- RULE 8: Groups of option arguments following an option must be separated by commas or separated by white space and quoted.
- RULE 9: All options must precede operands on the command line.
- RULE 10: The characters `--` may be used to delimit the end of the options.
- RULE 11: The order of options relative to one another should not matter.
- RULE 12: The order of operands may matter and position-related interpretations should be determined on a command-specific basis.
- RULE 13: The `-` character preceded and followed by white space should be used only to mean standard input.

NAME

getnetpath - get netconfig entry corresponding to NETPATH component

SYNOPSIS

```
#include <netconfig.h>

void *setnetpath(void);
struct netconfig *getnetpath(void *handlep);
int endnetpath(void *handlep);
```

DESCRIPTION

The three routines described on this page are part of the UNIX System V Network Selection component. They provide application access to the system network configuration database, `/etc/netconfig`, as it is “filtered” by the NETPATH environment variable [see `environ(5)`]. Network Selection also includes routines that access the network configuration database directly [see `getnetconfig(3N)`].

A call to `setnetpath` “binds” or “rewinds” NETPATH. `setnetpath` must be called before the first call to `getnetpath` and may be called at any other time. It returns a handle that is used by `getnetpath`. `setnetpath` will fail if the netconfig database is not present. If NETPATH is unset, `setnetpath` returns the number of “visible” networks in the netconfig file. The set of visible networks constitutes a default NETPATH.

When first called, `getnetpath` returns a pointer to the netconfig database entry corresponding to the first valid NETPATH component. The netconfig entry is formatted as a netconfig structure. On each subsequent call, `getnetpath` returns a pointer to the netconfig entry that corresponds to the next valid NETPATH component. `getnetpath` can thus be used to search the netconfig database for all networks included in the NETPATH variable. When NETPATH has been exhausted, `getnetpath` returns NULL.

`getnetpath` silently ignores invalid NETPATH components. A NETPATH component is invalid if there is no corresponding entry in the netconfig database.

If the NETPATH variable is unset, `getnetpath` behaves as if NETPATH were set to the sequence of “default” or “visible” networks in the netconfig database, in the order in which they are listed.

`endnetpath` may be called to “unbind” NETPATH when processing is complete, releasing resources for reuse. Programmer’s should be aware, however, that `endnetpath` frees all memory allocated by `setnetpath`. `endnetpath` returns 0 on success and -1 on failure (for example, if `setnetpath` was not called previously).

SEE ALSO

`getnetconfig(3N)`, `netconfig(4)`, `environ(5)`.

getnetgrent (3N)

getnetgrent (3N)

NAME

getnetgrent, setnetgrent, endnetgrent, innetgr - get network group entry

SYNOPSIS

```
getnetgrent (machinep, userp, domainp)
char **machinep, **userp, **domainp;

setnetgrent (netgroup)
char *netgroup

endnetgrent ()

innetgr (netgroup, machine, user, domain)
char *netgroup, *machine, *user, *domain;
```

DESCRIPTION

getnetgrent() returns the next member of a network group. After the call, *machinep* will contain a pointer to a string containing the name of the machine part of the network group member, and similarly for *userp* and *domainp*. If any of *machinep*, *userp* or *domainp* is returned as a NULL pointer, it signifies a wild card. getnetgrent() will use malloc(3C) to allocate space for the name. This space is released when a endnetgrent() call is made. getnetgrent() returns 1 if it succeeded in obtaining another member of the network group, 0 if it has reached the end of the group.

getnetgrent() establishes the network group from which getnetgrent() will obtain members, and also restarts calls to getnetgrent() from the beginning of the list. If the previous setnetgrent() call was to a different network group, a endnetgrent() call is implied. endnetgrent() frees the space allocated during the getnetgrent() calls. innetgr returns 1 or 0, depending on whether *netgroup* contains the machine, user, domain triple as a member. Any of the three strings *machine*, *user*, or *domain* can be NULL, in which case it signifies a wild card.

FILES

/etc/netgroup

WARNINGS

The Network Information Service (NIS) package must be installed and running when using getnetgrent(), since it only inspects the NIS netgroup map, never the local files.

NOTES

The Network Information Service (NIS) was formerly known as Sun Yellow Pages (YP). The functionality of the two remains the same; only the name has changed.

getnetent (3N)

getnetent (3N)

DIAGNOSTICS

A `NULL` pointer is returned on EOF or error.

NOTES

All information is contained in a static area so it must be copied if it is to be saved. Only Internet network numbers are currently understood.

NAME

getnetent, getnetbyaddr, getnetbyname, setnetent, endnetent - get network entry

SYNOPSIS

```
#include <netdb.h>

struct netent *getnetent(void);

struct netent *getnetbyname(char *name);

struct netent *getnetbyaddr(long net, int type);

int setnetent(int stayopen);

int endnetent(void);
```

DESCRIPTION

getnetent, getnetbyname, and getnetbyaddr each return a pointer to an object with the following structure containing the broken-out fields of a line in the network data base, /etc/networks.

The structure netent include the following members:

```
char    *n_name;           /* official name of net */
char    **n_aliases;      /* alias list */
int     n_addrtype;       /* net type */
unsigned long n_net;      /* network number */
```

The members of this structure are:

| | |
|-------------------|---|
| <i>n_name</i> | The official name of the network. |
| <i>n_aliases</i> | A zero terminated list of alternate names for the network. |
| <i>n_addrtype</i> | The type of the network number returned; currently only AF_INET. |
| <i>n_net</i> | The network number. Network numbers are returned in machine byte order. |

getnetent reads the next line of the file, opening the file if necessary.

setnetent opens and rewinds the file. If the *stayopen* flag is non-zero, the net data base will not be closed after each call to getnetent (either directly, or indirectly through one of the other getnet calls).

endnetent closes the file.

getnetbyname and getnetbyaddr sequentially search from the beginning of the file until a matching net name or net address and type is found, or until EOF is encountered. Network numbers are supplied in host order.

FILES

/etc/networks

SEE ALSO

networks(4)

`nc_spperror` is similar to `nc_perror` but instead of sending the message to the standard error indicating why the network selection routines failed, it returns the string which contains the message:

Warning: It returns pointer to static data that is overwritten on each call.

`nc_perror` and `nc_spperror` can also be used with the NETPATH access routines defined in `getnetpath(3N)`.

SEE ALSO

`netconfig(4)`, `getnetpath(3N)`, and `environ(5)`.

NAME

getnetconfig - get network configuration database entry

SYNOPSIS

```
#include <netconfig.h>

void *setnetconfig(void);

struct netconfig *getnetconfig(void *handlep);

int endnetconfig(void *handlep);

struct netconfig *getnetconfigent(char *netid);

void freenetconfigent(struct netconfig *netconfigp);

void nc_perror (char *msg);

char *nc_spperror (void);
```

DESCRIPTION

The five library routines described on this page are part of the UNIX System V Network Selection component. They provide application access to the system network configuration database, `/etc/netconfig`. In addition to the `netconfig` database and the routines for accessing it, Network Selection includes the environment variable `NETPATH` [see `environ(5)`] and the `NETPATH` access routines described in `getnetpath(3N)`.

A call to `setnetconfig` has the effect of “binding” or “rewinding” the `netconfig` database. `setnetconfig` must be called before the first call to `getnetconfig` and may be called at any other time. `setnetconfig` need *not* be called before a call to `getnetconfigent`. `setnetconfig` returns a unique handle to be used by `getnetconfig`. In the case of an error, `setnetconfig` returns `NULL` and `nc_perror` or `nc_spperror` can be used to print the reason for failure.

When first called, `getnetconfig` returns a pointer to the current entry in the `netconfig` database, formatted as a `netconfig` structure. `getnetconfig` can thus be used to search the entire `netconfig` file. `getnetconfig` returns `NULL` at end of file.

`endnetconfig` should be called when processing is complete to release resources for reuse. Programmers should be aware, however, that the last call to `endnetconfig` frees all memory allocated by `getnetconfig` for the `struct netconfig` data structure. `endnetconfig` may not be called before `setnetconfig`. `endnetconfig` returns 0 on success and -1 on failure (for example, if `setnetconfig` was not called previously).

`getnetconfigent` returns a pointer to the `netconfig` structure corresponding to `netid`. It returns `NULL` if `netid` is invalid (that is, does not name an entry in the `netconfig` database). It returns `NULL` and sets `errno` in case of failure (for example, if `setnetconfig` was not called previously).

`freenetconfigent` frees the `netconfig` structure pointed to by `netconfigp`, previously returned by `getnetconfigent`.

`nc_perror` prints a message to the standard error indicating why any of the above routines failed. The message is prepended with *string msg* and a colon. A NEW-LINE is appended at the end of the message.

getmsg (2)

getmsg (2)

DIAGNOSTICS

Upon successful completion, a non-negative value is returned. A value of 0 indicates that a full message was read successfully. A return value of `MORECTL` indicates that more control information is waiting for retrieval. A return value of `MOREDATA` indicates that more data are waiting for retrieval. A return value of `MORECTL | MOREDATA` indicates that both types of information remain. Subsequent `getmsg` calls retrieve the remainder of the message. However, if a message of higher priority has come in on the stream head read queue, the next call to `getmsg` will retrieve that higher priority message before retrieving the remainder of the previously received partial message.

0, `getmsg` retrieves any message available on the stream head read queue. In this case, on return, the integer pointed to by *flagsp* will be set to `RS_HIPRI` if a high priority message was retrieved, or 0 otherwise.

For `getpmsg`, the flags are different. *flagsp* points to a bitmask with the following mutually-exclusive flags defined: `MSG_HIPRI`, `MSG_BAND`, and `MSG_ANY`. Like `getmsg`, `getpmsg` processes the first available message on the stream head read queue. A user may choose to retrieve only high-priority messages by setting the integer pointed to by *flagsp* to `MSG_HIPRI` and the integer pointed to by *bandp* to 0. In this case, `getpmsg` will only process the next message if it is a high-priority message. In a similar manner, a user may choose to retrieve a message from a particular priority band by setting the integer pointed to by *flagsp* to `MSG_BAND` and the integer pointed to by *bandp* to the priority band of interest. In this case, `getpmsg` will only process the next message if it is in a priority band equal to, or greater than, the integer pointed to by *bandp*, or if it is a high-priority message. If a user just wants to get the first message off the queue, the integer pointed to by *flagsp* should be set to `MSG_ANY` and the integer pointed to by *bandp* should be set to 0. On return, if the message retrieved was a high-priority message, the integer pointed to by *flagsp* will be set to `MSG_HIPRI` and the integer pointed to by *bandp* will be set to 0. Otherwise, the integer pointed to by *flagsp* will be set to `MSG_BAND` and the integer pointed to by *bandp* will be set to the priority band of the message.

If `O_NDELAY` and `O_NONBLOCK` are clear, `getmsg` blocks until a message of the type specified by *flagsp* is available on the stream head read queue. If `O_NDELAY` or `O_NONBLOCK` has been set and a message of the specified type is not present on the read queue, `getmsg` fails and sets `errno` to `EAGAIN`.

If a hangup occurs on the stream from which messages are to be retrieved, `getmsg` continues to operate normally, as described above, until the stream head read queue is empty. Thereafter, it returns 0 in the `len` fields of *ctlptr* and *dataptr*.

`getmsg` or `getpmsg` will fail if one or more of the following are true:

| | |
|----------------------|--|
| <code>EAGAIN</code> | The <code>O_NDELAY</code> or <code>O_NONBLOCK</code> flag is set, and no messages are available. |
| <code>EBADF</code> | <i>fd</i> is not a valid file descriptor open for reading. |
| <code>EBADMSG</code> | Queued message to be read is not valid for <code>getmsg</code> . |
| <code>EFAULT</code> | <i>ctlptr</i> , <i>dataptr</i> , <i>bandp</i> , or <i>flagsp</i> points to a location outside the allocated address space. |
| <code>EINTR</code> | A signal was caught during the <code>getmsg</code> system call. |
| <code>EINVAL</code> | An illegal value was specified in <i>flagsp</i> , or the stream referenced by <i>fd</i> is linked under a multiplexor. |
| <code>ENOSTR</code> | A stream is not associated with <i>fd</i> . |

`getmsg` can also fail if a STREAMS error message had been received at the stream head before the call to `getmsg`. The error returned is the value contained in the STREAMS error message.

SEE ALSO

`intro(2)`, `poll(2)`, `putmsg(2)`, `read(2)`, `write(2)`.

NAME

getmsg - get next message off a stream

SYNOPSIS

```
#include <stropts.h>

int getmsg(int fd, struct strbuf *ctlptr,
           struct strbuf *dataptr, int *flagsp);

int getpmsg(int fd, struct strbuf *ctlptr,
            struct strbuf *dataptr, int *bandp, int *flagsp);
```

DESCRIPTION

getmsg retrieves the contents of a message [see intro(2)] located at the stream head read queue from a STREAMS file, and places the contents into user specified buffer(s). The message must contain either a data part, a control part, or both. The data and control parts of the message are placed into separate buffers, as described below. The semantics of each part is defined by the STREAMS module that generated the message.

The function getpmsg does the same thing as getmsg, but provides finer control over the priority of the messages received. Except where noted, all information pertaining to getmsg also pertains to getpmsg.

fd specifies a file descriptor referencing an open stream. *ctlptr* and *dataptr* each point to a strbuf structure, which contains the following members:

```
int maxlen;    /* maximum buffer length */
int len;       /* length of data */
char *buf;     /* ptr to buffer */
```

buf points to a buffer in which the data or control information is to be placed, and *maxlen* indicates the maximum number of bytes this buffer can hold. On return, *len* contains the number of bytes of data or control information actually received, or 0 if there is a zero-length control or data part, or -1 if no data or control information is present in the message. *flagsp* should point to an integer that indicates the type of message the user is able to receive. This is described later.

ctlptr is used to hold the control part from the message and *dataptr* is used to hold the data part from the message. If *ctlptr* (or *dataptr*) is NULL or the *maxlen* field is -1, the control (or data) part of the message is not processed and is left on the stream head read queue. If *ctlptr* (or *dataptr*) is not NULL and there is no corresponding control (or data) part of the messages on the stream head read queue, *len* is set to -1. If the *maxlen* field is set to 0 and there is a zero-length control (or data) part, that zero-length part is removed from the read queue and *len* is set to 0. If the *maxlen* field is set to 0 and there are more than zero bytes of control (or data) information, that information is left on the read queue and *len* is set to 0. If the *maxlen* field in *ctlptr* or *dataptr* is less than, respectively, the control or data part of the message, *maxlen* bytes are retrieved. In this case, the remainder of the message is left on the stream head read queue and a non-zero return value is provided, as described below under DIAGNOSTICS.

By default, getmsg processes the first available message on the stream head read queue. However, a user may choose to retrieve only high priority messages by setting the integer pointed by *flagsp* to RS_HIPRI. In this case, getmsg processes the next message only if it is a high priority message. If the integer pointed by *flagsp* is

NAME

getmntent, getmntany - get mnttab file entry

SYNOPSIS

```
#include <stdio.h>
#include <sys/mnttab.h>

int getmntent (FILE *fp, struct mnttab *mp);

int getmntany (FILE *fp, struct mnttab *mp, struct mnttab *mpref);
```

DESCRIPTION

getmntent and getmntany each fill in the structure pointed to by *mp* with the broken-out fields of a line in the `/etc/mnttab` file. Each line in the file contains a mnttab structure, declared in the `sys/mnttab.h` header file:

```
struct mnttab {
    char *mnt_special;
    char *mnt_mountp;
    char *mnt_fstype;
    char *mnt_mntopts;
    char *mnt_time;
};
```

The fields have meanings described in `mnttab(4)`.

getmntent returns a pointer to the next mnttab structure in the file; so successive calls can be used to search the entire file. getmntany searches the file referenced by *fp* until a match is found between a line in the file and *mpref*. *mpref* matches the line if all non-null entries in *mpref* match the corresponding fields in the file. Note that these routines do not open, close, or rewind the file.

FILES

`/etc/mnttab`

SEE ALSO

`mnttab(4)`

DIAGNOSTICS

If the next entry is successfully read by getmntent or a match is found with getmntany, 0 is returned. If an end-of-file is encountered on reading, these functions return -1. If an error is encountered, a value greater than 0 is returned. The possible error values are:

| | |
|-------------|---|
| MNT_TOOLONG | A line in the file exceeded the internal buffer size of MNT_LINE_MAX. |
| MNT_TOOMANY | A line in the file contains too many fields. |
| MNT_TOOFEW | A line in the file contains too few fields. |

NOTES

The members of the mnttab structure point to information contained in a static area, so it must be copied if it is to be saved.

NAME

getlogin - get login name

SYNOPSIS

```
#include <stdlib.h>
char *getlogin (void);
```

DESCRIPTION

getlogin returns a pointer to the login name as found in /var/adm/utmp. It may be used in conjunction with getpwnam to locate the correct password file entry when the same user id is shared by several login names.

If getlogin is called within a process that is not attached to a terminal, it returns a null pointer. The correct procedure for determining the login name is to call cuserid, or to call getlogin and if it fails to call getpwuid.

FILES

/var/adm/utmp

SEE ALSO

cuserid(3S), getgrent(3C), getpwent(3C), utmp(4)

DIAGNOSTICS

Returns a null pointer if the login name is not found.

NOTES

The return values point to static data whose content is overwritten by each call.

getitimer (3C)

getitimer (3C)

Under the following conditions, the functions `getitimer` and `setitimer` fail and set `errno` to:

`EINVAL` The specified number of seconds is greater than 100,000,000, the number of microseconds is greater than or equal to 1,000,000, or the *which* parameter is unrecognized.

NOTES

The microseconds field should not be equal to or greater than one second.

`setitimer` is independent of the alarm system call.

Do not use `setitimer` with the `sleep` routine. A `sleep` following a `setitimer` wipes out knowledge of the user signal handler.

NAME

getitimer, setitimer - get/set value of interval timer

SYNOPSIS

```
#include <sys/time.h>

int getitimer(int which, struct itimerval *value);

int setitimer(int which, struct itimerval *value, struct itimerval
              *ovalue);
```

DESCRIPTION

The system provides each process with three interval timers, defined in `sys/time.h`. The `getitimer` call stores the current value of the timer specified by *which* into the structure pointed to by *value*. The `setitimer` call sets the value of the timer specified by *which* to the value specified in the structure pointed to by *value*, and if *ovalue* is not `NULL`, stores the previous value of the timer in the structure pointed to by *ovalue*.

A timer value is defined by the `itimerval` structure [see `gettimeofday(3C)` for the definition of `timeval`], which includes the following members:

```
    struct timeval  it_interval;    /* timer interval */
    struct timeval  it_value;       /* current value */
```

If `it_value` is non-zero, it indicates the time to the next timer expiration. If `it_interval` is non-zero, it specifies a value to be used in reloading `it_value` when the timer expires. Setting `it_value` to zero disables a timer, regardless of the value of `it_interval`. Setting `it_interval` to zero disables a timer after its next expiration (assuming `it_value` is non-zero).

Time values smaller than the resolution of the system clock are rounded up to this resolution.

The three timers are:

| | |
|-----------------------------|--|
| <code>ITIMER_REAL</code> | Decrements in real time. A <code>SIGALRM</code> signal is delivered when this timer expires. |
| <code>ITIMER_VIRTUAL</code> | Decrements in process virtual time. It runs only when the process is executing. A <code>SIGVTALRM</code> signal is delivered when it expires. |
| <code>ITIMER_PROF</code> | Decrements both in process virtual time and when the system is running on behalf of the process. It is designed to be used by interpreters in statistically profiling the execution of interpreted programs. Each time the <code>ITIMER_PROF</code> timer expires, the <code>SIGPROF</code> signal is delivered. Because this signal may interrupt in-progress system calls, programs using this timer must be prepared to restart interrupted system calls. |

SEE ALSO

`alarm(2)`, `gettimeofday(3C)`

DIAGNOSTICS

If the calls succeed, a value of 0 is returned. If an error occurs, the value -1 is returned, and an error code is placed in the global variable `errno`.

NAME

gethostname, sethostname - get/set name of current host

SYNOPSIS

```
/usr/ucb/cc [flag...] file...  
int gethostname(name, namelen)  
char *name;  
int namelen;  
int sethostname(name, namelen)  
char *name;  
int namelen;
```

DESCRIPTION

gethostname returns the standard host name for the current processor, as previously set by sethostname. The parameter *namelen* specifies the size of the array pointed to by *name*. The returned name is null-terminated unless insufficient space is provided.

sethostname sets the name of the host machine to be *name*, which has length *namelen*. This call is restricted to the privileged user and is normally used only when the system is bootstrapped.

RETURN VALUE

If the call succeeds a value of 0 is returned. If the call fails, then a value of -1 is returned and an error code is placed in the global location `errno`.

ERRORS

The following error may be returned by these calls:

| | |
|--------|---|
| EFAULT | The <i>name</i> or <i>namelen</i> parameter gave an invalid address. |
| EPERM | The caller was not the privileged user. Note: this error only applies to sethostname. |

SEE ALSO

uname(2), gethostid(3).

NOTES

Host names are limited to MAXHOSTNAMELEN characters, currently 256. (See the `param.h` header file.)

NAME

gethostid - get unique identifier of current host

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...
```

```
gethostid()
```

DESCRIPTION

gethostid returns the 32-bit identifier for the current host, which should be unique across all hosts. This number is usually taken from the CPU board's ID PROM.

This routine resides in libucb.

SEE ALSO

hostid(1), sysinfo(2).

gethostent (3N)

gethostent (3N)

| | |
|-------------|--|
| TRY_AGAIN | This is usually a temporary error and means that the local server did not receive a response from an authoritative server. A retry at some later time may succeed. |
| NO_RECOVERY | Some unexpected server failure was encountered (This is a non-recoverable error). |
| NO_DATA | The requested name is valid, but does not have an IP address. This is not a temporary error: instead, this means that the name is known to the name server, but there is no address associated with this name. Another type of request to the name server using this domain name should result in an answer (for example, a "mail-forwarder" may be registered for this domain). |

USER CONSIDERATIONS

Since all information will be stored in a static area it must be copied if it is to be saved.

Only the Internet address format is currently supported.

FILES

/etc/hosts

SEE ALSO

resolver(3), hosts(4), named(1M).

gethostent (3N)

gethostent (3N)

| | |
|--------------------------|---|
| <code>h_aliases</code> | A zero-terminated array of alternate names for the host. |
| <code>h_addrtype</code> | The type of address being returned; currently always <code>AF_INET</code> . |
| <code>h_length</code> | The length, in bytes, of the address. |
| <code>h_addr_list</code> | A zero-terminated array of network addresses for the named host; the host addresses are returned in network byte order. |
| <code>h_addr</code> | The first address in <code>h_addr_list</code> ; this is for backward compatibility. |

When using the nameserver, `gethostbyname()` will search for the named host in the current domain and its parents unless the name ends in a dot ("."). If the name contains no dot - and if the environment variable `HOSTALIASES` contains the name of an alias file - this alias file will be searched first for an alias matching the input name.

The `gethostent()` system call will read the next line of the file, after opening the file if necessary.

The `sethostent()` system call will open and rewind the file; `sethostent()` may be used to request the use of a connected TCP socket for queries. If the `stayopen` flag is non-zero, the host data base will not be closed after each call to `gethostent()` - either directly, or indirectly through one of the other `gethost*` calls. In other words, if the `stayopen` flag is non-zero, this option will send all queries to the named server using TCP and maintain the connection after each call of `gethostbyname()` or `gethostbyaddr()`; otherwise the queries will utilize UDP datagrams.

The `endhostent()` system call will close the file and the TCP connection.

The `gethostbyname()` and `gethostbyaddr()` system calls will search sequentially from the beginning of the file until a matching host name or host address is found, or until an EOF is encountered. The host addresses will be supplied in network order.

The `gethostbyaddr()` system call will accept a pointer to an address structure. This structure will be unique to each type of address. For an address of type `AF_INET`, this is an `in_addr` structure [see `netinet/in.h`].

DIAGNOSTICS

A NULL pointer will be returned at EOF or when an error has occurred.

An error return status from `gethostbyname` and `gethostbyaddr` will be indicated by a NULL pointer. The external integer `h_errno` may then be checked to see whether this is a temporary failure, or an invalid or unknown host. The routine `herror` can be used to print an error message describing the failure. If its argument `string` is non-NULL, it will be printed, followed by a colon and a space. The error message will be printed with a trailing newline symbol.

`h_errno` can have the following values:

`HOST_NOT_FOUND`

No such host is known.

NAME

gethostent, gethostbyaddr, gethostbyname, sethostent, endhostent, herror
- get network host entry

SYNOPSIS

```
cc [flags] files -lsocket -lnsl

#include <sys/types.h>
#include <sys/socket.h>
#include <netdb.h>

extern int h_errno;

struct hostent *gethostbyname (name)
char *name;

struct hostent *gethostbyaddr (addr, len, type)
char *addr;
int len, type;

struct hostent *gethostent ()

sethostent (stayopen)
int stayopen;

endhostent ()

herror (string)
char *string;
```

DESCRIPTION

The `gethostent()`, `gethostbyaddr()`, and `gethostbyname()` system calls each return a pointer to an object with the following structure which describes an internet host referenced by name or by address, respectively. This structure contains either the information obtained from the name server, `named`, or broken-out fields from a line in the network host data base, `/etc/hosts`. If the local name server is not running, these routines do a lookup in `/etc/hosts`. In the case of `gethostbyaddr()`, `addr` is a pointer to the binary format address of length `len` (not a character string).

The `hostent` structure is as follows:

```
struct    hostent {
char      *h_name           /* official name of host */
char      **h_aliases      /* alias list */
int       h_addrtype       /* host address type */
int       h_length         /* length of address */
char      **h_addr_list    /* list of addresses from name server */ }
#define   h_addr h_addr_list [0] /* address, for backward compatibility */
```

The members of this structure are:

`h_name` The official name of the host.

getgroups(2)

getgroups(2)

NAME

getgroups, setgroups - get or set supplementary group access list IDs

SYNOPSIS

```
#include <unistd.h>

int getgroups(int gidsetsize, gid_t *grouplist)
int setgroups(int ngroups, const gid_t *grouplist)
```

DESCRIPTION

getgroups gets the current supplemental group access list of the calling process and stores the result in the array of group IDs specified by *grouplist*. This array has *gidsetsize* entries and must be large enough to contain the entire list. This list cannot be greater than {NGROUPS_MAX}. If *gidsetsize* equals 0, getgroups will return the number of groups to which the calling process belongs without modifying the array pointed to by *grouplist*.

setgroups sets the supplementary group access list of the calling process from the array of group IDs specified by *grouplist*. The number of entries is specified by *ngroups* and can not be greater than {NGROUPS_MAX}. This function may be invoked only by the super-user.

getgroups will fail if:

EINVAL The value of *gidsetsize* is non-zero and less than the number of supplementary group IDs set for the calling process.

setgroups will fail if:

EINVAL The value of *ngroups* is greater than {NGROUPS_MAX}.

EPERM The effective user ID is not super-user.

Either call will fail if:

EFAULT A referenced part of the array pointed to by *grouplist* is outside of the allocated address space of the process.

SEE ALSO

groups(1), chown(2), getuid(2), setuid(2), initgroups(3C).

DIAGNOSTICS

Upon successful completion, getgroups returns the number of supplementary group IDs set for the calling process and setgroups returns the value 0. Otherwise, a value of -1 is returned and errno is set to indicate the error.

getgrent (3C)

(C Programming Language Utilities)

getgrent (3C)

getlogin(3C), getpwent(3C), group(4).

DIAGNOSTICS

getgrent, getgrgid, getgrnam, and fgetgrent return a null pointer on EOF or error.

NOTES

All information is contained in a static area, so it must be copied if it is to be saved.

NAME

getgrent, getgrgid, getgrnam, setgrent, endgrent, fgetgrent - get group file entry

SYNOPSIS

```
#include <grp.h>

struct group *getgrent (void);
struct group *getgrgid (gid_t gid);
struct group *getgrnam (const char *name);
void setgrent (void);
void endgrent (void);
struct group *fgetgrent (FILE *f);
```

DESCRIPTION

getgrent, getgrgid, and getgrnam each return pointers to an object containing the broken-out fields of a line in the `/etc/group` file. Each line contains a “group” structure, defined in the `grp.h` header file with the following members:

```
char *gr_name; /* the name of the group */
char *gr_passwd; /* the encrypted group password */
gid_t gr_gid; /* the numerical group ID */
char **gr_mem; /* vector of pointers to member names */
```

When first called, `getgrent` returns a pointer to the first group structure in the file; thereafter, it returns a pointer to the next group structure in the file; so, successive calls may be used to search the entire file. `getgrgid` searches from the beginning of the file until a numerical group id matching `gid` is found and returns a pointer to the particular structure in which it was found.

`getgrnam` searches from the beginning of the file until a group name matching `name` is found and returns a pointer to the particular structure in which it was found. If an end-of-file or an error is encountered on reading, these functions return a null pointer.

A call to `setgrent` has the effect of rewinding the group file to allow repeated searches. `endgrent` may be called to close the group file when processing is complete.

`fgetgrent` returns a pointer to the next group structure in the stream `f`, which matches the format of `/etc/group`.

FILES

`/etc/group`

SEE ALSO

NAME

getenv - return value for environment name

SYNOPSIS

```
#include <stdlib.h>

char *getenv (const char *name);
```

DESCRIPTION

getenv searches the environment list [see environ(5)] for a string of the form *name=value* and, if the string is present, returns a pointer to the *value* in the current environment. Otherwise, it returns a null pointer.

SEE ALSO

exec(2), putenv(3C), environ(5)

NAME

getdtablesize - get descriptor table size

SYNOPSIS

```
/usr/ucb/cc [flag...] file...
```

```
long getdtablesize()
```

DESCRIPTION

Each process has a descriptor table which is guaranteed to have at least 20 slots. The entries in the descriptor table are numbered with small integers starting at 0. The call `getdtablesize` returns the current maximum size of this table by calling the `getrlimit` system call.

SEE ALSO

`close(2)`, `dup(2)`, `getrlimit(2)`, `open(2)`.

getdents(2)

getdents(2)

NAME

getdents - read directory entries and put in a file system independent format

SYNOPSIS

```
#include <sys/dirent.h>
int getdents (int fildes, struct dirent *buf, size_t nbyte);
```

DESCRIPTION

fildes is a file descriptor obtained from a `creat`, `open`, `dup`, `fcntl`, `pipe`, or `ioctl` system call.

`getdents` attempts to read *nbyte* bytes from the directory associated with *fildes* and to format them as file system independent directory entries in the buffer pointed to by *buf*. Since the file system independent directory entries are of variable length, in most cases the actual number of bytes returned will be strictly less than *nbyte*. See `dirent(4)` to calculate the number of bytes.

The file system independent directory entry is specified by the `dirent` structure. For a description of this see `dirent(4)`.

On devices capable of seeking, `getdents` starts at a position in the file given by the file pointer associated with *fildes*. Upon return from `getdents`, the file pointer is incremented to point to the next directory entry.

This system call was developed in order to implement the `readdir` routine [for a description, see `directory(3C)`], and should not be used for other purposes.

`getdents` will fail if one or more of the following are true:

| | |
|---------|--|
| EBADF | <i>fildes</i> is not a valid file descriptor open for reading. |
| EFAULT | <i>buf</i> points outside the allocated address space. |
| EINVAL | <i>nbyte</i> is not large enough for one directory entry. |
| ENOENT | The current file pointer for the directory is not located at a valid entry. |
| ENOLINK | <i>fildes</i> points to a remote machine and the link to that machine is no longer active. |
| ENOTDIR | <i>fildes</i> is not a directory. |
| EIO | An I/O error occurred while accessing the file system. |

SEE ALSO

`directory(3C)`, `dirent(4)`.

DIAGNOSTICS

Upon successful completion a non-negative integer is returned indicating the number of bytes actually read. A value of 0 indicates the end of the directory has been reached. If the system call failed, a -1 is returned and `errno` is set to indicate the error.

NOTES

Subsequent calls to `getdate(3C)` alter the contents of `getdate_err`.

Dates before 1970 and after 2037 are illegal.

`getdate` makes explicit use of macros described in `ctype(3C)`.

If no date is given, today is assumed if the given hour is greater than the current hour and tomorrow is assumed if it is less.

The following examples illustrate the above rules. Assume that the current date is Mon Sep 22 12:19:47 EDT 1986 and the LANG environment variable is not set.

| Input | Line in Template | Date |
|--------------|------------------|------------------------------|
| Mon | %a | Mon Sep 22 12:19:48 EDT 1986 |
| Sun | %a | Sun Sep 28 12:19:49 EDT 1986 |
| Fri | %a | Fri Sep 26 12:19:49 EDT 1986 |
| September | %B | Mon Sep 1 12:19:49 EDT 1986 |
| January | %B | Thu Jan 1 12:19:49 EST 1987 |
| December | %B | Mon Dec 1 12:19:49 EST 1986 |
| Sep Mon | %b %a | Mon Sep 1 12:19:50 EDT 1986 |
| Jan Fri | %b %a | Fri Jan 2 12:19:50 EST 1987 |
| Dec Mon | %b %a | Mon Dec 1 12:19:50 EST 1986 |
| Jan Wed 1989 | %b %a %Y | Wed Jan 4 12:19:51 EST 1989 |
| Fri 9 | %a %H | Fri Sep 26 09:00:00 EDT 1986 |
| Feb 10:30 | %b %H:%S | Sun Feb 1 10:00:30 EST 1987 |
| 10:30 | %H:%M | Tue Sep 23 10:30:00 EDT 1986 |
| 13:30 | %H:%M | Mon Sep 22 13:30:00 EDT 1986 |

FILES

/usr/lib/locale/<locale>/LC_TIME language specific printable files
 /usr/lib/locale/<locale>/LC_CTYPE code set specific printable files

SEE ALSO

setlocale(3C), ctype(3C), environ(5)

DIAGNOSTICS

On failure getdate returns NULL and sets the variable getdate_err to indicate the error.

The following is a complete list of the getdate_err settings and their meanings.

- 1 The DATEMSK environment variable is null or undefined.
- 2 The template file cannot be opened for reading.
- 3 Failed to get file status information.
- 4 The template file is not a regular file.
- 5 An error is encountered while reading the template file.
- 6 malloc failed (not enough memory is available).
- 7 There is no line in the template that matches the input.
- 8 The input specification is invalid (for example, February 31).

%Y year as ccy (for example, 1986)
 %Z time zone name or no characters if no time zone exists

The month and weekday names can consist of any combination of upper and lower case letters. The user can request that the input date or time specification be in a specific language by setting the categories `LC_TIME` and `LC_CTYPE` of `setlocale(3C)`.

The following example shows the possible contents of a template:

```
%m
%A %B %d %Y, %H:%M:%S
%A
%B
%m/%d/%y %I %p
%d,%m,%Y %H:%M
at %A the %dst of %B in %Y
run job at %I %p,%B %dnd
%A den %d. %B %Y %H.%M Uhr
```

The following are examples of valid input specifications for the above template:

```
getdate("10/1/87 4 PM")
getdate("Friday")
getdate("Friday September 19 1987, 10:30:30")
getdate("24,9,1986 10:30")
getdate("at monday the 1st of december in 1986")
getdate("run job at 3 PM, december %2nd")
```

If the `LANG` environment variable is set to `german`, the following is valid:

```
getdate("freitag den 10. oktober 1986 10.30 Uhr")
```

Local time and date specification are also supported. The following examples show how local date and time specification can be defined in the template.

| Invocation | Line in Template |
|---|--------------------------|
| <code>getdate("11/27/86")</code> | <code>%m/%d/%y</code> |
| <code>getdate("27.11.86")</code> | <code>%d.%m.%y</code> |
| <code>getdate("86-11-27")</code> | <code>%y-%m-%d</code> |
| <code>getdate("Friday 12:00:00")</code> | <code>%A %H:%M:%S</code> |

The following rules are applied for converting the input specification into the internal format:

If only the weekday is given, today is assumed if the given day is equal to the current day and next week if it is less.

If only the month is given, the current month is assumed if the given month is equal to the current month and next year if it is less and no year is given. (The first day of month is assumed if no day is given.)

If no hour, minute, and second are given, the current hour, minute, and second are assumed.

NAME

getdate - convert user format date and time

SYNOPSIS

```
#include <time.h>

struct tm *getdate (const char *string);

extern int getdate_err;
```

DESCRIPTION

getdate converts user-definable date and/or time specifications pointed to by *string* into a `tm` structure. The structure declaration is in the `time.h` header file [see also `ctime(3C)`].

User-supplied templates are used to parse and interpret the input string. The templates are text files created by the user and identified via the environment variable `DATMSK`. Each line in the template represents an acceptable date and/or time specification using some of the same field descriptors as the ones used by the `date` command. The first line in the template that matches the input specification is used for interpretation and conversion into the internal time format. If successful, the function `getdate` returns a pointer to a `tm` structure; otherwise, it returns `NULL` and sets the global variable `getdate_err` to indicate the error.

The following field descriptors are supported:

| | |
|-----------------|---|
| <code>%%</code> | same as <code>%</code> |
| <code>%a</code> | abbreviated weekday name |
| <code>%A</code> | full weekday name |
| <code>%b</code> | abbreviated month name |
| <code>%B</code> | full month name |
| <code>%c</code> | locale's appropriate date and time representation |
| <code>%d</code> | day of month (01 - 31; the leading 0 is optional) |
| <code>%e</code> | same as <code>%d</code> |
| <code>%D</code> | date as <code>%m/%d/%y</code> |
| <code>%h</code> | abbreviated month name |
| <code>%H</code> | hour (00 - 23) |
| <code>%I</code> | hour (01 - 12) |
| <code>%m</code> | month number (01 - 12) |
| <code>%M</code> | minute (00 - 59) |
| <code>%n</code> | same as <code>\n</code> |
| <code>%p</code> | locale's equivalent of either AM or PM |
| <code>%r</code> | time as <code>%I:%M:%S %p</code> |
| <code>%R</code> | time as <code>%H:%M</code> |
| <code>%S</code> | seconds (00 - 59) |
| <code>%t</code> | insert a tab |
| <code>%T</code> | time as <code>%H:%M:%S</code> |
| <code>%w</code> | weekday number (Sunday = 0 - 6) |
| <code>%x</code> | locale's appropriate date representation |
| <code>%X</code> | locale's appropriate time representation |
| <code>%y</code> | year with century (00 - 99) |

NAME

getcwd - get pathname of current working directory

SYNOPSIS

```
#include <unistd.h>
char *getcwd (char *buf, int size);
```

DESCRIPTION

getcwd returns a pointer to the current directory pathname. The value of *size* must be at least one greater than the length of the pathname to be returned.

If *buf* is not NULL, the pathname will be stored in the space pointed to by *buf*.

If *buf* is a NULL pointer, getcwd will obtain *size* bytes of space using malloc(3C). In this case, the pointer returned by getcwd may be used as the argument in a subsequent call to free.

getcwd will fail if one or more of the following are true:

- | | |
|--------|--|
| EACCES | A parent directory cannot be read to get its name. |
| EINVAL | <i>size</i> is equal to 0. |
| ERANGE | <i>size</i> is less than 0 or is greater than 0 and less than the length of the pathname plus 1. |

EXAMPLE

Here is a program that prints the current working directory.

```
#include <unistd.h>
#include <stdio.h>

main()
{
    char *cwd;
    if ((cwd = getcwd(NULL, 64)) == NULL)
    {
        perror("pwd");
        exit(2);
    }
    (void)printf("%s\n", cwd);
    return(0);
}
```

SEE ALSO

malloc(3C)

DIAGNOSTICS

Returns NULL with *errno* set if *size* is not large enough, or if an error occurs in a lower-level function.

getcontext(2)

getcontext(2)

NAME

getcontext, setcontext - get and set current user context

SYNOPSIS

```
#include <ucontext.h>

int getcontext(ucontext_t *ucp);

int setcontext(ucontext_t *ucp);
```

DESCRIPTION

These functions, along with those defined in `makecontext(3C)`, are useful for implementing user level context switching between multiple threads of control within a process.

`getcontext` initializes the structure pointed to by `ucp` to the current user context of the calling process. The user context is defined by `ucontext(5)` and includes the contents of the calling process's machine registers, signal mask and execution stack.

`setcontext` restores the user context pointed to by `ucp`. The call to `setcontext` does not return; program execution resumes at the point specified by the context structure passed to `setcontext`. The context structure should have been one created either by a prior call to `getcontext` or `makecontext` or passed as the third argument to a signal handler [see `sigaction(2)`]. If the context structure was one created with `getcontext`, program execution continues as if the corresponding call of `getcontext` had just returned. If the context structure was one created with `makecontext`, program execution continues with the function specified to `makecontext`.

NOTES

When a signal handler is executed, the current user context is saved and a new context is created by the kernel. If the process leaves the signal handler via `longjmp(3C)` the original context will not be restored, and future calls to `getcontext` will not be reliable. Signal handlers should use `siglongjmp(3C)` or `setcontext` instead.

DIAGNOSTICS

On successful completion, `setcontext` does not return and `getcontext` returns 0. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

SEE ALSO

`sigaction(2)`, `sigaltstack(2)`, `sigprocmask(2)`, `makecontext(3C)`, `ucontext(5)`

NAME

getc, getchar, fgetc, getw - get character or word from a stream

SYNOPSIS

```
#include <stdio.h>

int getc (FILE *stream);
int getchar (void);
int fgetc (FILE *stream);
int getw (FILE *stream);
```

DESCRIPTION

getc returns the next character (that is, byte) from the named input *stream* [see intro(3)] as an unsigned char converted to an int. It also moves the file pointer, if defined, ahead one character in *stream*. getchar is defined as getc(stdin). getc and getchar are macros.

fgetc behaves like getc, but is a function rather than a macro. fgetc runs more slowly than getc, but it takes less space per invocation and its name can be passed as an argument to a function.

getw returns the next word (that is, integer) from the named input *stream*. getw increments the associated file pointer, if defined, to point to the next word. The size of a word is the size of an integer and varies from machine to machine. getw assumes no special alignment in the file.

SEE ALSO

fclose(3S), ferror(3S), fopen(3S), fread(3S), gets(3S), putc(3S), scanf(3S), stdio(3S), ungetc(3S)

DIAGNOSTICS

These functions return the constant EOF at end-of-file or upon an error and set the EOF or error indicator of *stream*, respectively. Because EOF is a valid integer, ferror should be used to detect getw errors.

NOTES

If the integer value returned by getc, getchar, or fgetc is stored into a character variable and then compared against the integer constant EOF, the comparison may never succeed, because sign-extension of a character on widening to integer is implementation dependent.

The macro version of getc evaluates a *stream* argument more than once and may treat side effects incorrectly. In particular, getc(*f++) does not work sensibly. Use fgetc instead.

Because of possible differences in word length and byte ordering, files written using putw are implementation dependent, and may not be read using getw on a different processor.

Functions exist for all the above-defined macros. To get the function form, the macro name must be undefined (for example, #undef getc).

NAME

gamma, lgamma - log gamma function

SYNOPSIS

```
cc [flag ...]file ... -lm [library ...]
#include <math.h>
double gamma (double x);
double lgamma (double x);
extern int signgam;
```

DESCRIPTION

gamma and lgamma return

$$\ln(|\Gamma(x)|)$$

where $\Gamma(x)$ is defined as

$$\int_0^{\infty} e^{-t} t^{x-1} dt$$

The sign of $\Gamma(x)$ is returned in the external integer signgam. The argument x may not be a non-positive integer.

The following C program fragment might be used to calculate Γ :

```
if ((y = gamma(x)) > LN_MAXDOUBLE)
    error();
y = signgam * exp(y);
```

where LN_MAXDOUBLE is the least value that causes exp to return a range error, and is defined in the values.h header file.

SEE ALSO

exp(3M), matherr(3M), values(5)

DIAGNOSTICS

For non-positive integer arguments HUGE is returned and errno is set to EDOM. A message indicating SING error is printed on the standard error output.

If the correct value would overflow, gamma and lgamma return HUGE and set errno to ERANGE.

Except when the -Xc compilation option is used, these error-handling procedures may be changed with the function matherr. When the -Xa or -Xc compilation options are used, HUGE_VAL is returned instead of HUGE and no error messages are printed.

`base` is the offset into the pathname of the base name of the object. `level` indicates the depth relative to the rest of the walk, where the root level is zero.

The values of the third argument are as follows:

| | |
|---------|--|
| FTW_F | The object is a file. |
| FTW_D | The object is a directory. |
| FTW_DP | The object is a directory and subdirectories have been visited. |
| FTW_SLN | The object is a symbolic link that points to a non-existent file. |
| FTW_DNR | The object is a directory that cannot be read. <i>fn</i> will not be called for any of its descendants. |
| FTW_NS | <i>stat</i> failed on the object because of lack of appropriate permission. The <i>stat</i> buffer passed to <i>fn</i> is undefined. <i>stat</i> failure other than lack of appropriate permission (EACCES) is considered an error and <i>nftw</i> will return -1. |

Both *ftw* and *nftw* use one file descriptor for each level in the tree. The *depth* argument limits the number of file descriptors so used. If *depth* is zero or negative, the effect is the same as if it were 1. *depth* must not be greater than the number of file descriptors currently available for use. *ftw* will run faster if *depth* is at least as large as the number of levels in the tree. When *ftw* and *nftw* return, they close any file descriptors they have opened; they do not close any file descriptors that may have been opened by *fn*.

SEE ALSO

stat(2), *malloc*(3C)

NOTES

Because *ftw* is recursive, it is possible for it to terminate with a memory fault when applied to very deep file structures.

ftw uses *malloc*(3C) to allocate dynamic storage during its operation. If *ftw* is forcibly terminated, such as by *longjmp* being executed by *fn* or an interrupt routine, *ftw* will not have a chance to free that storage, so it will remain permanently allocated. A safe way to handle interrupts is to store the fact that an interrupt has occurred, and arrange to have *fn* return a nonzero value at its next invocation.

NAME

ftw, nftw - walk a file tree

SYNOPSIS

```
#include <ftw.h>

int ftw (const char *path, int (*fn) (const char *, const struct
      stat *, int), int depth);

int nftw (const char *path, int (*fn) (const char *, const struct
      stat *, int, struct FTW*), int depth, int flags);
```

DESCRIPTION

ftw recursively descends the directory hierarchy rooted in *path*. For each object in the hierarchy, ftw calls the user-defined function *fn*, passing it a pointer to a null-terminated character string containing the name of the object, a pointer to a *stat* structure (see *stat(2)*) containing information about the object, and an integer. Possible values of the integer, defined in the *ftw.h* header file, are:

| | |
|---------|--|
| FTW_F | The object is a file. |
| FTW_D | The object is a directory. |
| FTW_DNR | The object is a directory that cannot be read. Descendants of the directory will not be processed. |
| FTW_NS | <i>stat</i> failed on the object because of lack of appropriate permission or the object is a symbolic link that points to a non-existent file. The <i>stat</i> buffer passed to <i>fn</i> is undefined. |

ftw visits a directory before visiting any of its descendants.

The tree traversal continues until the tree is exhausted, an invocation of *fn* returns a nonzero value, or some error is detected within ftw (such as an I/O error). If the tree is exhausted, ftw returns zero. If *fn* returns a nonzero value, ftw stops its tree traversal and returns whatever value was returned by *fn*. If ftw detects an error other than EACCES, it returns -1, and sets the error type in *errno*.

The function nftw is similar to ftw except that it takes an additional argument, *flags*. The *flags* field is used to specify:

| | |
|-----------|---|
| FTW_PHYS | Physical walk, does not follow symbolic links. Otherwise, nftw will follow links but will not walk down any path that crosses itself. |
| FTW_MOUNT | The walk will not cross a mount point. |
| FTW_DEPTH | All subdirectories will be visited before the directory itself. |
| FTW_CHDIR | The walk will change to each directory before reading it. |

The function nftw calls *fn* with four arguments at each file and directory. The first argument is the pathname of the object, the second is a pointer to the *stat* buffer, the third is an integer giving additional information, and the fourth is a *struct FTW* that contains the following members:

```
int base;
int level;
```

NAME

ftime - get date and time

SYNOPSIS

```
/usr/ucb/cc [flag...] file...  
#include <sys/types.h>  
#include <sys/timeb.h>  
  
ftime(tp)  
struct timeb *tp;
```

DESCRIPTION

The ftime entry fills in a structure pointed to by its argument, as defined by <sys/timeb.h>:

```
struct timeb  
{  
    time_t time;  
    unsigned short millitm;  
    short timezone;  
    short dstflag;  
};
```

The structure contains the time since the epoch in seconds, up to 1000 milliseconds of more-precise interval, the local time zone (measured in minutes of time westward from Greenwich), and a flag that, if nonzero, indicates that Daylight Saving time applies locally during the appropriate part of the year.

SEE ALSO

date(1), gettimeofday(2), ctime(3).

NAME

ftime - get time and date

SYNOPSIS

```
cc [flag ...] file ... -lX [library ...]
#include <sys/times.h>
ftime(struct timeb *tp);
```

DESCRIPTION

ftime returns the time in a structure (see DIAGNOSTICS below). ftime will fail if *tp* points to an illegal address [EFAULT].

DIAGNOSTICS

The ftime entry fills in a structure pointed to by its argument, as defined by sys/timeb.h:

```
/* Structure returned by ftime system call */
struct timeb {
    long time;
    unsigned short millitm;
    short timezone;
    short dstflag;
};
```

Note that the timezone value is a system default timezone and not the value of the TZ environment variable.

The structure contains the time since the 00:00:00 GMT, January 1, 1970 up to 1000 milliseconds of more-precise interval, the local time zone (measured in minutes of time westward from Greenwich), and a flag that, if nonzero, indicates that Daylight Saving time applies locally during the appropriate part of the year.

SEE ALSO

cc(1), stime(2), ctime(3C)

NOTES

Since ftime does not return the correct timezone value, its use is not recommended. See ctime(3C) for accurate use of the TZ variable.

fsync(2)

fsync(2)

NAME

`fsync` - synchronize a file's in-memory state with that on the physical medium

SYNOPSIS

```
#include <unistd.h>

int fsync(int fildes);
```

DESCRIPTION

`fsync` moves all modified data and attributes of *fildes* to a storage device. When `fsync` returns, all in-memory modified copies of buffers associated with *fildes* have been written to the physical medium. `fsync` is different from `sync`, which schedules disk I/O for all files but returns before the I/O completes.

`fsync` should be used by programs that require that a file be in a known state. For example, a program that contains a simple transaction facility might use `fsync` to ensure that all changes to a file or files caused by a given transaction were recorded on a storage medium.

`fsync` fails if one or more of the following are true:

| | |
|---------|--|
| EBADF | <i>fildes</i> is not a valid file descriptor open for writing. |
| ENOLINK | <i>fildes</i> is on a remote machine and the link on that machine is no longer active. |
| EINTR | A signal was caught during execution of the <code>fsync</code> system call. |
| EIO | An I/O error occurred while reading from or writing to the file system. |

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NOTES

The way the data reach the physical medium depends on both implementation and hardware. `fsync` returns when the device driver tells it that the write has taken place.

SEE ALSO

`sync(2)`

NAME

fsetpos, fgetpos - reposition a file pointer in a stream

SYNOPSIS

```
#include <stdio.h>
int fsetpos (FILE *stream, const fpos_t *pos);
int fgetpos (FILE *stream, fpos_t *pos);
```

DESCRIPTION

fsetpos sets the position of the next input or output operation on the *stream* according to the value of the object pointed to by *pos*. The object pointed to by *pos* must be a value returned by an earlier call to fgetpos on the same stream.

fsetpos clears the end-of-file indicator for the stream and undoes any effects of the ungetc function on the same stream. After fsetpos, the next operation on a file opened for update may be either input or output.

fgetpos stores the current value of the file position indicator for *stream* in the object pointed to by *pos*. The value stored contains information usable by fsetpos for repositioning the stream to its position at the time of the call to fgetpos.

If successful, both fsetpos and fgetpos return zero. Otherwise, they both return nonzero.

SEE ALSO

fseek(3S), lseek(2) ungetc(3S)

NAME

fseek, rewind, ftell - reposition a file pointer in a stream

SYNOPSIS

```
#include <stdio.h>

int fseek (FILE *stream, long offset, int ptrname);
void rewind (FILE *stream);
long ftell (FILE *stream);
```

DESCRIPTION

fseek sets the position of the next input or output operation on the *stream* [see intro(3)]. The new position is at the signed distance *offset* bytes from the beginning, from the current position, or from the end of the file, according to a *ptrname* value of SEEK_SET, SEEK_CUR, or SEEK_END (defined in `stdio.h`) as follows:

SEEK_SET set position equal to *offset* bytes.
SEEK_CUR set position to current location plus *offset*.
SEEK_END set position to EOF plus *offset*.

fseek allows the file position indicator to be set beyond the end of the existing data in the file. If data is later written at this point, subsequent reads of data in the gap will return zero until data is actually written into the gap. fseek, by itself, does not extend the size of the file.

rewind (*stream*) is equivalent to:

```
(void) fseek (stream, 0L, SEEK_SET);
```

except that rewind also clears the error indicator on *stream*.

fseek and rewind clear the EOF indicator and undo any effects of ungetc on *stream*. After fseek or rewind, the next operation on a file opened for update may be either input or output.

If *stream* is writable and buffered data has not been written to the underlying file, fseek and rewind cause the unwritten data to be written to the file.

ftell returns the offset of the current byte relative to the beginning of the file associated with the named *stream*.

SEE ALSO

lseek(2), write(2), fopen(3S), popen(3S), stdio(3S), ungetc(3S)

DIAGNOSTICS

fseek returns -1 for improper seeks, otherwise zero. An improper seek can be, for example, an fseek done on a file that has not been opened via fopen; in particular, fseek may not be used on a terminal or on a file opened via popen. After a stream is closed, no further operations are defined on that stream.

NOTES

Although on the UNIX system an offset returned by ftell is measured in bytes, and it is permissible to seek to positions relative to that offset, portability to non-UNIX systems requires that an offset be used by fseek directly. Arithmetic may not meaningfully be performed on such an offset, which is not necessarily measured in bytes.

If input *value1* to `nextafter` is positive or negative infinity, that input is returned and `errno` is set to `EDOM`. The overflow and inexact exceptions are signalled when input *value1* is finite, but `nextafter(value1, value2)` is not. The underflow and inexact exceptions are signalled when `nextafter(value1, value2)` lies strictly between $\pm 2^{-1022}$. In both cases `errno` is set to `ERANGE`.

When the program is compiled with the `cc` options `-Xc` or `-Xa`, `HUGE_VAL` is returned instead of `HUGE`.

NAME

frexp, ldexp, logb, modf, modff, nextafter, scalb - manipulate parts of floating-point numbers

SYNOPSIS

```
#include <math.h>

double frexp (double value, int *eptr);
double ldexp (double value, int exp);
double logb (double value);
double nextafter (double value1, double value2);
double scalb (double value, double exp);
double modf (double value, double *iptr);
float modff (float value, float *iptr);
```

DESCRIPTION

Every non-zero number can be written uniquely as $x * 2^n$, where the “mantissa” (fraction) x is in the range $0.5 \leq |x| < 1.0$, and the “exponent” n is an integer. `frexp` returns the mantissa of a double *value*, and stores the exponent indirectly in the location pointed to by *eptr*. If *value* is zero, both results returned by `frexp` are zero.

`ldexp` and `scalb` return the quantity $value * 2^{exp}$. The only difference between the two is that `scalb` of a signaling NaN will result in the invalid operation exception being raised.

`logb` returns the unbiased exponent of its floating-point argument as a double-precision floating-point value.

`modf` and `modff` (single-precision version) return the signed fractional part of *value* and store the integral part indirectly in the location pointed to by *iptr*.

`nextafter` returns the next representable double-precision floating-point value following *value1* in the direction of *value2*. Thus, if *value2* is less than *value1*, `nextafter` returns the largest representable floating-point number less than *value1*.

SEE ALSO

cc(1), intro(3M)

DIAGNOSTICS

If `ldexp` would cause overflow, `±HUGE` (defined in `math.h`) is returned (according to the sign of *value*), and `errno` is set to `ERANGE`. If `ldexp` would cause underflow, zero is returned and `errno` is set to `ERANGE`. If the input *value* to `ldexp` is NaN or infinity, that input is returned and `errno` is set to `EDOM`. The same error conditions apply to `scalb` except that a signaling NaN as input will result in the raising of the invalid operation exception.

`logb` of NaN returns that NaN, `logb` of infinity returns positive infinity, and `logb` of zero returns negative infinity and results in the raising of the divide by zero exception. In each of these conditions `errno` is set to `EDOM`.

NAME

fread, fwrite - binary input/output

SYNOPSIS

```
#include <stdio.h>

size_t fread (void *ptr, size_t size, size_t nitems, FILE *stream);

size_t fwrite (const void *ptr, size_t size, size_t nitems, FILE
               *stream);
```

DESCRIPTION

fread reads into an array pointed to by *ptr* up to *nitems* items of data from *stream*, where an item of data is a sequence of bytes (not necessarily terminated by a null byte) of length *size*. fread stops reading bytes if an end-of-file or error condition is encountered while reading *stream*, or if *nitems* items have been read. fread increments the data pointer in *stream* to point to the byte following the last byte read if there is one. fread does not change the contents of *stream*. fread returns the number of items read.

fwrite writes to the named output *stream* at most *nitems* items of data from the array pointed to by *ptr*, where an item of data is a sequence of bytes (not necessarily terminated by a null byte) of length *size*. fwrite stops writing when it has written *nitems* items of data or if an error condition is encountered on *stream*. fwrite does not change the contents of the array pointed to by *ptr*. fwrite increments the data-pointer in *stream* by the number of bytes written. fwrite returns the number of items written.

If *size* or *nitems* is zero, then fread and fwrite return a value of 0 and do not effect the state of *stream*.

The ferror or feof routines must be used to distinguish between an error condition and end-of-file condition.

SEE ALSO

exit(2), lseek(2), read(2), write(2), abort(3C), fclose(3S), fopen(3S), getc(3S), gets(3S), printf(3S), putc(3S), puts(3S), scanf(3S), stdio(3S)

DIAGNOSTICS

If an error occurs, the error indicator for *stream* is set.

C requires truncation (round to zero) for floating point to integral conversions. The current rounding mode has no effect on these conversions.

NAME

fpgetround, fpsetround, fpgetmask, fpsetmask, fpgetsticky, fpsetsticky - IEEE floating-point environment control

SYNOPSIS

```
#include <ieeefp.h>

fp_rnd fpgetround (void);
fp_rnd fpsetround (fp_rnd rnd_dir);
fp_except fpgetmask (void);
fp_except fpsetmask (fp_except mask);
fp_except fpgetsticky (void);
fp_except fpsetsticky (fp_except sticky);
```

DESCRIPTION

There are five floating-point exceptions: divide-by-zero, overflow, underflow, imprecise (inexact) result, and invalid operation. When a floating-point exception occurs, the corresponding sticky bit is set, and if the mask bit is enabled, the trap takes place. These routines let the user change the behavior on occurrence of any of these exceptions, as well as change the rounding mode for floating-point operations.

```
FP_X_INV      /* invalid operation exception */
FP_X_OFL      /* overflow exception */
FP_X_UFL      /* underflow exception */
FP_X_DZ       /* divide-by-zero exception */
FP_X_IMP      /* imprecise (loss of precision) */
FP_RN         /* round to nearest representative number */
FP_RP         /* round to plus infinity */
FP_RM         /* round to minus infinity */
FP_RZ         /* round to zero (truncate) */
```

fpgetround returns the current rounding mode.

fpsetround sets the rounding mode and returns the previous rounding mode.

fpgetmask returns the current exception masks.

fpsetmask sets the exception masks and returns the previous setting.

fpgetsticky returns the current exception sticky flags.

fpsetsticky sets (clears) the exception sticky flags and returns the previous setting.

The default environment is rounding mode set to nearest (FP_RN) and all traps disabled.

Individual bits may be examined using the constants defined in ieeefp.h.

SEE ALSO

isnan(3C)

NOTES

fpsetsticky modifies all sticky flags. fpsetmask changes all mask bits. fpsetmask clears the sticky bit corresponding to any exception being enabled.

- 6 If *path* or *fildev* refers to a pipe or FIFO, the value returned applies to the FIFO itself. If *path* or *fildev* refers to a directory, the value returned applies to any FIFOs that exist or can be created within the directory. If *path* or *fildev* refer to any other type of file, the behavior is undefined.
- 7 If *path* or *fildev* refers to a directory, the value returned applies to any files, other than directories, that exist or can be created within the directory.

The value of the configurable system limit or option specified by *name* does not change during the lifetime of the calling process.

fpathconf fails if the following is true:

EBADF *fildev* is not a valid file descriptor.

pathconf fails if one or more of the following are true:

EACCES search permission is denied for a component of the path prefix.

ELOOP too many symbolic links are encountered while translating *path*.

EMULTIHOP components of *path* require hopping to multiple remote machines and file system type does not allow it.

ENAMETOOLONG the length of a pathname exceeds {PATH_MAX}, or pathname component is longer than {NAME_MAX} while (_POSIX_NO_TRUNC) is in effect.

ENOENT *path* is needed for the command specified and the named file does not exist or if the *path* argument points to an empty string.

ENOLINK *path* points to a remote machine and the link to that machine is no longer active.

ENOTDIR a component of the path prefix is not a directory.

Both fpathconf and pathconf fail if the following is true:

EINVAL if *name* is an invalid value.

SEE ALSO

sysconf(3C), limits(4)

DIAGNOSTICS

If fpathconf or pathconf are invoked with an invalid symbolic constant or the symbolic constant corresponds to a configurable system limit or option not supported on the system, a value of -1 is returned to the invoking process. If the function fails because the configurable system limit or option corresponding to *name* is not supported on the system the value of `errno` is not changed.

NAME

fpathconf, pathconf - get configurable pathname variables

SYNOPSIS

```
#include <unistd.h>

long fpathconf (int fildes, int name);
long pathconf (char *path, int name);
```

DESCRIPTION

The functions `fpathconf` and `pathconf` return the current value of a configurable limit or option associated with a file or directory. The *path* argument points to the pathname of a file or directory; *fildes* is an open file descriptor; and *name* is the symbolic constant (defined in `unistd.h`) representing the configurable system limit or option to be returned.

The values returned by `pathconf` and `fpathconf` depend on the type of file specified by *path* or *fildes*. The following table contains the symbolic constants supported by `pathconf` and `fpathconf` along with the POSIX defined return value. The return value is based on the type of file specified by *path* or *fildes*.

| Value of <i>name</i> | See Note |
|-----------------------------------|----------|
| <code>_PC_LINK_MAX</code> | 1 |
| <code>_PC_MAX_CANNON</code> | 2 |
| <code>_PC_MAX_INPUT</code> | 2 |
| <code>_PC_NAME_MAX</code> | 3,4 |
| <code>_PC_PATH_MAX</code> | 4,5 |
| <code>_PC_PIPE_BUF</code> | 6 |
| <code>_PC_CHOWN_RESTRICTED</code> | 7 |
| <code>_PC_NO_TRUNC</code> | 3,4 |
| <code>_PC_VDISABLE</code> | 2 |

Notes:

- 1 If *path* or *fildes* refers to a directory, the value returned applies to the directory itself.
- 2 The behavior is undefined if *path* or *fildes* does not refer to a terminal file.
- 3 If *path* or *fildes* refers to a directory, the value returned applies to the filenames within the directory.
- 4 The behavior is undefined if *path* or *fildes* does not refer to a directory.
- 5 If *path* or *fildes* refers to a directory, the value returned is the maximum length of a relative pathname when the specified directory is the working directory.

| forms Routine Name | Manual Page Name |
|--------------------|-----------------------|
| set_form_fields | form_field(3X) |
| set_form_init | form_hook(3X) |
| set_form_opts | form_opts(3X) |
| set_form_page | form_page(3X) |
| set_form_sub | form_win(3X) |
| set_form_term | form_hook(3X) |
| set_form_userptr | form_userptr(3X) |
| set_form_win | form_win(3X) |
| set_max_field | form_field_buffer(3X) |
| set_new_page | form_new_page(3X) |
| unpost_form | form_post(3X) |

RETURN VALUE

Routines that return a pointer always return `NULL` on error. Routines that return an integer return one of the following:

- `E_OK` - The function returned successfully.
- `E_CONNECTED` - The field is already connected to a form.
- `E_SYSTEM_ERROR` - System error.
- `E_BAD_ARGUMENT` - An argument is incorrect.
- `E_CURRENT` - The field is the current field.
- `E_POSTED` - The form is posted.
- `E_NOT_POSTED` - The form is not posted.
- `E_INVALID_FIELD` - The field contents are invalid.
- `E_NOT_CONNECTED` - The field is not connected to a form.
- `E_NO_ROOM` - The form does not fit in the subwindow.
- `E_BAD_STATE` - The routine was called from an initialization or termination function.
- `E_REQUEST_DENIED` - The form driver request failed.
- `E_UNKNOWN_COMMAND` - An unknown request was passed to the the form driver.

NOTES

The header file `form.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, and 3X pages whose names begin "form_" for detailed routine descriptions.

forms(3X)**forms(3X)**

| forms Routine Name | Manual Page Name |
|----------------------|---------------------------|
| field_opts_off | form_field_opts(3X) |
| field_opts_on | form_field_opts(3X) |
| field_pad | form_field_attributes(3X) |
| field_status | form_field_buffer(3X) |
| field_term | form_hook(3X) |
| field_type | form_field_validation(3X) |
| field_userptr | form_field_userptr(3X) |
| form_driver | form_driver(3X) |
| form_fields | form_field(3X) |
| form_init | form_hook(3X) |
| form_opts | form_opts(3X) |
| form_opts_off | form_opts(3X) |
| form_opts_on | form_opts(3X) |
| form_page | form_page(3X) |
| form_sub | form_win(3X) |
| form_term | form_hook(3X) |
| form_userptr | form_userptr(3X) |
| form_win | form_win(3X) |
| free_field | form_field_new(3X) |
| free_fieldtype | form_fieldtype(3X) |
| free_form | form_new(3X) |
| link_field | form_field_new(3X) |
| link_fieldtype | form_fieldtype(3X) |
| move_field | form_field(3X) |
| new_field | form_field_new(3X) |
| new_fieldtype | form_fieldtype(3X) |
| new_form | form_new(3X) |
| new_page | form_new_page(3X) |
| pos_form_cursor | form_cursor(3X) |
| post_form | form_post(3X) |
| scale_form | form_win(3X) |
| set_current_field | form_page(3X) |
| set_field_back | form_field_attributes(3X) |
| set_field_buffer | form_field_buffer(3X) |
| set_field_fore | form_field_attributes(3X) |
| set_field_init | form_hook(3X) |
| set_field_just | form_field_just(3X) |
| set_field_opts | form_field_opts(3X) |
| set_field_pad | form_field_attributes(3X) |
| set_field_status | form_field_buffer(3X) |
| set_field_term | form_hook(3X) |
| set_field_type | form_field_validation(3X) |
| set_field_userptr | form_field_userptr(3X) |
| set_fieldtype_arg | form_fieldtype(3X) |
| set_fieldtype_choice | form_fieldtype(3X) |

NAME

forms - character based forms package

SYNOPSIS

```
#include <form.h>
```

DESCRIPTION

The form library is built using the curses library, and any program using forms routines must call one of the curses initialization routines such as `initscr`. A program using these routines must be compiled with `-lform` and `-lcurses` on the `cc` command line.

The forms package gives the applications programmer a terminal-independent method of creating and customizing forms for user-interaction. The forms package includes: field routines, which are used to create and customize fields, link fields and assign field types; fieldtype routines, which are used to create new field types for validating fields; and form routines, which are used to create and customize forms, assign pre/post processing functions, and display and interact with forms.

Current Default Values for Field Attributes

The forms package establishes initial current default values for field attributes. During field initialization, each field attribute is assigned the current default value for that attribute. An application can change or retrieve a current default attribute value by calling the appropriate set or retrieve routine with a `NULL` field pointer. If an application changes a current default field attribute value, subsequent fields created using `new_field` will have the new default attribute value. (The attributes of previously created fields are not changed if a current default attribute value is changed.)

Routine Name Index

The following table lists each forms routine and the name of the manual page on which it is described.

| forms Routine Name | Manual Page Name |
|---------------------------------|--|
| <code>current_field</code> | <code>form_page(3X)</code> |
| <code>data_ahead</code> | <code>form_data(3X)</code> |
| <code>data_behind</code> | <code>form_data(3X)</code> |
| <code>dup_field</code> | <code>form_field_new(3X)</code> |
| <code>dynamic_field_info</code> | <code>form_field_info(3X)</code> |
| <code>field_arg</code> | <code>form_field_validation(3X)</code> |
| <code>field_back</code> | <code>form_field_attributes(3X)</code> |
| <code>field_buffer</code> | <code>form_field_buffer(3X)</code> |
| <code>field_count</code> | <code>form_field(3X)</code> |
| <code>field_fore</code> | <code>form_field_attributes(3X)</code> |
| <code>field_index</code> | <code>form_page(3X)</code> |
| <code>field_info</code> | <code>form_field_info(3X)</code> |
| <code>field_init</code> | <code>form_hook(3X)</code> |
| <code>field_just</code> | <code>form_field_just(3X)</code> |
| <code>field_opts</code> | <code>form_field_opts(3X)</code> |

form_win(3X)

form_win(3X)

NAME

form_win: set_form_win, form_win, set_form_sub, form_sub, scale_form - forms window and subwindow association routines

SYNOPSIS

```
#include <form.h>

int set_form_win(FORM *form, WINDOW *win);
WINDOW *form_win(FORM *form);

int set_form_sub(FORM *form, WINDOW *sub);
WINDOW *form_sub(FORM *form);

int scale_form(FORM *form, int *rows, int *cols);
```

DESCRIPTION

set_form_win sets the window of *form* to *win*. form_win returns a pointer to the window associated with *form*.

set_form_sub sets the subwindow of *form* to *sub*. form_sub returns a pointer to the subwindow associated with *form*.

scale_form returns the smallest window size necessary for the subwindow of *form*. *rows* and *cols* are pointers to the locations used to return the number of rows and columns for the form.

RETURN VALUE

Routines that return pointers always return NULL on error. Routines that return an integer return one of the following:

| | |
|-----------------|---|
| E_OK | - The function returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An argument is incorrect. |
| E_NOT_CONNECTED | - The field is not connected to a form. |
| E_POSTED | - The form is posted. |

NOTES

The header file form.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), forms(3X)

form_userptr(3X)

form_userptr(3X)

NAME

form_userptr: set_form_userptr, form_userptr - associate application data with forms

SYNOPSIS

```
#include <form.h>
```

```
int set_form_userptr(FORM *form, char *ptr);  
char *form_userptr(FORM *form);
```

DESCRIPTION

Every form has an associated user pointer that can be used to store pertinent data. set_form_userptr sets the user pointer of *form*. form_userptr returns the user pointer of *form*.

RETURN VALUE

form_userptr returns NULL on error. set_form_userptr returns one of the following:

| | |
|----------------|---------------------------------------|
| E_OK | - The function returned successfully. |
| E_SYSTEM_ERROR | - System error. |

NOTES

The header file form.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), forms(3X)

form_post(3X)

form_post(3X)

NAME

`form_post`: `post_form`, `unpost_form` - write or erase forms from associated subwindows

SYNOPSIS

```
#include <form.h>

int post_form(FORM *form);
int unpost_form(FORM *form);
```

DESCRIPTION

`post_form` writes *form* into its associated subwindow. The application programmer must use `curses` library routines to display the form on the physical screen or call `update_panels` if the `panels` library is being used.

`unpost_form` erases *form* from its associated subwindow.

RETURN VALUE

These routines return one of the following:

| | |
|------------------------------|--|
| <code>E_OK</code> | - The function returned successfully. |
| <code>E_SYSTEM_ERROR</code> | - System error. |
| <code>E_BAD_ARGUMENT</code> | - An argument is incorrect. |
| <code>E_POSTED</code> | - The form is posted. |
| <code>E_NOT_POSTED</code> | - The form is not posted. |
| <code>E_NO_ROOM</code> | - The form does not fit in the subwindow. |
| <code>E_BAD_STATE</code> | - The routine was called from an initialization or termination function. |
| <code>E_NOT_CONNECTED</code> | - The field is not connected to a form. |

NOTES

The header file `form.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `forms(3X)`, `panels(3X)`, `panel_update(3X)`

form_page(3X)

form_page(3X)

NAME

form_page: set_form_page, form_page, set_current_field, current_field, field_index - set forms current page and field

SYNOPSIS

```
#include <form.h>

int set_form_page(FORM *form, int page);
int form_page(FORM *form);

int set_current_field(FORM *form, FIELD *field);
FIELD *current_field(FORM *form);

int field_index(FIELD *field);
```

DESCRIPTION

set_form_page sets the page number of *form* to *page*. form_page returns the current page number of *form*.

set_current_field sets the current field of *form* to *field*. current_field returns a pointer to the current field of *form*.

field_index returns the index in the field pointer array of *field*.

RETURN VALUE

form_page returns -1 on error.

current_field returns NULL on error.

field_index returns -1 on error.

set_form_page and set_current_field return one of the following:

| | |
|------------------|--|
| E_OK | - The function returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An argument is incorrect. |
| E_BAD_STATE | - The routine was called from an initialization or termination function. |
| E_INVALID_FIELD | - The field contents are invalid. |
| E_REQUEST_DENIED | - The form driver request failed. |

NOTES

The header file form.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), forms(3X)

form_opts(3X)

form_opts(3X)

NAME

form_opts: set_form_opts, form_opts_on, form_opts_off, form_opts - forms option routines

SYNOPSIS

```
#include <form.h>
```

```
int set_form_opts(FORM *form, OPTIONS opts);
int form_opts_on(FORM *form, OPTIONS opts);
int form_opts_off(FORM *form, OPTIONS opts);
OPTIONS form_opts(FORM *form);
```

DESCRIPTION

set_form_opts turns on the named options for *form* and turns off all remaining options. Options are boolean values which can be OR-ed together.

form_opts_on turns on the named options; no other options are changed.

form_opts_off turns off the named options; no other options are changed.

form_opts returns the options set for *form*.

Form Options:

| | |
|---------------|--|
| O_NL_OVERLOAD | Overload the REQ_NEW_LINE form driver request. |
| O_BS_OVERLOAD | Overload the REQ_DEL_PREV form driver request. |

RETURN VALUE

set_form_opts, form_opts_on and form_opts_off return one of the following:

| | |
|----------------|---------------------------------------|
| E_OK | - The function returned successfully. |
| E_SYSTEM_ERROR | - System error. |

NOTES

The header file form.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), forms(3X)

form_new_page(3X)

form_new_page(3X)

NAME

form_new_page: set_new_page, new_page - forms pagination

SYNOPSIS

```
#include <form.h>

int set_new_page(FIELD *field, int bool);
int new_page(FIELD *field);
```

DESCRIPTION

set_new_page marks *field* as the beginning of a new page on the form.

new_page returns a boolean value indicating whether or not *field* begins a new page of the form.

RETURN VALUE

new_page returns TRUE or FALSE.

set_new_page returns one of the following:

- | | |
|----------------|---|
| E_OK | - The function returned successfully. |
| E_CONNECTED | - The field is already connected to a form. |
| E_SYSTEM_ERROR | - System error. |

NOTES

The header file `form.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `forms(3X)`

form_new(3X)

form_new(3X)

NAME

form_new: new_form, free_form - create and destroy forms

SYNOPSIS

```
#include <form.h>

FORM *new_form(FIELD **fields);

int free_form(FORM *form);
```

DESCRIPTION

`new_form` creates a new form connected to the designated fields and returns a pointer to the form.

`free_form` disconnects the *form* from its associated field pointer array and deallocates the space for the form.

RETURN VALUE

`new_form` always returns NULL on error. `free_form` returns one of the following:

| | |
|----------------|---------------------------------------|
| E_OK | - The function returned successfully. |
| E_BAD_ARGUMENT | - An argument is incorrect. |
| E_POSTED | - The form is posted. |

NOTES

The header file `form.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `forms(3X)`

form_hook(3X)

form_hook(3X)

SEE ALSO

curses(3X), forms(3X)

form_hook(3X)

form_hook(3X)

NAME

form_hook: set_form_init, form_init, set_form_term, form_term, set_field_init, field_init, set_field_term, field_term - assign application-specific routines for invocation by forms

SYNOPSIS

```
#include <form.h>
```

```
int set_form_init(FORM *form, void (*func)(FORM *));
void (*)(FORM *) form_init(FORM *form);

int set_form_term(FORM *form, void (*func)(FORM *));
void (*)(FORM *) form_term(FORM *form);

int set_field_init(FORM *form, void (*func)(FORM *));
void (*)(FORM *) field_init(FORM *form);

int set_field_term(FORM *form, void (*func)(FORM *));
void (*)(FORM *) field_term(FORM *form);
```

DESCRIPTION

These routines allow the programmer to assign application specific routines to be executed automatically at initialization and termination points in the forms application. The user need not specify any application-defined initialization or termination routines at all, but they may be helpful for displaying messages or page numbers and other chores.

`set_form_init` assigns an application-defined initialization function to be called when the *form* is posted and just after a page change. `form_init` returns a pointer to the initialization function, if any.

`set_form_term` assigns an application-defined function to be called when the *form* is unposted and just before a page change. `form_term` returns a pointer to the function, if any.

`set_field_init` assigns an application-defined function to be called when the *form* is posted and just after the current field changes. `field_init` returns a pointer to the function, if any.

`set_field_term` assigns an application-defined function to be called when the *form* is unposted and just before the current field changes. `field_term` returns a pointer to the function, if any.

RETURN VALUE

Routines that return pointers always return NULL on error. Routines that return an integer return one of the following:

| | |
|----------------|---------------------------------------|
| E_OK | - The function returned successfully. |
| E_SYSTEM_ERROR | - System error. |

NOTES

The header file `form.h` automatically includes the header files `eti.h` and `curses.h`.

form_fieldtype(3X)

form_fieldtype(3X)

| | |
|-----------------------------|--|
| <code>E_OK</code> | - The function returned successfully. |
| <code>E_SYSTEM_ERROR</code> | - System error. |
| <code>E_BAD_ARGUMENT</code> | - An argument is incorrect. |
| <code>E_CONNECTED</code> | - Type is connected to one or more fields. |

NOTES

The header file `form.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `forms(3X)`

form_fieldtype (3X)

form_fieldtype (3X)

NAME

form_fieldtype: new_fieldtype, free_fieldtype, set_fieldtype_arg, set_fieldtype_choice, link_fieldtype - forms **fieldtype** routines

SYNOPSIS

```
#include <form.h>

FIELDTYPE *new_fieldtype(int (* field_check)(FIELD *, char *),
                        int (* char_check)(int, char *));

int free_fieldtype(FIELDTYPE *fieldtype);

int set_fieldtype_arg(FIELDTYPE *fieldtype,
                    char *(* mak_arg)(va_list *),
                    char *(* copy_arg)(char *), void (* free_arg)(char *));

int set_fieldtype_choice(FIELDTYPE *fieldtype,
                        int (* next_choice)(FIELD *, char *),
                        int (* prev_choice)(FIELD *, char *));

FIELDTYPE *link_fieldtype(FIELDTYPE *type1, FIELDTYPE *type2);
```

DESCRIPTION

new_fieldtype creates a new field type. The application programmer must write the function *field_check*, which validates the field value, and the function *char_check*, which validates each character. *free_fieldtype* frees the space allocated for the field type.

By associating function pointers with a field type, *set_fieldtype_arg* connects to the field type additional arguments necessary for a *set_fieldtype* call. Function *mak_arg* allocates a structure for the field specific parameters to *set_fieldtype* and returns a pointer to the saved data. Function *copy_arg* duplicates the structure created by *make_arg*. Function *free_arg* frees any storage allocated by *make_arg* or *copy_arg*.

The *form_driver* requests `REQ_NEXT_CHOICE` and `REQ_PREV_CHOICE` let the user request the next or previous value of a field type comprising an ordered set of values. *set_fieldtype_choice* allows the application programmer to implement these requests for the given field type. It associates with the given field type those application-defined functions that return pointers to the next or previous choice for the field.

link_fieldtype returns a pointer to the field type built from the two given types. The constituent types may be any application-defined or pre-defined types.

RETURN VALUE

Routines that return pointers always return `NULL` on error. Routines that return an integer return one of the following:

form_field_validation(3X)

form_field_validation(3X)

NAME

form_field_validation: set_field_type, field_type, field_arg - forms field data type validation

SYNOPSIS

```
#include <form.h>

int set_field_type(FIELD *field, FIELDTYPE *type,...);
FIELDTYPE *field_type(FIELD *field);
char *field_arg(FIELD *field);
```

DESCRIPTION

set_field_type associates the specified field type with *field*. Certain field types take additional arguments. TYPE_ALNUM, for instance, requires one, the minimum width specification for the field. The other predefined field types are: TYPE_ALPHA, TYPE_ENUM, TYPE_INTEGER, TYPE_NUMERIC, TYPE_REGEX.

field_type returns a pointer to the field type of *field*. NULL is returned if no field type is assigned.

field_arg returns a pointer to the field arguments associated with the field type of *field*. NULL is returned if no field type is assigned.

RETURN VALUE

field_type and field_arg return NULL on error.

set_field_type returns one of the following:

| | |
|----------------|---------------------------------------|
| E_OK | - The function returned successfully. |
| E_SYSTEM_ERROR | - System error. |

NOTES

The header file form.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), forms(3X)

form_field_userptr(3X)

form_field_userptr(3X)

NAME

form_field_userptr: set_field_userptr, field_userptr - associate application data with forms

SYNOPSIS

```
#include <form.h>
```

```
int set_field_userptr(FIELD *field, char *ptr);  
char *field_userptr(FIELD *field);
```

DESCRIPTION

Every field has an associated user pointer that can be used to store pertinent data. set_field_userptr sets the user pointer of *field*. field_userptr returns the user pointer of *field*.

RETURN VALUE

field_userptr returns NULL on error. set_field_userptr returns one of the following:

| | |
|----------------|---------------------------------------|
| E_OK | - The function returned successfully. |
| E_SYSTEM_ERROR | - System error. |

NOTES

The header file form.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), forms(3X)

NAME

form_field_opts: set_field_opts, field_opts_on, field_opts_off,
field_opts - forms field option routines

SYNOPSIS

```
#include <form.h>

int set_field_opts(FIELD *field, OPTIONS opts);
int field_opts_on(FIELD *field, OPTIONS opts);
int field_opts_off(FIELD *field, OPTIONS opts);
OPTIONS field_opts(FIELD *field);
```

DESCRIPTION

set_field_opts turns on the named options of *field* and turns off all remaining options. Options are boolean values that can be OR-ed together.

field_opts_on turns on the named options; no other options are changed.

field_opts_off turns off the named options; no other options are changed.

field_opts returns the options set for *field*.

Field Options:

| | |
|------------|---|
| O_VISIBLE | The field is displayed. |
| O_ACTIVE | The field is visited during processing. |
| O_PUBLIC | The field contents are displayed as data is entered. |
| O_EDIT | The field can be edited. |
| O_WRAP | Words not fitting on a line are wrapped to the next line. |
| O_BLANK | The whole field is cleared if a character is entered in the first position. |
| O_AUTOSKIP | Skip to the next field when the current field becomes full. |
| O_NULLOK | A blank field is considered valid. |
| O_STATIC | The field buffers are fixed in size. |
| O_PASSOK | Validate field only if modified by user. |

RETURN VALUE

set_field_opts, field_opts_on and field_opts_off return one of the following:

| | |
|----------------|---------------------------------------|
| E_OK | - The function returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_CURRENT | - The field is the current field. |

NOTES

The header file form.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), forms(3X)

form_field_new (3X)

form_field_new (3X)

NAME

form_field_new: new_field, dup_field, link_field, free_field, - create and destroy forms fields

SYNOPSIS

```
#include <form.h>

FIELD *new_field(int r, int c, int frow, int fcol,
                 int nrow, int ncol);

FIELD *dup_field(FIELD *field, int frow, int fcol);

FIELD *link_field(FIELD *field, int frow, int fcol);

int free_field(FIELD *field);
```

DESCRIPTION

`new_field` creates a new field with *r* rows and *c* columns, starting at *frow*, *fcol*, in the subwindow of a form. *nrow* is the number of off-screen rows and *nbuf* is the number of additional working buffers. This routine returns a pointer to the new field.

`dup_field` duplicates *field* at the specified location. All field attributes are duplicated, including the current contents of the field buffers.

`link_field` also duplicates *field* at the specified location. However, unlike `dup_field`, the new field shares the field buffers with the original field. After creation, the attributes of the new field can be changed without affecting the original field.

`free_field` frees the storage allocated for *field*.

RETURN VALUE

Routines that return pointers return NULL on error. `free_field` returns one of the following:

| | |
|----------------|---|
| E_OK | - The function returned successfully. |
| E_CONNECTED | - The field is already connected to a form. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An argument is incorrect. |

NOTES

The header file `form.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`forms(3X)`

form_field_just(3X)

form_field_just(3X)

NAME

form_field_just: set_field_just, field_just - format the general appearance of forms

SYNOPSIS

```
#include <form.h>

int set_field_just(FIELD *field, int justification);
int field_just(FIELD *field);
```

DESCRIPTION

set_field_just sets the justification for *field*. Justification may be one of: NO_JUSTIFICATION, JUSTIFY_RIGHT, JUSTIFY_LEFT, or JUSTIFY_CENTER.

The field justification will be ignored if *field* is a dynamic field.

field_just returns the type of justification assigned to *field*.

RETURN VALUE

field_just returns the one of: NO_JUSTIFICATION, JUSTIFY_RIGHT, JUSTIFY_LEFT, or JUSTIFY_CENTER.

set_field_just returns one of the following:

- E_OK - The function returned successfully.
- E_SYSTEM_ERROR - System error.
- E_BAD_ARGUMENT - An argument is incorrect.

NOTES

The header file form.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), forms(3X)

form_field_info(3X)

form_field_info(3X)

NAME

form_field_info: field_info, dynamic_field_info - get forms field characteristics

SYNOPSIS

```
#include <form.h>

int field_info(FIELD *field, int *rows, int *cols,
              int *frow, int *fcol, int *nrow, int *nbuf);

int dynamic_field_info(FIELD *field, int *drows, int *dcols,
                      int *max);
```

DESCRIPTION

field_info returns the size, position, and other named field characteristics, as defined in the original call to new_field, to the locations pointed to by the arguments rows, cols, frow, fcol, nrow, and nbuf.

dynamic_field_info returns the actual size of the field in the pointer arguments drows, dcols and returns the maximum growth allowed for field in max. If no maximum growth limit is specified for field, max will contain 0. A field can be made dynamic by turning off the field option O_STATIC.

RETURN VALUE

These routines return one of the following:

| | |
|----------------|---------------------------------------|
| E_OK | - The function returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An argument is incorrect. |

NOTES

The header file form.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), forms(3X)

form_field_buffer(3X)

form_field_buffer(3X)

NAME

form_field_buffer: set_field_buffer, field_buffer, set_field_status, field_status, set_max_field - set and get forms field attributes

SYNOPSIS

```
#include <form.h>

int set_field_buffer(FIELD *field, int buf, char *value);
char *field_buffer(FIELD *field, int buf);

int set_field_status(FIELD *field, int status);
int field_status(FIELD *field);

int set_max_field(FIELD *field, int max);
```

DESCRIPTION

set_field_buffer sets buffer *buf* of *field* to *value*. Buffer 0 stores the displayed contents of the field. Buffers other than 0 are application specific and not used by the forms library routines. field_buffer returns the value of *field* buffer *buf*.

Every field has an associated status flag that is set whenever the contents of field buffer 0 changes. set_field_status sets the status flag of *field* to *status*. field_status returns the status of *field*.

set_max_field sets a maximum growth on a dynamic field, or if *max*=0 turns off any maximum growth.

RETURN VALUE

field_buffer returns NULL on error.

field_status returns TRUE or FALSE.

set_field_buffer, set_field_status and set_max_field return one of the following:

- | | |
|----------------|---------------------------------------|
| E_OK | - The function returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An argument is incorrect. |

NOTES

The header file form.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), forms(3X)

form_field_attributes(3X)

form_field_attributes(3X)

NAME

form_field_attributes: set_field_fore, field_fore, set_field_back, field_back, set_field_pad, field_pad - format the general display attributes of forms

SYNOPSIS

```
#include <form.h>

int set_field_fore(FIELD *field, chtype attr);
chtype field_fore(FIELD *field);

int set_field_back(FIELD *field, chtype attr);
chtype field_back(FIELD *field);

int set_field_pad(FIELD *field, int pad);
int field_pad(FIELD *field);
```

DESCRIPTION

set_field_fore sets the foreground attribute of *field*. The foreground attribute is the low-level curses display attribute used to display the field contents. field_fore returns the foreground attribute of *field*.

set_field_back sets the background attribute of *field*. The background attribute is the low-level curses display attribute used to display the extent of the field. field_back returns the background attribute of *field*.

set_field_pad sets the pad character of *field* to *pad*. The pad character is the character used to fill within the field. field_pad returns the pad character of *field*.

RETURN VALUE

field_fore, field_back and field_pad return default values if *field* is NULL. If *field* is not NULL and is not a valid FIELD pointer, the return value from these routines is undefined.

set_field_fore, set_field_back and set_field_pad return one of the following:

| | |
|----------------|---------------------------------------|
| E_OK | - The function returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An argument is incorrect. |

NOTES

The header file form.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), forms(3X)

form_field(3X)

form_field(3X)

NAME

form_field: set_form_fields, form_fields, field_count, move_field - connect fields to forms

SYNOPSIS

```
#include <form.h>

int set_form_fields(FORM *form, FIELD **field);
FIELD **form_fields(FORM *form);
int field_count(FORM *form);
int move_field(FIELD *field, int frow, int fcol);
```

DESCRIPTION

set_form_fields changes the fields connected to *form* to *fields*. The original fields are disconnected.

form_fields returns a pointer to the field pointer array connected to *form*.

field_count returns the number of fields connected to *form*.

move_field moves the disconnected *field* to the location *frow*, *fcol* in the forms subwindow.

RETURN VALUE

form_fields returns NULL on error.

field_count returns -1 on error.

set_form_fields and move_field return one of the following:

| | |
|----------------|---|
| E_OK | - The function returned successfully. |
| E_CONNECTED | - The field is already connected to a form. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An argument is incorrect. |
| E_POSTED | - The form is posted. |

NOTES

The header file form.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), forms(3X)

form_driver(3X)

form_driver(3X)

SEE ALSO

`courses(3X)`, `forms(3X)`

| | |
|-----------------|---|
| REQ_UP_CHAR | Move up in the field. |
| REQ_DOWN_CHAR | Move down in the field. |
| REQ_NEW_LINE | Insert/overlay a new line. |
| REQ_INS_CHAR | Insert the blank character at the cursor. |
| REQ_INS_LINE | Insert a blank line at the cursor. |
| REQ_DEL_CHAR | Delete the character at the cursor. |
| REQ_DEL_PREV | Delete the character before the cursor. |
| REQ_DEL_LINE | Delete the line at the cursor. |
| REQ_DEL_WORD | Delete the word at the cursor. |
| REQ_CLR_EOL | Clear to the end of the line. |
| REQ_CLR_EOF | Clear to the end of the field. |
| REQ_CLR_FIELD | Clear the entire field. |
| REQ_OVL_MODE | Enter overlay mode. |
| REQ_INS_MODE | Enter insert mode. |
| REQ_SCR_FLINE | Scroll the field forward a line. |
| REQ_SCR_BLINE | Scroll the field backward a line. |
| REQ_SCR_FPAGE | Scroll the field forward a page. |
| REQ_SCR_BPAGE | Scroll the field backward a page. |
| REQ_SCR_FHPAGE | Scroll the field forward half a page. |
| REQ_SCR_BHPAGE | Scroll the field backward half a page. |
| REQ_SCR_FCHAR | Horizontal scroll forward a character. |
| REQ_SCR_BCHAR | Horizontal scroll backward a character. |
| REQ_SCR_HFLINE | Horizontal scroll forward a line. |
| REQ_SCR_HBLINE | Horizontal scroll backward a line. |
| REQ_SCR_HFHALF | Horizontal scroll forward half a line. |
| REQ_SCR_HBHALF | Horizontal scroll backward half a line. |
| REQ_VALIDATION | Validate field. |
| REQ_PREV_CHOICE | Display the previous field choice. |
| REQ_NEXT_CHOICE | Display the next field choice. |

RETURN VALUE

`form_driver` returns one of the following:

| | |
|-------------------|--|
| E_OK | - The function returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An argument is incorrect. |
| E_NOT_POSTED | - The form is not posted. |
| E_INVALID_FIELD | - The field contents are invalid. |
| E_BAD_STATE | - The routine was called from an initialization or termination function. |
| E_REQUEST_DENIED | - The form driver request failed. |
| E_UNKNOWN_COMMAND | - An unknown request was passed to the the form driver. |

NOTES

The header file `form.h` automatically includes the header files `eti.h` and `curses.h`.

NAME

form_driver - command processor for the forms subsystem

SYNOPSIS

```
#include <form.h>
```

```
int form_driver(FORM *form, int c);
```

DESCRIPTION

form_driver is the workhorse of the forms subsystem; it checks to determine whether the character *c* is a forms request or data. If it is a request, the form driver executes the request and reports the result. If it is data (a printable ASCII character), it enters the data into the current position in the current field. If it is not recognized, the form driver assumes it is an application-defined command and returns E_UNKNOWN_COMMAND. Application defined commands should be defined relative to MAX_COMMAND, the maximum value of a request listed below.

Form driver requests:

| | |
|------------------|--|
| REQ_NEXT_PAGE | Move to the next page. |
| REQ_PREV_PAGE | Move to the previous page. |
| REQ_FIRST_PAGE | Move to the first page. |
| REQ_LAST_PAGE | Move to the last page. |
| REQ_NEXT_FIELD | Move to the next field. |
| REQ_PREV_FIELD | Move to the previous field. |
| REQ_FIRST_FIELD | Move to the first field. |
| REQ_LAST_FIELD | Move to the last field. |
| REQ_SNEXT_FIELD | Move to the sorted next field. |
| REQ_SPREV_FIELD | Move to the sorted prev field. |
| REQ_SFIRST_FIELD | Move to the sorted first field. |
| REQ_SLAST_FIELD | Move to the sorted last field. |
| REQ_LEFT_FIELD | Move left to field. |
| REQ_RIGHT_FIELD | Move right to field. |
| REQ_UP_FIELD | Move up to field. |
| REQ_DOWN_FIELD | Move down to field. |
| REQ_NEXT_CHAR | Move to the next character in the field. |
| REQ_PREV_CHAR | Move to the previous character in the field. |
| REQ_NEXT_LINE | Move to the next line in the field. |
| REQ_PREV_LINE | Move to the previous line in the field. |
| REQ_NEXT_WORD | Move to the next word in the field. |
| REQ_PREV_WORD | Move to the previous word in the field. |
| REQ_BEG_FIELD | Move to the first char in the field. |
| REQ_END_FIELD | Move after the last char in the field. |
| REQ_BEG_LINE | Move to the beginning of the line. |
| REQ_END_LINE | Move after the last char in the line. |
| REQ_LEFT_CHAR | Move left in the field. |
| REQ_RIGHT_CHAR | Move right in the field. |

form_data(3X)

form_data(3X)

NAME

`form_data: data Ahead, data Behind` - tell if forms field has off-screen data ahead or behind

SYNOPSIS

```
#include <form.h>

int data Ahead(FORM *form);
int data Behind(FORM *form);
```

DESCRIPTION

`data Ahead` returns TRUE (1) if the current field has more off-screen data ahead; otherwise it returns FALSE (0).

`data Behind` returns TRUE (1) if the current field has more off-screen data behind; otherwise it returns FALSE (0).

NOTES

The header file `form.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `forms(3X)`

form_cursor(3X)

form_cursor(3X)

NAME

form_cursor: pos_form_cursor - position forms window cursor

SYNOPSIS

```
#include <form.h>
```

```
int pos_form_cursor(FORM *form);
```

DESCRIPTION

pos_form_cursor moves the form window cursor to the location required by the form driver to resume form processing. This may be needed after the application calls a curses library I/O routine.

RETURN VALUE

pos_form_cursor returns one of the following:

| | |
|----------------|---------------------------------------|
| E_OK | - The function returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An argument is incorrect. |
| E_NOT_POSTED | - The form is not posted. |

NOTES

The header file form.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), forms(3X)

fork(2)

fork(2)

The child process's tms structure is cleared: tms_utime, stime, cutime, and cstime are set to 0 [see times(2)].

The time left until an alarm clock signal is reset to 0.

The set of signals pending for the child process is initialized to the empty set.

Record locks set by the parent process are not inherited by the child process [see fcntl(2)].

fork will fail and no child process will be created if one or more of the following are true:

EAGAIN

The system imposed limit on the total number of processes under execution system wide {PROC_MAX} or by a single user ID {CHILD_MAX} would be exceeded, or the system lacked the necessary resources to create another process."

SEE ALSO

alarm(2), exec(2), fcntl(2), getrlimit(2), nice(2), plock(2), priocntl(2), ptrace(2), semop(2), shmop(2), signal(2), times(2), umask(2), wait(2), system(3S)

DIAGNOSTICS

Upon successful completion, fork returns a value of 0 to the child process and returns the process ID of the child process to the parent process. Otherwise, a value of (pid_t)-1 is returned to the parent process, no child process is created, and errno is set to indicate the error.

fork(2)

fork(2)

NAME

fork - create a new process

SYNOPSIS

```
#include <sys/types.h>
#include <unistd.h>

pid_t fork(void);
```

DESCRIPTION

fork causes creation of a new process. The new process (child process) is an exact copy of the calling process (parent process). This means the child process inherits the following attributes from the parent process:

- real user ID, real group ID, effective user ID, effective group ID
- environment
- close-on-exec flag [see [exec\(2\)](#)]
- signal handling settings (i.e., SIG_DFL, SIG_IGN, SIG_HOLD, function address)
- supplementary group IDs
- set-user-ID mode bit
- set-group-ID mode bit
- profiling on/off status
- nice value [see [nice\(2\)](#)]
- scheduler class [see [prctl\(2\)](#)]
- all attached shared memory segments [see [shmop\(2\)](#)]
- process group ID
- session ID [see [exit\(2\)](#)]
- current working directory
- root directory
- file mode creation mask [see [umask\(2\)](#)]
- resource limits [see [getrlimit\(2\)](#)]
- controlling terminal

Scheduling priority and any per-process scheduling parameters that are specific to a given scheduling class may or may not be inherited according to the policy of that particular class [see [prctl\(2\)](#)].

The child process differs from the parent process in the following ways:

- The child process has a unique process ID which does not match any active process group ID.

- The child process has a different parent process ID (i.e., the process ID of the parent process).

- The child process has its own copy of the parent's file descriptors and directory streams. Each of the child's file descriptors shares a common file pointer with the corresponding file descriptor of the parent.

- All `semadj` values are cleared [see [semop\(2\)](#)].

- Process locks, text locks and data locks are not inherited by the child [see [plock\(2\)](#)].

SEE ALSO

`open(2)`, `pipe(2)`, `fclose(3S)`, `fseek(3S)`, `fopen(3S)`, `malloc(3C)`.

RETURN VALUE

`fopen`, `freopen`, and `fdopen` return a NULL pointer on failure.

NOTES

`fopen` differs from the library routine of the same name in the base system only in interface.

In order to support the same number of open files that the system does, `fopen` must allocate additional memory for data structures using `calloc` [see `malloc(3)`] after 64 files have been opened. This confuses some programs which use their own memory allocators.

NAME

fopen, freopen, fdopen - open a stream

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
#include <stdio.h>
FILE *fopen(filename, type)
char *filename, *type;
FILE *freopen(filename, type, stream)
char *filename, *type;
FILE *stream;
FILE *fdopen(fildes, type)
int fildes;
char *type;
```

DESCRIPTION

fopen opens the file named by *filename* and associates a stream with it. If the open succeeds, fopen returns a pointer to be used to identify the stream in subsequent operations.

filename points to a character string that contains the name of the file to be opened.

type is a character string having one of the following values:

- r open for reading
- w truncate or create for writing
- a append: open for writing at end of file, or create for writing
- r+ open for update (reading and writing)
- w+ truncate or create for update
- a+ append; open or create for update at EOF

freopen opens the file named by *filename* and associates the stream pointed to by *stream* with it. The *type* argument is used just as in fopen. The original stream is closed, regardless of whether the open ultimately succeeds. If the open succeeds, freopen returns the original value of *stream*.

freopen is typically used to attach the preopened streams associated with stdin, stdout, and stderr to other files.

fdopen associates a stream with the file descriptor *fildes*. File descriptors are obtained from calls like open, dup, creat, or pipe(2), which open files but do not return streams. Streams are necessary input for many of the Section 3S library routines. The *type* of the stream must agree with the mode of the open file.

When a file is opened for update, both input and output may be done on the resulting stream. However, output may not be directly followed by input without an intervening fseek or rewind, and input may not be directly followed by output without an intervening fseek, rewind, or an input operation which encounters EOF.

When a file is opened for append (i.e., when *type* is "a", "ab", "a+", or "ab+"), it is impossible to overwrite information already in the file. `fseek` may be used to reposition the file pointer to any position in the file, but when output is written to the file, the current file pointer is disregarded. All output is written at the end of the file and causes the file pointer to be repositioned at the end of the output. If two separate processes open the same file for append, each process may write freely to the file without fear of destroying output being written by the other. The output from the two processes will be intermixed in the file in the order in which it is written.

When opened, a *stream* is fully buffered if and only if it can be determined not to refer to an interactive device. The error and end-of-file indicators are cleared for the *stream*.

SEE ALSO

`close(2)`, `creat(2)`, `dup(2)`, `open(2)`, `pipe(2)`, `write(2)`, `fclose(3S)`, `fseek(3S)`, `setbuf(3S)`, `stdio(3S)`

DIAGNOSTICS

The functions `fopen` and `freopen` return a null pointer if *path* cannot be accessed, or if *type* is invalid, or if the file cannot be opened.

The function `fdopen` returns a null pointer if *fdes* is not an open file descriptor, or if *type* is invalid, or if the file cannot be opened.

The functions `fopen` or `fdopen` may fail and not set `errno` if there are no free `stdio` streams.

File descriptors used by `fdopen` must be less than 255.

NAME

fopen, freopen, fdopen - open a stream

SYNOPSIS

```
#include <stdio.h>

FILE *fopen (const char *filename, const char *type);
FILE *freopen (const char *filename, const char *type, FILE
               *stream);
FILE *fdopen (int fildes, const char *type);
```

DESCRIPTION

fopen opens the file named by *filename* and associates a *stream* with it. fopen returns a pointer to the FILE structure associated with the *stream*.

filename points to a character string that contains the name of the file to be opened.

type is a character string beginning with one of the following sequences:

- "r" or "rb" open for reading
- "w" or "wb" truncate to zero length or create for writing
- "a" or "ab" append; open for writing at end of file, or create for writing
- "r+", "r+b" or "rb+" open for update (reading and writing)
- "w+", "w+b" or "wb+" truncate or create for update
- "a+", "a+b" or "ab+" append; open or create for update at end-of-file

The "b" is ignored in the above *types*. The "b" exists to distinguish binary files from text files. However, there is no distinction between these types of files on a UNIX system.

freopen substitutes the named file in place of the open *stream*. A flush is first attempted, and then the original *stream* is closed, regardless of whether the open ultimately succeeds. Failure to flush or close *stream* successfully is ignored. freopen returns a pointer to the FILE structure associated with *stream*.

freopen is typically used to attach the preopened *streams* associated with stdin, stdout, and stderr to other files. stderr is by default unbuffered, but the use of freopen will cause it to become buffered or line-buffered.

fdopen associates a *stream* with a file descriptor. File descriptors are obtained from open, dup, creat, or pipe, which open files but do not return pointers to a FILE structure *stream*. Streams are necessary input for almost all of the Section 3S library routines. The *type* of *stream* must agree with the mode of the open file. The file position indicator associated with *stream* is set to the position indicated by the file offset associated with *fildes*.

When a file is opened for update, both input and output may be done on the resulting *stream*. However, output may not be directly followed by input without an intervening fflush, fseek, fsetpos, or rewind, and input may not be directly followed by output without an intervening fseek, fsetpos, or rewind, or an input operation that encounters end-of-file.

DIAGNOSTICS

The exit codes for `fmtmsg` are the following:

- | | |
|-----------------------|--|
| <code>MM_OK</code> | The function succeeded. |
| <code>MM_NOTOK</code> | The function failed completely. |
| <code>MM_NOMSG</code> | The function was unable to generate a message on the standard error stream, but otherwise succeeded. |
| <code>MM_NOCON</code> | The function was unable to generate a console message, but otherwise succeeded. |

FUTURE DIRECTIONS

A slightly different standard error message format and a new developer interface, `pfmt`, is being introduced as the replacement for `fmtmsg`. A similar interface, `lfmt`, is also being introduced for producing a standard format message and forwarding messages to the console and/or to the system message logging and monitoring facilities. `fmtmsg` will be removed at a future time.

| Argument | Type | Null-Value | Identifier |
|-----------------|-------|--------------|-------------|
| <i>label</i> | char* | (char*) NULL | MM_NULLLBLE |
| <i>severity</i> | int | 0 | MM_NULLLSEV |
| <i>class</i> | long | 0L | MM_NULLLMC |
| <i>text</i> | char* | (char*) NULL | MM_NULLLTXT |
| <i>action</i> | char* | (char*) NULL | MM_NULLLACT |
| <i>tag</i> | char* | (char*) NULL | MM_NULLLTAG |

Another means of systematically omitting a component is by omitting the component keyword(s) when defining the MSGVERB environment variable (see the "Environment Variables" section).

EXAMPLES

Example 1:

The following example of `fmtmsg`:

```
fmtmsg(MM_PRINT, "UX:cat", MM_ERROR, "invalid syntax",
"refer to manual", "UX:cat:001")
```

produces a complete message in the standard message format:

```
UX:cat: ERROR: invalid syntax
      TO FIX: refer to manual   UX:cat:001
```

Example 2:

When the environment variable MSGVERB is set as follows:

```
MSGVERB=severity:text:action
```

and the Example 1 is used, `fmtmsg` produces:

```
ERROR: invalid syntax
      TO FIX: refer to manual
```

Example 3:

When the environment variable SEV_LEVEL is set as follows:

```
SEV_LEVEL=note,5,NOTE
```

the following call to `fmtmsg`:

```
fmtmsg(MM_UTIL | MM_PRINT, "UX:cat", 5, "invalid syntax",
"refer to manual", "UX:cat:001")
```

produces:

```
UX:cat: NOTE: invalid syntax
      TO FIX: refer to manual   UX:cat:001
```

SEE ALSO

`addseverity(3C)`, `gettxt(3C)`, `printf(3S)`
`fmtmsg(1)`

MSGVERB affects only which components are selected for display to the standard error stream. All message components are included in console messages.

SEV_LEVEL defines severity levels and associates print strings with them for use by fmtmsg. The standard severity levels shown below cannot be modified. Additional severity levels can also be defined, redefined, and removed using addseverity [see addseverity(3C)]. If the same severity level is defined by both SEV_LEVEL and addseverity, the definition by addseverity is controlling.

- 0 (no severity is used)
- 1 HALT
- 2 ERROR
- 3 WARNING
- 4 INFO

SEV_LEVEL can be set as follows:

```
SEV_LEVEL=[description[:description[:...]]]
export SEV_LEVEL
```

description is a comma-separated list containing three fields:

```
description=severity_keyword,level,printstring
```

severity_keyword is a character string that is used as the keyword on the `-s severity` option to the `fmtmsg` command. (This field is not used by the `fmtmsg` function.)

level is a character string that evaluates to a positive integer (other than 0, 1, 2, 3, or 4, which are reserved for the standard severity levels). If the keyword *severity_keyword* is used, *level* is the severity value passed on to the `fmtmsg` function.

printstring is the character string used by `fmtmsg` in the standard message format whenever the severity value *level* is used.

If a *description* in the colon list is not a three-field comma list, or, if the second field of a comma list does not evaluate to a positive integer, that *description* in the colon list is ignored.

The first time `fmtmsg` is called, it examines the `SEV_LEVEL` environment variable, if defined, to see whether the environment expands the levels of severity beyond the five standard levels and those defined using `addseverity`. The values accepted on the initial call are saved for future calls.

Use in Applications

One or more message components may be systematically omitted from messages generated by an application by using the null value of the argument for that component.

The table below indicates the null values and identifiers for `fmtmsg` arguments.

severity

Indicates the seriousness of the condition. Identifiers for the standard levels of *severity* are:

MM_HALT indicates that the application has encountered a severe fault and is halting. Produces the print string HALT.

MM_ERROR indicates that the application has detected a fault. Produces the print string ERROR.

MM_WARNING indicates a condition out of the ordinary that might be a problem and should be watched. Produces the print string WARNING.

MM_INFO provides information about a condition that is not in error. Produces the print string INFO.

MM_NOSEV indicates that no severity level is supplied for the message.

Other severity levels may be added by using the `addseverity` routine.

text Describes the condition that produced the message. The *text* string is not limited to a specific size.

action Describes the first step to be taken in the error recovery process. `fmtmsg` precedes each action string with the prefix: TO FIX:.. The *action* string is not limited to a specific size.

tag An identifier which references on-line documentation for the message. Suggested usage is that *tag* includes the *label* and a unique identifying number. A sample *tag* is `UX:cat:146`.

Environment Variables

There are two environment variables that control the behavior of `fmtmsg`: `MSGVERB` and `SEV_LEVEL`.

`MSGVERB` tells `fmtmsg` which message components it is to select when writing messages to `stderr`. The value of `MSGVERB` is a colon-separated list of optional keywords. `MSGVERB` can be set as follows:

```
MSGVERB=[keyword[:keyword[:...]]]
export MSGVERB
```

Valid *keywords* are: `label`, `severity`, `text`, `action`, and `tag`. If `MSGVERB` contains a keyword for a component and the component's value is not the component's null value, `fmtmsg` includes that component in the message when writing the message to `stderr`. If `MSGVERB` does not include a keyword for a message component, that component is not included in the display of the message. The keywords may appear in any order. If `MSGVERB` is not defined, if its value is the null-string, if its value is not of the correct format, or if it contains keywords other than the valid ones listed above, `fmtmsg` selects all components.

The first time `fmtmsg` is called, it examines the `MSGVERB` environment variable to see which message components it is to select when generating a message to write to the standard error stream, `stderr`. The values accepted on the initial call are saved for future calls.

NAME

fmtmsg - display a message on stderr or system console

SYNOPSIS

```
#include <fmtmsg.h>

int fmtmsg(long classification, const char *label, int severity,
           const char *text, const char *action, const char *tag);
```

DESCRIPTION

Based on a message's classification component, `fmtmsg` writes a formatted message to `stderr`, to the console, or to both.

`fmtmsg` can be used instead of the traditional `printf` interface to display messages to `stderr`. `fmtmsg`, in conjunction with `gettext`, provides a simple interface for producing language-independent applications.

A formatted message consists of up to five standard components as defined below. The component, *classification*, is not part of the standard message displayed to the user, but rather defines the source of the message and directs the display of the formatted message.

classification

Contains identifiers from the following groups of major classifications and subclassifications. Any one identifier from a subclass may be used in combination by ORing the values together with a single identifier from a different subclass. Two or more identifiers from the same subclass should not be used together, with the exception of identifiers from the display subclass. (Both display subclass identifiers may be used so that messages can be displayed to both `stderr` and the system console).

“Major classifications” identify the source of the condition. Identifiers are: `MM_HARD` (hardware), `MM_SOFT` (software), and `MM_FIRM` (firmware).

“Message source subclassifications” identify the type of software in which the problem is spotted. Identifiers are: `MM_APPL` (application), `MM_UTIL` (utility), and `MM_OPSYS` (operating system).

“Display subclassifications” indicate where the message is to be displayed. Identifiers are: `MM_PRINT` to display the message on the standard error stream, `MM_CONSOLE` to display the message on the system console. Neither, either, or both identifiers may be used.

“Status subclassifications” indicate whether the application will recover from the condition. Identifiers are: `MM_RECOVER` (recoverable) and `MM_NRECOV` (non-recoverable).

An additional identifier, `MM_NULLMC`, indicates that no classification component is supplied for the message.

label Identifies the source of the message. The format of this component is two fields separated by a colon. The first field is up to 10 characters long; the second is up to 14 characters. Suggested usage is that *label* identifies the package in which the application resides as well as the program or application name. For example, the *label* `UX:cat` indicates the UNIX System V package and the `cat` application.

floating_to_decimal(3) (BSD Compatibility Package) floating_to_decimal(3)

If *pm->df* == *fixed_form* and *pm->ndigits* < 0, then *pm->ds* always contains *-pm->ndigits* trailing zeros; in other words, rounding occurs *-pm->ndigits* to the left of the decimal point, but the digits rounded away are retained as zeros. The total number of digits required is in *pd->ndigits*. *pd->exponent* always gets 0. Thus if **px* == 12.34 and *pm->ndigits* == -1, then *pd->ds* gets 10, *pd->exponent* gets 0, and *pd->ndigits* gets 2.

pd->more is not used.

econvert(3), *fconvert*, *gconvert*, *printf(3S)*, and *sprintf*, all use *double_to_decimal*.

SEE ALSO

econvert(3), *printf(3S)*.

NAME

floating_to_decimal: single_to_decimal, double_to_decimal, extended_to_decimal - convert floating-point value to decimal record

SYNOPSIS

```
/usr/ucb/cc [flag...] file...
#include <floatingpoint.h>
void single_to_decimal(px, pm, pd, ps)
single *px ;
decimal_mode *pm;
decimal_record *pd;
fp_exception_field_type *ps;
void double_to_decimal(px, pm, pd, ps)
double *px ;
decimal_mode *pm;
decimal_record *pd;
fp_exception_field_type *ps;
void extended_to_decimal(px, pm, pd, ps)
extended *px ;
decimal_mode *pm;
decimal_record *pd;
fp_exception_field_type *ps;
```

DESCRIPTION

The `floating_to_decimal` functions convert the floating-point value at `*px` into a decimal record at `*pd`, observing the modes specified in `*pm` and setting exceptions in `*ps`. If there are no IEEE exceptions, `*ps` will be zero.

If `*px` is zero, infinity, or NaN, then only `pd->sign` and `pd->fpclass` are set. Otherwise `pd->exponent` and `pd->ds` are also set so that

$$(pd->sign) * (pd->ds) * 10^{(pd->exponent)}$$

is a correctly rounded approximation to `*px`. `pd->ds` has at least one and no more than `DECIMAL_STRING_LENGTH-1` significant digits because one character is used to terminate the string with a NULL.

`pd->ds` is correctly rounded according to the IEEE rounding modes in `pm->rd`. `*ps` has `fp_inexact` set if the result was inexact, and has `fp_overflow` set if the string result does not fit in `pd->ds` because of the limitation `DECIMAL_STRING_LENGTH`.

If `pm->df==floating_form`, then `pd->ds` always contains `pm->ndigits` significant digits. Thus if `*px == 12.34` and `pm->ndigits == 8`, then `pd->ds` will contain 12340000 and `pd->exponent` will contain -6.

If `pm->df==fixed_form` and `pm->ndigits >= 0`, then `pd->ds` always contains `pm->ndigits` after the point and as many digits as necessary before the point. Since the latter is not known in advance, the total number of digits required is returned in `pd->ndigits`; if that number `>= DECIMAL_STRING_LENGTH`, then `ds` is undefined. `pd->exponent` always gets `-pm->ndigits`. Thus if `*px == 12.34` and `pm->ndigits == 1`, then `pd->ds` gets 123, `pd->exponent` gets -1, and `pd->ndigits` gets 3.

NAME

floor, floorf, ceil, ceilf, copysign, fmod, fmodf, fabs, fabsf, rint, remainder - floor, ceiling, remainder, absolute value functions

SYNOPSIS

```
cc [flag ...] file ... -lm [library ...]
#include <math.h>
double floor (double x);
float floorf (float x);
double ceil (double x);
float ceilf (float x);
double copysign (double x, double y);
double fmod (double x, double y);
float fmodf (float x, float y);
double fabs (double x);
float fabsf (float x);
double rint (double x);
double remainder (double x, double y);
```

DESCRIPTION

floor and floorf return the largest integer not greater than x . ceil and ceilf return the smallest integer not less than x .

copysign returns x but with the sign of y .

fmod and fmodf return the floating point remainder of the division of x by y . More precisely, they return the number f with the same sign as x , such that $x = iy + f$ for some integer i , and $|f| < |y|$.

fabs and fabsf return the absolute value of x , $|x|$.

rint returns the nearest integer value to its floating point argument x as a double-precision floating point number. The returned value is rounded according to the currently set machine rounding mode. If round-to-nearest (the default mode) is set and the difference between the function argument and the rounded result is exactly 0.5, then the result will be rounded to the nearest even integer.

remainder returns the floating point remainder of the division of x by y . More precisely, it returns the value $r = x - yn$, where n is the integer nearest the exact value x/y . Whenever $|n - x/y| = 1/2$, then n is even.

SEE ALSO

abs(3C), matherr(3M)

DIAGNOSTICS

fmod and fmodf return x when y is 0 and set errno to EDOM. remainder returns NaN when y is 0 and sets errno to EDOM. In both cases, except in compilation modes -Xa or -Xc, a message indicating DOMAIN error is printed on the standard error output. Except under -Xc, these error-handling procedures may be changed with the function matherr.

floatingpoint(3)

(BSD Compatibility Package)

floatingpoint(3)

FILES

/usr/include/sys/ieeefp.h
/usr/include/fp.h
/usr/ucblib/libucb.a

SEE ALSO

decimal_to_floating(3), econvert(3), floating_to_decimal(3),
ieee_handler(3M), sigfpe(3)
abort(3), strtod(3).

| | |
|--------------------------------------|--|
| <code>fp_exception_type</code> | The type of the <code>N_IEEE_EXCEPTION</code> exceptions. Each exception is given a bit number. |
| <code>fp_exception_field_type</code> | The type intended to hold at least <code>N_IEEE_EXCEPTION</code> bits corresponding to the IEEE exceptions numbered by <code>fp_exception_type</code> . Thus <code>fp_inexact</code> corresponds to the least significant bit and <code>fp_invalid</code> to the fifth least significant bit. Note: some operations may set more than one exception. |
| <code>fp_accrued_exceptions</code> | The IEEE exceptions between the time this global variable was last cleared, and the last time a function was called to update the variable by obtaining the hardware state. |
| <code>ieee_handlers</code> | An array of user-specifiable signal handlers for use by the standard <code>SIGFPE</code> handler for IEEE arithmetic-related <code>SIGFPE</code> codes. Since IEEE trapping modes correspond to hardware modes, elements of this array should only be modified with a function like <code>ieee_handler(3M)</code> that performs the appropriate hardware mode update. If no <code>sigfpe_handler</code> has been declared for a particular IEEE-related <code>SIGFPE</code> code, then the related <code>ieee_handlers</code> will be invoked. |

IEEE Formats and Classification:

| | |
|----------------------------|---|
| <i>single;extended</i> | Definitions of IEEE formats. |
| <code>fp_class_type</code> | An enumeration of the various classes of IEEE values and symbols. |

IEEE Base Conversion:

The functions described under `floating_to_decimal(3)` and `decimal_to_floating(3)` not only satisfy the IEEE Standard, but also the stricter requirements of correct rounding for all arguments.

| | |
|------------------------------------|--|
| <code>DECIMAL_STRING_LENGTH</code> | The length of a <code>decimal_string</code> . |
| <code>decimal_string</code> | The digit buffer in a <code>decimal_record</code> . |
| <code>decimal_record</code> | The canonical form for representing an unpacked decimal floating-point number. |
| <code>decimal_form</code> | The type used to specify fixed or floating binary to decimal conversion. |
| <code>decimal_mode</code> | A struct that contains specifications for conversion between binary and decimal. |
| <code>decimal_string_form</code> | An enumeration of possible valid character strings representing floating-point numbers, infinities, or NaNs. |

NAME

floatingpoint - IEEE floating point definitions

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...
#include <sys/ieee.h>
#include <fp.h>
```

DESCRIPTION

This file defines constants, types, variables, and functions used to implement standard floating point according to ANSI/IEEE Std 754-1985. The variables and functions are implemented in `libucb.a`. The included file `sys/ieee.h` defines certain types of interest to the kernel.

IEEE Rounding Modes:

| | |
|--------------------------------|--|
| <code>fp_direction_type</code> | The type of the IEEE rounding direction mode. Note: the order of enumeration varies according to hardware. |
| <code>fp_direction</code> | The IEEE rounding direction mode currently in force. This is a global variable that is intended to reflect the hardware state, so it should only be written indirectly through a function that also sets the hardware state. |
| <code>fp_precision_type</code> | The type of the IEEE rounding precision mode, which only applies on systems that support extended precision. |
| <code>fp_precision</code> | The IEEE rounding precision mode currently in force. This is a global variable that is intended to reflect the hardware state on systems with extended precision, so it should only be written indirectly. |

SIGFPE Handling:

| | |
|----------------------------------|---|
| <code>sigfpe_code_type</code> | The type of a SIGFPE code. |
| <code>sigfpe_handler_type</code> | The type of a user-definable SIGFPE exception handler called to handle a particular SIGFPE code. |
| <code>SIGFPE_DEFAULT</code> | A macro indicating the default SIGFPE exception handling, namely to perform the exception handling specified by calls to <code>ieee_handler(3M)</code> , if any, and otherwise to dump core using <code>abort(3)</code> . |
| <code>SIGFPE_IGNORE</code> | A macro indicating an alternate SIGFPE exception handling, namely to ignore and continue execution. |
| <code>SIGFPE_ABORT</code> | A macro indicating an alternate SIGFPE exception handling, namely to abort with a core dump. |

IEEE Exception Handling:

| | |
|-------------------------------|--|
| <code>N_IEEE_EXCEPTION</code> | The number of distinct IEEE floating-point exceptions. |
|-------------------------------|--|

NAME

`ffs` - find first set bit

SYNOPSIS

```
#include <string.h>
int ffs(const int i);
```

DESCRIPTION

`ffs` finds the first bit set in the argument passed it and returns the index of that bit. Bits are numbered starting at 1 from the low order bit. A return value of zero indicates that the value passed is zero.

NAME

ferror, feof, clearerr, fileno - stream status inquiries

SYNOPSIS

```
#include <stdio.h>
int ferror (FILE *stream);
int feof (FILE *stream);
void clearerr (FILE *stream);
int fileno (FILE *stream);
```

DESCRIPTION

`ferror` returns non-zero when an error has previously occurred reading from or writing to the named *stream* [see `intro(3)`], otherwise zero.

`feof` returns non-zero when EOF has previously been detected reading the named input *stream*, otherwise zero.

`clearerr` resets the error indicator and EOF indicator to zero on the named *stream*.

`fileno` returns the integer file descriptor associated with the named *stream* [see `open(2)`].

SEE ALSO

`open(2)`, `fopen(3S)`, `stdio(3S)`

fdetach (3C)

fdetach (3C)

NAME

fdetach - detach a name from a STREAMS-based file descriptor

SYNOPSIS

```
int fdetach(const char *path);
```

DESCRIPTION

The `fdetach` routine detaches a STREAMS-based file descriptor from a name in the file system. *path* is the path name of the object in the file system name space, which was previously attached [see `fattach(3C)`]. The user must be the owner of the file or a user with the appropriate privileges. All subsequent operations on *path* will operate on the file system node and not on the STREAMS file. The permissions and status of the node are restored to the state the node was in before the STREAMS file was attached to it.

RETURN VALUE

If successful, `fdetach` returns 0; otherwise it returns -1 and sets `errno` to indicate an error.

ERRORS

Under the following conditions, the function `fdetach` fails and sets `errno` to:

| | |
|--------------|--|
| EPERM | The effective user ID is not the owner of <i>path</i> or is not a user with appropriate permissions. |
| ENOTDIR | A component of the path prefix is not a directory. |
| ENOENT | <i>path</i> does not exist. |
| EINVAL | <i>path</i> is not attached to a STREAMS file. |
| ENAMETOOLONG | The size of <i>path</i> exceeds <code>{PATH_MAX}</code> , or a path name component is longer than <code>{NAME_MAX}</code> while <code>{_POSIX_NO_TRUNC}</code> is in effect. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |

SEE ALSO

`fdetach(1M)`, `fattach(3C)`, `streamio(7)`.

O_TRUNC Truncate flag

File status flags used for open and fcntl:

O_APPEND Set append mode
 O_NDELAY Non-blocking mode
 O_NONBLOCK Non-blocking mode (POSIX)
 O_SYNC Synchronous writes
 O_PRIV Private access to file

Mask for use with file access modes:

O_ACCMODE Mask for file access modes

File access modes used for open and fcntl:

O_RDONLY Open for reading only
 O_RDWR Open for reading and writing
 O_WRONLY Open for writing only

The structure flock describes a file lock. It includes the following members:

```
short  l_type;      /* Type of lock */
short  l_whence;   /* Flag for starting offset */
off_t  l_start;    /* Relative offset in bytes */
off_t  l_len;      /* Size; if 0 then until EOF */
pid_t  l_pid;      /* Returned with F_GETLK */
short  l_sysid;    /* Returned with F_GETLK */
```

SEE ALSO

creat(2), exec(2), fcntl(2), open(2)

NAME

fcntl - file control options

SYNOPSIS

#include <fcntl.h>

DESCRIPTION

The `fcntl.h` header defines the following requests and arguments for use by the functions `fcntl` [see `fcntl(2)`] and `open` [see `open(2)`].

Values for *cmd* used by `fcntl` (the following values are unique):

| | |
|-------------------------|--|
| <code>F_DUPFD</code> | Duplicate file descriptor |
| <code>F_GETFD</code> | Get file descriptor flags |
| <code>F_SETFD</code> | Set file descriptor flags |
| <code>F_GETFL</code> | Get file status flags |
| <code>F_SETFL</code> | Set file status flags |
| <code>F_GETLK</code> | Get record locking information |
| <code>F_SETLK</code> | Set record locking information |
| <code>F_SETLKW</code> | Set record locking information; wait if blocked |
| <code>F_CHKFL</code> | Unused |
| <code>F_ALLOCSP</code> | Reserved |
| <code>F_FREESP</code> | Free file space |
| <code>F_ISSTREAM</code> | Is the file desc. a stream |
| <code>F_BLOCKS</code> | Get number of <code>BLKSIZE</code> blocks allocated |
| <code>F_BLKSIZE</code> | Get optimal I/O block size |
| <code>F_RSETLK</code> | Remote <code>SETLK</code> for NFS |
| <code>F_RGETLK</code> | Remote <code>GETLK</code> for NFS |
| <code>F_RSETLKW</code> | Remote <code>SETLKW</code> for NFS |
| <code>F_GETOWN</code> | Get owner (socket emulation, M88000 only) |
| <code>F_SETOWN</code> | Set owner (socket emulation, M88000 only) |

File descriptor flags used for `fcntl`:

| | |
|-------------------------|--|
| <code>FD_CLOEXEC</code> | Close the file descriptor upon execution of an <code>exec</code> function [see <code>exec(2)</code>] |
|-------------------------|--|

Values for *l_type* used for record locking with `fcntl`
(the following values are unique):

| | |
|----------------------|-------------------------|
| <code>F_RDLCK</code> | Shared or read lock |
| <code>F_UNLCK</code> | Unlock |
| <code>F_WRLCK</code> | Exclusive or write lock |

The following three sets of values are bitwise distinct:

Values for *oflag* used by `open`:

| | |
|-----------------------|----------------------------------|
| <code>O_CREAT</code> | Create file if it does not exist |
| <code>O_EXCL</code> | Exclusive use flag |
| <code>O_NOCTTY</code> | Do not assign controlling tty |

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fcntl(2)

| | |
|----------|---|
| F_DUPFD | A new file descriptor. |
| F_GETFD | Value of flag (only the low-order bit is defined). The return value will not be negative. |
| F_SETFD | Value other than -1. |
| F_FREESP | Value of 0. |
| F_GETFL | Value of file status flags. The return value will not be negative. |
| F_SETFL | Value other than -1. |
| F_GETLK | Value other than -1. |
| F_SETLK | Value other than -1. |
| F_SETLKW | Value other than -1. |

On failure, `fcntl` returns -1 and sets `errno` to indicate the error.

NOTES

In the future, the variable `errno` will be set to `EAGAIN` rather than `EACCES` when a section of a file is already locked by another process. Therefore, portable application programs should expect and test for either value.

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| | |
|------------|---|
| EDFADLK | <i>cmd</i> is F_SETLKW, the lock is blocked by some lock from another process, and if fcntl blocked the calling process waiting for that lock to become free, a deadlock would occur. |
| EDFADLK | <i>cmd</i> is F_FREESP, mandatory record locking is enabled, O_NDELAY and O_NONBLOCK are clear and a deadlock condition was detected. |
| EFAULT | <i>cmd</i> is F_FREESP and the value pointed to by the third argument <i>arg</i> resulted in an address outside the process's allocated address space. |
| EFAULT | <i>cmd</i> is F_GETLK, F_SETLK or F_SETLKW and the value pointed to by the third argument resulted in an address outside the program address space. |
| EINTR | A signal was caught during execution of the fcntl system call. |
| EIO | An I/O error occurred while reading from or writing to the file system. |
| EMFILE | <i>cmd</i> is F_DUPFD and the number of file descriptors currently open in the calling process is the configured value for the maximum number of open file descriptors allowed each user. |
| EINVAL | <i>cmd</i> is F_DUPFD and the third argument is either negative, or greater than or equal to the configured value for the maximum number of open file descriptors allowed each user. |
| EINVAL | <i>cmd</i> is F_GETOWN or F_SETOWN and the <i>fildev</i> is not a STREAM device. |
| EINVAL | <i>cmd</i> is F_SETOWN and the third argument is not a valid process ID or the negative of a valid process-group ID. |
| EINVAL | <i>cmd</i> is not a valid value. |
| EINVAL | <i>cmd</i> is F_GETLK, F_SETLK, or F_SETLKW and the third argument or the data it points to is not valid, or <i>fildev</i> refers to a file that does not support locking. |
| ENOLCK | <i>cmd</i> is F_SETLK or F_SETLKW, the type of lock is a read or write lock, and there are no more record locks available (too many file segments locked) because the system maximum has been exceeded. |
| ENOLINK | <i>fildev</i> is on a remote machine and the link to that machine is no longer active. |
| ENOLINK | <i>cmd</i> is F_FREESP, the file is on a remote machine, and the link to that machine is no longer active. |
| E_OVERFLOW | <i>cmd</i> is F_GETLK and the process ID of the process holding the requested lock is too large to be stored in the <i>l_pid</i> field. |

SEE ALSO

close(2), creat(2), dup(2), exec(2), fork(2), open(2), pipe(2), fcntl(5)
The "File and Record Locking" chapter

DIAGNOSTICS

On success, fcntl returns a value that depends on *cmd*:

A read lock prevents any process from write locking the protected area. More than one read lock may exist for a given segment of a file at a given time. The file descriptor on which a read lock is being placed must have been opened with read access.

A write lock prevents any process from read locking or write locking the protected area. Only one write lock and no read locks may exist for a given segment of a file at a given time. The file descriptor on which a write lock is being placed must have been opened with write access.

The `flock` structure describes the type (`l_type`), starting offset (`l_whence`), relative offset (`l_start`), size (`l_len`), process ID (`l_pid`), and system ID (`l_sysid`) of the segment of the file to be affected. The process ID and system ID fields are used only with the `F_GETLK` *cmd* to return the values for a blocking lock. Locks may start and extend beyond the current end of a file, but may not be negative relative to the beginning of the file. A lock may be set to always extend to the end of file by setting `l_len` to 0. If such a lock also has `l_whence` and `l_start` set to 0, the whole file will be locked. Changing or unlocking a segment from the middle of a larger locked segment leaves two smaller segments at either end. Locking a segment that is already locked by the calling process causes the old lock type to be removed and the new lock type to take effect. All locks associated with a file for a given process are removed when a file descriptor for that file is closed by that process or the process holding that file descriptor terminates. Locks are not inherited by a child process in a `fork(2)` system call.

When mandatory file and record locking is active on a file [see `chmod(2)`], `creat(2)`, `open(2)`, `read(2)` and `write(2)` system calls issued on the file will be affected by the record locks in effect.

`fcntl` will fail if one or more of the following are true:

| | |
|--------|--|
| EACCES | <i>cmd</i> is <code>F_SETLK</code> , the type of lock (<code>l_type</code>) is a read lock (<code>F_RDLCK</code>) and the segment of a file to be locked is already write locked by another process, or the type is a write lock (<code>F_WRLCK</code>) and the segment of a file to be locked is already read or write locked by another process. |
| EAGAIN | <i>cmd</i> is <code>F_FREESP</code> , the file exists, mandatory file/record locking is set, and there are outstanding record locks on the file. |
| EAGAIN | <i>cmd</i> is <code>F_SETLK</code> or <code>F_SETLKW</code> and the file is currently being mapped to virtual memory via <code>mmap</code> [see <code>mmap(2)</code>]. |
| EBADF | <i>fildev</i> is not a valid open file descriptor. |
| EBADF | <i>cmd</i> is <code>F_SETLK</code> or <code>F_SETLKW</code> , the type of lock (<code>l_type</code>) is a read lock (<code>F_RDLCK</code>), and <i>fildev</i> is not a valid file descriptor open for reading. |
| EBADF | <i>cmd</i> is <code>F_SETLK</code> or <code>F_SETLKW</code> , the type of lock (<code>l_type</code>) is a write lock (<code>F_WRLCK</code>), and <i>fildev</i> is not a valid file descriptor open for writing. |
| EBADF | <i>cmd</i> is <code>F_FREESP</code> , and <i>fildev</i> is not a valid file descriptor open for writing. |

F_GETTOWN (M88000 only)

The argument is ignored. Return the `int` value that is the process ID or the process-group ID that is receiving `SIGIO` or `SIGURG` signals for the socket referred to by the descriptor passed to `fcntl`. This is identical to the `ioctl` commands `FIOGETOWN` and `STIOCGPRP`.

F_FREESP Free storage space associated with a section of the ordinary file *files*. The section is specified by a variable of data type `struct flock` pointed to by the third argument *arg*. The data type `struct flock` is defined in the `<fcntl.h>` header file [see `fcntl(5)`] and contains the following members: `l_whence` is 0, 1, or 2 to indicate that the relative offset `l_start` will be measured from the start of the file, the current position, or the end of the file, respectively. `l_start` is the offset from the position specified in `l_whence`. `l_len` is the size of the section. An `l_len` of 0 frees up to the end of the file; in this case, the end of file (i.e., file size) is set to the beginning of the section freed. Any data previously written into this section is no longer accessible.

The following commands are used for record-locking. Locks may be placed on an entire file or on segments of a file.

F_SETLK Set or clear a file segment lock according to the `flock` structure that *arg* points to [see `fcntl(5)`]. The *cmd* `F_SETLK` is used to establish read (`F_RDLCK`) and write (`F_WRLCK`) locks, as well as remove either type of lock (`F_UNLCK`). If a read or write lock cannot be set, `fcntl` will return immediately with an error value of -1.

F_SETLKW This *cmd* is the same as `F_SETLK` except that if a read or write lock is blocked by other locks, `fcntl` will block until the segment is free to be locked.

F_GETLK If the lock request described by the `flock` structure that *arg* points to could be created, then the structure is passed back unchanged except that the lock type is set to `F_UNLCK` and the `l_whence` field will be set to `SEEK_SET`.

If a lock is found that would prevent this lock from being created, then the structure is overwritten with a description of the first lock that is preventing such a lock from being created. The structure also contains the process ID and the system ID of the process holding the lock.

This command never creates a lock; it tests whether a particular lock could be created.

F_RSETLK Used by the network lock daemon, `lockd(3N)`, to communicate with the NFS server kernel to handle locks on NFS files.

F_RSETLKW Used by the network lock daemon, `lockd(3N)`, to communicate with the NFS server kernel to handle locks on NFS files.

F_RGETLK Used by the network lock daemon, `lockd(3N)`, to communicate with the NFS server kernel to handle locks on NFS files.

NAME

fcntl - file control

SYNOPSIS

```
#include <sys/types.h>
#include <fcntl.h>
#include <unistd.h>

int fcntl (int fildes, int cmd, . . . /* arg */);
```

DESCRIPTION

fcntl provides for control over open files. *fildes* is an open file descriptor [see intro(2)].

fcntl may take a third argument, *arg*, whose data type, value and use depend upon the value of *cmd*. *cmd* specifies the operation to be performed by fcntl and may be one of the following:

- | | |
|------------------------|--|
| F_DUPFD | Return a new file descriptor with the following characteristics: Lowest numbered available file descriptor greater than or equal to the integer value given as the third argument. Same open file (or pipe) as the original file. Same file pointer as the original file (that is, both file descriptors share one file pointer). Same access mode (read, write, or read/write) as the original file. Shares any locks associated with the original file descriptor. Same file status flags (that is, both file descriptors share the same file status flags) as the original file. The close-on-exec flag [see F_GETFD] associated with the new file descriptor is set to remain open across exec(2) system calls. |
| F_GETFD | Get the close-on-exec flag associated with <i>fildes</i> . If the low-order bit is 0, the file will remain open across exec. Otherwise, the file will be closed upon execution of exec. |
| F_SETFD | Set the close-on-exec flag associated with <i>fildes</i> to the low-order bit of the integer value given as the third argument (0 or 1 as above). |
| F_GETFL | Get <i>fildes</i> status flags. |
| F_SETFL | Set <i>fildes</i> status flags to the integer value given as the third argument. Only certain flags can be set [see fcntl(5)]. |
| F_SETOWN (M88000 only) | The argument is an int that if greater than zero refers to a process ID and if less than zero refers to a process-group ID which is the absolute value of the argument. Set the process or process-group ID that will subsequently receive SIGIO or SIGURG signals for the socket referred to by the descriptor passed to fcntl to the value of that int. This is identical to the ioctl commands FIOSETOWN and SIOCSGRP. |

NAME

fclose, fflush - close or flush a stream

SYNOPSIS

```
#include <stdio.h>
int fclose (FILE *stream);
int fflush (FILE *stream);
```

DESCRIPTION

fclose causes any buffered data waiting to be written for the named *stream* [see intro(3)] to be written out, and the *stream* to be closed. If the underlying file pointer is not already at end of file, and the file is one capable of seeking, the file pointer is adjusted so that the next operation on the open file pointer deals with the byte after the last one read from or written to the file being closed.

fclose is performed automatically for all open files upon calling `exit`.

If *stream* points to an output stream or an update stream on which the most recent operation was not input, fflush causes any buffered data waiting to be written for the named *stream* to be written to that file. Any unread data buffered in *stream* is discarded. The *stream* remains open. If *stream* is open for reading, the underlying file pointer is not already at end of file, and the file is one capable of seeking, the file pointer is adjusted so that the next operation on the open file pointer deals with the byte after the last one read from or written to the stream.

When calling fflush, if *stream* is a null pointer, all files open for writing are flushed.

SEE ALSO

close(2), exit(2), intro(3), fopen(3S), setbuf(3S), stdio(3S)

DIAGNOSTICS

Upon successful completion these functions return a value of zero. Otherwise EOF is returned.

NAME

`fattach` - attach a STREAMS-based file descriptor to an object in the file system name space

SYNOPSIS

```
int fattach(int fildes, const char *path);
```

DESCRIPTION

The `fattach` routine attaches a STREAMS-based file descriptor to an object in the file system name space, effectively associating a name with *fildes*. *fildes* must be a valid open file descriptor representing a STREAMS file. *path* is a path name of an existing object and the user must have appropriate privileges or be the owner of the file and have write permissions. All subsequent operations on *path* will operate on the STREAMS file until the STREAMS file is detached from the node. *fildes* can be attached to more than one *path*, that is, a stream can have several names associated with it.

The attributes of the named stream [see `stat(2)`], are initialized as follows: the permissions, user ID, group ID, and times are set to those of *path*, the number of links is set to 1, and the size and device identifier are set to those of the streams device associated with *fildes*. If any attributes of the named stream are subsequently changed [e.g., `chmod(2)`], the attributes of the underlying object are not affected.

RETURN VALUE

If successful, `fattach` returns 0; otherwise it returns -1 and sets `errno` to indicate an error.

ERRORS

Under the following conditions, the function `fattach` fails and sets `errno` to:

| | |
|--------------|---|
| EACCES | The user is the owner of <i>path</i> but does not have write permissions on <i>path</i> or <i>fildes</i> is locked. |
| EBADF | <i>fildes</i> is not a valid open file descriptor. |
| ENOENT | <i>path</i> does not exist. |
| ENOTDIR | A component of a path prefix is not a directory. |
| EINVAL | <i>fildes</i> does not represent a STREAMS file. |
| EPERM | The effective user ID is not the owner of <i>path</i> or a user with the appropriate privileges. |
| EBUSY | <i>path</i> is currently a mount point or has a STREAMS file descriptor attached it. |
| ENAMETOOLONG | The size of <i>path</i> exceeds <code>{PATH_MAX}</code> , or the component of a path name is longer than <code>{NAME_MAX}</code> while <code>{_POSIX_NO_TRUNC}</code> is in effect. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EREMOTE | <i>path</i> is a file in a remotely mounted directory. |

SEE ALSO

`fdetach(1M)`, `fdetach(3C)`, `isastream(3C)`, `streamio(7)`.

`sqrt` and `sqrtf` return 0 and set `errno` to `EDOM` when x is negative. A message indicating `DOMAIN` error is printed on the standard error output.

Except when the `-Xc` compilation option is used, these error-handling procedures may be changed with the function `matherr`. When the `-Xa` or `-Xc` compilation options are used, `HUGE_VAL` is returned instead of `HUGE` and no error messages are printed. In the `-Xc` compilation mode, `pow` and `powf` return 1, setting `errno` to `EDOM`, when both x and y are 0; in the `-Xa` compilation mode, `pow` and `powf` return 0, setting `errno` to `EDOM`; when x is 0 and y is negative, they return `-HUGE_VAL` and set `errno` to `EDOM`. Under `-Xc`, `log` and `logf` return `-HUGE_VAL` and set `errno` to `ERANGE` when x is 0. Under `-Xc`, `sqrt` and `sqrtf` return `NaN` when x is negative.

NAME

exp, expf, cbrt, log, logf, log10, log10f, pow, powf, sqrt, sqrtf - exponential, logarithm, power, square root functions

SYNOPSIS

```
cc [flag ...] file ... -lm [library ...]
cc -O -Ksd [flag ...] file ... -J sfm [library ...]
#include <math.h>
double exp (double x);
float expf (float x);
double cbrt (double x);
double log (double x);
float logf (float x);
double log10 (double x);
float log10f (float x);
double pow (double x, double y);
float powf (float x, float y);
double sqrt (double x);
float sqrtf (float x);
```

DESCRIPTION

exp and expf return e^x .

cbrt returns the cube root of x .

log and logf return the natural logarithm of x . The value of x must be positive.

log10 and log10f return the base ten logarithm of x . The value of x must be positive.

pow and powf return x^y . If x is 0, y must be positive. If x is negative, y must be an integer.

sqrt and sqrtf return the non-negative square root of x . The value of x may not be negative.

SEE ALSO

hypot(3M), matherr(3M), sinh(3M)

DIAGNOSTICS

exp and expf return HUGE when the correct value would overflow, or 0 when the correct value would underflow, and set errno to ERANGE.

log, logf, log10, and log10f return -HUGE and set errno to EDOM when x is non-positive. A message indicating DOMAIN error is printed on standard error.

pow and powf return 0 and set errno to EDOM when x is 0 and y is non-positive, or when x is negative and y is not an integer. In these cases, a message indicating DOMAIN error is printed on standard error. When the correct value for pow or powf would overflow or underflow, these functions return \pm HUGE or 0, respectively, and set errno to ERANGE.

exit(2)

exit(2)

The symbols `EXIT_SUCCESS` and `EXIT_FAILURE` are defined in `stdlib.h` and may be used as the value of *status* to indicate successful or unsuccessful termination, respectively.

SEE ALSO

`acct(2)`, `intro(2)`, `plock(2)`, `semop(2)`, `sigaction(2)`, `signal(2)`, `times(2)`, `wait(2)`, `atexit(3C)`

NOTES

See `signal(2)` NOTES.

NAME

exit, _exit - terminate process

SYNOPSIS

```
#include <stdlib.h>
void exit(int status);
#include <unistd.h>
void _exit(int status);
```

DESCRIPTION

`_exit` terminates the calling process with the following consequences:

All of the file descriptors, directory streams and message catalogue descriptors open in the calling process are closed.

A `SIGCHLD` signal is sent to the calling process's parent process.

If the parent process of the calling process has not specified the `SA_NOCLDWAIT` flag [see `sigaction(2)`], the calling process is transformed into a "zombie process." A zombie process is a process that only occupies a slot in the process table. It has no other space allocated either in user or kernel space. The process table slot that it occupies is partially overlaid with time accounting information [see `<sys/proc.h>`] to be used by the `times` system call.

The parent process ID of all of the calling process's existing child processes and zombie processes is set to 1. This means the initialization process [see `intro(2)`] inherits each of these processes.

Each attached shared memory segment is detached and the value of `shm_nattach` in the data structure associated with its shared memory identifier is decremented by 1.

For each semaphore for which the calling process has set a `semadj` value [see `semop(2)`], that `semadj` value is added to the `semval` of the specified semaphore.

If the process has a process, text, or data lock, an *unlock* is performed [see `plock(2)`].

An accounting record is written on the accounting file if the system's accounting routine is enabled [see `acct(2)`].

If the process is a controlling process, `SIGHUP` is sent to the foreground process group of its controlling terminal and its controlling terminal is deallocated.

If the calling process has any stopped children whose process group will be orphaned when the calling process exits, or if the calling process is a member of a process group that will be orphaned when the calling process exits, that process group will be sent `SIGHUP` and `SIGCONT` signals.

The C function `exit(3C)` calls any functions registered through the `atexit` function in the reverse order of their registration. The function `_exit` circumvents all such functions and cleanup.

exec(2)

exec(2)

| | |
|---------|--|
| ENOENT | One or more components of the new process path name of the file do not exist or is a null pathname. |
| ENOTDIR | A component of the new process path of the file prefix is not a directory. |
| ENOEXEC | The <code>exec</code> is not an <code>execlp</code> or <code>execvp</code> , and the new process file has the appropriate access permission but an invalid magic number in its header. |
| ETXTBSY | The new process file is a pure procedure (shared text) file that is currently open for writing by some process. |
| ENOMEM | The new process requires more memory than is allowed by the system-imposed maximum <code>MAXMEM</code> . |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |

SEE ALSO

`ps(1)`, `sh(1)`, `alarm(2)`, `exit(2)`, `fcntl(2)`, `fork(2)`, `getrlimit(2)`, `nice(2)`, `prctl(2)`, `ptrace(2)`, `semop(2)`, `signal(2)`, `sigpending(2)`, `sigprocmask(2)`, `times(2)`, `umask(2)`, `lockf(3C)`, `system(3S)`, `a.out(4)`, `environ(5)`.

DIAGNOSTICS

If `exec` returns to the calling process, an error has occurred; the return value is `-1` and `errno` is set to indicate the error.

time left until an alarm clock signal [see `alarm(2)`]
 current working directory
 root directory
 file mode creation mask [see `umask(2)`]
 resource limits [see `getrlimit(2)`]
`utime`, `stime`, `cutime`, and `cstime` [see `times(2)`]
 file-locks [see `fcntl(2)` and `lockf(3C)`]
 controlling terminal
 process signal mask [see `sigprocmask(2)`]
 pending signals [see `sigpending(2)`]

Upon successful completion, `exec` marks for update the `st_atime` field of the file. Should the `exec` succeed, the process image file is considered to have been `open()`-ed. The corresponding `close()` is considered to occur at a time after this open, but before process termination or successful completion of a subsequent call to `exec`.

`exec` will fail and return to the calling process if one or more of the following are true:

| | |
|--------------|--|
| EACCES | Search permission is denied for a directory listed in the new process file's path prefix. |
| E2BIG | The number of bytes in the new process's argument list is greater than the system-imposed limit. In order to determine the system-imposed limit, see the <code>sysconf(3C)</code> manual page for further information. |
| EACCES | The new process file is not an ordinary file. |
| EACCES | The new process file mode denies execution permission. |
| EAGAIN | Total amount of system memory available when reading via raw I/O is temporarily insufficient. |
| EFAULT | Required hardware is not present. |
| EFAULT | An <i>a.out</i> that was compiled with the MAU or 32B flag is running on a machine without a MAU or 32B. |
| EFAULT | An argument points to an illegal address. |
| EINTR | A signal was caught during the <code>exec</code> system call. |
| ELIBACC | Required shared library does not have execute permission. |
| ELIBEXEC | Trying to <code>exec(2)</code> a shared library directly. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> or <i>file</i> . |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and the file system type does not allow it. |
| ENAMETOOLONG | The length of the <i>file</i> or <i>path</i> argument exceeds <code>{PATH_MAX}</code> , or the length of a <i>file</i> or <i>path</i> component exceeds <code>{NAME_MAX}</code> while <code>_POSIX_NO_TRUNC</code> is in effect. |

The arguments *arg0*, . . . , *argn* point to null-terminated character strings. These strings constitute the argument list available to the new process image. Minimally, *arg0* must be present. It will become the name of the process, as displayed by the `ps` command. Conventionally, *arg0* points to a string that is the same as *path* (or the last component of *path*). The list of argument strings is terminated by a `(char *)0` argument.

argv is an array of character pointers to null-terminated strings. These strings constitute the argument list available to the new process image. By convention, *argv* must have at least one member, and it should point to a string that is the same as *path* (or its last component). *argv* is terminated by a null pointer.

envp is an array of character pointers to null-terminated strings. These strings constitute the environment for the new process image. *envp* is terminated by a null pointer. For `execl`, `execv`, `execvp`, and `execlp`, the C run-time start-off routine places a pointer to the environment of the calling process in the global object `extern char **environ`, and it is used to pass the environment of the calling process to the new process.

File descriptors open in the calling process remain open in the new process, except for those whose close-on-exec flag is set; [see `fcntl(2)`]. For those file descriptors that remain open, the file pointer is unchanged.

Signals that are being caught by the calling process are set to the default disposition in the new process image [see `signal(2)`]. Otherwise, the new process image inherits the signal dispositions of the calling process.

If the set-user-ID mode bit of the new process file is set [see `chmod(2)`], `exec` sets the effective user ID of the new process to the owner ID of the new process file. Similarly, if the set-group-ID mode bit of the new process file is set, the effective group ID of the new process is set to the group ID of the new process file. The real user ID and real group ID of the new process remain the same as those of the calling process.

If the effective user-ID is `root` or `super-user`, the set-user-ID and set-group-ID bits will be honored when the process is being controlled by `ptrace`.

The shared memory segments attached to the calling process will not be attached to the new process [see `shmop(2)`].

Profiling is disabled for the new process; see `profil(2)`.

The new process also inherits the following attributes from the calling process:

- nice value [see `nice(2)`]
- scheduler class and priority [see `prctl(2)`]
- process ID
- parent process ID
- process group ID
- supplementary group IDs
- `semadj` values [see `semop(2)`]
- session ID [see `exit(2)` and `signal(2)`]
- trace flag [see `ptrace(2)` request 0]

NAME

exec: execl, execv, execl, execve, execlp, execvp - execute a file

SYNOPSIS

```
#include <unistd.h>

int execl (const char *path, const char *arg0, ..., const char
          *argn, (char *)0);

int execv (const char *path, char *const *argv);

int execl (const char *path, const char *arg0, ..., const char
          *argn, (char *)0, const char *envp[]);

int execve (const char *path, char *const *argv, char *const
          *envp);

int execlp (const char *file, const char *arg0, ..., const char
          *argn, (char *)0);

int execvp (const char *file, char *const *argv);
```

DESCRIPTION

exec in all its forms overlays a new process image on an old process. The new process image is constructed from an ordinary, executable file. This file is either an executable object file, or a file of data for an interpreter. There can be no return from a successful exec because the calling process image is overlaid by the new process image.

An interpreter file begins with a line of the form

```
#! pathname [arg]
```

where *pathname* is the path of the interpreter, and *arg* is an optional argument. When an interpreter file is exec'd, the system execs the specified interpreter. The *pathname* specified in the interpreter file is passed as *arg0* to the interpreter. If *arg* was specified in the interpreter file, it is passed as *arg1* to the interpreter. The remaining arguments to the interpreter are *arg0* through *argn* of the originally exec'd file.

When a C program is executed, it is called as follows:

```
int main (int argc, char *argv[], char *envp[]);
```

where *argc* is the argument count, *argv* is an array of character pointers to the arguments themselves, and *envp* is an array of character pointers to the environment strings. As indicated, *argc* is at least one, and the first member of the array points to a string containing the name of the file.

path points to a path name that identifies the new process file.

file points to the new process file. If *file* does not contain a slash character, the path prefix for this file is obtained by a search of the directories passed in the `PATH` environment variable [see `environ(5)`]. The environment is supplied typically by the shell [see `sh(1)`].

If the new process file is not an executable object file, `execlp` and `execvp` use the contents of that file as standard input to `sh(1)`.

eucioctl(5)

eucioctl(5)

| | |
|------------|--|
| EUC_MREST | If a mode was saved via a previous EUC_MSAVE call, the saved mode is restored, and the "saved state" flag is cleared. If the mode was not previously saved, this call has no effect. (The exact semantics are somewhat dependent on the module, since some modules may respond to specific user-requests to switch modes, even while a mode is being saved via EUC_MSAVE.) |
| EUC_IXLOFF | If a module is currently in a state where "input conversion" is being performed on the incoming byte stream, then input conversion is turned off, and the module's "mode" status is saved. If no input conversion is being performed, there is no effect on the module. The purpose of this call is to provide a way of insuring a "pure" byte stream to the program. The byte stream while input conversion is off is, of course, not guaranteed to be a stream of EUC characters. Turning off input conversion is roughly equivalent to the old concept of "raw" mode, if used in conjunction with ICANON off. It should normally not be used by applications. |
| EUC_IXLON | If a module previously saved its state and turned off input conversion, then input conversion is restored (i.e., turned back on); otherwise, there is no effect. |
| EUC_OXLOFF | In a manner similar to EUC_IXLOFF, any "output conversion" is turned off, and the current mode status saved. |
| EUC_OXLON | In a manner similar to EUC_IXLON, any saved "output conversion" status is restored (i.e., output conversion is turned back on if previously turned off via EUC_OXLOFF). |

LIMITATIONS

Drivers and modules that support EUC should all respond appropriately to these calls, depending on their type. Line disciplines must respond to EUC_WSET and EUC_WGET, changing their current codeset sizes to match EUC_WSET requests. All TTY STREAMS modules that do any input or output conversion should recognize the other calls; modules that do no codeset conversion are not required to recognize the calls, but *must* pass them through. Drivers that support EUC TTY STREAMS must all acknowledge the ON/OFF calls, whether the drivers themselves are affected or not, since these calls are purposely *not* acknowledged by modules which receive them; they are intended to be made available for affecting all modules in *the whole STREAM*.

NOTES

Adherence to this protocol for all EUC handling modules is strongly encouraged in order to increase portability and language-independence of applications. These calls are intended as a small set of primitives to help reduce an anticipated plethora of module- and language-dependent operations.

FILES

/usr/include/sys/eucioctl.h

SEE ALSO

eucset(1).

NAME

eucioctl - generic interface to EUC handling TTY drivers and modules

SYNOPSIS

```
#include <sys/eucioctl.h>

ioctl(int fd, I_STR, struct strioctl *sb);
```

DESCRIPTION

This interface is implemented in TTY drivers and pushable *STREAMS* modules that handle EUC codes. It is intended as a generic interface for EUC handling, to eliminate an explosion of "module specific" *ioctl* calls that would otherwise be necessary, and to provide uniformity in dealing with EUC codesets in the TTY subsystem.

Several calls are defined. The first two calls take an argument, which is expected to be a pointer to an *eucioc* structure, defined in the header file `<sys/eucioctl.h>`:

```
struct eucioc {
    unsigned char eucw[4];
    unsigned char scrw[4];
};
typedef struct eucioc eucioc_t;
```

In all cases, these calls return non-zero on failure. Failure should be usually taken as an indication that the current driver, or line discipline module, does not support EUC in which case *errno* will be set to `EINVAL`. For the `EUC_WSET` and `EUC_WGET` calls *errno* will be set to `EPROTO` if the *struct eucioc* argument is invalid.

`EUC_WSET` This call takes a pointer to an *eucioc* structure, and uses it to set the EUC line discipline's local definition for the codeset widths to be used for subsequent operations. Within the *STREAM*, the line discipline may optionally notify other modules of this setting via `M_CTL` messages.

`EUC_WGET` This call takes a pointer to an *eucioc* structure, and returns in it the EUC codeset widths currently in use by the EUC line discipline. It need be recognized *only* by line discipline modules.

The following calls take no arguments. They should only fail if the driver (at the bottom of the TTY *STREAM*) does not recognize EUC codes. Drivers that support EUC, whether the *STREAM* contains modules that respond to the calls or not, will *recognize* the calls and acknowledge them. These calls are normally only *interpreted* by modules that have modes other than ASCII, and/or do some form of I/O conversion that normally prevents a program from receiving non-EUC characters in its byte stream. All of these calls, when received by modules, are passed down the TTY *STREAM*, to be ultimately acknowledged by the TTY driver.

`EUC_MSAVE` This call has no effect on modules that are currently in ASCII mode. Otherwise (i.e., for modules *not* in ASCII mode), the following actions are taken by all modules that recognize this call: (1) the current "mode" status is saved, (2) the mode is changed to ASCII mode immediately.

NAME

ethers - Ethernet address mapping operations

SYNOPSIS

```
#include <sys/types.h>
#include <sys/socket.h>
#include <net/if.h>
#include <netinet/in.h>
#include <netinet/if_ether.h>

char *ether_ntoa(struct ether_addr *e);

struct ether_addr *ether_aton(char *s);

int ether_ntohost(char *hostname, struct ether_addr *e);

int ether_hostton(char *hostname, struct ether_addr *e);

int ether_line(char *l, struct ether_addr *e, char *hostname);
```

DESCRIPTION

These routines are useful for mapping 48 bit Ethernet numbers to their ASCII representations or their corresponding host names, and vice versa.

The function `ether_ntoa` converts a 48 bit Ethernet number pointed to by `e` to its standard ASCII representation; it returns a pointer to the ASCII string. The representation is of the form `x:x:x:x:x` where `x` is a hexadecimal number between 0 and ff. The function `ether_aton` converts an ASCII string in the standard representation back to a 48 bit Ethernet number; the function returns `NULL` if the string cannot be scanned successfully.

The function `ether_ntohost` maps an Ethernet number (pointed to by `e`) to its associated hostname. The string pointed to by `hostname` must be long enough to hold the hostname and a `NULL` character. The function returns zero upon success and non-zero upon failure. Inversely, the function `ether_hostton` maps a hostname string to its corresponding Ethernet number; the function modifies the Ethernet number pointed to by `e`. The function also returns zero upon success and non-zero upon failure. The function `ether_line` scans a line (pointed to by `l`) and sets the hostname and the Ethernet number (pointed to by `e`). The string pointed to by `hostname` must be long enough to hold the hostname and a `NULL` character. The function returns zero upon success and non-zero upon failure. The format of the scanned line is described by `ethers(4)`.

FILES

/etc/ethers

SEE ALSO

`ethers(4)`

NAME

erf, erfc - error function and complementary error function

SYNOPSIS

```
cc [flag ...] file ... -lm [library ...]
#include <math.h>
double erf (double x);
double erfc (double x);
```

DESCRIPTION

erf returns the error function of x , defined as

$$\frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$$

erfc, which returns $1.0 - \text{erf}(x)$, is provided because of the extreme loss of relative accuracy if erf(x) is called for large x and the result subtracted from 1.0 (for example, for $x = 5$, 12 places are lost).

SEE ALSO

exp(3M)

NAME

end, etext, edata - last locations in program

SYNOPSIS

```
extern etext;  
extern edata;  
extern end;
```

DESCRIPTION

These names refer neither to routines nor to locations with interesting contents; only their addresses are meaningful.

`etext` The address of `etext` is the first address above the program text.

`edata` The address of `edata` is the first address above the initialized data region.

`end` The address of `end` is the first address above the uninitialized data region.

SEE ALSO

`cc(1)`, `brk(2)`, `malloc(3C)`, `stdio(3S)`

NOTE

When execution begins, the program break (the first location beyond the data) coincides with `end`, but the program break may be reset by the routines `brk`, `malloc`, the standard input/output library [see `stdio(3S)`], by the profile (`-p`) option of `cc`, and so on. Thus, the current value of the program break should be determined by `sbrk (0)` [see `brk(2)`].

| Elf_Type | 32-Bit Memory Type |
|-------------|--------------------|
| ELF_T_ADDR | Elf32_Addr |
| ELF_T_BYTE | unsigned char |
| ELF_T_DYN | Elf32_Dyn |
| ELF_T_EHDR | Elf32_Ehdr |
| ELF_T_HALF | Elf32_Half |
| ELF_T_OFF | Elf32_Off |
| ELF_T_PHDR | Elf32_Phdr |
| ELF_T_REL | Elf32_Rel |
| ELF_T_RELA | Elf32_Rela |
| ELF_T_SHDR | Elf32_Shdr |
| ELF_T_SWORD | Elf32_Sword |
| ELF_T_SYM | Elf32_Sym |
| ELF_T_WORD | Elf32_Word |

“Translating” buffers of type `ELF_T_BYTE` does not change the byte order.

SEE ALSO

`elf(3E)`, `elf_fsize(3E)`, `elf_getdata(3E)`, `elf_getident(3E)`

NAME

elf_xlate:elf32_xlatetof,elf32_xlatetom - class-dependent data translation

SYNOPSIS

```
cc [flag ...]file ... -lelf [library ...]
#include <libelf.h>

Elf_Data *elf32_xlatetof(Elf_Data *dst, const Elf_Data *src,
    unsigned encode);

Elf_Data *elf32_xlatetom(Elf_Data *dst, const Elf_Data *src,
    unsigned encode);
```

DESCRIPTION

elf32_xlatetom translates various data structures from their 32-bit class file representations to their memory representations; elf32_xlatetof provides the inverse. This conversion is particularly important for cross development environments. *src* is a pointer to the source buffer that holds the original data; *dst* is a pointer to a destination buffer that will hold the translated copy. *encode* gives the byte encoding in which the file objects are (to be) represented and must have one of the encoding values defined for the ELF header's *e_ident[EI_DATA]* entry [see elf_getident(3E)]. If the data can be translated, the functions return *dst*. Otherwise, they return null because an error occurred, such as incompatible types, destination buffer overflow, etc.

elf_getdata(3E) describes the Elf_Data descriptor, which the translation routines use as follows.

| | |
|------------------|---|
| <i>d_buf</i> | Both the source and destination must have valid buffer pointers. |
| <i>d_type</i> | This member's value specifies the type of the data to which <i>d_buf</i> points and the type of data to be created in the destination. The program supplies a <i>d_type</i> value in the source; the library sets the destination's <i>d_type</i> to the same value. These values are summarized below. |
| <i>d_size</i> | This member holds the total size, in bytes, of the memory occupied by the source data and the size allocated for the destination data. If the destination buffer is not large enough, the routines do not change its original contents. The translation routines reset the destination's <i>d_size</i> member to the actual size required, after the translation occurs. The source and destination sizes may differ. |
| <i>d_version</i> | This member holds version number of the objects (desired) in the buffer. The source and destination versions are independent. |

Translation routines allow the source and destination buffers to coincide. That is, *dst->d_buf* may equal *src->d_buf*. Other cases where the source and destination buffers overlap give undefined behavior.

NAME

elf_version - coordinate ELF library and application versions

SYNOPSIS

```
cc [flag ...] file ... -lelf [library ...]
#include <libelf.h>
unsigned elf_version(unsigned ver);
```

DESCRIPTION

As elf(3E) explains, the program, the library, and an object file have independent notions of the "latest" ELF version. `elf_version` lets a program determine the ELF library's *internal version*. It further lets the program specify what memory types it uses by giving its own *working version*, `ver`, to the library. Every program that uses the ELF library must coordinate versions as described below.

The header file `libelf.h` supplies the version to the program with the macro `EV_CURRENT`. If the library's internal version (the highest version known to the library) is lower than that known by the program itself, the library may lack semantic knowledge assumed by the program. Accordingly, `elf_version` will not accept a working version unknown to the library.

Passing `ver` equal to `EV_NONE` causes `elf_version` to return the library's internal version, without altering the working version. If `ver` is a version known to the library, `elf_version` returns the previous (or initial) working version number. Otherwise, the working version remains unchanged and `elf_version` returns `EV_NONE`.

EXAMPLE

The following excerpt from an application program protects itself from using an older library.

```
if (elf_version(EV_CURRENT) == EV_NONE)
{
    /* library out of date */
    /* recover from error */
}
```

NOTES

The working version should be the same for all operations on a particular elf descriptor. Changing the version between operations on a descriptor will probably not give the expected results.

SEE ALSO

elf(3E), elf_begin(3E), elf_xlate(3E)

| | Member | Notes |
|-----------------|-----------|--|
| Data Descriptor | d_buf | Only when <code>ELF_F_LAYOUT</code> asserted |
| | d_type | |
| | d_size | |
| | d_off | |
| | d_align | |
| | d_version | |

Note the program is responsible for two particularly important members (among others) in the ELF header. The `e_version` member controls the version of data structures written to the file. If the version is `EV_NONE`, the library uses its own internal version. The `e_ident[EI_DATA]` entry controls the data encoding used in the file. As a special case, the value may be `ELFDATANONE` to request the native data encoding for the host machine. An error occurs in this case if the native encoding doesn't match a file encoding known by the library.

Further note that the program is responsible for the `sh_entsize` section header member. Although the library sets it for sections with known types, it cannot reliably know the correct value for all sections. Consequently, the library relies on the program to provide the values for unknown section type. If the entry size is unknown or not applicable, the value should be set to zero.

When deciding how to build the output file, `elf_update` obeys the alignments of individual data buffers to create output sections. A section's most strictly aligned data buffer controls the section's alignment. The library also inserts padding between buffers, as necessary, to ensure the proper alignment of each buffer.

SEE ALSO

`elf(3E)`, `elf_begin(3E)`, `elf_flag(3E)`, `elf_fsize(3E)`, `elf_getdata(3E)`, `elf_getehdr(3E)`, `elf_getshdr(3E)`, `elf_xlate(3E)`

NOTE

As mentioned above, the `ELF_C_WRITE` command translates data as necessary, before writing them to the file. This translation is not always transparent to the application program. If a program has obtained pointers to data associated with a file [for example, see `elf_getehdr(3E)` and `elf_getdata(3E)`], the program should reestablish the pointers after calling `elf_update`.

As `elf_begin(3E)` describes, a program may "update" a COFF file to make the image consistent for ELF. The `ELF_C_NULL` command updates only the memory image; one can use the `ELF_C_WRITE` command to modify the file as well. Absolute executable files (a.out files) require special alignment, which cannot normally be preserved between COFF and ELF. Consequently, one may not update an executable COFF file with the `ELF_C_WRITE` command (though `ELF_C_NULL` is allowed).

mknod may be invoked only by the privileged user for file types other than FIFO special.

mknod fails and creates no new file if one or more of the following are true:

| | |
|--------------|--|
| EEXIST | The named file exists. |
| EINVAL | Invalid <i>arg</i> value. |
| EFAULT | <i>path</i> points outside the allocated address space of the process. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines. |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds {PATH_MAX}, or the length of a <i>path</i> component exceeds {NAME_MAX} while {_POSIX_NO_TRUNC} is in effect. |
| ENOTDIR | A component of the path prefix is not a directory. |
| ENOENT | A component of the path prefix does not exist or is a null pathname. |
| EPERM | The effective user ID of the process is not super-user. |
| EROFS | The directory in which the file is to be created is located on a read-only file system. |
| ENOSPC | No space is available. |
| EINTR | A signal was caught during the mknod system call. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |

SEE ALSO

mkdir(1), creatsem(2), chmod(2), exec(2), sdget(2), umask(2), mkfifo(3C), fs(4), stat(5).

DIAGNOSTICS

Upon successful completion a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NOTES

If mknod creates a device in a remote directory using Remote File Sharing, the major and minor device numbers are interpreted by the server.

Semaphore files should be created with the `creatsem` system call. Shared data files should be created with the `sdget` system call.

NAME

mknod - make a directory, or a special or ordinary file

SYNOPSIS

```
#include <sys/types.h>
#include <osfcn.h>
#include <sys/stat.h>

int mknod (const char *path, mode_t mode, dev_t dev);
```

DESCRIPTION

mknod creates a new file named by the path name pointed to by *path*. The file type and permissions of the new file are initialized from *mode*.

The file type is specified in *mode* by the *S_IFMT* bits, which must be set to one of the following values:

| | |
|----------------|-------------------|
| <i>S_IFIFO</i> | fifo special |
| <i>S_IFCHR</i> | character special |
| <i>S_IFDIR</i> | directory |
| <i>S_IFBLK</i> | block special |
| <i>S_IFREG</i> | ordinary file |
| <i>S_IFNAM</i> | name special file |

The file access permissions are specified in *mode* by the 0007777 bits, and may be constructed by an OR of the following values:

| | | |
|----------------|-------|---|
| <i>S_ISUID</i> | 04000 | Set user ID on execution. |
| <i>S_ISGID</i> | 020#0 | Set group ID on execution if # is 7, 5, 3, or 1 Enable mandatory file/record locking if # is 6, 4, 2, or 0 |
| <i>S_ISVTX</i> | 01000 | Save text image after execution. |
| <i>S_IRUSR</i> | 00400 | Read by owner. |
| <i>S_IWUSR</i> | 00200 | Write by owner. |
| <i>S_IXUSR</i> | 00100 | Execute (search if a directory) by owner. |
| <i>S_IRWXG</i> | 00070 | Read, write, execute by group. |
| <i>S_IRGRP</i> | 00040 | Read by group. |
| <i>S_IWGRP</i> | 00020 | Write by group. |
| <i>S_IXGRP</i> | 00010 | Execute by group. |
| <i>S_IRWXO</i> | 00007 | Read, write, execute (search) by others. |
| <i>S_IROTH</i> | 00004 | Read by others. |
| <i>S_IWOTH</i> | 00002 | Write by others |
| <i>S_IXOTH</i> | 00001 | Execute by others. |

The owner ID of the file is set to the effective user ID of the process. The group ID of the file is set to the effective group ID of the process. However, if the *S_ISGID* bit is set in the parent directory, then the group ID of the file is inherited from the parent. If the group ID of the new file does not match the effective group ID or one of the supplementary group IDs, the *S_ISGID* bit is cleared.

Values of *mode* other than those above are undefined and should not be used. The access permission bits of *mode* are modified by the process's file mode creation mask: all bits set in the process's file mode creation mask are cleared [see *umask(2)*]. For block and character special files, *dev* is the special file's device number. For name special files, *dev* is the file type of the name file, either a XENIX shared data file or a XENIX semaphore. Otherwise, *dev* is ignored. See *mkdev(3C)*.

configuration-dependent specification of a character or block I/O device. If *mode* does not indicate a block special or character special device, *dev* is ignored.

mknod may be invoked only by a privileged user for file types other than FIFO special.

If *path* is a symbolic link, it is not followed.

mknod fails and creates no new file if one or more of the following are true:

| | |
|--------------|--|
| EEXIST | The named file exists. |
| EINVAL | <i>dev</i> is invalid. |
| EFAULT | <i>path</i> points outside the allocated address space of the process. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and the file system type does not allow it. |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds {PATH_MAX}, or the length of a <i>path</i> component exceeds {NAME_MAX} while _POSIX_NO_TRUNC is in effect. |
| ENOTDIR | A component of the path prefix is not a directory. |
| ENOENT | A component of the path prefix does not exist or is a null pathname. |
| EPERM | The effective user ID of the process is not super-user. |
| EROFS | The directory in which the file is to be created is located on a read-only file system. |
| ENOSPC | No space is available. |
| EINTR | A signal was caught during the mknod system call. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |

SEE ALSO

mkdir(1), chmod(2), exec(2), umask(2), makedev(3C), mkfifo(3C), fs(4), stat(5).

DIAGNOSTICS

Upon successful completion a value of 0 is returned. Otherwise, a value of -1 is returned and *errno* is set to indicate the error.

NOTES

If mknod creates a device in a remote directory using Remote File Sharing, the major and minor device numbers are interpreted by the server.

NAME

mknod - make a directory, or a special or ordinary file

SYNOPSIS

```
#include <sys/types.h>
#include <sys/stat.h>

int mknod(const char *path, mode_t mode, dev_t dev);
```

DESCRIPTION

mknod creates a new file named by the path name pointed to by *path*. The file type and permissions of the new file are initialized from *mode*.

The file type is specified in *mode* by the `S_IFMT` bits, which must be set to one of the following values:

| | |
|----------------------|-------------------|
| <code>S_IFIFO</code> | fifo special |
| <code>S_IFCHR</code> | character special |
| <code>S_IFDIR</code> | directory |
| <code>S_IFBLK</code> | block special |
| <code>S_IFREG</code> | ordinary file |
| <code>S_INSEM</code> | semaphore |
| <code>S_INSHD</code> | shared data |

The file access permissions are specified in *mode* by the `0007777` bits, and may be constructed by an OR of the following values:

| | | |
|----------------------|-------|---|
| <code>S_ISUID</code> | 04000 | Set user ID on execution. |
| <code>S_ISGID</code> | 020#0 | Set group ID on execution if # is 7, 5, 3, or 1 Enable mandatory file/record locking if # is 6, 4, 2, or 0 |
| <code>S_ISVTX</code> | 01000 | Save text image after execution. |
| <code>S_IRWXU</code> | 00700 | Read, write, execute by owner. |
| <code>S_IRUSR</code> | 00400 | Read by owner. |
| <code>S_IWUSR</code> | 00200 | Write by owner. |
| <code>S_IXUSR</code> | 00100 | Execute (search if a directory) by owner. |
| <code>S_IRWXG</code> | 00070 | Read, write, execute by group. |
| <code>S_IRGRP</code> | 00040 | Read by group. |
| <code>S_IWGRP</code> | 00020 | Write by group. |
| <code>S_IXGRP</code> | 00010 | Execute by group. |
| <code>S_IRWXO</code> | 00007 | Read, write, execute (search) by others. |
| <code>S_IROTH</code> | 00004 | Read by others. |
| <code>S_IWOTH</code> | 00002 | Write by others |
| <code>S_IXOTH</code> | 00001 | Execute by others. |

The owner ID of the file is set to the effective user ID of the process. The group ID of the file is set to the effective group ID of the process. However, if the `S_ISGID` bit is set in the parent directory, then the group ID of the file is inherited from the parent. If the group ID of the new file does not match the effective group ID or one of the supplementary group IDs, the `S_ISGID` bit is cleared.

The access permission bits of *mode* are modified by the process's file mode creation mask: all bits set in the process's file mode creation mask are cleared [see `umask(2)`]. If *mode* indicates a block or character special file, *dev* is a

NAME

mkfifo - create a new FIFO

SYNOPSIS

```
#include <sys/types.h>
#include <sys/stat.h>

int mkfifo (const char *path, mode_t mode);
```

DESCRIPTION

The `mkfifo` routine creates a new FIFO special file named by the pathname pointed to by *path*. The mode of the new FIFO is initialized from *mode*. The file permission bits of the *mode* argument are modified by the process's file creation mask [see `umask(2)`].

The FIFO's owner ID is set to the process's effective user ID. The FIFO's group ID is set to the process's effective group ID, or if the `S_ISGID` bit is set in the parent directory then the group ID of the FIFO is inherited from the parent.

`mkfifo` calls the system call `mknod` to make the file.

SEE ALSO

`mkdir(1)`, `chmod(2)`, `exec(2)`, `mknod(2)`, `umask(2)`, `fs(4)`, `stat(5)`.

DIAGNOSTICS

Upon successful completion a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NOTES

Bits other than the file permission bits in *mode* are ignored.

NAME

mkdirp, rmdirp - create, remove directories in a path

SYNOPSIS

```
cc [flag ...] file ... -lgen [library ...]
#include <libgen.h>
int mkdirp (const char *path, mode_t mode);
int rmdirp (char *d, char *d1);
```

DESCRIPTION

mkdirp creates all the missing directories in the given *path* with the given *mode*. [See chmod(2) for the values of *mode*.] The protection part of the *mode* argument is modified by the process's file creation mask [see umask(2)].

rmdirp removes directories in path *d*. This removal starts at the end of the path and moves back toward the root as far as possible. If an error occurs, the remaining path is stored in *d1*. rmdirp returns a 0 only if it is able to remove every directory in the path.

EXAMPLES

```
/* create scratch directories */
if(mkdirp("/tmp/sub1/sub2/sub3", 0755) == -1) {
    fprintf(stderr, "cannot create directory");
    exit(1);
}
chdir("/tmp/sub1/sub2/sub3");
.
.
.
/* cleanup */
chdir("/tmp");
rmdirp("sub1/sub2/sub3");
```

DIAGNOSTICS

If a needed directory cannot be created, mkdirp returns -1 and sets errno to one of the mkdir error numbers. If all the directories are created, or existed to begin with, it returns zero.

NOTES

mkdirp uses malloc to allocate temporary space for the string.

rmdirp returns -2 if a "." or ".." is in the path and -3 if an attempt is made to remove the current directory. If an error occurs other than one of the above, -1 is returned.

SEE ALSO

mkdir(2), rmdir(2), umask(2)

mkdir(2)

mkdir(2)

| | |
|---------|--|
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| ENOSPC | No free space is available on the device containing the directory. |
| ENOTDIR | A component of the path prefix is not a directory. |
| EROFS | The path prefix resides on a read-only file system. |

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned, and `errno` is set to indicate the error.

SEE ALSO

`chmod(2)`, `mknod(2)`, `umask(2)`, `stat(5)`

NAME

mkdir - make a directory

SYNOPSIS

```
#include <sys/types.h>
#include <sys/stat.h>

int mkdir(const char *path, mode_t mode);
```

DESCRIPTION

mkdir creates a new directory named by the path name pointed to by *path*. The mode of the new directory is initialized from *mode* [see [chmod\(2\)](#) for values of mode]. The protection part of the *mode* argument is modified by the process's file creation mask [see [umask\(2\)](#)].

The directory's owner ID is set to the process's effective user ID. The directory's group ID is set to the process's effective group ID, or if the `S_ISGID` bit is set in the parent directory, then the group ID of the directory is inherited from the parent. The `S_ISGID` bit of the new directory is inherited from the parent directory.

If *path* is a symbolic link, it is not followed.

The newly created directory is empty with the exception of entries for itself (.) and its parent directory (..).

Upon successful completion, mkdir marks for update the `st_atime`, `st_ctime` and `st_mtime` fields of the directory. Also, the `st_ctime` and `st_mtime` fields of the directory that contains the new entry are marked for update.

mkdir fails and creates no directory if one or more of the following are true:

| | |
|--------------|--|
| EACCES | Either a component of the path prefix denies search permission or write permission is denied on the parent directory of the directory to be created. |
| EEXIST | The named file already exists. |
| EFAULT | <i>path</i> points outside the allocated address space of the process. |
| EIO | An I/O error has occurred while accessing the file system. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMLINK | The maximum number of links to the parent directory would be exceeded. |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and the file system type does not allow it. |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds <code>{PATH_MAX}</code> , or the length of a <i>path</i> component exceeds <code>{NAME_MAX}</code> while <code>_POSIX_NO_TRUNC</code> is in effect. |
| ENOENT | A component of the path prefix does not exist or is a null pathname. |

NAME

mincore - determine residency of memory pages

SYNOPSIS

```
#include <unistd.h>
int mincore(caddr_t addr, size_t len, char *vec);
```

DESCRIPTION

mincore returns the primary memory residency status of pages in the address space covered by mappings in the range [*addr*, *addr* + *len*). The status is returned as a character-per-page in the character array referenced by *vec* (which the system assumes to be large enough to encompass all the pages in the address range). The least significant bit of each character is set to 1 to indicate that the referenced page is in primary memory, 0 if it is not. The settings of other bits in each character are undefined and may contain other information in future implementations.

mincore returns residency information that is accurate at an instant in time. Because the system may frequently adjust the set of pages in memory, this information may quickly be outdated. Only locked pages are guaranteed to remain in memory; see `memcntl(2)`.

RETURN VALUE

mincore returns 0 on success, -1 on failure.

ERRORS

mincore fails if:

| | |
|--------|--|
| EFAULT | <i>vec</i> includes an out-of-range or otherwise inaccessible address. |
| EINVAL | <i>addr</i> is not a multiple of the page size as returned by <code>sysconf(3C)</code> . |
| EINVAL | The argument <i>len</i> has a value less than or equal to 0. |
| ENOMEM | Addresses in the range [<i>addr</i> , <i>addr</i> + <i>len</i>) are invalid for the address space of a process, or specify one or more pages which are not mapped. |

SEE ALSO

`mlock(3C)`, `mmap(2)`, `sysconf(3C)`

menus(3X)

menus(3X)

| | |
|-------------------|--|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An incorrect argument was passed to the routine. |
| E_POSTED | - The menu is already posted. |
| E_CONNECTED | - One or more items are already connected to another menu. |
| E_BAD_STATE | - The routine was called from an initialization or termination function. |
| E_NO_ROOM | - The menu does not fit within its subwindow. |
| E_NOT_POSTED | - The menu has not been posted. |
| E_UNKNOWN_COMMAND | - An unknown request was passed to the menu driver. |
| E_NO_MATCH | - The character failed to match. |
| E_NOT_SELECTABLE | - The item cannot be selected. |
| E_NOT_CONNECTED | - No items are connected to the menu. |
| E_REQUEST_DENIED | - The menu driver could not process the request. |

NOTES

The header file `menu.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, and 3X pages whose names begin "menu_" for detailed routine descriptions

| menus Routine Name | Manual Page Name |
|--------------------|-----------------------|
| menu_driver | menu_driver(3X) |
| menu_fore | menu_attributes(3X) |
| menu_format | menu_format(3X) |
| menu_grey | menu_attributes(3X) |
| menu_init | menu_hook(3X) |
| menu_items | menu_items(3X) |
| menu_mark | menu_mark(3X) |
| menu_opts | menu_opts(3X) |
| menu_opts_off | menu_opts(3X) |
| menu_opts_on | menu_opts(3X) |
| menu_pad | menu_attributes(3X) |
| menu_pattern | menu_pattern(3X) |
| menu_sub | menu_win(3X) |
| menu_term | menu_hook(3X) |
| menu_userptr | menu_userptr(3X) |
| menu_win | menu_win(3X) |
| new_item | menu_item_new(3X) |
| new_menu | menu_new(3X) |
| pos_menu_cursor | menu_cursor(3X) |
| post_menu | menu_post(3X) |
| scale_menu | menu_win(3X) |
| set_current_item | menu_item_current(3X) |
| set_item_init | menu_hook(3X) |
| set_item_opts | menu_item_opts(3X) |
| set_item_term | menu_hook(3X) |
| set_item_userptr | menu_item_userptr(3X) |
| set_item_value | menu_item_value(3X) |
| set_menu_back | menu_attributes(3X) |
| set_menu_fore | menu_attributes(3X) |
| set_menu_format | menu_format(3X) |
| set_menu_grey | menu_attributes(3X) |
| set_menu_init | menu_hook(3X) |
| set_menu_items | menu_items(3X) |
| set_menu_mark | menu_mark(3X) |
| set_menu_opts | menu_opts(3X) |
| set_menu_pad | menu_attributes(3X) |
| set_menu_pattern | menu_pattern(3X) |
| set_menu_sub | menu_win(3X) |
| set_menu_term | menu_hook(3X) |
| set_menu_userptr | menu_userptr(3X) |
| set_menu_win | menu_win(3X) |
| set_top_row | menu_item_current(3X) |
| top_row | menu_item_current(3X) |
| unpost_menu | menu_post(3X) |

RETURN VALUE

Routines that return pointers always return NULL on error. Routines that return an integer return one of the following:

NAME

menus - character based menus package

SYNOPSIS

```
#include <menu.h>
```

DESCRIPTION

The menu library is built using the curses library, and any program using menus routines must call one of the curses initialization routines, such as initscr. A program using these routines must be compiled with -lmenu and -lcurses on the cc command line.

The menus package gives the applications programmer a terminal-independent method of creating and customizing menus for user interaction. The menus package includes: item routines, which are used to create and customize menu items; and menu routines, which are used to create and customize menus, assign pre- and post-processing routines, and display and interact with menus.

Current Default Values for Item Attributes

The menus package establishes initial current default values for item attributes. During item initialization, each item attribute is assigned the current default value for that attribute. An application can change or retrieve a current default attribute value by calling the appropriate set or retrieve routine with a NULL item pointer. If an application changes a current default item attribute value, subsequent items created using new_item will have the new default attribute value. (The attributes of previously created items are not changed if a current default attribute value is changed.)

Routine Name Index

The following table lists each menus routine and the name of the manual page on which it is described.

| menus Routine Name | Manual Page Name |
|--------------------|-----------------------|
| current_item | menu_item_current(3X) |
| free_item | menu_item_new(3X) |
| free_menu | menu_new(3X) |
| item_count | menu_items(3X) |
| item_description | menu_item_name(3X) |
| item_index | menu_item_current(3X) |
| item_init | menu_hook(3X) |
| item_name | menu_item_name(3X) |
| item_opts | menu_item_opts(3X) |
| item_opts_off | menu_item_opts(3X) |
| item_opts_on | menu_item_opts(3X) |
| item_term | menu_hook(3X) |
| item_userptr | menu_item_userptr(3X) |
| item_value | menu_item_value(3X) |
| item_visible | menu_item_visible(3X) |
| menu_back | menu_attributes(3X) |

NAME

menu_win: set_menu_win, menu_win, set_menu_sub, menu_sub, scale_menu -
menus **window and subwindow association routines**

SYNOPSIS

```
#include <menu.h>

int set_menu_win(MENU *menu, WINDOW *win);
WINDOW *menu_win(MENU *menu);

int set_menu_sub(MENU *menu, WINDOW *sub);
WINDOW *menu_sub(MENU *menu);

int scale_window(MENU *menu, int *rows, int *cols);
```

DESCRIPTION

set_menu_win sets the window of *menu* to *win*. menu_win returns a pointer to the window of *menu*.

set_menu_sub sets the subwindow of *menu* to *sub*. menu_sub returns a pointer to the subwindow of *menu*.

scale_window returns the minimum window size necessary for the subwindow of *menu*. *rows* and *cols* are pointers to the locations used to return the values.

RETURN VALUE

Routines that return pointers always return NULL on error. Routines that return an integer return one of the following:

| | |
|-----------------|--|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An incorrect argument was passed to the routine. |
| E_POSTED | - The menu is already posted. |
| E_NOT_CONNECTED | - No items are connected to the menu. |

NOTES

The header file menu.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), menus(3X)

menu_userptr(3X)

menu_userptr(3X)

NAME

`menu_userptr`: `set_menu_userptr`, `menu_userptr` - associate application data with menus

SYNOPSIS

```
#include <menu.h>
```

```
int set_menu_userptr(MENU *menu, char *userptr);  
char *menu_userptr(MENU *menu);
```

DESCRIPTION

Every menu has an associated user pointer that can be used to store relevant information. `set_menu_userptr` sets the user pointer of *menu*. `menu_userptr` returns the user pointer of *menu*.

RETURN VALUE

`menu_userptr` returns NULL on error.

`set_menu_userptr` returns one of the following:

| | |
|-----------------------------|--------------------------------------|
| <code>E_OK</code> | - The routine returned successfully. |
| <code>E_SYSTEM_ERROR</code> | - System error. |

NOTES

The header file `menu.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `menus(3X)`

menu_post(3X)

menu_post(3X)

NAME

menu_post: post_menu, unpost_menu - write or erase menus from associated subwindows

SYNOPSIS

```
#include <menu.h>

int post_menu(MENU *menu);
int unpost_menu(MENU *menu);
```

DESCRIPTION

post_menu writes *menu* to the subwindow. The application programmer must use curses library routines to display the menu on the physical screen or call update_panels if the panels library is being used.

unpost_menu erases *menu* from its associated subwindow.

RETURN VALUE

These routines return one of the following:

- | | |
|-----------------|--|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An incorrect argument was passed to the routine. |
| E_POSTED | - The menu is already posted. |
| E_BAD_STATE | - The routine was called from an initialization or termination function. |
| E_NO_ROOM | - The menu does not fit within its subwindow. |
| E_NOT_POSTED | - The menu has not been posted. |
| E_NOT_CONNECTED | - No items are connected to the menu. |

NOTES

The header file menu.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), menus(3X), panels(3X)

NAME

menu_pattern: set_menu_pattern, menu_pattern - set and get menus pattern match buffer

SYNOPSIS

```
#include <menu.h>
```

```
int set_menu_pattern(MENU *menu, char *pat);
```

```
char *menu_pattern(MENU *menu);
```

DESCRIPTION

Every menu has a pattern buffer to match entered data with menu items. set_menu_pattern sets the pattern buffer to *pat* and tries to find the first item that matches the pattern. If it does, the matching item becomes the current item. If not, the current item does not change. menu_pattern returns the string in the pattern buffer of *menu*.

RETURN VALUE

menu_pattern returns NULL on error. set_menu_pattern returns one of the following:

| | |
|----------------|--|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An incorrect argument was passed to the routine. |
| E_NO_MATCH | - The character failed to match. |

NOTES

The header file menu.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), menus(3X)

NAME

menu_opts: set_menu_opts, menu_opts_on, menu_opts_off, menu_opts -
menus option routines

SYNOPSIS

```
#include <menu.h>

int set_menu_opts(MENU *menu, OPTIONS opts);
int menu_opts_on(MENU *menu, OPTIONS opts);
int menu_opts_off(MENU *menu, OPTIONS opts);
OPTIONS menu_opts(MENU *menu);
```

DESCRIPTION**Menu Options**

set_menu_opts turns on the named options for *menu* and turns off all other options. Options are boolean values that can be OR-ed together.

menu_opts_on turns on the named options for *menu*; no other option is changed.

menu_opts_off turns off the named options for *menu*; no other option is changed.

menu_opts returns the current options of *menu*.

Menu Options:

| | |
|--------------|--|
| O_ONEVALUE | Only one item can be selected from the menu. |
| O_SHOWDESC | Display the description of the items. |
| O_ROWMAJOR | Display the menu in row major order. |
| O_IGNORECASE | Ignore the case when pattern matching. |
| O_SHOWMATCH | Place the cursor within the item name when pattern matching. |
| O_NONCYCLIC | Make certain menu driver requests non-cyclic. |

RETURN VALUE

Except for menu_opts, these routines return one of the following:

| | |
|----------------|--------------------------------------|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_POSTED | - The menu is already posted. |

NOTES

The header file menu.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), menus(3X)

menu_new(3X)

menu_new(3X)

NAME

menu_new: new_menu, free_menu - create and destroy menus

SYNOPSIS

```
#include <menu.h>

MENU *new_menu(ITEM **items);

int free_menu(MENU *menu);
```

DESCRIPTION

`new_menu` creates a new menu connected to the item pointer array *items* and returns a pointer to the new menu.

`free_menu` disconnects *menu* from its associated item pointer array and frees the storage allocated for the menu.

RETURN VALUE

`new_menu` returns NULL on error.

`free_menu` returns one of the following:

| | |
|----------------|--|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An incorrect argument was passed to the routine. |
| E_POSTED | - The menu is already posted. |

NOTES

The header file `menu.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `menus(3X)`

NAME

menu_mark: set_menu_mark, menu_mark - menus mark string routines

SYNOPSIS

```
#include <menu.h>
```

```
int set_menu_mark(MENU *menu, char *mark);
```

```
char *menu_mark(MENU *menu);
```

DESCRIPTION

menus displays mark strings to distinguish selected items in a menu (or the current item in a single-valued menu). set_menu_mark sets the mark string of *menu* to *mark*. menu_mark returns a pointer to the mark string of *menu*.

RETURN VALUE

menu_mark returns NULL on error. set_menu_mark returns one of the following:

| | |
|----------------|--|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An incorrect argument was passed to the routine. |

NOTES

The header file menu.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), menus(3X)

menu_items(3X)

menu_items(3X)

NAME

menu_items: set_menu_items, menu_items, item_count - connect and disconnect items to and from menus

SYNOPSIS

```
#include <menu.h>

int set_menu_items(MENU *menu, ITEM **items);
ITEM **menu_items(MENU *menu);
int item_count(MENU *menu);
```

DESCRIPTION

set_menu_items changes the item pointer array connected to *menu* to the item pointer array *items*.

menu_items returns a pointer to the item pointer array connected to *menu*.

item_count returns the number of items in *menu*.

RETURN VALUE

menu_items returns NULL on error.

item_count returns -1 on error.

set_menu_items returns one of the following:

| | |
|----------------|--|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An incorrect argument was passed to the routine. |
| E_POSTED | - The menu is already posted. |
| E_CONNECTED | - One or more items are already connected to another menu. |

NOTES

The header file menu.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), menus(3X)

menu_item_visible(3X)

menu_item_visible(3X)

NAME

menu_item_visible: item_visible - tell if menu item is visible

SYNOPSIS

```
#include <menu.h>

int item_visible(ITEM *item);
```

DESCRIPTION

A menu item is visible if it currently appears in the subwindow of a posted menu. `item_visible` returns TRUE if *item* is visible, otherwise it returns FALSE.

NOTES

The header file `menu.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `menus(3X)`, `menu_new(3X)`

menu_item_value(3X)

menu_item_value(3X)

NAME

menu_item_value: set_item_value, item_value - set and get menu item values

SYNOPSIS

```
#include <menu.h>

int set_item_value(ITEM *item, int bool);
int item_value(ITEM *item);
```

DESCRIPTION

Unlike single-valued menus, multi-valued menus enable the end-user to select one or more items from a menu. `set_item_value` sets the selected value of the *item* — TRUE (selected) or FALSE (not selected). `set_item_value` may be used only with multi-valued menus. To make a menu multi-valued, use `set_menu_opts` or `menu_opts_off` to turn off the option `O_ONEVALUE`. [see `menu_opts(3X)`].

`item_value` returns the select value of *item*, either TRUE (selected) or FALSE (unselected).

RETURN VALUE

`set_item_value` returns one of the following:

| | |
|-------------------------------|--|
| <code>E_OK</code> | - The routine returned successfully. |
| <code>E_SYSTEM_ERROR</code> | - System error. |
| <code>E_REQUEST_DENIED</code> | - The menu driver could not process the request. |

NOTES

The header file `menu.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `menus(3X)`, `menu_opts(3X)`

menu_item_userptr(3X)

menu_item_userptr(3X)

NAME

menu_item_userptr: set_item_userptr, item_userptr - associate application data with menu items

SYNOPSIS

```
#include <menu.h>

int set_item_userptr(ITEM *item, char *userptr);
char *item_userptr(ITEM *item);
```

DESCRIPTION

Every item has an associated user pointer that can be used to store relevant information. `set_item_userptr` sets the user pointer of *item*. `item_userptr` returns the user pointer of *item*.

RETURN VALUE

`item_userptr` returns NULL on error. `set_item_userptr` returns one of the following:

| | |
|----------------|--------------------------------------|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |

NOTES

The header file `menu.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `menus(3X)`

menu_item_opts(3X)

menu_item_opts(3X)

NAME

menu_item_opts: set_item_opts, item_opts_on, item_opts_off, item_opts -
menus item option routines

SYNOPSIS

```
#include <menu.h>
```

```
int set_item_opts(ITEM *item, OPTIONS opts);  
int item_opts_on(ITEM *item, OPTIONS opts);  
int item_opts_off(ITEM *item, OPTIONS opts);  
OPTIONS item_opts(ITEM *item);
```

DESCRIPTION

set_item_opts turns on the named options for *item* and turns off all other options. Options are boolean values that can be OR-ed together.

item_opts_on turns on the named options for *item*; no other option is changed.

item_opts_off turns off the named options for *item*; no other option is changed.

item_opts returns the current options of *item*.

Item Options:

O_SELECTABLE The item can be selected during menu processing.

RETURN VALUE

Except for item_opts, these routines return one of the following:

E_OK - The routine returned successfully.
E_SYSTEM_ERROR - System error.

NOTES

The header file menu.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), menus(3X)

menu_item_new(3X)

menu_item_new(3X)

NAME

menu_item_new: new_item, free_item - create and destroy menu items

SYNOPSIS

```
#include <menu.h>

ITEM *new_item(char *name, char *desc);

int free_item(ITEM *item);
```

DESCRIPTION

`new_item` creates a new item from *name* and *description*, and returns a pointer to the new item.

`free_item` frees the storage allocated for *item*. Once an item is freed, the user can no longer connect it to a menu.

RETURN VALUE

`new_item` returns NULL on error.

`free_item` returns one of the following:

- | | |
|----------------|--|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An incorrect argument was passed to the routine. |
| E_CONNECTED | - One or more items are already connected to another menu. |

NOTES

The header file `menu.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `menus(3X)`

menu_item_name(3X)

menu_item_name(3X)

NAME

menu_item_name: item_name, item_description - get menus item name and description

SYNOPSIS

```
#include <menu.h>

char *item_name(ITEM *item);
char *item_description(ITEM *item);
```

DESCRIPTION

item_name returns a pointer to the name of *item*.

item_description returns a pointer to the description of *item*.

RETURN VALUE

These routines return NULL on error.

NOTES

The header file menu.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), menus(3X), menu_new(3X)

menu_item_current(3X)

menu_item_current(3X)

NAME

menu_item_current: set_current_item, current_item, set_top_row, top_row, item_index - set and get current menus items

SYNOPSIS

```
#include <menu.h>

int set_current_item(MENU *menu, ITEM *item);
ITEM *current_item(MENU *menu);

int set_top_row(MENU *menu, int row);
int top_row(MENU *menu);

int item_index(ITEM *item);
```

DESCRIPTION

The current item of a menu is the item where the cursor is currently positioned. `set_current_item` sets the current item of *menu* to *item*. `current_item` returns a pointer to the the current item in *menu*.

`set_top_row` sets the top row of *menu* to *row*. The left-most item on the new top row becomes the current item. `top_row` returns the number of the menu row currently displayed at the top of *menu*.

`item_index` returns the index to the *item* in the item pointer array. The value of this index ranges from 0 through *N*-1, where *N* is the total number of items connected to the menu.

RETURN VALUE

`current_item` returns NULL on error.

`top_row` and `index_item` return -1 on error.

`set_current_item` and `set_top_row` return one of the following:

- | | |
|------------------------------|--|
| <code>E_OK</code> | - The routine returned successfully. |
| <code>E_SYSTEM_ERROR</code> | - System error. |
| <code>E_BAD_ARGUMENT</code> | - An incorrect argument was passed to the routine. |
| <code>E_BAD_STATE</code> | - The routine was called from an initialization or termination function. |
| <code>E_NOT_CONNECTED</code> | - No items are connected to the menu. |

NOTES

The header file `menu.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `menus(3X)`

NAME

menu_hook: set_item_init, item_init, set_item_term, item_term, set_menu_init, menu_init, set_menu_term, menu_term - assign application-specific routines for automatic invocation by menus

SYNOPSIS

```
#include <menu.h>

int set_item_init(MENU *menu, void (*func)(MENU *));
void (*)(MENU *) item_init(MENU *menu);

int set_item_term(MENU *menu, void (*func)(MENU *));
void (*)(MENU *) item_term(MENU *menu);

int set_menu_init(MENU *menu, void (*func)(MENU *));
void (*)(MENU *) menu_init(MENU *menu);

int set_menu_term(MENU *menu, void (*func)(MENU *));
void (*)(MENU *) menu_term(MENU *menu);
```

DESCRIPTION

set_item_init assigns the application-defined function to be called when the *menu* is posted and just after the current item changes. item_init returns a pointer to the item initialization routine, if any, called when the *menu* is posted and just after the current item changes.

set_item_term assigns an application-defined function to be called when the *menu* is unposted and just before the current item changes. item_term returns a pointer to the termination function, if any, called when the *menu* is unposted and just before the current item changes.

set_menu_init assigns an application-defined function to be called when the *menu* is posted and just after the top row changes on a posted menu. menu_init returns a pointer to the menu initialization routine, if any, called when the *menu* is posted and just after the top row changes on a posted menu.

set_menu_term assigns an application-defined function to be called when the *menu* is unposted and just before the top row changes on a posted menu. menu_term returns a pointer to the menu termination routine, if any, called when the *menu* is unposted and just before the top row changes on a posted menu.

RETURN VALUE

Routines that return pointers always return NULL on error. Routines that return an integer return one of the following:

| | |
|----------------|--------------------------------------|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |

NOTES

The header file menu.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), menus(3X), menu_control(3X), menu_hook(3X)

NAME

`menu_format`: `set_menu_format`, `menu_format` - set and get maximum numbers of rows and columns in menus

SYNOPSIS

```
#include <menu.h>
```

```
int set_menu_format(MENU *menu, int rows, int cols);
```

```
void menu_format(MENU *menu, int *rows, int *cols);
```

DESCRIPTION

`set_menu_format` sets the maximum number of rows and columns of items that may be displayed at one time on a menu. If the menu contains more items than can be displayed at once, the menu will be scrollable.

`menu_format` returns the maximum number of rows and columns that may be displayed at one time on *menu*. *rows* and *cols* are pointers to the variables used to return these values.

RETURN VALUE

`set_menu_format` returns one of the following:

| | |
|-----------------------------|--|
| <code>E_OK</code> | - The routine returned successfully. |
| <code>E_SYSTEM_ERROR</code> | - System error. |
| <code>E_BAD_ARGUMENT</code> | - An incorrect argument was passed to the routine. |
| <code>E_POSTED</code> | - The menu is already posted. |

NOTES

The header file `menu.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `menus(3X)`

menu_driver(3X)

menu_driver(3X)

- E_UNKNOWN_COMMAND - An unknown request was passed to the menu driver.
- E_NO_MATCH - The character failed to match.
- E_NOT_SELECTABLE - The item cannot be selected.
- E_REQUEST_DENIED - The menu driver could not process the request.

NOTES

Application defined commands should be defined relative to (greater than) `MAX_COMMAND`, the maximum value of a request listed above.

The header file `menu.h` automatically includes the header files `eti.h` and `curses.h`.

SEE ALSO

`curses(3X)`, `menus(3X)`

NAME

menu_driver - command processor for the menus subsystem

SYNOPSIS

```
#include <menu.h>
```

```
int menu_driver(MENU *menu, int c);
```

DESCRIPTION

menu_driver is the workhorse of the menus subsystem. It checks to determine whether the character *c* is a menu request or data. If *c* is a request, the menu driver executes the request and reports the result. If *c* is data (a printable ASCII character), it enters the data into the pattern buffer and tries to find a matching item. If no match is found, the menu driver deletes the character from the pattern buffer and returns E_NO_MATCH. If the character is not recognized, the menu driver assumes it is an application-defined command and returns E_UNKNOWN_COMMAND.

Menu driver requests:

| | |
|-------------------|--|
| REQ_LEFT_ITEM | Move left to an item. |
| REQ_RIGHT_ITEM | Move right to an item. |
| REQ_UP_ITEM | Move up to an item. |
| REQ_DOWN_ITEM | Move down to an item. |
| REQ_SCR_ULINE | Scroll up a line. |
| REQ_SCR_DLINE | Scroll down a line. |
| REQ_SCR_DPAGE | Scroll up a page. |
| REQ_SCR_UPAGE | Scroll down a page. |
| REQ_FIRST_ITEM | Move to the first item. |
| REQ_LAST_ITEM | Move to the last item. |
| REQ_NEXT_ITEM | Move to the next item. |
| REQ_PREV_ITEM | Move to the previous item. |
| REQ_TOGGLE_ITEM | Select/de-select an item. |
| REQ_CLEAR_PATTERN | Clear the menu pattern buffer. |
| REQ_BACK_PATTERN | Delete the previous character from pattern buffer. |
| REQ_NEXT_MATCH | Move the next matching item. |
| REQ_PREV_MATCH | Move to the previous matching item. |

RETURN VALUE

menu_driver returns one of the following:

| | |
|----------------|--|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An incorrect argument was passed to the routine. |
| E_BAD_STATE | - The routine was called from an initialization or termination function. |
| E_NOT_POSTED | - The menu has not been posted. |

menu_cursor(3X)

menu_cursor(3X)

NAME

menu_cursor: pos_menu_cursor - correctly position a menu cursor

SYNOPSIS

```
#include <menu.h>
```

```
int pos_menu_cursor(MENU *menu);
```

DESCRIPTION

pos_menu_cursor moves the cursor in the window of *menu* to the correct position to resume menu processing. This is needed after the application calls a curses library I/O routine.

RETURN VALUE

This routine returns one of the following:

| | |
|----------------|--|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An incorrect argument was passed to the routine. |
| E_NOT_POSTED | - The menu has not been posted. |

NOTES

The header file menu.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), menus(3X), panels(3X), panel_update(3X)

NAME

menu_attributes: set_menu_fore, menu_fore, set_menu_back, menu_back, set_menu_grey, menu_grey, set_menu_pad, menu_pad - control menus display attributes

SYNOPSIS

```
#include <menu.h>

int set_menu_fore(MENU *menu, chtype attr);
chtype menu_fore(MENU *menu);

int set_menu_back(MENU *menu, chtype attr);
chtype menu_back(MENU *menu);

int set_menu_grey(MENU *menu, chtype attr);
chtype menu_grey(MENU *menu);

int set_menu_pad(MENU *menu, int pad);
int menu_pad(MENU *menu);
```

DESCRIPTION

set_menu_fore sets the foreground attribute of *menu* — the display attribute for the current item (if selectable) on single-valued menus and for selected items on multi-valued menus. This display attribute is a curses library visual attribute. menu_fore returns the foreground attribute of *menu*.

set_menu_back sets the background attribute of *menu* — the display attribute for unselected, yet selectable, items. This display attribute is a curses library visual attribute.

set_menu_grey sets the grey attribute of *menu* — the display attribute for non-selectable items in multi-valued menus. This display attribute is a curses library visual attribute. menu_grey returns the grey attribute of *menu*.

The pad character is the character that fills the space between the name and description of an item. set_menu_pad sets the pad character for *menu* to *pad*. menu_pad returns the pad character of *menu*.

RETURN VALUE

These routines return one of the following:

- | | |
|----------------|--|
| E_OK | - The routine returned successfully. |
| E_SYSTEM_ERROR | - System error. |
| E_BAD_ARGUMENT | - An incorrect argument was passed to the routine. |

NOTES

The header file menu.h automatically includes the header files eti.h and curses.h.

SEE ALSO

curses(3X), menus(3X)

NAME

memory: memccpy, memchr, memcmp, memcpy, memmove, memset - memory operations

SYNOPSIS

```
#include <string.h>

void *memccpy (void *s1, const void *s2, int c, size_t n);
void *memchr (const void *s, int c, size_t n);
int memcmp (const void *s1, const void *s2, size_t n);
void *memcpy (void *s1, const void *s2, size_t n);
void *memmove (void *s1, const void *s2, size_t n);
void *memset (void *s, int c, size_t n);
```

DESCRIPTION

These functions operate as efficiently as possible on memory areas (arrays of bytes bounded by a count, not terminated by a null character). They do not check for the overflow of any receiving memory area.

`memccpy` copies bytes from memory area `s2` into `s1`, stopping after the first occurrence of `c` (converted to an unsigned char) has been copied, or after `n` bytes have been copied, whichever comes first. It returns a pointer to the byte after the copy of `c` in `s1`, or a null pointer if `c` was not found in the first `n` bytes of `s2`.

`memchr` returns a pointer to the first occurrence of `c` (converted to an unsigned char) in the first `n` bytes (each interpreted as an unsigned char) of memory area `s`, or a null pointer if `c` does not occur.

`memcmp` compares its arguments, looking at the first `n` bytes (each interpreted as an unsigned char), and returns an integer less than, equal to, or greater than 0, according as `s1` is lexicographically less than, equal to, or greater than `s2` when taken to be unsigned characters.

`memcpy` copies `n` bytes from memory area `s2` to `s1`. It returns `s1`.

`memmove` copies `n` bytes from memory areas `s2` to `s1`. Copying between objects that overlap will take place correctly. It returns `s1`.

`memset` sets the first `n` bytes in memory area `s` to the value of `c` (converted to an unsigned char). It returns `s`.

SEE ALSO

string(3C)

The *mask* argument must be zero; it is reserved for future use.

Locks established with the lock operations are not inherited by a child process after fork. memcntl fails if it attempts to lock more memory than a system-specific limit.

Due to the potential impact on system resources, all operations, with the exception of MC_SYNC, are restricted to processes with superuser effective user ID . The memcntl function subsumes the operations of plock and mctl.

RETURN VALUE

Upon successful completion, the function memcntl returns a value of 0; otherwise, it returns a value of -1 and sets errno to indicate an error.

ERRORS

Under the following conditions, the function memcntl fails and sets errno to:

| | |
|--------|--|
| EAGAIN | if some or all of the memory identified by the operation could not be locked when MC_LOCK or MC_LOCKAS is specified. |
| EBUSY | if some or all the addresses in the range [<i>addr</i> , <i>addr</i> + <i>len</i>) are locked and MC_SYNC with MS_INVALIDATE option is specified. |
| EINVAL | if <i>addr</i> is not a multiple of the page size as returned by sysconf. |
| EINVAL | if <i>addr</i> and/or <i>len</i> do not have the value 0 when MC_LOCKAS or MC_UNLOCKAS is specified. |
| EINVAL | if <i>arg</i> is not valid for the function specified. |
| EINVAL | if invalid selection criteria are specified in <i>attr</i> . |
| ENOMEM | if some or all the addresses in the range [<i>addr</i> , <i>addr</i> + <i>len</i>) are invalid for the address space of the process or pages not mapped are specified. |
| EPERM | if the process's effective user ID is not superuser and one of MC_LOCK, MC_LOCKAS, MC_UNLOCK, MC_UNLOCKAS was specified. |

SEE ALSO

mmap(2), mprotect(2), plock(2), sysconf(2), mlock(3C), mlockall(3C), msync(3C)

a different mapping in the locking process) is locked in memory as long as the locking process does neither an implicit nor explicit unlock operation. If a locked mapping is removed, or a page is deleted through file removal or truncation, an unlock operation is implicitly performed. If a writable `MAP_PRIVATE` page in the address range is changed, the lock will be transferred to the private page.

At present *arg* is unused, but must be 0 to ensure compatibility with potential future enhancements.

`MC_LOCKAS` Lock in memory all pages mapped by the address space with attributes *attr*. At present *addr* and *len* are unused, but must be `NULL` and 0 respectively, to ensure compatibility with potential future enhancements. *arg* is a bit pattern built from the flags:

| | |
|--------------------------|-----------------------|
| <code>MCL_CURRENT</code> | Lock current mappings |
| <code>MCL_FUTURE</code> | Lock future mappings |

The value of *arg* determines whether the pages to be locked are those currently mapped by the address space, those that will be mapped in the future, or both. If `MCL_FUTURE` is specified, then all mappings subsequently added to the address space will be locked, provided sufficient memory is available.

`MC_SYNC` Write to their backing storage locations all modified pages in the range with attributes *attr*. Optionally, invalidate cache copies. The backing storage for a modified `MAP_SHARED` mapping is the file the page is mapped to; the backing storage for a modified `MAP_PRIVATE` mapping is its swap area. *arg* is a bit pattern built from the flags used to control the behavior of the operation:

| | |
|----------------------------|-----------------------------|
| <code>MS_ASYNC</code> | perform asynchronous writes |
| <code>MS_SYNC</code> | perform synchronous writes |
| <code>MS_INVALIDATE</code> | invalidate mappings |

`MS_ASYNC` returns immediately once all write operations are scheduled; with `MS_SYNC` the system call will not return until all write operations are completed.

`MS_INVALIDATE` invalidates all cached copies of data in memory, so that further references to the pages will be obtained by the system from their backing storage locations. This operation should be used by applications that require a memory object to be in a known state.

`MC_UNLOCK` Unlock all pages in the range with attributes *attr*. At present *arg* is unused, but must be 0 to ensure compatibility with potential future enhancements.

`MC_UNLOCKAS` Remove address space memory locks, and locks on all pages in the address space with attributes *attr*. At present *addr*, *len*, and *arg* are unused, but must be `NULL`, 0 and 0 respectively, to ensure compatibility with potential future enhancements.

NAME

memcntl - memory management control

SYNOPSIS

```
#include <sys/types.h>
#include <sys/mman.h>

int memcntl(caddr_t addr, size_t len, int cmd, caddr_t arg,
            int attr, int mask);
```

DESCRIPTION

The function `memcntl` allows the calling process to apply a variety of control operations over the address space identified by the mappings established for the address range `[addr, addr + len)`.

`addr` must be a multiple of the `pagesize` as returned by `sysconf(3C)`. The scope of the control operations can be further defined with additional selection criteria (in the form of attributes) according to the bit pattern contained in `attr`.

The following attributes specify page mapping selection criteria:

SHARED Page is mapped shared.
PRIVATE Page is mapped private.

The following attributes specify page protection selection criteria:

PROT_READ Page can be read.
PROT_WRITE Page can be written.
PROT_EXEC Page can be executed.

See the *System V Application Binary Interface* for further information concerning combinations of the `PROT_READ`, `PROT_WRITE`, and `PROT_EXEC` flags.

The selection criteria are constructed by an OR of the attribute bits and must match exactly.

In addition, the following criteria may be specified:

PROC_TEXT process text
PROC_DATA process data

where `PROC_TEXT` specifies all privately mapped segments with read and execute permission, and `PROC_DATA` specifies all privately mapped segments with write permission.

Selection criteria can be used to describe various abstract memory objects within the address space on which to operate. If an operation shall not be constrained by the selection criteria, `attr` must have the value 0.

The operation to be performed is identified by the argument `cmd`. The symbolic names for the operations are defined in `sys/mman.h` as follows:

MC_LOCK Lock in memory all pages in the range with attributes `attr`. A given page may be locked multiple times through different mappings; however, within a given mapping, page locks do not nest. Multiple lock operations on the same address in the same process will all be removed with a single unlock operation. A page locked in one process and mapped in another (or visible through

RETURN VALUE

mctl returns 0 on success, -1 on failure.

ERRORS

mctl fails if:

| | |
|--------|--|
| EAGAIN | Some or all of the memory identified by the operation could not be locked due to insufficient system resources. |
| EBUSY | MS_INVALIDATE was specified and one or more of the pages is locked in memory. |
| EINVAL | <i>addr</i> is not a multiple of the page size as returned by <code>getpagesize</code> . |
| EINVAL | <i>addr</i> and/or <i>len</i> do not have the value 0 when <code>MC_LOCKAS</code> or <code>MC_UNLOCKAS</code> are specified. |
| EINVAL | <i>arg</i> is not valid for the function specified. |
| EIO | An I/O error occurred while reading from or writing to the file system. |
| ENOMEM | Addresses in the range [<i>addr</i> , <i>addr</i> + <i>len</i>) are invalid for the address space of a process, or specify one or more pages which are not mapped. |
| EPERM | The process's effective user ID is not super-user and one of <code>MC_LOCK</code> , <code>MC_LOCKAS</code> , <code>MC_UNLOCK</code> , or <code>MC_UNLOCKAS</code> was specified. |

SEE ALSO

`mmap(2)`, `getpagesize(3)`, `mlock(3C)`, `mlockall(3C)`, `msync(3C)`.

NAME

mctl - memory management control

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
#include <sys/types.h>
#include <sys/mman.h>

mctl(caddr_t addr, size_t len, int function, void *arg);
```

DESCRIPTION

mctl applies a variety of control functions over pages identified by the mappings established for the address range [*addr*, *addr + len*). The function to be performed is identified by the argument *function*. Valid functions are defined in *mman.h* as follows.

MC_LOCK

Lock the pages in the range in memory. This function is used to support *mlock*. See *mlock(3)* for semantics and usage. *arg* is ignored.

MC_LOCKAS

Lock the pages in the address space in memory. This function is used to support *mlockall*. See *mlockall(3)* for semantics and usage. *addr* and *len* are ignored. *arg* is an integer built from the flags:

| | |
|-------------|-----------------------|
| MCL_CURRENT | Lock current mappings |
| MCL_FUTURE | Lock future mappings |

MC_SYNC

Synchronize the pages in the range with their backing storage. Optionally invalidate cache copies. This function is used to support *msync*. See *msync(3)* for semantics and usage. *arg* is used to represent the *flags* argument to *msync*. It is constructed from an OR of the following values:

| | |
|---------------|---------------------|
| MS_SYNC | Synchronized write |
| MS_ASYNC | Return immediately |
| MS_INVALIDATE | Invalidate mappings |

MS_ASYNC returns after all I/O operations are scheduled. *MS_SYNC* does not return until all I/O operations are complete. Specify exactly one of *MS_ASYNC* or *MS_SYNC*. *MS_INVALIDATE* invalidates all cached copies of data from memory, requiring them to be re-obtained from the object's permanent storage location upon the next reference.

MC_UNLOCK

Unlock the pages in the range. This function is used to support *munlock*. See *munlock(3)* for semantics and usage. *arg* is ignored.

MC_UNLOCKAS

Remove address space memory lock, and locks on all current mappings. This function is used to support *munlockall(3)*. *addr* and *len* must have the value 0. *arg* is ignored.

NAME

mbstring: mbstowcs, wcstombs - multibyte string functions

SYNOPSIS

```
#include <stdlib.h>

size_t mbstowcs (wchar_t *pwcs, const char *s, size_t n);
size_t wcstombs (char *s, const wchar_t *pwcs, size_t n);
```

DESCRIPTION

`mbstowcs` converts a sequence of multibyte characters from the array pointed to by *s* into a sequence of corresponding wide character codes and stores these codes into the array pointed to by *pwcs*, stopping after *n* codes are stored or a code with value zero (a converted null character) is stored. If an invalid multibyte character is encountered, `mbstowcs` returns `(size_t)-1`. Otherwise, `mbstowcs` returns the number of array elements modified, not including the terminating zero code, if any.

`wcstombs` converts a sequence of wide character codes from the array pointed to by *pwcs* into a sequence of multibyte characters and stores these multibyte characters into the array pointed to by *s*, stopping if a multibyte character would exceed the limit of *n* total bytes or if a null character is stored. If a wide character code is encountered that does not correspond to a valid multibyte character, `wcstombs` returns `(size_t)-1`. Otherwise, `wcstombs` returns the number of bytes modified, not including a terminating null character, if any.

SEE ALSO

`chrtbl(1M)`, `mbchar(3C)`, `setlocale(3C)`, `environ(5)`.

mbchar(3C)

(C Programming Language Utilities)

mbchar(3C)

SEE ALSO

`chrtbl(1M)`, `mbstring(3C)`, `setlocale(3C)`, `environ(5)`.

NAME

mbchar: `mbtowc`, `mblen`, `wctomb` - multibyte character handling

SYNOPSIS

```
#include <stdlib.h>

int mbtowc (wchar_t *pwc, const char *s, size_t n);
int mblen (const char *s, size_t n);
int wctomb (char *s, wchar_t wchar);
```

DESCRIPTION

Multibyte characters are used to represent characters in an extended character set. This is needed for locales where 8 bits are not enough to represent all the characters in the character set.

The multibyte character handling functions provide the means of translating multibyte characters into wide characters and back again. Wide characters have type `wchar_t` (defined in `stdlib.h`), which is an integral type whose range of values can represent distinct codes for all members of the largest extended character set specified among the supported locales.

A maximum of 3 extended character sets are supported for each locale. The number of bytes in an extended character set is defined by the `LC_CTYPE` category of the locale [see `setlocale(3C)`]. However, the maximum number of bytes in any multibyte character will never be greater than `MB_LEN_MAX`, which is defined in `stdlib.h`. The maximum number of bytes in a character in an extended character set in the current locale is given by the macro, `MB_CUR_MAX`, also defined in `stdlib.h`.

`mbtowc` determines the number of bytes that comprise the multibyte character pointed to by *s*. Also, if *pwc* is not a null pointer, `mbtowc` converts the multibyte character to a wide character and places the result in the object pointed to by *pwc*. (The value of the wide character corresponding to the null character is zero.) At most *n* characters will be examined, starting at the character pointed to by *s*.

If *s* is a null pointer, `mbtowc` simply returns 0. If *s* is not a null pointer, then, if *s* points to the null character, `mbtowc` returns 0; if the next *n* or fewer bytes form a valid multibyte character, `mbtowc` returns the number of bytes that comprise the converted multibyte character; otherwise, *s* does not point to a valid multibyte character and `mbtowc` returns -1.

`mblen` determines the number of bytes comprising the multibyte character pointed to by *s*. It is equivalent to

```
mbtowc ((wchar_t *)0, s, n);
```

`wctomb` determines the number of bytes needed to represent the multibyte character corresponding to the code whose value is *wchar*, and, if *s* is not a null pointer, stores the multibyte character representation in the array pointed to by *s*. At most `MB_CUR_MAX` characters are stored.

If *s* is a null pointer, `wctomb` simply returns 0. If *s* is not a null pointer, `wctomb` returns -1 if the value of *wchar* does not correspond to a valid multibyte character; otherwise it returns the number of bytes that comprise the multibyte character corresponding to the value of *wchar*.

| Abbreviations | |
|---------------|--|
| M | Message is printed (not with the <code>-Xa</code> or <code>-Xc</code> options). |
| H | HUGE is returned (HUGE_VAL with the <code>-Xa</code> or <code>-Xc</code> options). |
| -H | -HUGE is returned (-HUGE_VAL with the <code>-Xa</code> or <code>-Xc</code> options). |
| \pm H | HUGE or -HUGE is returned. (HUGE_VAL or -HUGE_VAL with the <code>-Xa</code> or <code>-Xc</code> options). |
| 0 | 0 is returned. |
| X | <i>arg1</i> is returned. |
| N | NaN is returned. |

EXAMPLE

```

#include <math.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

int
matherr(register struct exception *x);
{
    switch (x->type) {
    case DOMAIN:
        /* change sqrt to return sqrt(-arg1), not 0 */
        if (!strcmp(x->name, "sqrt")) {
            x->retval = sqrt(-x->arg1);
            return (0); /* print message and set errno */
        }
    case SING:
        /* all other domain or sing errors, print message */
        /* and abort */
        fprintf(stderr, "domain error in %s\n", x->name);
        abort( );
    case PLOSS:
        /* print detailed error message */
        fprintf(stderr, "loss of significance in %s(%g)=%g\n",
            x->name, x->arg1, x->retval);
        return (1); /* take no other action */
    }
    return (0); /* all other errors, execute default procedure */
}

```

NOTES

Error handling in `-xa` and `-xt` modes [see `cc(1)`] is described more completely on individual math library pages.

| Default Error Handling Procedures | | | | | | |
|--|-------------------|-------------|--------------|-------------|-------------|-------------|
| | Types of Errors | | | | | |
| type | DOMAIN | SING | OVERFLOW | UNDERFLOW | TLOSS | PLOSS |
| errno | EDOM | EDOM | ERANGE | ERANGE | ERANGE | ERANGE |
| BESSEL: y0, y1, yn (arg ≤ 0) | - M, -H | - - | - - | - - | M, 0 - | - - |
| EXP, EXPF: | - | - | H | 0 | - | - |
| LOG, LOG10: LOGF, LOG10F: (arg < 0) (arg = 0) | M, -H M, -H | - - | - - | - - | - - | - - |
| POW, POWF: neg ** non-int 0 ** non-pos | - M, 0 M, 0 | - - - | ±H - - | 0 - - | - - - | - - - |
| SQRT, SQRTF: | M, 0 | - | - | - | - | - |
| FMOD, FMODE: (arg2 = 0) | M, X | - | - | - | - | - |
| REMAINDER: (arg2 = 0) | M, N | - | - | - | - | - |
| GAMMA, LGAMMA: | - | M, H | H | - | - | - |
| HYPOT: | - | - | H | - | - | - |
| SINH, SINHF: | - | - | ±H | - | - | - |
| COSH, COSHF: | - | - | H | - | - | - |
| ASIN, ACOS, ATAN2: ASINF, ACOSF, ATAN2F: | M, 0 | - | - | - | - | - |
| ACOSH: | M, N | - | - | - | - | - |
| ATANH: (\| arg \| > 1) (\| arg \| = 1) | M, N - | - M, N | - - | - - | - - | - - |

NAME

matherr - error-handling function

SYNOPSIS

```
cc [flag ...] file ... -lm [library ...]
#include <math.h>
int matherr (struct exception *x);
```

DESCRIPTION

matherr is invoked by functions in the math libraries when errors are detected. Note that matherr is not invoked when the `-Xc` compilation option is used. Users may define their own procedures for handling errors, by including a function named `matherr` in their programs. `matherr` must be of the form described above. When an error occurs, a pointer to the exception structure `x` will be passed to the user-supplied `matherr` function. This structure, which is defined in the `math.h` header file, is as follows:

```
struct exception {
    int type;
    char *name;
    double arg1, arg2, retval;
};
```

The element `type` is an integer describing the type of error that has occurred, from the following list of constants (defined in the header file):

| | |
|-----------|------------------------------|
| DOMAIN | argument domain error |
| SING | argument singularity |
| OVERFLOW | overflow range error |
| UNDERFLOW | underflow range error |
| TLOSS | total loss of significance |
| PLOSS | partial loss of significance |

The element `name` points to a string containing the name of the function that incurred the error. The variables `arg1` and `arg2` are the arguments with which the function was invoked. `retval` is set to the default value that will be returned by the function unless the user's `matherr` sets it to a different value.

If the user's `matherr` function returns non-zero, no error message will be printed, and `errno` will not be set.

If `matherr` is not supplied by the user, the default error-handling procedures, described with the math functions involved, will be invoked upon error. These procedures are also summarized in the table below. In every case, `errno` is set to `EDOM` or `ERANGE` and the program continues.

NAME

math - math functions and constants

SYNOPSIS

```
#include <math.h>
```

DESCRIPTION

This file contains declarations of all the functions in the Math Library (described in Section 3M), as well as various functions in the C Library (Section 3C) that return floating-point values.

It defines the structure and constants used by the `matherr(3M)` error-handling mechanisms, including the following constant used as a error-return value:

`HUGE` The maximum value of a single-precision floating-point number.

The following mathematical constants are defined for user convenience:

`M_E` The base of natural logarithms (e).

`M_LOG2E` The base-2 logarithm of e .

`M_LOG10E` The base-10 logarithm of e .

`M_LN2` The natural logarithm of 2.

`M_LN10` The natural logarithm of 10.

`M_PI` π , the ratio of the circumference of a circle to its diameter.

`M_PI_2` $\pi/2$.

`M_PI_4` $\pi/4$.

`M_1_PI` $1/\pi$.

`M_2_PI` $2/\pi$.

`M_2_SQRTPI` $2/\sqrt{\pi}$.

`M_SQRT2` The positive square root of 2.

`M_SQRT1_2` The positive square root of $1/2$.

The following mathematical constants are also defined in this header file:

`MAXFLOAT` The maximum value of a non-infinite single-precision floating point number.

`HUGE_VAL` positive infinity.

For the definitions of various machine-dependent constants, see `values(5)`.

SEE ALSO

`intro(3)`, `matherr(3M)`, `values(5)`

set.

M_KEEP Preserve data in a freed block until the next `malloc`, `realloc`, or `calloc`. This option is provided only for compatibility with the old version of `malloc` and is not recommended.

These values are defined in the `malloc.h` header file.

`malloc` may be called repeatedly, but may not be called after the first small block is allocated.

`mallinfo` provides instrumentation describing space usage. It returns the structure:

```

struct mallinfo {
    int arena;          /* total space in arena */
    int ordblks;       /* number of ordinary blocks */
    int smlblks;       /* number of small blocks */
    int hblkhd;        /* space in holding block headers */
    int hblks;         /* number of holding blocks */
    int usmlblks;      /* space in small blocks in use */
    int fsmblks;       /* space in free small blocks */
    int uordblks;      /* space in ordinary blocks in use */
    int fordblks;      /* space in free ordinary blocks */
    int keepcost;      /* space penalty if keep option */
                      /* is used */
}

```

This structure is defined in the `malloc.h` header file.

Each of the allocation routines returns a pointer to space suitably aligned (after possible pointer coercion) for storage of any type of object.

SEE ALSO

`brk(2)`, `malloc(3C)`.

DIAGNOSTICS

`malloc`, `realloc`, and `calloc` return a `NULL` pointer if there is not enough available memory. When `realloc` returns `NULL`, the block pointed to by `ptr` is left intact. If `malloc` is called after any allocation or if `cmd` or `value` are invalid, non-zero is returned. Otherwise, it returns zero.

NOTES

Note that unlike `malloc(3C)`, this package does not preserve the contents of a block when it is freed, unless the `M_KEEP` option of `malloc` is used.

Undocumented features of `malloc(3C)` have not been duplicated.

Function prototypes for `malloc`, `realloc`, `calloc` and `free` are also defined in the `<malloc.h>` header file for compatibility with old applications. New applications should include `<stdlib.h>` to access the prototypes for these functions.

NAME

malloc, free, realloc, calloc, malloc, mallinfo - memory allocator

SYNOPSIS

```
cc [flag ...] file ... -lmalloc [library ...]
#include <stdlib.h>
void *malloc (size_t size)
void free (void *ptr)
void *realloc (void *ptr, size_t size)
void *calloc (size_t nelem, size_t elsize)
#include <malloc.h>
int mallopt (int cmd, int value)
struct mallinfo mallinfo (void)
```

DESCRIPTION

malloc and free provide a simple general-purpose memory allocation package.

malloc returns a pointer to a block of at least *size* bytes suitably aligned for any use.

The argument to free is a pointer to a block previously allocated by malloc; after free is performed this space is made available for further allocation, and its contents have been destroyed (but see mallopt below for a way to change this behavior). If *ptr* is a null pointer, no action occurs.

Undefined results occur if the space assigned by malloc is overrun or if some random number is handed to free.

realloc changes the size of the block pointed to by *ptr* to *size* bytes and returns a pointer to the (possibly moved) block. The contents are unchanged up to the lesser of the new and old sizes. If *ptr* is a null pointer, realloc behaves like malloc for the specified size. If *size* is zero and *ptr* is not a null pointer, the object it points to is freed.

calloc allocates space for an array of *nelem* elements of size *elsize*. The space is initialized to zeros.

mallopt provides for control over the allocation algorithm. The available values for *cmd* are:

M_MXFAST Set *maxfast* to *value*. The algorithm allocates all blocks below the size of *maxfast* in large groups and then doles them out very quickly. The default value for *maxfast*, a system dependent value, is 24 on the M68000, and 96 on the M88000 family of processors.

M_NLBLKS Set *numlblks* to *value*. The above mentioned "large groups" each contain *numlblks* blocks. *numlblks* must be greater than 0. The default value for *numlblks* is 100.

M_GRAIN Set *grain* to *value*. The sizes of all blocks smaller than *maxfast* are considered to be rounded up to the nearest multiple of *grain*. *grain* must be greater than 0. The default value of *grain* is the smallest number of bytes which will allow alignment of any data type. Value will be rounded up to a multiple of the default when *grain* is

NAME

malloc, free, realloc, calloc, memalign, valloc, - memory allocator

SYNOPSIS

```
#include <stdlib.h>
void *malloc (size_t size);
void free (void *ptr);
void *realloc (void *ptr, size_t size);
void *calloc (size_t nelem, size_t elsize);
void *memalign(size_t alignment, size_t size);
void *valloc(size_t size);
```

DESCRIPTION

malloc and free provide a simple general-purpose memory allocation package. malloc returns a pointer to a block of at least *size* bytes suitably aligned for any use.

The argument to free is a pointer to a block previously allocated by malloc, calloc or realloc. After free is performed this space is made available for further allocation. If *ptr* is a NULL pointer, no action occurs.

Undefined results will occur if the space assigned by malloc is overrun or if some random number is handed to free.

realloc changes the size of the block pointed to by *ptr* to *size* bytes and returns a pointer to the (possibly moved) block. The contents will be unchanged up to the lesser of the new and old sizes. If *ptr* is NULL, realloc behaves like malloc for the specified size. If *size* is zero and *ptr* is not a null pointer, the object pointed to is freed.

calloc allocates space for an array of *nelem* elements of size *elsize*. The space is initialized to zeros.

memalign allocates *size* bytes on a specified alignment boundary, and returns a pointer to the allocated block. The value of the returned address is guaranteed to be an even multiple of *alignment*. Note: the value of *alignment* must be a power of two, and must be greater than or equal to the size of a word.

valloc(*size*) is equivalent to memalign(sysconf(_SC_PAGESIZE), *size*).

Each of the allocation routines returns a pointer to space suitably aligned (after possible pointer coercion) for storage of any type of object.

malloc, realloc, calloc, memalign, and valloc will fail if there is not enough available memory.

SEE ALSO

malloc(3X)

DIAGNOSTICS

If there is no available memory, malloc, realloc, memalign, valloc, and calloc return a null pointer. When realloc returns NULL, the block pointed to by *ptr* is left intact. If *size*, *nelem*, or *elsize* is 0, a unique pointer to the arena is returned.

NAME

makedev, major, minor - manage a device number

SYNOPSIS

```
#include <sys/types.h>
#include <sys/mkdev.h>

dev_t makedev(major_t maj, minor_t min);
major_t major(dev_t device);
minor_t minor(dev_t device);
```

DESCRIPTION

The **makedev** routine returns a formatted device number on success and **NODEV** on failure. *maj* is the major number. *min* is the minor number. **makedev** can be used to create a device number for input to **mknod(2)**.

The **major** routine returns the major number component from *device*.

The **minor** routine returns the minor number component from *device*.

makedev will fail if one or more of the following are true:

EINVAL One or both of the arguments *maj* and *min* is too large.

EINVAL The *device* number created from *maj* and *min* is **NODEV**.

major will fail if one or more of the following are true:

EINVAL The *device* argument is **NODEV**.

EINVAL The major number component of *device* is too large.

minor will fail if the following is true:

EINVAL The *device* argument is **NODEV**.

SEE ALSO

stat(2), **mknod(2)**

DIAGNOSTICS

On failure, **NODEV** is returned and **errno** is set to indicate the error.

NAME

makecontext, swapcontext - manipulate user contexts

SYNOPSIS

```
#include <ucontext.h>

void makecontext (ucontext_t *ucp, (void(*)())func, int argc,...);
int swapcontext (ucontext_t *oucp, ucontext_t *ucp);
```

DESCRIPTION

These functions are useful for implementing user-level context switching between multiple threads of control within a process.

makecontext modifies the context specified by *ucp*, which has been initialized using getcontext; when this context is resumed using swapcontext or setcontext [see getcontext(2)], program execution continues by calling the function *func*, passing it the arguments that follow *argc* in the makecontext call. The integer value of *argc* must match the number of arguments that follow *argc*. Otherwise the behavior is undefined.

swapcontext saves the current context in the context structure pointed to by *oucp* and sets the context to the context structure pointed to by *ucp*. swapcontext does not return; program execution continues at the point specified by the context structure *oucp* passed to swapcontext.

These functions will fail if either of the following is true:

| | |
|--------|---|
| ENOMEM | <i>ucp</i> does not have enough stack left to complete the operation. |
| EFAULT | <i>ucp</i> or <i>oucp</i> points to an invalid address. |

SEE ALSO

exit(2), getcontext(2), sigaction(2), sigprocmask(2), ucontext(5).

DIAGNOSTICS

On successful completion, swapcontext does not return. Otherwise, a value of -1 is returned and *errno* is set to indicate the error.

NOTES

The size of the ucontext_t structure may change in future releases. To remain binary compatible, users of these features must always use makecontext or getcontext to create new instances of them.

maillock(3X)

maillock(3X)

NAME

maillock - manage lockfile for user's mailbox

SYNOPSIS

```
cc [flag ...] file ... -lmail [library ...]
#include <maillock.h>
int maillock (const char *user, int retrycnt);
int mailunlock (void);
```

DESCRIPTION

The maillock function attempts to create a lockfile for the user's mailfile. If a lockfile already exists, maillock assumes the contents of the file is the process ID (as a null-terminated ASCII string) of the process that created the lockfile (presumably with a call to maillock). If the process that created the lockfile is still alive, maillock will sleep and try again *retrycnt* times before returning with an error indication. The sleep algorithm is to sleep for 5 seconds times the attempt number. That is, the first sleep will be for 5 seconds, the next sleep will be for 10 seconds, etc. until the number of attempts reaches *retrycnt*. When the lockfile is no longer needed, it should be removed by calling mailunlock.

user is the login name of the user for whose mailbox the lockfile will be created. maillock assumes that users' mailfiles are in the "standard" place as defined in maillock.h.

RETURN VALUE

The following return code definitions are contained in maillock.h. Only L_SUCCESS is returned for mailunlock.

```
#define L_SUCCESS      0 /* Lockfile created or removed */
#define L_NAMELEN     1 /* Recipient name > 13 chars */
#define L_TMPLOCK     2 /* Can't create tmp file */
#define L_TMPWRITE    3 /* Can't write pid into lockfile */
#define L_MAXTRY     4 /* Failed after retrycnt attempts */
#define L_ERROR       5 /* Check errno for reason */
```

FILES

```
LIBDIR/l1ib-mail.ln
LIBDIR/mail.a
/var/mail/*
/var/mail/*.lock
```

NOTES

mailunlock will only remove the lockfile created from the most previous call to maillock. Calling maillock for different users without intervening calls to mailunlock will cause the initially created lockfile(s) to remain, potentially blocking subsequent message delivery until the current process finally terminates.

NAME

lseek - move read/write file pointer

SYNOPSIS

```
#include <sys/types.h>
#include <unistd.h>

off_t lseek (int fildes, off_t offset, int whence);
```

DESCRIPTION

fildes is a file descriptor returned from a *creat*, *open*, *dup*, *fcntl*, *pipe*, or *ioctl* system call. *lseek* sets the file pointer associated with *fildes* as follows:

If *whence* is *SEEK_SET*, the pointer is set to *offset* bytes.

If *whence* is *SEEK_CUR*, the pointer is set to its current location plus *offset*.

If *whence* is *SEEK_END*, the pointer is set to the size of the file plus *offset*.

On success, *lseek* returns the resulting pointer location, as measured in bytes from the beginning of the file. Note that if *fildes* is a remote file descriptor and *offset* is negative, *lseek* returns the file pointer even if it is negative.

lseek allows the file pointer to be set beyond the existing data in the file. If data are later written at this point, subsequent reads in the gap between the previous end of data and the newly written data will return bytes of value 0 until data are written into the gap.

lseek fails and the file pointer remains unchanged if one or more of the following are true:

| | |
|--------|--|
| EBADF | <i>fildes</i> is not an open file descriptor. |
| ESPIPE | <i>fildes</i> is associated with a pipe or fifo. |
| EINVAL | <i>whence</i> is not <i>SEEK_SET</i> , <i>SEEK_CUR</i> , or <i>SEEK_END</i> . The process also gets a SIGSYS signal. |
| EINVAL | <i>fildes</i> is not a remote file descriptor, and the resulting file pointer would be negative. |

Some devices are incapable of seeking. The value of the file pointer associated with such a device is undefined.

SEE ALSO

creat(2), *dup*(2), *fcntl*(2), *open*(2)

DIAGNOSTICS

Upon successful completion, a non-negative integer indicating the file pointer value is returned. Otherwise, a value of -1 is returned and *errno* is set to indicate the error.

```
        nel < TABSIZE)
        (void) lsearch(line, tab, &nel, ELSIZE, mycmp);
for( i = 0; i < nel; i++ )
        (void) fputs(tab[i], stdout);
return 0;
}
```

SEE ALSO

bsearch(3C), hsearch(3C), string(3C), tsearch(3C)

NOTES

If the searched-for datum is found, both `lsearch` and `lfind` return a pointer to it. Otherwise, `lfind` returns `NULL` and `lsearch` returns a pointer to the newly added element.

Undefined results can occur if there is not enough room in the table to add a new item.

NAME

`lsearch`, `lfind` - linear search and update

SYNOPSIS

```
#include <search.h>

void *lsearch (const void *key, void * base, size_t *nel,
              size_t width, int (*compar) (const void *, const void *));

void *lfind (const void *key, const void *base, size_t *nel,
            size_t width, int (*compar)(const void *, const void *));
```

DESCRIPTION

`lsearch` is a linear search routine generalized from Knuth (6.1) Algorithm S. It returns a pointer into a table indicating where a datum may be found. If the datum does not occur, it is added at the end of the table. *key* points to the datum to be sought in the table. *base* points to the first element in the table. *nel* points to an integer containing the current number of elements in the table. The integer is incremented if the datum is added to the table. *width* is the size of an element in bytes. *compar* is a pointer to the comparison function that the user must supply (`strcmp`, for example). It is called with two arguments that point to the elements being compared. The function must return zero if the elements are equal and non-zero otherwise.

`lfind` is the same as `lsearch` except that if the datum is not found, it is not added to the table. Instead, a null pointer is returned.

NOTES

The pointers to the key and the element at the base of the table may be pointers to any type.

The comparison function need not compare every byte, so arbitrary data may be contained in the elements in addition to the values being compared.

The value returned should be cast into type pointer-to-element.

EXAMPLE

This program will read in less than `TABSIZE` strings of length less than `ELSIZE` and store them in a table, eliminating duplicates, and then will print each entry.

```
#include <search.h>
#include <string.h>
#include <stdlib.h>
#include <stdio.h>

#define TABSIZE 50
#define ELSIZE 120

main()
{
    char line[ELSIZE];          /* buffer to hold input string */
    char tab[TABSIZE][ELSIZE]; /* table of strings */
    size_t nel = 0;           /* number of entries in tab */
    int i;

    while (fgets(line, ELSIZE, stdin) != NULL &&
```

```
fd=open("datafile",O_RDWR);
lseek(fd, 200L, 0);
locking(fd, LK_LOCK, 200L);
```

Accordingly, to lock or unlock an entire file a seek to the beginning of the file (position 0) must be done and then a `locking` call must be executed with a size of 0.

size is the number of contiguous bytes to be locked for unlocked. The region to be locked starts at the current offset in the file. If *size* is 0, the entire file is locked or unlocked. *size* may extend beyond the end of the file, in which case only the process issuing the lock call may access or add information to the file within the boundary defined by *size*.

The potential for a deadlock occurs when a process controlling a locked area is put to sleep by accessing another process's locked area. Thus calls to `locking`, `read`, or `write` scan for a deadlock prior to sleeping on a locked region. An `EDEADLK` error return is made if sleeping on the locked region would cause a deadlock.

Lock requests may, in whole or part, contain or be contained by a previously locked region for the same process. When this occurs, or when adjacent regions are locked, the regions are combined into a single area if the mode of the lock is the same (that is, either read permitted or regular lock). If the mode of the overlapping locks differ, the locked areas will be assigned assuming that the most recent request must be satisfied. Thus if a read only lock is applied to a region, or part of a region, that had been previously locked by the same process against both reading and writing, the area of the file specified by the new lock will be locked for read only, while the remaining region, if any, will remain locked against reading and writing. There is no arbitrary limit to the number of regions which may be locked in a file.

Unlock requests may, in whole or part, release one or more locked regions controlled by the process. When regions are not fully released, the remaining areas are still locked by the process. Release of the center section of a locked area requires an additional locked element to hold the separated section. If the lock table is full, an error is returned, and the requested region is not released. Only the process which locked the file region may unlock it. An `unlock` request for a region that the process does not have locked, or that is already unlocked, has no effect. When a process terminates, all locked regions controlled by that process are unlocked.

If a process has done more than one open on a file, all locks put on the file by that process will be released on the first close of the file.

Although no error is returned if locks are applied to special files or pipes, read/write operations on these types of files will ignore the locks. Locks may not be applied to a directory.

SEE ALSO

`close(2)` `creat(2)`, `dup(2)`, `lseek(2)`, `open(2)`, `read(2)`, `write(2)`

DIAGNOSTICS

`locking` returns the value `(int) -1` if an error occurs. If any portion of the region has been locked by another process for the `LK_LOCK` and `LK_RLCK` actions and the lock request is to test only, `errno` is set to `EAGAIN`. If locking the region would cause a deadlock, `errno` is set to `EDEADLK`. If an internal lock cannot be allocated, `errno` is set to `ENOLCK`.

NAME

locking - lock or unlock a file region for reading or writing

SYNOPSIS

```
cc [flag ...] file ... -lx
locking (int fildes, int mode, long size);
```

DESCRIPTION

locking allows a specified number of bytes in a file to be controlled by the locking process. Other processes which attempt to read or write a portion of the file containing the locked region may sleep until the area become unlocked depending upon the mode in which the file region was locked.

A process that attempts to write to or read a file region that has been locked against reading and writing by another process (using the `LK_LOCK` or `LK_NBLCK` mode) with sleep until the region of the file has been released by the locking process.

A process that attempts to write to a file region that has been locked against writing by another process (using the `LK_RLCK` or `LK_NBRLCK` mode) will sleep until the region of the file has been released by the locking process, but a read request for that file region will proceed normally.

A process that attempts to lock a region of a file that contains areas that have been locked by other processes will sleep if it has specified the `LK_LOCK` or `LK_RLCK` mode in its lock request, but will return with the error `EACCES` if it specified `LK_NBLCK` or `LK_NBRLCK`.

fildes is the value returned from a successful `create`, `open`, `dup`, or `pipe` system call.

mode specifies the type of lock operation to be performed on the file region. The available values for mode are:

| | |
|--------------------------|--|
| <code>LK_UNLCK</code> 0 | Unlocks the specified region. The calling process releases a region of the file it has previously locked. |
| <code>LK_LOCK</code> 1 | Locks the specified region. The calling process will sleep until the entire region is available if any part of it has been locked by a different process. The region is then locked for the calling process and no other process may read or write in any part of the locked region (lock against read and write). |
| <code>LK_NBLCK</code> 2 | Locks the specified region. If any part of the region is already locked by a different process, return the error <code>EACCES</code> instead of waiting for the region to become available for locking (nonblocking lockrequest). |
| <code>LK_RLCK</code> 3 | Same as <code>LK_LOCK</code> except that the locked region may be read by other processes (read permitted lock). |
| <code>LK_NBRLCK</code> 4 | Same as <code>LK_NBLCK</code> except that the locked region may be read by other processes (nonblocking, read permitted lock). |

The locking utility uses the current file pointer position as the starting point for the locking of the file segment. So a typical sequence of commands to lock a specific range within a file might be as follows:

`F_ULOCK` requests may, in whole or in part, release one or more locked sections controlled by the process. When sections are not fully released, the remaining sections are still locked by the process. Releasing the center section of a locked section requires an additional element in the table of active locks. If this table is full, an `errno` is set to `ENOLCK` and the requested section is not released.

A potential for deadlock occurs if a process controlling a locked resource is put to sleep by requesting another process's locked resource. Thus calls to `lockf` or `fcntl` scan for a deadlock prior to sleeping on a locked resource. An error return is made if sleeping on the locked resource would cause a deadlock.

Sleeping on a resource is interrupted with any signal. The `alarm` system call may be used to provide a timeout facility in applications that require this facility.

`lockf` will fail if one or more of the following are true:

| | |
|----------------------|---|
| <code>EBADF</code> | <i>fdes</i> is not a valid open descriptor. |
| <code>EAGAIN</code> | <i>cmd</i> is <code>F_TLOCK</code> or <code>F_TEST</code> and the section is already locked by another process. |
| <code>EDEADLK</code> | <i>cmd</i> is <code>F_LOCK</code> and a deadlock would occur. |
| <code>ENOLCK</code> | <i>cmd</i> is <code>F_LOCK</code> , <code>F_TLOCK</code> , or <code>F_ULOCK</code> and the number of entries in the lock table would exceed the number allocated on the system. |
| <code>ECOMM</code> | <i>fdes</i> is on a remote machine and the link to that machine is no longer active. |

SEE ALSO

`intro(2)`, `alarm(2)`, `chmod(2)`, `close(2)`, `creat(2)`, `fcntl(2)`, `open(2)`, `read(2)`, `write(2)`

DIAGNOSTICS

On success, `lockf` returns 0. On failure, `lockf` returns -1 and sets `errno` to indicate the error.

NOTES

Unexpected results may occur in processes that do buffering in the user address space. The process may later read/write data that is/was locked. The standard I/O package is the most common source of unexpected buffering.

Because in the future the variable `errno` will be set to `EAGAIN` rather than `EACCES` when a section of a file is already locked by another process, portable application programs should expect and test for either value.

NAME

lockf - record locking on files

SYNOPSIS

```
#include <unistd.h>

int lockf (int fildes, int function, long size);
```

DESCRIPTION

lockf locks sections of a file. Advisory or mandatory write locks depend on the mode bits of the file; see `chmod(2)`. Other processes that try to lock the locked file section either get an error or go to sleep until the resource becomes unlocked. All the locks for a process are removed when the process terminates. See `fcntl(2)` for more information about record locking.

fildes is an open file descriptor. The file descriptor must have `O_WRONLY` or `O_RDWR` permission in order to establish locks with this function call.

function is a control value that specifies the action to be taken. The permissible values for *function* are defined in `unistd.h` as follows:

```
#define F_ULOCK 0 /* unlock previously locked section */
#define F_LOCK 1 /* lock section for exclusive use */
#define F_TLOCK 2 /* test & lock section for exclusive use */
#define F_TEST 3 /* test section for other locks */
```

All other values of *function* are reserved for future extensions and will result in an error return if not implemented.

`F_TEST` is used to detect if a lock by another process is present on the specified section. `F_LOCK` and `F_TLOCK` both lock a section of a file if the section is available. `F_ULOCK` removes locks from a section of the file.

size is the number of contiguous bytes to be locked or unlocked. The resource to be locked or unlocked starts at the current offset in the file and extends forward for a positive *size* and backward for a negative *size* (the preceding bytes up to but not including the current offset). If *size* is zero, the section from the current offset through the largest file offset is locked (that is, from the current offset through the present or any future end-of-file). An area need not be allocated to the file in order to be locked as such locks may exist past the end-of-file.

The sections locked with `F_LOCK` or `F_TLOCK` may, in whole or in part, contain or be contained by a previously locked section for the same process. Locked sections will be unlocked starting at the the point of the offset through *size* bytes or to the end of file if *size* is (`off_t`) 0. When this situation occurs, or if this situation occurs in adjacent sections, the sections are combined into a single section. If the request requires that a new element be added to the table of active locks and this table is already full, an error is returned, and the new section is not locked.

`F_LOCK` and `F_TLOCK` requests differ only by the action taken if the resource is not available. `F_LOCK` will cause the calling process to sleep until the resource is available. `F_TLOCK` will cause the function to return a -1 and set `errno` to `EACCES` if the section is already locked by another process.

lock (2)

(Application Compatibility Package)

lock (2)

NAME

lock - lock a process in primary memory

SYNOPSIS

```
cc [flag ...] file ... -lx  
int lock(flag);
```

DESCRIPTION

If the *flag* argument is nonzero, the process executing this call will not be swapped unless it is required to grow. If the argument is zero, the process is unlocked. This call may only be executed by the super-user. If someone other than the super-user tries to execute this call, a value of -1 is returned and the `errno` is set to `EPERM`.

localeconv (3C)**(C Programming Language Utilities)****localeconv (3C)**

| | | | | |
|--------------------------|---|---|---|---|
| <code>p_sign_posn</code> | 1 | 1 | 1 | 1 |
| <code>n_sign_posn</code> | 1 | 4 | 2 | 2 |

FILES

| | |
|---|---|
| <code>/usr/lib/locale/locale/LC_MONETARY</code> | <code>LC_MONETARY</code> database for <i>locale</i> |
| <code>/usr/lib/locale/locale/LC_NUMERIC</code> | <code>LC_NUMERIC</code> database for <i>locale</i> |

SEE ALSO

`chrtbl(1M)`, `montbl(1M)`, `setlocale(3C)`.

char n_sep_by_space

Set to 1 or 0 if the `currency_symbol` respectively is or is not separated by a space from the value for a negative formatted monetary quantity.

char p_sign_posn

Set to a value indicating the positioning of the `positive_sign` for a non-negative formatted monetary quantity. The value of `p_sign_posn` is interpreted according to the following:

- 0 Parentheses surround the quantity and `currency_symbol`.
- 1 The sign string precedes the quantity and `currency_symbol`.
- 2 The sign string succeeds the quantity and `currency_symbol`.
- 3 The sign string immediately precedes the `currency_symbol`.
- 4 The sign string immediately succeeds the `currency_symbol`.

char n_sign_posn

Set to a value indicating the positioning of the `negative_sign` for a negative formatted monetary quantity. The value of `n_sign_posn` is interpreted according to the rules described under `p_sign_posn`.

RETURNS

`localeconv` returns a pointer to the filled-in object. The structure pointed to by the return value may be overwritten by a subsequent call to `localeconv`.

EXAMPLES

The following table illustrates the rules used by four countries to format monetary quantities.

| Country | Positive format | Negative format | International format |
|-------------|-----------------|-----------------|----------------------|
| Italy | L.1.234 | -L.1.234 | ITL.1.234 |
| Netherlands | F 1.234,56 | F -1.234,56 | NLG 1.234,56 |
| Norway | kr1.234,56 | kr1.234,56- | NOK 1.234,56 |
| Switzerland | SFrs.1,234.56 | SFrs.1,234.56C | CHF 1,234.56 |

For these four countries, the respective values for the monetary members of the structure returned by `localeconv` are as follows:

| | Italy | Netherlands | Norway | Switzerland |
|--------------------------------|--------|-------------|--------|-------------|
| <code>int_curr_symbol</code> | "ITL." | "NLG " | "NOK " | "CHF " |
| <code>currency_symbol</code> | "L." | "F" | "kr" | "SFrs." |
| <code>mon_decimal_point</code> | " " | "," | "," | ." |
| <code>mon_thousands_sep</code> | "." | "." | "." | "," |
| <code>mon_grouping</code> | "\3" | "\3" | "\3" | "\3" |
| <code>positive_sign</code> | "" | "" | "" | "" |
| <code>negative_sign</code> | "-" | "-" | "-" | "C" |
| <code>int_frac_digits</code> | 0 | 2 | 2 | 2 |
| <code>frac_digits</code> | 0 | 2 | 2 | 2 |
| <code>p_cs_precedes</code> | 1 | 1 | 1 | 1 |
| <code>p_sep_by_space</code> | 0 | 1 | 0 | 0 |
| <code>n_cs_precedes</code> | 1 | 1 | 1 | 1 |
| <code>n_sep_by_space</code> | 0 | 1 | 0 | 0 |

| | |
|-------------------------|--|
| CHAR-MAX | No further grouping is to be performed. |
| 0 | The previous element is to be repeatedly used for the remainder of the digits. |
| <i>other</i> | The value is the number of digits that comprise the current group. The next element is examined to determine the size of the next group of digits to the left of the current group. |
| char *int_curr_symbol | The international currency symbol applicable to the current locale, left-justified within a four-character space-padded field. The character sequences should match with those specified in: <i>ISO 4217 Codes for the Representation of Currency and Funds</i> . |
| char *currency_symbol | The local currency symbol applicable to the current locale. |
| char *mon_decimal_point | The decimal point used to format monetary quantities. |
| char *mon_thousands_sep | The separator for groups of digits to the left of the decimal point in formatted monetary quantities. |
| char *mon_grouping | A string in which each element is taken as an integer that indicates the number of digits that comprise the current group in a formatted monetary quantity. The elements of <code>mon_grouping</code> are interpreted according to the rules described under <code>grouping</code> . |
| char *positive_sign | The string used to indicate a nonnegative-valued formatted monetary quantity. |
| char *negative_sign | The string used to indicate a negative-valued formatted monetary quantity. |
| char int_frac_digits | The number of fractional digits (those to the right of the decimal point) to be displayed in an internationally formatted monetary quantity. |
| char frac_digits | The number of fractional digits (those to the right of the decimal point) to be displayed in a formatted monetary quantity. |
| char p_cs_precedes | Set to 1 or 0 if the <code>currency_symbol</code> respectively precedes or succeeds the value for a nonnegative formatted monetary quantity. |
| char p_sep_by_space | Set to 1 or 0 if the <code>currency_symbol</code> respectively is or is not separated by a space from the value for a nonnegative formatted monetary quantity. |
| char n_cs_precedes | Set to 1 or 0 if the <code>currency_symbol</code> respectively precedes or succeeds the value for a negative formatted monetary quantity. |

NAME

localeconv - get numeric formatting information

SYNOPSIS

```
#include <locale.h>

struct lconv *localeconv (void);
```

DESCRIPTION

localeconv sets the components of an object with type struct lconv (defined in locale.h) with the values appropriate for the formatting of numeric quantities (monetary and otherwise) according to the rules of the current locale [see setlocale(3C)]. The definition of struct lconv is given below (the values for the fields in the C locale are given in comments):

```
char *decimal_point;      /* "." */
char *thousands_sep;    /* "" (zero length string) */
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_MAX */
char frac_digits;        /* CHAR_MAX */
char p_cs_precedes;      /* CHAR_MAX */
char p_sep_by_space;     /* CHAR_MAX */
char n_cs_precedes;      /* CHAR_MAX */
char n_sep_by_space;     /* CHAR_MAX */
char p_sign_posn;        /* CHAR_MAX */
char n_sign_posn;        /* CHAR_MAX */
```

The members of the structure with type char * are strings, any of which (except decimal_point) can point to "", to indicate that the value is not available in the current locale or is of zero length. The members with type char are nonnegative numbers, any of which can be CHAR_MAX (defined in the limits.h header file) to indicate that the value is not available in the current locale. The members are the following:

char *decimal_point

The decimal-point character used to format non-monetary quantities.

char *thousands_sep

The character used to separate groups of digits to the left of the decimal-point character in formatted non-monetary quantities.

char *grouping

A string in which each element is taken as an integer that indicates the number of digits that comprise the current group in a formatted non-monetary quantity. The elements of grouping are interpreted according to the following:

listen(3N)

listen(3N)

NAME

listen - listen for connections on a socket

SYNOPSIS

```
int listen(int s, int backlog);
```

DESCRIPTION

To accept connections, a socket is first created with `socket`, a backlog for incoming connections is specified with `listen` and then the connections are accepted with `accept`. The `listen` call applies only to sockets of type `SOCK_STREAM` or `SOCK_SEQPACKET`.

The *backlog* parameter defines the maximum length the queue of pending connections may grow to. If a connection request arrives with the queue full, the client will receive an error with an indication of `ECONNREFUSED`.

RETURN VALUE

A 0 return value indicates success; -1 indicates an error.

ERRORS

The call fails if:

| | |
|-------------------------|---|
| <code>EBADF</code> | The argument <i>s</i> is not a valid descriptor. |
| <code>ENOTSOCK</code> | The argument <i>s</i> is not a socket. |
| <code>EOPNOTSUPP</code> | The socket is not of a type that supports the operation <code>listen</code> . |

NOTES

There is currently no *backlog* limit.

link(2)

link(2)

EXDEV

The link named by *path2* and the file named by *path1* are on different logical devices (file systems).

SEE ALSO

unlink(2)

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

link - link to a file

SYNOPSIS

```
#include <unistd.h>

int link(const char *path1, const char *path2);
```

DESCRIPTION

path1 points to a path name naming an existing file. *path2* points to a path name naming the new directory entry to be created. `link` creates a new link (directory entry) for the existing file and increments its link count by one.

Upon successful completion, `link` marks for update the `st_ctime` field of the file. Also, the `st_ctime` and `st_mtime` fields of the directory that contains the new entry are marked for update.

`link` will fail and no link will be created if one or more of the following are true:

| | |
|--------------|--|
| EACCES | A component of either path prefix denies search permission. |
| EACCES | The requested link requires writing in a directory with a mode that denies write permission. |
| EEXIST | The link named by <i>path2</i> exists. |
| EFAULT | <i>path</i> points outside the allocated address space of the process. |
| EINTR | A signal was caught during the <code>link</code> system call. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMLINK | The maximum number of links to a file would be exceeded. |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and file system type does not allow it. |
| ENAMETOOLONG | The length of the <i>path1</i> or <i>path2</i> argument exceeds <code>{PATH_MAX}</code> , or the length of a <i>path1</i> or <i>path2</i> component exceeds <code>{NAME_MAX}</code> while <code>_POSIX_NO_TRUNC</code> is in effect. |
| ENOTDIR | A component of either path prefix is not a directory. |
| ENOENT | <i>path1</i> or <i>path2</i> is a null path name. |
| ENOENT | A component of either path prefix does not exist. |
| ENOENT | The file named by <i>path1</i> does not exist. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| ENOSPC | the directory that would contain the link cannot be extended. |
| EPERM | The file named by <i>path1</i> is a directory and the effective user ID is not super-user. |
| EROFS | The requested link requires writing in a directory on a read-only file system. |

For example, for a terminal with `New`, `Newlayer`, and `Reshape` minimum values of 8 (pixels) for `origin_x` and `origin_y` and maximum values of 792 (pixels) for `corner_x` and 1016 (pixels) for `corner_y`, the minimum layer size is 28 by 28 pixels and the maximum layer size is 784 by 1008 pixels.

It is recommended that applications use `/dev/xt/??[0-7]` instead of `/dev/xt??[0-7]` when accessing the `xt` driver.

The `Runlayer` routine runs the specified *command* in the layer associated with the channel argument *chan*. This layer is usually a layer previously created with `Newlayer`. Any processes currently attached to this layer will be killed, and the new process will have the environment of the `layers` process.

The `Current` routine makes the layer associated with the channel argument *chan* current (that is, attached to the keyboard).

The `Delete` routine deletes the layer associated with the channel argument *chan* and kills all host processes associated with the layer.

The `Top` routine makes the layer associated with the channel argument *chan* appear on top of all overlapping layers.

The `Bottom` routine puts the layer associated with the channel argument *chan* under all overlapping layers.

The `Move` routine moves the layer associated with the channel argument *chan* from its current screen location to a new screen location at the origin point (*origin_x*, *origin_y*). The size and contents of the layer are maintained.

The `Reshape` routine reshapes the layer associated with the channel argument *chan*. The arguments *origin_x*, *origin_y*, *corner_x*, and *corner_y* are the new coordinates of the layer rectangle. If all the coordinate arguments are 0, the user is allowed to define the layer's rectangle interactively.

The `Exit` routine causes the `layers` program to exit, killing all processes associated with it.

FILES

`ULIBDIR/libwindows.a` windowing terminal function library
`ULIBDIR` usually `/usr/lib`

SEE ALSO

`layers(1)`, `close(2)`, `write(2)`, `jagent(5)`.

DIAGNOSTICS

Upon successful completion, `Runlayer`, `Current`, `Delete`, `Top`, `Bottom`, `Move`, `Reshape`, and `Exit` return 0, while `openagent`, `New`, `Newlayer`, and `openchan` return values as described above under each routine. If an error occurs, -1 is returned.

NOTES

The values of layer rectangle coordinates are dependent on the type of terminal. This dependency affects the routines that pass layer rectangle coordinates: `Move`, `New`, `Newlayer`, and `Reshape`. Some terminals will expect these numbers to be passed as character positions (bytes); others will expect the information to be in pixels (bits).

NAME

libwindows - windowing terminal function library

SYNOPSIS

```
cc [flag ...]file ... -lwindows [library ...]
int openagent (void);
int New (int cntlfd, int origin_x, int origin_y,
        int corner_x, int corner_y);
int Newlayer (int cntlfd, int origin_x, int origin_y,
             int corner_x, int corner_y);
int openchan (int chan);
int Runlayer (int chan, char *command);
int Current (int cntlfd, int chan);
int Delete (int cntlfd, int chan);
int Top (int cntlfd, int chan);
int Bottom (int cntlfd, int chan);
int Move (int cntlfd, int chan, int origin_x, int origin_y);
int Reshape (int cntlfd, int chan, int origin_x, int origin_y,
            int corner_x, int corner_y);
int Exit (int cntlfd);
```

DESCRIPTION

This library of routines enables a program running on a host UNIX system to perform windowing terminal functions [see [layers\(1\)](#)].

The `openagent` routine opens the control channel of the `xt(7)` channel group to which the calling process belongs. Upon successful completion, `openagent` returns a file descriptor that can be passed to any of the other `libwindows` routines except `openchan` and `Runlayer`. (The file descriptor can also be passed to the `close` system call.) Otherwise, the value `-1` is returned.

The `New` routine creates a new layer with a separate shell. The `origin_x`, `origin_y`, `corner_x`, and `corner_y` arguments are the coordinates of the layer rectangle. If all the coordinate arguments are 0, the user must define the layer's rectangle interactively. The layer appears on top of any overlapping layers. The layer is not made current (that is, the keyboard is not attached to the new layer). Upon successful completion, `New` returns the `xt(7)` channel number associated with the layer. Otherwise, the value `-1` is returned.

The `Newlayer` routine creates a new layer without executing a separate shell. Otherwise it is identical to `New`, described above.

The `openchan` routine opens the channel argument `chan` which is obtained from the `New` or `Newlayer` routine. Upon successful completion, `openchan` returns a file descriptor that can be used as input to `write(2)` or `close(2)`. Otherwise, the value `-1` is returned.

Major classification

Identifies the source of the condition. Identifiers are: MM_HARD (hardware), MM_SOFT (software), and MM_FIRM (firmware).

Message source subclassification

Identifies the type of software in which the problem is spotted. Identifiers are: MM_APPL (application), MM_UTIL (utility), and MM_OPSYS (operating system).

STANDARD ERROR MESSAGE FORMAT

lfmt() displays error messages in the following format:
label: severity: text

If no *label* was defined by a call to `setLabel()`, the message is displayed in the format:

severity: text

If `lfmt()` is called twice to display an error message and a helpful *action* or recovery message, the output can look like:

label: severity: text
label: TO FIX: text

RETURN VALUE

Upon success, `lfmt()` returns the number of bytes transmitted. Upon failure, it returns a negative value:

- 1 write error to *stream*.
- 2 cannot log and/or display at console.

EXAMPLES

Example 1:

```
setLabel("UX:test");
lfmt(stderr, MM_ERROR|MM_CONSOLE|MM_SOFT|MM_UTIL,
      "test:2:Cannot open file: %s\n", strerror(errno));
```

displays the message to *stderr* and to the console and makes it available for logging:

```
UX:test: ERROR: Cannot open file: No such file or directory
```

Example 2:

```
setLabel("UX:test");
lfmt(stderr, MM_INFO|MM_SOFT|MM_UTIL,
      "test:23:test facility is enabled\n");
```

displays the message to *stderr* and makes it available for logging:

```
UX:test: INFO: test facility enabled
```

SEE ALSO

`addsev(3C)`, `environ(5)`, `gettext(3C)`, `pfmt(3C)`, `lfmt(1)`, `printf(3C)`, `setcat(3C)`, `setLabel(3C)`, `setlocale(3C)`.

The *flags* are composed of several groups, and can take the following values (one from each group): *Output format control*

| | |
|----------|--|
| MM_NOSTD | Do not use the standard message format, interpret <i>format</i> as a <code>printf()</code> <i>format</i> . Only <i>catalog access control flags</i> , <i>console display control</i> and <i>logging information</i> should be specified if MM_NOSTD is used; all other flags will be ignored |
| MM_STD | Output using the standard message format (default, value 0). |

Catalog access control

| | |
|----------|--|
| MM_NOGET | Do not retrieve a localized version of <i>format</i> . In this case, only the <code><defmsg></code> part of the <i>format</i> is specified. |
| MM_GET | Retrieve a localized version of <i>format</i> , from the <code><catalog></code> , using <code><msgid></code> as the index and <code><defmsg></code> as the default message (default, value 0). |

Severity (standard message format only)

| | |
|------------|--|
| MM_HALT | generates a localized version of HALT. |
| MM_ERROR | generates a localized version of ERROR (default, value 0). |
| MM_WARNING | generates a localized version of WARNING. |
| MM_INFO | generates a localized version of INFO. |

Additional severities can be defined. Add-on severities can be defined with number-string pairs with numeric values from the range [5-255], using `addsev()`. The numeric value ORed with other *flags* will generate the specified severity.

If the severity is not defined, `lfmt()` used the string `SEV=N` where *N* is replaced by the integer severity value passed in *flags*.

Multiple severities passed in *flags* will not be detected as an error. Any combination of severities will be summed and the numeric value will cause the display of either a severity string (if defined) or the string `SEV=N` (if undefined).

Action

| | |
|-----------|--|
| MM_ACTION | specifies an action message. Any severity value is superseded and replaced by a localized version of TO FIX. |
|-----------|--|

Console display control

| | |
|--------------|--|
| MM_CONSOLE | display the message to the console in addition to the specified <i>stream</i> . |
| MM_NOCONSOLE | do not display the message to the console in addition to the specified <i>stream</i> (default, value 0). |

Logging information

NAME

lfmt - display error message in standard format and pass to logging and monitoring services

SYNOPSIS

```
#include <pfmt.h>
```

```
int lfmt(FILE *stream, long flags, char *format, ... /* arg */);
```

DESCRIPTION

lfmt() retrieves a format string from a locale-specific message database (unless MM_NOGET is specified) and uses it for printf() style formatting of args. The output is displayed on stream. If stream is NULL, no output is displayed.

lfmt() encapsulates the output in the standard error message format (unless MM_NOSTD is specified, in which case the output is simply printf() like).

lfmt() forwards its output to the logging and monitoring facility, even if stream is NULL. Optionally, lfmt() will display the output on the console, with a date and time stamp.

If the printf() format string is to be retrieved from a message database, the format argument must have the following structure:

```
<catalog> : <msgnum> : <defmsg>.
```

If MM_NOGET is specified, only the <defmsg> part must be specified.

<catalog> is used to indicate the message database that contains the localized version of the format string. <catalog> must be limited to 14 characters. These characters must be selected from a set of all characters values, excluding \0 (null) and the ASCII codes for / (slash) and : (colon).

<msgnum> is a positive number that indicates the index of the string into the message database.

If the catalog does not exist in the locale (specified by the last call to setlocale() using the LC_ALL or LC_MESSAGES categories), or if the message number is out of bound, lfmt() will attempt to retrieve the message from the C locale. If this second retrieval fails, lfmt() uses the <defmsg> part of the format argument.

If <catalog> is omitted, lfmt() will attempt to retrieve the string from the default catalog specified by the last call to setcat(). In this case, the format argument has the following structure:

```
: <msgnum> : <defmsg>.
```

lfmt() will output Message not found!\n as format string if <catalog> is not a valid catalog name, if no catalog is specified (either explicitly or via setcat()), if <msgnum> is not a valid number, or if no message could be retrieved from the message databases, and <defmsg> was omitted.

The flags determine the type of output (i.e. whether the format should be interpreted as is or encapsulated in the standard message format), and the access to message catalogs to retrieve a localized version of format.

NAME

l3tol, ltol3 - convert between 3-byte integers and long integers

SYNOPSIS

```
#include <stdlib.h>
void l3tol (long *lp, const char *cp, int n);
void ltol3 (char *cp, const long *lp, int n);
```

DESCRIPTION

l3tol converts a list of *n* three-byte integers packed into a character string pointed to by *cp* into a list of long integers pointed to by *lp*.

ltol3 performs the reverse conversion from long integers (*lp*) to three-byte integers (*cp*).

These functions are useful for file-system maintenance where the block numbers are three bytes long.

SEE ALSO

fs(4)

NOTES

Because of possible differences in byte ordering, the numerical values of the long integers are machine-dependent.

NAME

killpg - send signal to a process group

SYNOPSIS

```
/usr/ucb/cc [flag...] file...
```

```
int killpg(pgrp, sig)
int pgrp, sig;
```

DESCRIPTION

killpg sends the signal *sig* to the process group *pgrp*. See sigvec(3) for a list of signals.

The real or effective user ID of the sending process must match the real or saved set-user ID of the receiving process, unless the effective user ID of the sending process is the privileged user. A single exception is the signal SIGCONT, which may always be sent to any descendant of the current process.

RETURN VALUE

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and the global variable *errno* is set to indicate the error.

ERRORS

killpg will fail and no signal will be sent if any of the following occur:

- | | |
|--------|---|
| EINVAL | <i>sig</i> is not a valid signal number. |
| ESRCH | No processes were found in the specified process group. |
| EPERM | The effective user ID of the sending process is not privileged user, and neither its real nor effective user ID matches the real or saved set-user ID of one or more of the target processes. |

SEE ALSO

kill(2), setpgrp(2), sigaction(2), sigvec(3).

kill(2)

kill(2)

NOTES

`sigsend` is a more versatile way to send signals to processes. The user is encouraged to use `sigsend` instead of `kill`.

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

kill - send a signal to a process or a group of processes

SYNOPSIS

```
#include <sys/types.h>
#include <signal.h>

int kill (pid_t pid, int sig);
```

DESCRIPTION

kill sends a signal to a process or a group of processes. The process or group of processes to which the signal is to be sent is specified by *pid*. The signal that is to be sent is specified by *sig* and is either one from the list given in `signal` [see `signal(5)`], or 0. If *sig* is 0 (the null signal), error checking is performed but no signal is actually sent. This can be used to check the validity of *pid*.

The real or effective user ID of the sending process must match the real or saved [from `exec(2)`] user ID of the receiving process unless the effective user ID of the sending process is superuser, [see `intro(2)`], or *sig* is `SIGCONT` and the sending process has the same session ID as the receiving process.

The process with ID 0 and the process with ID 1 are special processes [see `intro(2)`] and will be referred to below as `proc0` and `proc1`, respectively.

If *pid* is greater than 0, *sig* will be sent to the process whose process ID is equal to *pid*. *pid* may equal 1.

If *pid* is negative but not `(pid_t)-1`, *sig* will be sent to all processes whose process group ID is equal to the absolute value of *pid* and for which the process has permission to send a signal.

If *pid* is 0, *sig* will be sent to all processes excluding `proc0` and `proc1` whose process group ID is equal to the process group ID of the sender. Permission is needed to send a signal to process groups.

If *pid* is `(pid_t)-1` and the effective user ID of the sender is not superuser, *sig* will be sent to all processes excluding `proc0` and `proc1` whose real user ID is equal to the effective user ID of the sender.

If *pid* is `(pid_t)-1` and the effective user ID of the sender is superuser, *sig* will be sent to all processes excluding `proc0` and `proc1`.

kill will fail and no signal will be sent if one or more of the following are true:

| | |
|--------|--|
| EINVAL | <i>sig</i> is not a valid signal number. |
| EINVAL | <i>sig</i> is <code>SIGKILL</code> and <i>pid</i> is <code>(pid_t)1</code> (that is, <i>pid</i> specifies <code>proc1</code>). |
| ESRCH | No process or process group can be found corresponding to that specified by <i>pid</i> . |
| EPERM | The user ID of the sending process is not privileged, and its real or effective user ID does not match the real or saved user ID of the receiving process, and the calling process is not sending <code>SIGCONT</code> to a process that shares the same session ID. |

SEE ALSO

kill(1), `getpid(2)`, `getsid(2)`, `intro(2)`, `setpgrp(2)`, `sigaction(2)`, `signal(2)`, `sigsend(2)`.

NAME

isnan, isnand, isnanf, finite, fpclass, unordered - determine type of floating-point number

SYNOPSIS

```
#include <ieeefp.h>
int isnand (double dsrc);
int isnanf (float fsrc);
int finite (double dsrc);
fpclass_t fpclass (double dsrc);
int unordered (double dsrc1, double dsrc2);
#include <math.h>
int isnan (double dsrc);
```

DESCRIPTION

isnan, isnand, and isnanf return true (1) if the argument *dsrc* or *fsrc* is NaN; otherwise they return false (0). The functionality of isnan is identical to that of isnand.

isnanf is implemented as a macro included in the ieeefp.h header file.

fpclass returns the class the *dsrc* belongs to. The 10 possible classes are as follows:

| | |
|------------|--------------------------------|
| FP_SNaN | signaling NaN |
| FP_QNaN | quiet NaN |
| FP_NINF | negative infinity |
| FP_PINF | positive infinity |
| FP_NDENORM | negative denormalized non-zero |
| FP_PDENORM | positive denormalized non-zero |
| FP_NZERO | negative zero |
| FP_PZERO | positive zero |
| FP_NNORM | negative normalized non-zero |
| FP_PNORM | positive normalized non-zero |

finite returns true (1) if the argument *dsrc* is neither infinity nor NaN; otherwise it returns false (0).

unordered returns true (1) if one of its two arguments is unordered with respect to the other argument. This is equivalent to reporting whether either argument is NaN. If neither of the arguments is NaN, false (0) is returned.

None of these routines generate any exception, even for signaling NaNs.

SEE ALSO

fpgetround(3C), intro(3M)

NAME

isencrypt - determine whether a character buffer is encrypted

SYNOPSIS

```
cc [flag ...] file ... -lgen [library ...]
#include <libgen.h>
int isencrypt (const char *fbuf, size_t ninbuf);
```

DESCRIPTION

isencrypt uses heuristics to determine whether a buffer of characters is encrypted. It requires two arguments: a pointer to an array of characters and the number of characters in the buffer.

isencrypt assumes that the file is not encrypted if all the characters in the first block are ASCII characters. If there are non-ASCII characters in the first *ninbuf* characters, isencrypt assumes that the buffer is encrypted if the `setlocale LC_CTYPE` category is set to `C` or `ascii`.

If the `LC_CTYPE` category is set to a value other than `C` or `ascii`, then isencrypt uses a combination of heuristics to determine if the buffer is encrypted. If *ninbuf* has at least 64 characters, a chi-square test is used to determine if the bytes in the buffer have a uniform distribution; and isencrypt assumes the buffer is encrypted if it does. If the buffer has less than 64 characters, a check is made for null characters and a terminating new-line to determine whether the buffer is encrypted.

DIAGNOSTICS

If the buffer is encrypted, 1 is returned; otherwise zero is returned.

SEE ALSO

setlocale(3C)

NAME

isastream - test a file descriptor

SYNOPSIS

```
int isastream(int fildes);
```

DESCRIPTION

The function `isastream()` determines if a file descriptor represents a STREAMS file. *fildes* refers to an open file.

RETURN VALUE

If successful, `isastream()` returns 1 if *fildes* represents a STREAMS file, and 0 if not. On failure, `isastream()` returns -1 with `errno` set to indicate an error.

ERRORS

Under the following conditions, `isastream()` fails and sets `errno` to:

`EBADF` *fildes* is not a valid open file.

SEE ALSO

`streamio(7)`.

ioctl(2)

ioctl(2)

STREAMS errors are described in `streamio(7)`.

SEE ALSO

`streamio(7)`, `termio(7)`.

DIAGNOSTICS

Upon successful completion, the value returned depends upon the device control function, but must be a non-negative integer. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

ioctl - control device

SYNOPSIS

```
#include <unistd.h>
int ioctl (int fildes, int request, ... /* arg */);
```

DESCRIPTION

ioctl performs a variety of control functions on devices and STREAMS. For non-STREAMS files, the functions performed by this call are device-specific control functions. *request* and an optional third argument with varying type are passed to the file designated by *fildes* and are interpreted by the device driver. This control is not frequently used on non-STREAMS devices, where the basic input/output functions are usually performed through the `read(2)` and `write(2)` system calls.

For STREAMS files, specific functions are performed by the `ioctl` call as described in `streamio(7)`.

fildes is an open file descriptor that refers to a device. *request* selects the control function to be performed and depends on the device being addressed. *arg* represents a third argument that has additional information that is needed by this specific device to perform the requested function. The data type of *arg* depends upon the particular control request, but it is either an `int` or a pointer to a device-specific data structure.

In addition to device-specific and STREAMS functions, generic functions are provided by more than one device driver, for example, the general terminal interface [see `termio(7)`].

ioctl fails for any type of file if one or more of the following are true:

| | |
|--------|--|
| EBADF | <i>fildes</i> is not a valid open file descriptor. |
| ENOTTY | <i>fildes</i> is not associated with a device driver that accepts control functions. |
| EINTR | A signal was caught during the <code>ioctl</code> system call. |

ioctl also fails if the device driver detects an error. In this case, the error is passed through `ioctl` without change to the caller. A particular driver might not have all of the following error cases. Under the following conditions, requests to device drivers may fail and set `errno` to:

| | |
|---------|--|
| EFAULT | <i>request</i> requires a data transfer to or from a buffer pointed to by <i>arg</i> , but some part of the buffer is outside the process's allocated space. |
| EINVAL | <i>request</i> or <i>arg</i> is not valid for this device. |
| EIO | Some physical I/O error has occurred. |
| ENXIO | The <i>request</i> and <i>arg</i> are valid for this device driver, but the service requested can not be performed on this particular subdevice. |
| ENOLINK | <i>fildes</i> is on a remote machine and the link to that machine is no longer active. |

NAME

insque, remque - insert/remove element from a queue

SYNOPSIS

```
include <search.h>
void insque(struct qelem *elem, struct qelem *pred);
void remque(struct qelem *elem);
```

DESCRIPTION

insque and remque manipulate queues built from doubly linked lists. Each element in the queue must be in the following form:

```
struct qelem {
    struct    qelem *q_forw;
    struct    qelem *q_back;
    char  q_data[];
};
```

insque inserts *elem* in a queue immediately after *pred*. remque removes an entry *elem* from a queue.

NAME

initgroups - initialize the supplementary group access list

SYNOPSIS

```
#include <grp.h>
#include <sys/types.h>

int initgroups (const char *name, gid_t basegid)
```

DESCRIPTION

initgroups reads the group file, using `getgrent`, to get the group membership for the user specified by *name* and then initializes the supplementary group access list of the calling process using `setgroups`. The *basegid* group ID is also included in the supplementary group access list. This is typically the real group ID from the password file.

While scanning the group file, if the number of groups, including the *basegid* entry, exceeds `{NGROUPS_MAX}`, subsequent group entries are ignored.

initgroups will fail and not change the supplementary group access list if:

`EPERM` The effective user ID is not superuser.

SEE ALSO

`setgroups(2)`, `getgrent(3C)`

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

When only one part is given, the value is stored directly in the network address without any byte rearrangement.

All numbers supplied as parts in a '.' notation may be decimal, octal, or hexadecimal, as specified in the C language (that is, a leading 0x or 0X implies hexadecimal; otherwise, a leading 0 implies octal; otherwise, the number is interpreted as decimal).

SEE ALSO

gethostent(3N), getnetent(3N), hosts(4), networks(4)

DIAGNOSTICS

The value -1 is returned by `inet_addr` and `inet_network` for malformed requests.

NOTES

The problem of host byte ordering versus network byte ordering is confusing. A simple way to specify Class C network addresses in a manner similar to that for Class B and Class A is needed.

The return value from `inet_ntoa` points to static information which is overwritten in each call.

NAME

inet: inet_addr, inet_network, inet_makeaddr, inet_lnaof, inet_netof, inet_ntoa - Internet address manipulation

SYNOPSIS

```
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <arpa/inet.h>

unsigned long inet_addr(char *cp);
unsigned long inet_network(char *cp);
struct in_addr inet_makeaddr(int net, int lna);
int inet_lnaof(struct in_addr in);
int inet_netof(struct in_addr in);
char *inet_ntoa(struct in_addr in);
```

DESCRIPTION

The routines `inet_addr` and `inet_network` each interpret character strings representing numbers expressed in the Internet standard '.' notation, returning numbers suitable for use as Internet addresses and Internet network numbers, respectively. The routine `inet_makeaddr` takes an Internet network number and a local network address and constructs an Internet address from it. The routines `inet_netof` and `inet_lnaof` break apart Internet host addresses, returning the network number and local network address part, respectively.

The routine `inet_ntoa` returns a pointer to a string in the base 256 notation *d.d.d.d* described below.

All Internet addresses are returned in network order (bytes ordered from left to right). All network numbers and local address parts are returned as machine format integer values.

INTERNET ADDRESSES

Values specified using the '.' notation take one of the following forms:

```
a.b.c.d
a.b.c
a.b
a
```

When four parts are specified, each is interpreted as a byte of data and assigned, from left to right, to the four bytes of an Internet address.

When a three part address is specified, the last part is interpreted as a 16-bit quantity and placed in the right most two bytes of the network address. This makes the three part address format convenient for specifying Class B network addresses as 128.net.host.

When a two part address is supplied, the last part is interpreted as a 24-bit quantity and placed in the right most three bytes of the network address. This makes the two part address format convenient for specifying Class A network addresses as net.host.

NAME

index, rindex - string operations

SYNOPSIS

```
#include <strings.h>
char *index(s, c)
char *s, c;
char *rindex(s, c)
char *s, c;
```

DESCRIPTION

These functions operate on NULL-terminated strings. They do not check for overflow of any receiving string.

index and rindex returns a pointer to the first (last) occurrence of character *c* in string *s*, or a NULL pointer if *c* does not occur in the string. The NULL character terminating a string is considered to be part of the string.

SEE ALSO

bstring(3), string(3C), malloc(3C).

NOTES

For user convenience, these functions are declared in the optional <strings.h> header file which is located in /usr/ucbinclude.

You can *not* use a NULL pointer to indicate a NULL string. A NULL pointer is an error and results in an abort of the program. If you wish to indicate a NULL string, you must have a pointer that points to an explicit NULL string. On some implementations of the C language on some machines, a NULL pointer, if dereferenced, would yield a NULL string; this highly non-portable trick was used in some programs. Programmers using a NULL pointer to represent an empty string should be aware of this portability issue; even on machines where dereferencing a NULL pointer does not cause an abort of the program, it does not necessarily yield a NULL string.

Character movement is performed differently in different implementations. Thus overlapping moves may yield surprises.

NAME

ifignore - check for ignored network interface

SYNOPSIS

```
int ifignore( if_name, serv_name )
char *if_name, *serv_name;
```

DESCRIPTION

`ifignore` provides a filtering mechanism for network applications that would otherwise indiscriminately send packets over all network interfaces attached to the machine. The function consults the file `/etc/if.ignore` and returns a value to indicate whether or not a particular network interface should be "ignored" by the invoking server. This indication is then used by the server itself in determining how to deal with the interface in question. `ifignore` returns a non-zero value if *if_name* should be ignored by *serv_name*; otherwise, zero is returned.

FILES

`/etc/if.ignore`

SEE ALSO

`routed(1M)`, `rwhod(1M)`, `timed(1M)`, `if.ignore(4)`

EXAMPLE

A user-specified signal handler might look like this:

```
void sample_handler( sig, code, scp, addr)
int sig ;                /* sig == SIGFPE always */
int code ;
struct sigcontext *scp ;
char *addr ;
{
    /*
     * Sample user-written sigfpe code handler.
     * Prints a message and continues.
     * struct sigcontext is defined in <signal.h>.
     */
    printf("ieee exception code %x occurred at pc %X \n",
           code, scp->sc_pc);
}
```

and it might be set up like this:

```
extern void sample_handler;
main
{
    sigfpe_handler_type hdl, old_handler1, old_handler2;
    /*
     * save current overflow and invalid handlers
     */
    ieee_handler("get", "overflow", old_handler1);
    ieee_handler("get", "invalid", old_handler2);
    /*
     * set new overflow handler to sample_handler and set new
     * invalid handler to SIGFPE_ABORT (abort on invalid)
     */
    hdl = (sigfpe_handler_type) sample_handler;
    if(ieee_handler("set", "overflow", hdl) != 0)
        printf("ieee_handler can't set overflow \n");
    if(ieee_handler("set", "invalid", SIGFPE_ABORT) != 0)
        printf("ieee_handler can't set invalid \n");
    ...
    /*
     * restore old overflow and invalid handlers
     */
    ieee_handler("set", "overflow", old_handler1);
    ieee_handler("set", "invalid", old_handler2);
}
```

FILES

```
/usr/include/fp.h
/usr/include/signal.h
```

SEE ALSO

signal(2), abort(3C), floatingpoint(3), ieee_handler(3), sigfpe(3), signal(3), sigvec(3).

NAME

ieee_handler - IEEE exception trap handler function

SYNOPSIS

```
/usr/ucb/cc [flag...] file...
#include <fp.h>
int ieee_handler(action, exception, hdl)
char action[], exception[];
sigfpe_handler_type hdl;
```

DESCRIPTION

This function provides easy exception handling to exploit ANSI/IEEE Std 754-1985 arithmetic in a C program. All arguments are pointers to strings. Results arising from invalid arguments and invalid combinations are undefined for efficiency.

There are three types of *action* : *get*, *set*, and *clear*. There are five types of *exception* :

| | |
|-----------|--|
| inexact | |
| division | division by zero exception |
| underflow | |
| overflow | |
| invalid | |
| all | all five exceptions above |
| common | invalid, overflow, and division exceptions |

Note: *all* and *common* only make sense with *set* or *clear*

hdl contains the address of a signal-handling routine. *<fp.h>* defines *sigfpe_handler_type*.

get will get the location of the current handler routine for *exception* in *hdl* . *set* will set the routine pointed at by *hdl* to be the handler routine and at the same time enable the trap on *exception*, except when *hdl* == SIGFPE_DEFAULT or SIGFPE_IGNORE; then *ieee_handler* will disable the trap on *exception*. When *hdl* == SIGFPE_ABORT, any trap on *exception* will dump core using *abort(3)*. *clear* all disables trapping on all five exceptions.

Two steps are required to intercept an IEEE-related SIGFPE code with *ieee_handler*:

- 1) Set up a handler with *ieee_handler*.
- 2) Perform a floating-point operation that generates the intended IEEE exception.

Unlike *sigfpe(3)*, *ieee_handler* also adjusts floating-point hardware mode bits affecting IEEE trapping. For *clear*, *set* SIGFPE_DEFAULT, or *set* SIGFPE_IGNORE, the hardware trap is disabled. For any other *set*, the hardware trap is enabled.

SIGFPE signals can be handled using *sigvec(2)*, *signal(3)*, *signal(3F)*, *sigfpe(3)*, or *ieee_handler(3M)*. In a particular program, to avoid confusion, use only one of these interfaces to handle SIGFPE signals.

RETURN VALUE

ieee_handler normally returns 0. In the case of *set*, 1 will be returned if the action is not available (for instance, not supported in hardware).

NAME

ieee_functions, fp_class, isnan, copysign, scalbn - miscellaneous functions for IEEE arithmetic

SYNOPSIS

```
/usr/ucb/cc [flag...] file...
#include <fp.h>
#include <math.h>
#include <stdio.h>

enum fp_class_type fp_class(x)
double x;

int isnan(x)
double x;

double copysign(x,y)
double x, y;

double scalbn(x,n)
double x; int n;
```

DESCRIPTION

Most of these functions provide capabilities required by ANSI/IEEE Std 754-1985 or suggested in its appendix.

`fp_class(x)` corresponds to the IEEE's `class()` and classifies `x` as zero, subnormal, normal, ∞ , or quiet or signaling *NaN*; `/usr/ucbinclude/sys/ieeefp.h` defines enum `fp_class_type`. The following function returns 0 if the indicated condition is not satisfied:

`isnan(x)` returns 1 if `x` is *NaN*

`copysign(x,y)` returns `x` with `y`'s sign bit.

`scalbn(x,n)` returns $x \cdot 2^{*n}$ computed by exponent manipulation rather than by actually performing an exponentiation or a multiplication. Thus

$$1 \leq \text{scalbn}(\text{fabs}(x), -\text{ilogb}(x)) < 2$$

for every `x` except 0, ∞ , and *NaN*.

FILES

```
/usr/ucbinclude/sys/ieeefp.h
/usr/ucbinclude/math.h
/usr/include/values.h
```

NAME

hypot - Euclidean distance function

SYNOPSIS

```
cc [flag ...] file ... -lm [library ...]
#include <math.h>
double hypot (double x, double y);
```

DESCRIPTION

hypot returns

```
sqrt(x * x + y * y)
```

taking precautions against unwarranted overflows.

SEE ALSO

matherr(3M)

DIAGNOSTICS

When the correct value would overflow, hypot returns HUGE and sets errno to ERANGE.

Except when the `-Xc` compilation option is used, these error-handling procedures may be changed with the function `matherr`. When the `-Xa` or `-Xc` compilation options are used, `HUGE_VAL` is returned instead of `HUGE`.

SEE ALSO

bsearch(3C), lsearch(3C), malloc(3C), malloc(3X), string(3C), tsearch(3C)

DIAGNOSTICS

hsearch returns a null pointer if either the action is `FIND` and the item could not be found or the action is `ENTER` and the table is full.

hcreate returns zero if it cannot allocate sufficient space for the table.

NOTES

hsearch and hcreate use malloc(3C) to allocate space.

Only one hash search table may be active at any given time.

```

char string_space[NUM_EMPL*20];
/* space to store employee info */
struct info info_space[NUM_EMPL];
/* next avail space in string_space */
char *str_ptr = string_space;
/* next avail space in info_space */
struct info *info_ptr = info_space;
ENTRY item, *found_item;
/* name to look for in table */
char name_to_find[30];
int i = 0;

/* create table */
(void) hcreate(NUM_EMPL);
while (scanf("%s%d%d", str_ptr, &info_ptr->age,
            &info_ptr->room) != EOF && i++ < NUM_EMPL) {
    /* put info in structure, and structure in item */
    item.key = str_ptr;
    item.data = (void *)info_ptr;
    str_ptr += strlen(str_ptr) + 1;
    info_ptr++;
    /* put item into table */
    (void) hsearch(item, ENTER);
}

/* access table */
item.key = name_to_find;
while (scanf("%s", item.key) != EOF) {
    if ((found_item = hsearch(item, FIND)) != NULL) {
        /* if item is in the table */
        (void)printf("found %s, age = %d, room = %d\n",
                    found_item->key,
                    ((struct info *)found_item->data)->age,
                    ((struct info *)found_item->data)->room);
    } else {
        (void)printf("no such employee %s\n",
                    name_to_find);
    }
}
return 0;
}

```

NAME

hsearch, hcreate, hdestroy - manage hash search tables

SYNOPSIS

```
#include <search.h>
ENTRY *hsearch (ENTRY item, ACTION action);
int hcreate (size_t nel);
void hdestroy (void);
```

DESCRIPTION

hsearch is a hash-table search routine generalized from Knuth (6.4) Algorithm D. It returns a pointer into a hash table indicating the location at which an entry can be found. The comparison function used by hsearch is strcmp [see string(3C)]. *item* is a structure of type ENTRY (defined in the search.h header file) containing two pointers: *item.key* points to the comparison key, and *item.data* points to any other data to be associated with that key. (Pointers to types other than void should be cast to pointer-to-void.) *action* is a member of an enumeration type ACTION (defined in search.h) indicating the disposition of the entry if it cannot be found in the table. ENTER indicates that the item should be inserted in the table at an appropriate point. Given a duplicate of an existing item, the new item is not entered and hsearch returns a pointer to the existing item. FIND indicates that no entry should be made. Unsuccessful resolution is indicated by the return of a null pointer.

hcreate allocates sufficient space for the table, and must be called before hsearch is used. *nel* is an estimate of the maximum number of entries that the table will contain. This number may be adjusted upward by the algorithm in order to obtain certain mathematically favorable circumstances.

hdestroy destroys the search table, and may be followed by another call to hcreate.

EXAMPLE

The following example will read in strings followed by two numbers and store them in a hash table, discarding duplicates. It will then read in strings and find the matching entry in the hash table and print it out.

```
#include <stdio.h>
#include <search.h>
#include <string.h>
#include <stdlib.h>

struct info {          /* this is the info stored in table */
    int age, room;    /* other than the key */
};

#define NUM_EMPL      5000    /* # of elements in search table */

main( )
{
    /* space to store strings */
```

NAME

grantpt - grant access to the slave pseudo-terminal device

SYNOPSIS

```
int grantpt(int fildes);
```

DESCRIPTION

The function `grantpt` changes the mode and ownership of the slave pseudo-terminal device associated with its master pseudo-terminal counter part. *fildes* is the file descriptor returned from a successful open of the master pseudo-terminal device. A `setuid` root program [see `setuid(2)`] is invoked to change the permissions. The user ID of the slave is set to the effective owner of the calling process and the group ID is set to a reserved group. The permission mode of the slave pseudo-terminal is set to readable, writeable by the owner and writeable by the group.

RETURN VALUE

Upon successful completion, the function `grantpt` returns 0; otherwise it returns -1. Failure could occur if *fildes* is not an open file descriptor, if *fildes* is not associated with a master pseudo-terminal device, or if the corresponding slave device could not be accessed.

SEE ALSO

`open(2)`, `setuid(2)`

`ptsname(3C)`, `unlockpt(3C)` in the *Programmer's Guide: STREAMS*

NAME

`gmatch` - shell global pattern matching

SYNOPSIS

```
cc [flag ...] file ... -lgen [library ...]
#include <libgen.h>
int gmatch (const char *str, const char *pattern);
```

DESCRIPTION

`gmatch` checks whether the null-terminated string *str* matches the null-terminated pattern string *pattern*. See the `sh(1)` section "File Name Generation" for a discussion of pattern matching. `gmatch` returns non-zero if the pattern matches the string, zero if the pattern doesn't. A backslash (`\`) is used as an escape character in pattern strings.

EXAMPLE

```
char *s;
gmatch (s, "[a\-" )
gmatch returns non-zero (true) for all strings with 'a' or '-' as their last character.
```

SEE ALSO

`sh(1)`.

NAME

getws, fgetws - get a `wchar_t` string from a stream

SYNOPSIS

```
#include <stdio.h>
#include <wchar.h>

wchar_t *getws(wchar_t *s);

wchar_t *fgetws(wchar_t *s, int n, FILE *stream);
```

DESCRIPTION (International Functions)

`getws()` reads EUC characters from *stdin*, converts them to `wchar_t` characters, and places them in the `wchar_t` array pointed to by *s*. `getws()` reads until a new-line character is read or an end-of-file condition is encountered. The new-line character is discarded and the `wchar_t` string is terminated with a `wchar_t` null character.

`fgetws()` reads EUC characters from the *stream*, converts them to `wchar_t` characters, and places them in the `wchar_t` array pointed to by *s*. `fgetws()` reads until *n-1* `wchar_t` characters are transferred to *s*, or a new-line character or an end-of-file condition is encountered. The `wchar_t` string is then terminated with a `wchar_t` null character.

DIAGNOSTICS

If end-of-file or a read error is encountered and no characters have been transformed, no `wchar_t` characters are transferred to *s* and a null pointer is returned and the error indicator for the stream is set. If the read error is an illegal byte sequence, `EILSEQ` is set to *errno*. If end-of-file is encountered, the EOF indicator for the stream is set. Otherwise, *s* is returned.

SEE ALSO

`ferror(3S)`, `fopen(3S)`, `fread(3S)`, `getwc(3W)`, `scanf(3S)`, `scanf(3W)`, `stdio(3S)`, `widec(3W)`.

NAME

getwidth - get information of supplementary code sets

SYNOPSIS

```
#include <sys/euc.h>
#include <getwidth.h>

void getwidth(eucwidth_t *ptr);
```

DESCRIPTION

getwidth() reads the *character class table*, which is generated by `chrtbl` or `wchrtbl`, to get information of supplementary code sets, and sets it into the structure `eucwidth_t`.

The structure `eucwidth_t` is defined in the header file `/usr/include/euc.h` as follows:

```
typedef struct {
    short int _eucw1,_eucw2,_eucw3;
    short int _scrw1,_scrw2,_scrw3;
    short int _pcw;
    char _multibyte;
} eucwidth_t;
```

Code set width values for three supplementary code sets are set in `_eucw1`, `_eucw2` and `_eucw3`, respectively. *Screen width* values for the three supplementary code sets are set in `_scrw1`, `_scrw2` and `_scrw3`, respectively. The width of EUC process code is set in `_pcw`. The maximum width in bytes of EUC is set in `_multibyte`.

If the `cswidth` parameter is not set, the system default is required. The system default is `cswidth 1:1,0:0,0:0`.

SEE ALSO

`chrtbl(1M)`, `wchrtbl(1M)`.

NAME

getwd - get current working directory pathname

SYNOPSIS

```
/usr/ucb/cc [flag...] file...  
#include <sys/param.h>  
char *getwd(pathname)  
char pathname[MAXPATHLEN];
```

DESCRIPTION

getwd copies the absolute pathname of the current working directory to *pathname* and returns a pointer to the result.

RETURN VALUE

getwd returns zero and places a message in *pathname* if an error occurs.

SEE ALSO

getcwd(3C).

NAME

`getwc`, `getwchar`, `fgetwc` - get `wchar_t` character from a stream

SYNOPSIS

```
#include <stdio.h>
#include <wchar.h>

int getwc(FILE *stream);
int getwchar(void);
int fgetwc(FILE *stream);
```

DESCRIPTION (International Functions)

`getwc()` transforms the next EUC character from the named input stream into a `wchar_t` character, and returns it. It also increments the file pointer, if defined, by one EUC character in the stream. `getwchar()` is defined as `getwc(stdin)`. `getwc()` and `getwchar()` are macros.

`fgetwc()` behaves like `getwc()`, however, it is a function.

DIAGNOSTICS

These functions return the constant `EOF` at the end-of-file or upon an error and set the `EOF` or error indicator of `stream`, respectively. If the error is an illegal sequence, `EILSEQ` is set to `errno`.

WARNINGS

If the value returned by `getwc()`, `getwchar()`, or `fgetwc()` is compared with the integer constant `EOF` after being stored in a `wchar_t` variable, the comparison may not succeed unless `EOF` is cast to type `wchar_t`.

SEE ALSO

`fclose(3S)`, `ferror(3S)`, `fopen(3S)`, `getws(3W)`, `putwc(3W)`, `scanf(3S)`, `scanf(3W)`, `stdio(3S)`, `widec(3W)`.

getvfsent (3C)

getvfsent (3C)

| | |
|-------------|---|
| VFS_TOOLONG | A line in the file exceeded the internal buffer size of VFS_LINE_MAX. |
| VFS_TOOMANY | A line in the file contains too many fields. |
| VFS_TOOFEW | A line in the file contains too few fields. |

NOTES

The members of the `vfstab` structure point to information contained in a static area, so it must be copied if it is to be saved.

NAME

getvfsent, getvfsfile, getvfsspec, getvfssany - get vfstab file entry

SYNOPSIS

```
#include <stdio.h>
#include <sys/vfstab.h>

int getvfsent (FILE *fp, struct vfstab *vp);
int getvfsfile (FILE *fp, struct vfstab *vp, char *file);
int getvfsspec (FILE *fp, struct vfstab *vp, char *spec);
int getvfssany (FILE *fp, struct vfstab *vp, struct vfstab *vref);
```

DESCRIPTION

getvfsent, getvfsfile, getvfsspec, and getvfssany each fill in the structure pointed to by *vp* with the broken-out fields of a line in the file *fp*. Each line in the file contains a vfstab structure, declared in the *sys/vfstab.h* header file:

```
char *vfs_special;
char *vfs_fsckdev;
char *vfs_mountp;
char *vfs_fstype;
char *vfs_fsckpass;
char *vfs_automnt;
char *vfs_mntopts;
```

The fields have meanings described in *vfstab(4)*.

getvfsent fills *vp* with the next vfstab structure in *fp* so successive calls can be used to search the entire file. *getvfsfile* searches the file referenced by *fp* until a mount point matching *file* is found and fills *vp* with the fields from the line in the file. *getvfsspec* searches the file referenced by *fp* until a special device matching *spec* is found and fills *vp* with the fields from the line in the file. *spec* will try to match on device type (block or character special) and major and minor device numbers. If it cannot match in this manner, then it compares the strings. *getvfssany* searches the file referenced by *fp* until a match is found between a line in the file and *vref*. *vref* matches the line if all non-null entries in *vref* match the corresponding fields in the file.

Lines in *fp* which are empty or contain a '#' in the first column are skipped.

Note that these routines do not open, close, or rewind the file.

FILES

/etc/vfstab

DIAGNOSTICS

If the next entry is successfully read by *getvfsent* or a match is found with *getvfsfile*, *getvfsspec*, or *getvfssany*, 0 is returned. If an end-of-file is encountered on reading, these functions return -1. If an error is encountered, a value greater than 0 is returned. The possible error values are:

NOTES

The most current entry is saved in a static structure. Multiple accesses require that it be copied before further accesses are made. On each call to either `getutxid` or `getutxline`, the routine examines the static structure before performing more I/O. If the contents of the static structure match what it is searching for, it looks no further. For this reason, to use `getutxline` to search for multiple occurrences it would be necessary to zero out the static after each success, or `getutxline` would just return the same structure over and over again. There is one exception to the rule about emptying the structure before further reads are done. The implicit read done by `pututxline` (if it finds that it is not already at the correct place in the file) will not hurt the contents of the static structure returned by the `getutxent`, `getutxid`, or `getutxline` routines, if the user has just modified those contents and passed the pointer back to `pututxline`.

These routines use buffered standard I/O for input, but `pututxline` uses an unbuffered write to avoid race conditions between processes trying to modify the `utmpx` and `wtmpx` files.

matches *id*->*ut_id*. If the end of file is reached without a match, it fails.

getutxline searches forward from the current point in the *utmpx* file until it finds an entry of the type `LOGIN_PROCESS` or `USER_PROCESS` which also has a *ut_line* string matching the *line*->*ut_line* string. If the end of file is reached without a match, it fails.

pututxline writes out the supplied *utmpx* structure into the *utmpx* file. It uses *getutxid* to search forward for the proper place if it finds that it is not already at the proper place. It is expected that normally the user of *pututxline* will have searched for the proper entry using one of the *getutx* routines. If so, *pututxline* will not search. If *pututxline* does not find a matching slot for the new entry, it will add a new entry to the end of the file. It returns a pointer to the *utmpx* structure.

setutxent resets the input stream to the beginning of the file. This should be done before each search for a new entry if it is desired that the entire file be examined.

endutxent closes the currently open file.

utmpxname allows the user to change the name of the file examined, from `/var/adm/utmpx` to any other file. It is most often expected that this other file will be `/var/adm/wtmpx`. If the file does not exist, this will not be apparent until the first attempt to reference the file is made. *utmpxname* does not open the file. It just closes the old file if it is currently open and saves the new file name. The new file name must end with the "x" character to allow the name of the corresponding *utmp* file to be easily obtainable (otherwise an error code of 1 is returned).

getutmp copies the information stored in the fields of the *utmpx* structure to the corresponding fields of the *utmp* structure. If the information in any field of *utmpx* does not fit in the corresponding *utmp* field, the data is truncated.

getutmpx copies the information stored in the fields of the *utmp* structure to the corresponding fields of the *utmpx* structure.

updwtmp checks the existence of *wfile* and its parallel file, whose name is obtained by appending an "x" to *wfile*. If only one of them exists, the second one is created and initialized to reflect the state of the existing file. *utmp* is written to *wfile* and the corresponding *utmpx* structure is written to the parallel file.

updwtmpx checks the existence of *wfilex* and its parallel file, whose name is obtained by truncating the final "x" from *wfilex*. If only one of them exists, the second one is created and initialized to reflect the state of the existing file. *utmpx* is written to *wfilex*, and the corresponding *utmp* structure is written to the parallel file.

FILES

`/var/adm/utmp`, `/var/adm/utmpx`
`/var/adm/wtmp`, `/var/adm/wtmpx`

SEE ALSO

`ttyslot(3C)`, `utmp(4)`, `utmpx(4)`

DIAGNOSTICS

A null pointer is returned upon failure to read, whether for permissions or having reached the end of file, or upon failure to write.

NAME

getutx: getutxent, getutxid, getutxline, pututxline, setutxent, endutxent, utmpxname, getutmp, getutmpx, updwtmp, updwtmpx - access utmpx file entry

SYNOPSIS

```
#include <utmpx.h>

struct utmpx *getutxent (void);
struct utmpx *getutxid (const struct utmpx *id);
struct utmpx *getutxline (const struct utmpx *line);
struct utmpx *pututxline (const struct utmpx *utmpx);
void setutxent (void);
void endutxent (void);
int utmpxname (const char *file);
void getutmp (struct utmpx *utmpx, struct utmp *utmp);
void getutmpx (struct utmp *utmp, struct utmpx *utmpx);
void updwtmp (char *wfile, struct utmp *utmp);
void updwtmpx (char *wfilex, struct utmpx *utmpx);
```

DESCRIPTION

getutxent, getutxid, and getutxline each return a pointer to a structure of the following type:

```
struct    utmpx {
    char    ut_user[32];        /* user login name */
    char    ut_id[4];          /* /etc/inittab id (usually */
                                /* line #) */
    char    ut_line[32];       /* device name (console, lnxx) */
    pid_t   ut_pid;            /* process id */
    short   ut_type;           /* type of entry */
    struct  exit_status {
        short  e_termination; /* termination status */
        short  e_exit;         /* exit status */
    } ut_exit;                 /* exit status of a process
                                /* marked as DEAD_PROCESS */
    struct  timeval   ut_tv;    /* time entry was made */
    short   ut_syslen;         /* significant length of ut_host */
                                /* including terminating null */
    char    ut_host[257];      /* host name, if remote */
};
```

getutxent reads in the next entry from a utmpx-like file. If the file is not already open, it opens it. If it reaches the end of the file, it fails.

getutxid searches forward from the current point in the utmpx file until it finds an entry with a ut_type matching id->ut_type if the type specified is RUN_LVL, BOOT_TIME, OLD_TIME, or NEW_TIME. If the type specified in id is INIT_PROCESS, LOGIN_PROCESS, USER_PROCESS, or DEAD_PROCESS, then getutxid will return a pointer to the first entry whose type is one of these four and whose ut_id field

search. If `pututline` does not find a matching slot for the new entry, it will add a new entry to the end of the file. It returns a pointer to the `utmp` structure.

`setutent` resets the input stream to the beginning of the file. This reset should be done before each search for a new entry if it is desired that the entire file be examined.

`endutent` closes the currently open file.

`utmpname` allows the user to change the name of the file examined, from `/var/adm/utmp` to any other file. It is most often expected that this other file will be `/var/adm/wtmp`. If the file does not exist, this will not be apparent until the first attempt to reference the file is made. `utmpname` does not open the file. It just closes the old file if it is currently open and saves the new file name. If the file name given is longer than 79 characters, `utmpname` returns 0. Otherwise, it will return 1.

FILES

`/var/adm/utmp`
`/var/adm/wtmp`

SEE ALSO

`ttyslot(3C)`, `utmp(4)`

DIAGNOSTICS

A null pointer is returned upon failure to read, whether for permissions or having reached the end of file, or upon failure to write.

NOTES

The most current entry is saved in a static structure. Multiple accesses require that it be copied before further accesses are made. On each call to either `getutid` or `getutline`, the routine examines the static structure before performing more I/O. If the contents of the static structure match what it is searching for, it looks no further. For this reason, to use `getutline` to search for multiple occurrences, it would be necessary to zero out the static area after each success, or `getutline` would just return the same structure over and over again. There is one exception to the rule about emptying the structure before further reads are done. The implicit read done by `pututline` (if it finds that it is not already at the correct place in the file) will not hurt the contents of the static structure returned by the `getutent`, `getutid` or `getutline` routines, if the user has just modified those contents and passed the pointer back to `pututline`.

These routines use buffered standard I/O for input, but `pututline` uses an unbuffered non-standard write to avoid race conditions between processes trying to modify the `utmp` and `wtmp` files.

NAME

getut: getutent, getutid, getutline, pututline, setutent, endutent, utmp-name - access utmp file entry

SYNOPSIS

```
#include <utmp.h>

struct utmp *getutent (void);
struct utmp *getutid (const struct utmp *id);
struct utmp *getutline (const struct utmp *line);
struct utmp *pututline (const struct utmp *utmp);
void setutent (void);
void endutent (void);
int utmpname (const char *file);
```

DESCRIPTION

getutent, getutid, getutline, and pututline each return a pointer to a structure with the following members:

```
char    ut_user[8];        /* user login name */
char    ut_id[4];         /* /etc/inittab id (usually line #) */
char    ut_line[12];     /* device name (console, lnx) */
short   ut_pid;          /* process id */
short   ut_type;         /* type of entry */
struct  exit_status {
} ut_exit;                /* exit status of a process */
                                /* marked as DEAD_PROCESS */
time_t  ut_time;         /* time entry was made */
```

The structure exit status includes the following members:

```
short   e_termination;   /* termination status */
short   e_exit;           /* exit status */
```

getutent reads in the next entry from a utmp-like file. If the file is not already open, it opens it. If it reaches the end of the file, it fails.

getutid searches forward from the current point in the utmp file until it finds an entry with a *ut_type* matching *id->ut_type* if the type specified is RUN_LVL, BOOT_TIME, OLD_TIME, or NEW_TIME. If the type specified in *id* is INIT_PROCESS, LOGIN_PROCESS, USER_PROCESS, or DEAD_PROCESS, then getutid will return a pointer to the first entry whose type is one of these four and whose *ut_id* field matches *id->ut_id*. If the end of file is reached without a match, it fails.

getutline searches forward from the current point in the utmp file until it finds an entry of the type LOGIN_PROCESS or USER_PROCESS that also has a *ut_line* string matching the *line->ut_line* string. If the end of file is reached without a match, it fails.

pututline writes out the supplied utmp structure into the utmp file. It uses getutid to search forward for the proper place if it finds that it is not already at the proper place. It is expected that normally the user of pututline will have searched for the proper entry using one of the getut routines. If so, pututline will not

NAME

getusershell, setusershell, endusershell - get legal user shells

SYNOPSIS

```
/usr/ucb/cc [flag...] file...  
char *getusershell()  
setusershell()  
endusershell()
```

DESCRIPTION

getusershell returns a pointer to a legal user shell as defined by the system manager in the file /etc/shells. If /etc/shells does not exist, the locations of the standard system shells, /usr/bin/csh, /usr/bin/sh, and /usr/bin/ksh are returned.

getusershell reads the next line (opening the file if necessary); setusershell rewinds the file; endusershell closes it.

FILES

```
/etc/shells  
/usr/bin/csh  
/usr/bin/ksh  
/usr/bin/sh
```

RETURN VALUE

The routine getusershell returns a NULL pointer (0) on EOF or error.

NOTES

All information is contained in a static area so it must be copied if it is to be saved.

NAME

getuid, geteuid, getgid, getegid - get real user, effective user, real group, and effective group IDs

SYNOPSIS

```
#include <sys/types.h>
#include <unistd.h>

uid_t getuid (void);
uid_t geteuid (void);
gid_t getgid (void);
gid_t getegid (void);
```

DESCRIPTION

getuid returns the real user ID of the calling process.
geteuid returns the effective user ID of the calling process.
getgid returns the real group ID of the calling process.
getegid returns the effective group ID of the calling process.

SEE ALSO

intro(2), setuid(2)

Upon failure to pass the correct argument to `gettxt()`, a pointer to the text string "Message not found!!\n" is returned.

FILES

| | |
|---|--|
| <code>/usr/lib/locale/C/LC_MESSAGES/*</code> | Default message files created by <code>mkmsgs()</code> |
| <code>/usr/lib/locale/locale/LC_MESSAGES/*</code> | message files for different languages created by <code>mkmsgs()</code> |

EXAMPLE

In the following code fragment:

```
gettxt("test:10", "hello world\n")
gettxt("test:10", "")
setcat("test");
gettxt(":10", "hello world\n")
```

`test` is the name of the file that contains the messages; `10` is the message number.

SEE ALSO

`environ(5)`, `gettxt(1)`, `mkmsgs(1)`, `setcat(3C)`, `setlocale(3C)`, `srchtxt(1)`.

NAME

gettxt - retrieve a text string

SYNOPSIS

```
char *gettxt(char *msgid, char *dflt_str);
```

DESCRIPTION

The routine `gettxt()` retrieves a text string from a message file. The arguments to the function are a message identification `msgid` and a default string `dflt_str` to be used if the retrieval fails.

The text strings are in files created by `mkmsgs` [see `mkmsgs(1)`] and installed in `/usr/lib/locale/locale/LC_MESSAGES` directories.

The directory `locale` can be viewed as the language in which the text strings are written. The user can request that messages be displayed in a specific language by setting the environment variable `LC_MESSAGES`. If `LC_MESSAGES` is not set the environment variable `LANG` will be used.

If `LANG` is not set, the locale in which the strings will be retrieved is the C locale and the files containing the strings are in

```
/usr/lib/locale/C/LC_MESSAGES/*.
```

The user can also change the language in which the messages are displayed by invoking the `setlocale()` [see `setlocale(3C)`] function with the appropriate arguments.

If `gettxt()` fails to access the message in a specific locale, it will try to retrieve the same message in the C locale. Upon failure, the processing depends on what the second argument, `dflt_str`, points to. A pointer to the second argument is returned if the second argument is not the null string. If `dflt_str` points to the null string, a pointer to the C locale text string

```
"Message not found!!\n"
```

is returned. A pointer to the same string is also returned if the message number is out of range.

The following depicts the acceptable syntax of `msgid` for a call to `gettxt()`:

```
<msgid> => <msgfilename>:<msgnumber>
```

The first argument consists of two fields separated by a colon. The first field is used to indicate the file that contains the text strings and must be limited to 14 characters. These characters must be selected from a set of all character values excluding `\0` (null) and the ASCII code for `/` (slash) and `:` (colon). The names of message files must be the same as the names of files created by `mkmsgs()` and installed in `/usr/lib/locale/locale/LC_MESSAGES/*`. If no file name is specified, `gettxt()` will use the name specified with `setcat()`. If neither a file name nor a default catalog is specified, `gettxt()` returns a pointer to the text string

```
"Message not found!!\n".
```

The numeric field indicates the sequence number of the string in the file. The strings are numbered from 1. If the numeric field is greater than the number of strings in the file, `gettxt()` will use the defaulting sequence described above.

gettimeofday (3C)

gettimeofday (3C)

NAME

gettimeofday, settimeofday - get or set the date and time

SYNOPSIS

```
#include <sys/time.h>
int gettimeofday (struct timeval *tp);
int settimeofday (struct timeval *tp);
```

DESCRIPTION

gettimeofday gets and settimeofday sets the system's notion of the current time. The current time is expressed in elapsed seconds and microseconds since 00:00 Universal Coordinated Time, January 1, 1970. The resolution of the system clock is hardware dependent; the time may be updated continuously or in clock ticks.

tp points to a `timeval` structure, which includes the following members:

```
    long    tv_sec;    /* seconds since Jan. 1, 1970 */
    long    tv_usec;   /* and microseconds */
```

If *tp* is a null pointer, the current time information is not returned or set.

The TZ environment variable holds time zone information. See `timezone(4)`.

Only the privileged user may set the time of day.

SEE ALSO

`adjtime(2)`, `ctime(3C)`, `timezone(4)`

DIAGNOSTICS

A -1 return value indicates that an error occurred and `errno` has been set. The following error codes may be set in `errno`:

EINVAL *tp* specifies an invalid time.

EPERM A user other than the privileged user attempted to set the time or time zone.

NOTES

The implementation of `settimeofday` ignores the `tv_usec` field of *tp*. If the time needs to be set with better than one second accuracy, call `settimeofday` for the seconds and then `adjtime` for finer accuracy.

NAME

gettimeofday, settimeofday - get or set the date and time

SYNOPSIS

```
/usr/ucb/cc [flag...] file...
#include <sys/time.h>

int gettimeofday(tp, tzp)
struct timeval *tp;
struct timezone *tzp;      /* obsolete */

int settimeofday(tp, tzp)
struct timeval *tp;
struct timezone *tzp;      /* obsolete */
```

DESCRIPTION

The system's notion of the current Greenwich time is obtained with the `gettimeofday` call, and set with the `settimeofday` call. The current time is expressed in elapsed seconds and microseconds since 00:00 GMT, January 1, 1970 (zero hour). The resolution of the system clock is hardware dependent; the time may be updated continuously, or in "ticks."

tp points to a `timeval` structure, which includes the following members:

```
    long tv_sec;   /* seconds since Jan. 1, 1970 */
    long tv_usec; /* and microseconds */
```

If *tp* is a `NULL` pointer, the current time information is not returned or set.

tzp is an obsolete pointer formerly used to get and set timezone information. *tzp* is now ignored. Timezone information is now handled using the `TZ` environment variable; see `timezone(4)`.

Only the privileged user may set the time of day.

RETURN VALUE

A -1 return value indicates an error occurred; in this case an error code is stored in the global variable `errno`.

ERRORS

The following error codes may be set in `errno`:

`EINVAL` *tp* specifies an invalid time.

`EPERM` A user other than the privileged user attempted to set the time.

SEE ALSO

`date(1)`, `adjtime(2)`, `ctime(3C)`, `gettimeofday(3C)`, `timezone(4)`.

NOTES

Time is never correct enough to believe the microsecond values.

tzp is ignored.

getsubopt(3C)

getsubopt(3C)

```
                break;
            default :
                /* process unknown token */
                error_bad_token(value);
                errflag++;
                break;
            }
        }
        break;
    }
}
if (errflag) {
    /* print usage instructions etc. */
}
for (; optind < argc; optind++) {
    /* process remaining arguments */
}
.
.
.
}
```

SEE ALSO

`getopt(3C)`.

DIAGNOSTICS

`getsubopt` returns -1 when the token it is scanning is not in the token vector. The variable addressed by *valuep* contains a pointer to the first character of the token that was not recognized rather than a pointer to a value for that token.

The variable addressed by *optionp* points to the next option to be parsed, or a null character if there are no more options.

NOTES

During parsing, commas in the option input string are changed to null characters. White space in tokens or token-value pairs must be protected from the shell by quotes.

getsubopt(3C)

getsubopt(3C)

```
#define WRITESIZE    2
                    "wsize",
#define READSIZE    3
                    "rsize",
                    NULL};

main(argc, argv)
    int  argc;
    char **argv;
{
    int  sc, c, errflag;
    char *options, *value;
    extern char *optarg;
    extern int  optind;
    .
    .
    .
    while((c = getopt(argc, argv, "abf:o:")) != -1) {
        switch (c) {
            case 'a': /* process a option */
                break;
            case 'b': /* process b option */
                break;
            case 'f':
                ofile = optarg;
                break;
            case '?':
                errflag++;
                break;
            case 'o':
                options = optarg;
                while (*options != '\0') {
                    switch(getsubopt(&options, myopts, &value)) {
                        case READONLY : /* process ro option */
                            break;
                        case READWRITE : /* process rw option */
                            break;
                        case WRITESIZE : /* process wsize option */
                            if (value == NULL) {
                                error_no_arg();
                                errflag++;
                            } else
                                write_size = atoi(value);
                            break;
                        case READSIZE : /* process rsize option */
                            if (value == NULL) {
                                error_no_arg();
                                errflag++;
                            } else
                                read_size = atoi(value);
                    }
                }
            }
    }
}
```

NAME

getsubopt - parse suboptions from a string

SYNOPSIS

```
#include <stdlib.h>

int getsubopt (char **optionp, char * const *tokens, char **valuep);
```

DESCRIPTION

getsubopt parses suboptions in a flag argument that was initially parsed by getopt. These suboptions are separated by commas and may consist of either a single token or a token-value pair separated by an equal sign. Since commas delimit suboptions in the option string, they are not allowed to be part of the suboption or the value of a suboption. A command that uses this syntax is mount(1M), which allows the user to specify mount parameters with the -o option as follows:

```
mount -o rw,hard,bg,wsiz=1024 speed:/usr /usr
```

In this example there are four suboptions: rw, hard, bg, and wsiz, the last of which has an associated value of 1024.

getsubopt takes the address of a pointer to the option string, a vector of possible tokens, and the address of a value string pointer. It returns the index of the token that matched the suboption in the input string or -1 if there was no match. If the option string at *optionp* contains only one suboption, getsubopt updates *optionp* to point to the null character at the end of the string; otherwise it isolates the suboption by replacing the comma separator with a null character, and updates *optionp* to point to the start of the next suboption. If the suboption has an associated value, getsubopt updates *valuep* to point to the value's first character. Otherwise it sets *valuep* to NULL.

The token vector is organized as a series of pointers to null strings. The end of the token vector is identified by a null pointer.

When getsubopt returns, if *valuep* is not NULL, then the suboption processed included a value. The calling program may use this information to determine if the presence or lack of a value for this suboption is an error.

Additionally, when getsubopt fails to match the suboption with the tokens in the *tokens* array, the calling program should decide if this is an error, or if the unrecognized option should be passed to another program.

EXAMPLE

The following code fragment shows how to process options to the mount command using getsubopt.

```
#include <stdlib.h>

char *myopts[] = {
#define READONLY      0
    "ro",
#define READWRITE    1
    "rw",
```

getspent(3C)

getspent(3C)

files.

`lckpwnf` attempts to lock the file `/etc/.pwd.lock` within 15 seconds. If unsuccessful, for example, `/etc/.pwd.lock` is already locked, it returns -1. If successful, a return code other than -1 is returned.

`ulckpwnf` attempts to unlock the file `/etc/.pwd.lock`. If unsuccessful, for example, `/etc/.pwd.lock` is already unlocked, it returns -1. If successful, it returns 0.

A call to the `setspent` routine has the effect of rewinding the shadow password file to allow repeated searches. The `endspent` routine may be called to close the shadow password file when processing is complete.

The `fgetspent` routine returns a pointer to the next `spwd` structure in the stream `fp`, which matches the format of `/etc/shadow`.

FILES

`/etc/shadow`
`/etc/passwd`
`/etc/.pwd.lock`

SEE ALSO

`getpwn(3C)`, `putpwn(3C)`, `putspent(3C)`

DIAGNOSTICS

`getspent`, `getspnam`, `lckpwnf`, `ulckpwnf`, and `fgetspent` return a null pointer on EOF or error.

NOTES

This routine is for internal use only; compatibility is not guaranteed.

All information is contained in a static area, so it must be copied if it is to be saved.

getspent (3C)

getspent (3C)

NAME

getspent, getsppnam, setspent, endspent, fgetspent, lckpwwdf, ulckpwwdf -
manipulate shadow password file entry

SYNOPSIS

```
#include <shadow.h>
struct spwd *getspent (void);
struct spwd *getsppnam (const char *name);
int lckpwwdf (void);
int ulckpwwdf (void);
void setspent (void);
void endspent (void);
struct spwd *fgetspent (FILE *fp);
```

DESCRIPTION

The `getspent` and `getsppnam` routines each return a pointer to an object with the following structure containing the broken-out fields of a line in the `/etc/shadow` file. Each line in the file contains a "shadow password" structure, declared in the `shadow.h` header file:

```
struct spwd{
    char *sp_namp;
    char *sp_pwwdp;
    long sp_lstchg;
    long sp_min;
    long sp_max;
    long sp_warn;
    long sp_inact;
    long sp_expire;
    unsigned long sp_flag;
};
```

The `getspent` routine when first called returns a pointer to the first `spwd` structure in the file; thereafter, it returns a pointer to the next `spwd` structure in the file; so successive calls can be used to search the entire file. The `getsppnam` routine searches from the beginning of the file until a login name matching *name* is found, and returns a pointer to the particular structure in which it was found. The `getspent` and `getsppnam` routines populate the `sp_min`, `sp_max`, `sp_lstchg`, `sp_warn`, `sp_inact`, `sp_expire`, or `sp_flag` field with -1 if the corresponding field in `/etc/shadow` is empty. If an end-of-file or an error is encountered on reading, or there is a format error in the file, these functions return a null pointer and set `errno` to `EINVAL`.

`/etc/.pwwd.lock` is the lock file. It is used to coordinate modification access to the password files `/etc/passwd` and `/etc/shadow`. `lckpwwdf` and `ulckpwwdf` are routines that are used to gain modification access to the password files, through the lock file. A process first uses `lckpwwdf` to lock the lock file, thereby gaining exclusive rights to modify the `/etc/passwd` or `/etc/shadow` password file. Upon completing modifications, a process should release the lock on the lock file via `ulckpwwdf`. This mechanism prevents simultaneous modification of the password

getsockopt(3N)

getsockopt(3N)

ENOSR

There were insufficient STREAMS resources available for the operation to complete.

SEE ALSO

socket(3N), getprotoent(3N)
close(2), ioctl(2), read(2).

getsockopt (3N)

getsockopt (3N)

| | |
|-----------|--|
| SO_SNDBUF | set buffer size for output |
| SO_RCVBUF | set buffer size for input |
| SO_TYPE | get the type of the socket (get only) |
| SO_ERROR | get and clear error on the socket (get only) |

SO_DEBUG enables debugging in the underlying protocol modules. SO_REUSEADDR indicates that the rules used in validating addresses supplied in a `bind` call should allow reuse of local addresses. SO_KEEPAALIVE enables the periodic transmission of messages on a connected socket. If the connected party fails to respond to these messages, the connection is considered broken and processes using the socket are notified using a SIGPIPE signal. SO_DONTROUTE indicates that outgoing messages should bypass the standard routing facilities. Instead, messages are directed to the appropriate network interface according to the network portion of the destination address.

SO_LINGER controls the action taken when unsent messages are queued on a socket and a `close` is performed. If the socket promises reliable delivery of data and SO_LINGER is set, the system will block the process on the `close` attempt until it is able to transmit the data or until it decides it is unable to deliver the information (a timeout period, termed the linger interval, is specified in the `setsockopt` call when SO_LINGER is requested). If SO_LINGER is disabled and a `close` is issued, the system will process the `close()` in a manner that allows the process to continue as quickly as possible.

The option SO_BROADCAST requests permission to send broadcast datagrams on the socket. With protocols that support out-of-band data, the SO_OOBINLINE option requests that out-of-band data be placed in the normal data input queue as received; it will then be accessible with `recv` or `read` calls without the MSG_OOB flag. SO_SNDBUF and SO_RCVBUF are options that adjust the normal buffer sizes allocated for output and input buffers, respectively. The buffer size may be increased for high-volume connections or may be decreased to limit the possible backlog of incoming data. The system places an absolute limit on these values. Finally, SO_TYPE and SO_ERROR are options used only with `getsockopt`. SO_TYPE returns the type of the socket (for example, SOCK_STREAM). It is useful for servers that inherit sockets on startup. SO_ERROR returns any pending error on the socket and clears the error status. It may be used to check for asynchronous errors on connected datagram sockets or for other asynchronous errors.

RETURN VALUE

A 0 is returned if the call succeeds, -1 if it fails.

ERRORS

The call succeeds unless:

| | |
|------------|---|
| EBADF | The argument <code>s</code> is not a valid descriptor. |
| ENOTSOCK | The argument <code>s</code> is a file, not a socket. |
| ENOPROTOPT | The option is unknown at the level indicated. |
| ENOMEM | There was insufficient user memory available for the operation to complete. |

getsockopt (3N)

getsockopt (3N)

NAME

getsockopt, setsockopt - get and set options on sockets

SYNOPSIS

```
#include <sys/types.h>
#include <sys/socket.h>

int getsockopt(int s, int level, int optname, char *optval,
              int *optlen);

int setsockopt(int s, int level, int optname, char *optval,
              int optlen);
```

DESCRIPTION

getsockopt and setsockopt manipulate *options* associated with a socket. Options may exist at multiple protocol levels; they are always present at the uppermost socket level.

When manipulating socket options, the level at which the option resides and the name of the option must be specified. To manipulate options at the socket level, *level* is specified as SOL_SOCKET. To manipulate options at any other level, *level* is the protocol number of the protocol that controls the option. For example, to indicate that an option is to be interpreted by the TCP protocol, *level* is set to the TCP protocol number [see getprotoent(3N)].

The parameters *optval* and *optlen* are used to access option values for setsockopt. For getsockopt, they identify a buffer in which the value(s) for the requested option(s) are to be returned. For getsockopt, *optlen* is a value-result parameter, initially containing the size of the buffer pointed to by *optval*, and modified on return to indicate the actual size of the value returned. If no option value is to be supplied or returned, a 0 *optval* may be supplied.

optname and any specified options are passed uninterpreted to the appropriate protocol module for interpretation. The include file `sys/socket.h` contains definitions for the socket-level options described below. Options at other protocol levels vary in format and name.

Most socket-level options take an int for *optval*. For setsockopt, the *optval* parameter should be non-zero to enable a boolean option, or zero if the option is to be disabled. SO_LINGER uses a struct `linger` parameter that specifies the desired state of the option and the linger interval (see below). struct `linger` is defined in `/usr/include/sys/socket.h`.

The following options are recognized at the socket level. Except as noted, each may be examined with getsockopt and set with setsockopt.

| | |
|--------------|--|
| SO_DEBUG | toggle recording of debugging information |
| SO_REUSEADDR | toggle local address reuse |
| SO_KEEPAIVE | toggle keep connections alive |
| SO_DONTROUTE | toggle routing bypass for outgoing messages |
| SO_LINGER | linger on close if data is present |
| SO_BROADCAST | toggle permission to transmit broadcast messages |
| SO_OOBINLINE | toggle reception of out-of-band data in band |

getsockname (3N)

getsockname (3N)

NAME

getsockname - get socket name

SYNOPSIS

```
int getsockname(int s, caddr_t name, int *namelen);
```

DESCRIPTION

getsockname returns the current *name* for socket *s*. The *namelen* parameter should be initialized to indicate the amount of space pointed to by *name*. On return it contains the actual size of the *name* returned (in bytes).

RETURN VALUE

0 is returned if the call succeeds; -1 if it fails.

ERRORS

The call succeeds unless:

| | |
|----------|--|
| EBADF | The argument <i>s</i> is not a valid descriptor. |
| ENOTSOCK | The argument <i>s</i> is a file, not a socket. |
| ENOMEM | There was insufficient user memory for the operation to complete. |
| ENOSR | There were insufficient STREAMS resources available for the operation to complete. |

SEE ALSO

bind(3N), getpeername(3N), socket(3N)

NOTES

The type of address structure passed to `accept` depends on the address family. UNIX domain sockets (address family `AF_UNIX`) require a `socketaddr_un` structure as defined in `sys/un.h`; Internet domain sockets (address family `AF_INET`) require a `sockaddr_in` structure as defined in `netinet/in.h`. Other address families may require other structures. Use the structure appropriate to the address family; cast the structure address to a generic `caddr_t` in the call to `getsockname` and pass the size of the structure in the *namelen* argument.

The functionality of `getsockname` is provided by `t_getname` in TLI. `t_getname` will be replaced in the next release of System V.

The syntax for `t_getname` is as follows:

```
t_getname(int fd, struct netbuf *name, register int type);
```

If *type* is equal to `LOCALNAME`, then the address of the local side of the connection is returned; otherwise, the address of the remote side is returned.

getsid(2)

getsid(2)

NAME

getsid - get session ID

SYNOPSIS

```
#include <sys/types.h>

pid_t getsid(pid_t pid);
```

DESCRIPTION

The function `getsid` returns the session ID of the process whose process ID is equal to *pid*. If *pid* is equal to `(pid_t)0`, `getsid` returns the session ID of the calling process.

RETURN VALUE

Upon successful completion, the function `getsid` returns the session ID of the specified process; otherwise, it returns a value of `(pid_t)-1` and sets `errno` to indicate an error.

ERRORS

Under the following conditions, the function `getsid` fails and sets `errno` to:

- `EPERM` if the process whose process ID is equal to *pid* is not in the same session as the calling process, and the implementation does not allow access to the session ID of that process from the calling process.
- `ESRCH` if there is no process with a process ID equal to *pid*.

SEE ALSO

`exec(2)`, `fork(2)`, `getpid(2)`, `setpgid(2)`, `setsid(2)`

getservent (3N)

getservent (3N)

A `NULL` pointer is returned on EOF or error.

All information is contained in a static area so it must be copied if it is to be saved.
Expecting port numbers to fit in a 32 bit quantity is probably naive.

getservent (3N)

getservent (3N)

NAME

getservent, getservbyport, getservbyname, setservent, endservent -
get service entry

SYNOPSIS

```
#include <netdb.h>

struct servent *getservent(void);

struct servent *getservbyname(char *name, char *proto);

struct servent *getservbyport(int port, char *proto);

int setservent(int stayopen);

int endservent(void);
```

DESCRIPTION

getservent, *getservbyname*, and *getservbyport* each return a pointer to an object with the following structure containing the broken-out fields of a line in the network services data base, /etc/services.

The servent structure includes the following members:

```
char   *s_name;           /* official name of service */
char   **s_aliases;       /* alias list */
int     s_port;           /* port service resides at */
char   *s_proto;         /* protocol to use */
```

The members of this structure are:

s_name The official name of the service.
s_aliases A zero terminated list of alternate names for the service.
s_port The port number at which the service resides. Port numbers
 are returned in network short byte order.
s_proto The name of the protocol to use when contacting the service.

getservent reads the next line of the file, opening the file if necessary.

setservent opens and rewinds the file. If the *stayopen* flag is non-zero, the net data base will not be closed after each call to getservent (either directly, or indirectly through one of the other getserv calls).

endservent closes the file.

getservbyname and getservbyport sequentially search from the beginning of the file until a matching protocol name or port number is found, or until EOF is encountered. If a protocol name is also supplied (non-NULL), searches must also match the protocol.

FILES

/etc/services

SEE ALSO

getprotoent(3N), services(4)

DIAGNOSTICS

NAME

gets, fgets - get a string from a stream

SYNOPSIS

```
#include <stdio.h>
char *gets (char *s);
char *fgets (char *s, int n, FILE *stream);
```

DESCRIPTION

`gets` reads characters from the standard input stream [see `intro(3)`], `stdin`, into the array pointed to by `s`, until a newline character is read or an end-of-file condition is encountered. The newline character is discarded and the string is terminated with a null character.

`fgets` reads characters from the *stream* into the array pointed to by `s`, until `n-1` characters are read, or a newline character is read and transferred to `s`, or an end-of-file condition is encountered. The string is then terminated with a null character.

When using `gets`, if the length of an input line exceeds the size of `s`, indeterminate behavior may result. For this reason, it is strongly recommended that `gets` be avoided in favor of `fgets`.

SEE ALSO

`lseek(2)`, `read(2)`, `ferror(3S)`, `fopen(3S)`, `fread(3S)`, `getc(3S)`, `scanf(3S)`, `stdio(3S)`, `ungetc(3S)`

DIAGNOSTICS

If end-of-file is encountered and no characters have been read, no characters are transferred to `s` and a null pointer is returned. If a read error occurs, such as trying to use these functions on a file that has not been opened for reading, a null pointer is returned and the error indicator for the stream is set. If end-of-file is encountered, the EOF indicator for the stream is set. Otherwise `s` is returned.

The way resident set size is calculated is an approximation, and could misrepresent the true resident set size.

Page faults can be generated from a variety of sources and for a variety of reasons. The customary cause for a page fault is a direct reference by the program to a page which is not in memory. Now, however, the kernel can generate page faults on behalf of the user, for example, servicing `read(2)` and `write(2)` system calls. Also, a page fault can be caused by an absent hardware translation to a page, even though the page is in physical memory.

In addition to hardware detected page faults, the kernel may cause pseudo page faults in order to perform some housekeeping. For example, the kernel may generate page faults, even if the pages exist in physical memory, in order to lock down pages involved in a raw I/O request.

By definition, *major* page faults require physical I/O, while *minor* page faults do not require physical I/O. For example, reclaiming the page from the free list would avoid I/O and generate a minor page fault. More commonly, minor page faults occur during process startup as references to pages which are already in memory. For example, if an address space faults on some hot executable or shared library, this results in a minor page fault for the address space. Also, any one doing a `read(2)` or `write(2)` to something that is in the page cache will get a minor page fault(s) as well.

There is no way to obtain information about a child process which has not yet terminated.

| | |
|-------------|---|
| ru_ixrss | Currently returns 0. |
| ru_idrss | An integral value indicating the amount of memory in use by a process while the process is running. This value is the sum of the resident set sizes of the process running when a clock tick occurs. The value is given in pages times clock ticks. Note: it does not take sharing into account. Also, see NOTES. |
| ru_isrss | Currently returns 0. |
| ru_minflt | The number of page faults serviced which did not require any physical I/O activity. Also, see NOTES. |
| ru_majflt | The number of page faults serviced which required physical I/O activity. This could include page ahead operations by the kernel. Also, see NOTES. |
| ru_nswap | The number of times a process was swapped out of main memory. |
| ru_inblock | The number of times the file system had to perform input in servicing a <code>read(2)</code> request. |
| ru_oublock | The number of times the file system had to perform output in servicing a <code>write(2)</code> request. |
| ru_msgsnd | The number of messages sent over sockets. |
| ru_msgrcv | The number of messages received from sockets. |
| ru_nsignals | The number of signals delivered. |
| ru_nvcsw | The number of times a context switch resulted due to a process voluntarily giving up the processor before its time slice was completed (usually to await availability of a resource). |
| ru_nivcsw | The number of times a context switch resulted due to a higher priority process becoming runnable or because the current process exceeded its time slice. |

RETURN VALUE

If successful, the value of the appropriate structure is filled in, and 0 is returned. If the call fails, a -1 is returned.

ERRORS

getrusage will fail if:

- EINVAL The `who` parameter is not a valid value.
- EFAULT The address specified by the `rusage` argument is not in a valid portion of the process's address space.

SEE ALSO

`sar(1M)`, `read(2)`, `times(2)`, `write(2)`, `gettimeofday(3)`, `wait(3)`.

NOTES

Only the *timeval* fields of `struct rusage` are supported in this implementation.

The numbers `ru_inblock` and `ru_oublock` account only for real I/O, and are approximate measures at best. Data supplied by the caching mechanism is charged only to the first process to read and the last process to write the data.

NAME

getrusage - get information about resource utilization

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
```

```
#include <sys/time.h>
#include <sys/resource.h>

getrusage(who, rusage)
int who;
struct rusage *rusage;
```

DESCRIPTION

getrusage returns information about the resources utilized by the current process, or all its terminated child processes. The interpretation for some values reported, such as ru_idrssi, are dependent on the clock tick interval. This interval is an implementation dependent value.

The who parameter is one of RUSAGE_SELF or RUSAGE_CHILDREN. The buffer to which rusage points will be filled in with the following structure:

```
struct    rusage {
    struct timeval ru_utime;    /* user time used */
    struct timeval ru_stime;    /* system time used */
    int    ru_maxrss;          /* maximum resident set size */
    int    ru_ixrss;           /* currently 0 */
    int    ru_idrssi;          /* integral resident set size */
    int    ru_isrss;           /* currently 0 */
    int    ru_minflt;          /* page faults not requiring physical I/O */
    int    ru_majflt;          /* page faults requiring physical I/O */
    int    ru_nswap;           /* swaps */
    int    ru_inblock;         /* block input operations */
    int    ru_oublock;         /* block output operations */
    int    ru_msgsnd;          /* messages sent */
    int    ru_msgrcv;          /* messages received */
    int    ru_nsignals;        /* signals received */
    int    ru_nvcsw;           /* voluntary context switches */
    int    ru_nivcsw;          /* involuntary context switches */
};
```

The fields are interpreted as follows:

| | |
|-----------|--|
| ru_utime | The total amount of time spent executing in user mode. Time is given in seconds and microseconds. |
| ru_stime | The total amount of time spent executing in system mode. Time is given in seconds and microseconds. |
| ru_maxrss | The maximum resident set size. Size is given in pages (the size of a page, in bytes, is given by the getpagesize(3) system call). Also, see NOTES. |

getrlimit(2)

getrlimit(2)

EPERM if the limit specified to `setrlimit` would have raised the maximum limit value, and the caller is not the superuser

SEE ALSO

`malloc(3C)`, `open(2)`, `sigaltstack(2)`, `signal(5)`.

| Resources | Description | Action |
|----------------------------|---|--|
| | limit of 0 will prevent the creation of a file. | SIGXFSZ, continued attempts to increase the size of a file beyond the limit will fail with <code>errno</code> set to <code>EFBIG</code> . |
| <code>RLIMIT_NOFILE</code> | The maximum number of open file descriptors that the process can have. | Functions that create new file descriptors will fail with <code>errno</code> set to <code>EMFILE</code> . |
| <code>RLIMIT_STACK</code> | The maximum size of a process's stack in bytes. The system will not automatically grow the stack beyond this limit. | <code>SIGSEGV</code> is sent to the process. If the process is holding or ignoring <code>SIGSEGV</code> , or is catching <code>SIGSEGV</code> and has not made arrangements to use an alternate stack [see <code>sigaltstack(2)</code>], the disposition of <code>SIGSEGV</code> will be set to <code>SIG_DFL</code> before it is sent. |
| <code>RLIMIT_VMEM</code> | The maximum size of a process's mapped address space in bytes. | <code>brk(2)</code> and <code>mmap(2)</code> functions will fail with <code>errno</code> set to <code>ENOMEM</code> . In addition, the automatic stack growth will fail with the effects outlined above. |

Because limit information is stored in the per-process information, the shell builtin `ulimit` must directly execute this system call if it is to affect all future processes created by the shell.

The value of the current limit of the following resources affect these implementation defined constants:

| Limit | Implementation Defined Constant |
|----------------------------|---------------------------------|
| <code>RLIMIT_FSIZE</code> | <code>FCHR_MAX</code> |
| <code>RLIMIT_NOFILE</code> | <code>OPEN_MAX</code> |

RETURN VALUE

Upon successful completion, the functions `getrlimit` and `setrlimit` return a value of 0; otherwise, they return a value of -1 and set `errno` to indicate an error.

ERRORS

Under the following conditions, the functions `getrlimit` and `setrlimit` fail and set `errno` to:

| | |
|---------------------|---|
| <code>EINVAL</code> | if an invalid <i>resource</i> was specified; or in a <code>setrlimit</code> call, the new <code>rlim_cur</code> exceeds the new <code>rlim_max</code> . |
|---------------------|---|

```
void
clnt_perror(const CLIENT *clnt, const char *s);
```

Print a message to standard error indicating why an RPC call failed; *clnt* is the handle used to do the call. The message is prepended with string *s* and a colon. A newline is appended at the end of the message. Normally used after a procedure call fails, for instance `clnt_call`.

```
char *
clnt_sperno(const enum clnt_stat stat);
```

Take the same arguments as `clnt_perrno`, but instead of sending a message to the standard error indicating why an RPC call failed, return a pointer to a string which contains the message.

`clnt_sperno` is normally used instead of `clnt_perrno` when the program does not have a standard error (as a program running as a server quite likely does not), or if the programmer does not want the message to be output with `printf` [see `printf(3S)`], or if a message format different than that supported by `clnt_perrno` is to be used. Note: unlike `clnt_sperno` and `clnt_spcreatererror` [see `rpc_clnt_create(3N)`], `clnt_sperno` does not return pointer to static data so the result will not get overwritten on each call.

```
char *
clnt_sperror(const CLIENT *clnt, const char *s);
```

Like `clnt_perror`, except that (like `clnt_sperno`) it returns a string instead of printing to standard error. However, `clnt_sperror` does not append a newline at the end of the message.

Note: returns pointer to static data that is overwritten on each call.

```
enum clnt_stat
rpc_broadcast(const u_long prognum, const u_long versnum,
              const u_long procnum, const xdrproc_t inproc, caddr_t in,
              const xdrproc_t outproc, caddr_t out, const resultproc_t eachresult,
              const char *nettype);
```

Like `rpc_call`, except the call message is broadcast to the connectionless network specified by *nettype*. If *nettype* is `NULL`, it defaults to `netpath`. Each time it receives a response, this routine calls `eachresult`, whose form is:

```
bool_t
eachresult(const caddr_t out, const struct netbuf *addr,
           struct netconfig *netconf);
```

where *out* is the same as *out* passed to `rpc_broadcast`, except that the remote procedure's output is decoded there; *addr* points to the address of the machine that sent the results, and *netconf* is the `netconfig` structure of the transport on which the remote server responded. If `eachresult` returns 0, `rpc_broadcast` waits for more replies; otherwise it returns with appropriate status.

NAME

rpc_clnt_calls: clnt_call, clnt_freeres, clnt_geterr, clnt_pererrno, clnt_perror, clnt_sperrno, clnt_sperror, rpc_broadcast, rpc_call - library routines for client side calls

DESCRIPTION

RPC library routines allow C language programs to make procedure calls on other machines across the network. First, the client calls a procedure to send a data packet to the server. Upon receipt of the packet, the server calls a dispatch routine to perform the requested service, and then sends back a reply.

The `clnt_call`, `rpc_call` and `rpc_broadcast` routines handle the client side of the procedure call. The remaining routines deal with error handling in the case of errors.

Routines

See `rpc(3N)` for the definition of the `CLIENT` data structure.

```
#include <rpc/rpc.h>
```

```
enum clnt_stat
```

```
clnt_call(CLIENT *clnt, const u_long procnum, const xdrproc_t inproc,
         caddr_t in, const xdrproc_t outproc, caddr_t out,
         const struct timeval tout);
```

A function macro that calls the remote procedure *procnum* associated with the client handle, *clnt*, which is obtained with an RPC client creation routine such as `clnt_create` [see `rpc_clnt_create(3N)`]. The parameter *in* is the address of the procedure's argument(s), and *out* is the address of where to place the result(s); *inproc* is used to encode the procedure's parameters, and *outproc* is used to decode the procedure's results; *tout* is the time allowed for results to be returned.

If the remote call succeeds, the status is returned in `RPC_SUCCESS`, otherwise an appropriate status is returned.

```
int clnt_freeres(CLIENT *clnt, const xdrproc_t outproc, caddr_t out);
```

A function macro that frees any data allocated by the RPC/XDR system when it decoded the results of an RPC call. The parameter *out* is the address of the results, and *outproc* is the XDR routine describing the results. This routine returns 1 if the results were successfully freed, and 0 otherwise.

```
void
```

```
clnt_geterr(const CLIENT *clnt, struct rpc_err *errp);
```

A function macro that copies the error structure out of the client handle to the structure at address *errp*.

```
void
```

```
clnt_pererrno(const enum clnt_stat stat);
```

Print a message to standard error corresponding to the condition indicated by *stat*. A newline is appended at the end of the message. Normally used after a procedure call fails, for instance `rpc_call`.

NAME

rpc_clnt_auth: auth_destroy, authnone_create, authsys_create, authsys_create_default - library routines for client side remote procedure call authentication

DESCRIPTION

These routines are part of the RPC library that allows C language programs to make procedure calls on other machines across the network, with desired authentication. First, the client calls a procedure to send a data packet to the server. Upon receipt of the packet, the server calls a dispatch routine to perform the requested service, and then sends back a reply.

These routines are normally called after creating the CLIENT handle. The client's authentication information is passed to the server when the RPC call is made.

Routines

The following routines require that the header `rpc.h` be included [see `rpc(3N)` for the definition of the AUTH data structure].

```
#include <rpc/rpc.h>

void
auth_destroy(AUTH *auth);
```

A function macro that destroys the authentication information associated with *auth*. Destruction usually involves deallocation of private data structures. The use of *auth* is undefined after calling `auth_destroy`.

```
AUTH *
authnone_create(void);
```

Create and return an RPC authentication handle that passes nonusable authentication information with each remote procedure call. This is the default authentication used by RPC.

```
AUTH *
authsys_create(const char *host, const uid_t uid, const gid_t gid,
               const int len, const gid_t *aup_gids);
```

Create and return an RPC authentication handle that contains AUTH_SYS authentication information. The parameter *host* is the name of the machine on which the information was created; *uid* is the user's user ID; *gid* is the user's current group ID; *len* and *aup_gids* refer to a counted array of groups to which the user belongs.

```
AUTH *
authsys_create_default(void);
```

Call `authsys_create` with the appropriate parameters.

SEE ALSO

`rpc(3N)`, `rpc_clnt_create(3N)`, `rpc_clnt_calls(3N)`

| RPC Routine | Manual Reference Page |
|--------------------|-----------------------|
| svc_unreg | rpc_svc_calls(3N) |
| svc_vc_create | rpc_svc_create(3N) |
| svcerr_auth | rpc_svc_err(3N) |
| svcerr_decode | rpc_svc_err(3N) |
| svcerr_noproc | rpc_svc_err(3N) |
| svcerr_noprogram | rpc_svc_err(3N) |
| svcerr_progvers | rpc_svc_err(3N) |
| svcerr_systemerr | rpc_svc_err(3N) |
| svcerr_weakauth | rpc_svc_err(3N) |
| user2netname | secure_rpc(3N) |
| xdr_accepted_reply | rpc_xdr(3N) |
| xdr_authsys_parms | rpc_xdr(3N) |
| xdr_callhdr | rpc_xdr(3N) |
| xdr_callmsg | rpc_xdr(3N) |
| xdr_opaque_auth | rpc_xdr(3N) |
| xdr_rejected_reply | rpc_xdr(3N) |
| xdr_replymsg | rpc_xdr(3N) |
| xprt_register | rpc_svc_calls(3N) |
| xprt_unregister | rpc_svc_calls(3N) |

FILES

/etc/netconfig

SEE ALSO

environ(5), getnetconfig(3N), getnetpath(3N), rpc_clnt_auth(3N),
 rpc_clnt_calls(3N), rpc_clnt_create(3N), rpc_svc_calls(3N),
 rpc_svc_create(3N), rpc_svc_err(3N), rpc_svc_reg(3N), rpc_xdr(3N),
 rpcbind(3N), secure_rpc(3N), xdr(3N), netconfig(4)

| RPC Routine | Manual Reference Page |
|------------------------|-----------------------|
| authnone_create | rpc_clnt_auth(3N) |
| authsys_create | rpc_clnt_auth(3N) |
| authsys_create_default | rpc_clnt_auth(3N) |
| clnt_call | rpc_clnt_calls(3N) |
| clnt_control | rpc_clnt_create(3N) |
| clnt_create | rpc_clnt_create(3N) |
| clnt_destroy | rpc_clnt_create(3N) |
| clnt_dg_create | rpc_clnt_create(3N) |
| clnt_freeres | rpc_clnt_calls(3N) |
| clnt_geterr | rpc_clnt_calls(3N) |
| clnt_pcreateerror | rpc_clnt_create(3N) |
| clnt_perrno | rpc_clnt_calls(3N) |
| clnt_perror | rpc_clnt_calls(3N) |
| clnt_raw_create | rpc_clnt_create(3N) |
| clnt_spcreateerror | rpc_clnt_create(3N) |
| clnt_sperrno | rpc_clnt_calls(3N) |
| clnt_spperror | rpc_clnt_calls(3N) |
| clnt_tli_create | rpc_clnt_create(3N) |
| clnt_tp_create | rpc_clnt_create(3N) |
| clnt_vc_create | rpc_clnt_create(3N) |
| getnetname | secure_rpc(3N) |
| host2netname | secure_rpc(3N) |
| key_decryptsession | secure_rpc(3N) |
| key_encryptsession | secure_rpc(3N) |
| key_gendes | secure_rpc(3N) |
| key_setsecret | secure_rpc(3N) |
| netname2host | secure_rpc(3N) |
| netname2user | secure_rpc(3N) |
| rpc_broadcast | rpc_clnt_calls(3N) |
| rpc_call | rpc_clnt_calls(3N) |
| rpc_reg | rpc_svc_calls(3N) |
| svc_create | rpc_svc_create(3N) |
| svc_destroy | rpc_svc_create(3N) |
| svc_dg_create | rpc_svc_create(3N) |
| svc_fd_create | rpc_svc_create(3N) |
| svc_freeargs | rpc_svc_reg(3N) |
| svc_getargs | rpc_svc_reg(3N) |
| svc_getreqset | rpc_svc_reg(3N) |
| svc_getrpccaller | rpc_svc_reg(3N) |
| svc_raw_create | rpc_svc_create(3N) |
| svc_reg | rpc_svc_calls(3N) |
| svc_run | rpc_svc_reg(3N) |
| svc_sendreply | rpc_svc_reg(3N) |
| svc_tli_create | rpc_svc_create(3N) |
| svc_tp_create | rpc_svc_create(3N) |

```

/*
 * This is the number of bytes per unit of external data.
 */
#define BYTES_PER_XDR_UNIT      (4)
#define RNDUP(x)  (((x) + BYTES_PER_XDR_UNIT - 1) / BYTES_PER_XDR_UNIT) \
    * BYTES_PER_XDR_UNIT)

/*
 * A xdrproc_t exists for each data type which is to be encoded or decoded.
 *
 * The second argument to the xdrproc_t is a pointer to an opaque pointer.
 * The opaque pointer generally points to a structure of the data type
 * to be decoded.  If this pointer is 0, then the type routines should
 * allocate dynamic storage of the appropriate size and return it.
 * bool_t    (*xdrproc_t)(XDR *, caddr_t *);
 */
typedef      bool_t (*xdrproc_t)();

/*
 * The XDR handle.
 * Contains operation which is being applied to the stream,
 * an operations vector for the particular implementation (for example,
 * see xdr_mem.c), and two private fields for the use of the
 * particular implementation.
 */
typedef struct {
    enum xdr_op x_op;          /* operation; fast additional param */
    struct xdr_ops {
        bool_t (*x_getlong)(); /* get a long from underlying stream */
        bool_t (*x_putlong)(); /* put a long to " */
        bool_t (*x_getbytes)(); /* get some bytes from " */
        bool_t (*x_putbytes)(); /* put some bytes to " */
        u_int (*x_getpostn)(); /* returns bytes off from beginning */
        bool_t (*x_setpostn)(); /* lets you reposition the stream */
        long * (*x_inline)(); /* buf quick ptr to buffered data */
        void (*x_destroy)(); /* free privates of this xdr_stream */
    } *x_ops;
    caddr_t x_public;         /* users' data */
    caddr_t x_private;       /* pointer to private data */
    caddr_t x_base;          /* private used for position info */
    int x_handy;             /* extra private word */
} XDR;

```

Index to Routines

The following table lists RPC routines and the manual reference pages on which they are described:

| <u>RPC Routine</u> | <u>Manual Reference Page</u> |
|--------------------|------------------------------|
| auth_destroy | rpc_clnt_auth(3N) |
| authdes_getucred | secure_rpc(3N) |
| authdes_seccreate | secure_rpc(3N) |

```

        caddr_t      cl_private;      /* private stuff */
        char         *cl_netid;      /* network token */
        char         *cl_tp;         /* device name */
    } CLIENT;

```

The SVCXPRT Structure

```

enum xpirt_stat {
    XPRT_DIED,
    XPRT_MOREREQS,
    XPRT_IDLE
};

/*
 * Server side transport handle
 */
typedef struct {
    int          xp_fd;
#define xp_sock  xp_fd
#undef xp_sock
    u_short     xp_port;             /* associated port number.
 * Obsolete, but still used to
 * specify whether rendezvouser
 * or normal connection
 */

    struct xp_ops {
        bool_t   (*xp_recv)();      /* receive incoming requests */
        enum xpirt_stat (*xp_stat)(); /* get transport status */
        bool_t   (*xp_getargs)();   /* get arguments */
        bool_t   (*xp_reply)();     /* send reply */
        bool_t   (*xp_freeargs)();  /* free mem allocated for args */
        void     (*xp_destroy)();    /* destroy this struct */
    } *xp_ops;

    int          xp_addrlen;         /* length of remote addr. Obsolete */
    char         *xp_tp;            /* transport provider device name */
    char         *xp_netid;         /* network token */
    struct netbuf xp_ltaddr;        /* local transport address */
    struct netbuf xp_rtaddr;        /* remote transport address */
    char         xp_raddr[16];     /* remote address. Obsolete */
    struct opaque_auth xp_verf;     /* raw response verifier */
    caddr_t      xp_p1;            /* private: for use by svc ops */
    caddr_t      xp_p2;            /* private: for use by svc ops */
    caddr_t      xp_p3;            /* private: for use by svc lib */
} SVCXPRT;

```

The XDR Structure

```

/*
 * Xdr operations.  XDR_ENCODE causes the type to be encoded into the
 * stream.  XDR_DECODE causes the type to be extracted from the stream.
 * XDR_FREE can be used to release the space allocated by an XDR_DECODE
 * request.
 */
enum xdr_op {
    XDR_ENCODE=0,
    XDR_DECODE=1,
    XDR_FREE=2
};

```

Data Structures

Some of the data structures used by the RPC package are shown below.

The AUTH Structure

```

union des_block {
    struct {
        u_int32 high;
        u_int32 low;
    } key;
    char c[8];
};
typedef union des_block des_block;
extern bool_t xdr_des_block();

/*
 * Authentication info. Opaque to client.
 */
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 */
};

/*
 * Auth handle, interface to client side authenticators.
 */
typedef struct {
    struct opaque_auth ah_cred;
    struct opaque_auth ah_verf;
    union des_block ah_key;
    struct auth_ops {
        void (*ah_nextverf)();
        int (*ah_marshall)(); /* nextverf & serialize */
        int (*ah_validate)(); /* validate varifier */
        int (*ah_refresh)(); /* refresh credentials */
        void (*ah_destroy)(); /* destroy this structure */
    } *ah_ops;
    caddr_t ah_private;
} AUTH;

```

The CLIENT Structure

```

/*
 * Client rpc handle.
 * Created by individual implementations
 * Client is responsible for initializing auth, see e.g. auth_none.c.
 */
typedef struct {
    AUTH *cl_auth; /* authenticator */
    struct clnt_ops {
        enum clnt_stat (*cl_call)(); /* call remote procedure */
        void (*cl_abort)(); /* abort a call */
        void (*cl_geterr)(); /* get specific error code */
        bool_t (*cl_freeres)(); /* frees results */
        void (*cl_destroy)(); /* destroy this structure */
        bool_t (*cl_control)(); /* the ioctl() of rpc */
    } *cl_ops;
}

```

NAME

rpc - library routines for remote procedure calls

DESCRIPTION

RPC routines allow C language programs to make procedure calls on other machines across a network. First, the client calls a procedure to send a data packet to the server. On receipt of the packet, the server calls a dispatch routine to perform the requested service, and then sends back a reply.

The following sections describe data objects use by the RPC package.

Nettype

Some of the high-level RPC interface routines take a *nettype* string as one of the parameters [for example, *clnt_create*, *svc_create*, *rpc_reg*, *rpc_call*]. This string defines a class of transports which can be used for a particular application. The transports are tried in left to right order in the *NETPATH* variable or in top to down order in the */etc/netconfig* file.

nettype can be one of the following:

| | |
|-------------------|--|
| <i>netpath</i> | Choose from the transports which have been indicated by their token names in the <i>NETPATH</i> variable. If <i>NETPATH</i> is unset or NULL, it defaults to <i>visible</i> . <i>netpath</i> is the default <i>nettype</i> . |
| <i>visible</i> | Choose the transports which have the visible flag (<i>v</i>) set in the <i>/etc/netconfig</i> file. |
| <i>circuit_v</i> | This is same as <i>visible</i> except that it chooses only the connection oriented transports from the entries in <i>/etc/netconfig</i> file. |
| <i>datagram_v</i> | This is same as <i>visible</i> except that it chooses only the connectionless datagram transports from the entries in <i>/etc/netconfig</i> file. |
| <i>circuit_n</i> | This is same as <i>netpath</i> except that it chooses only the connection oriented datagram transports |
| <i>datagram_n</i> | This is same as <i>netpath</i> except that it chooses only the connectionless datagram transports. |
| <i>udp</i> | It refers to Internet UDP. |
| <i>tcp</i> | It refers to Internet TCP. |
| <i>raw</i> | This is for memory based RPC, mainly for performance evaluation. |

If *nettype* is NULL, it defaults to *netpath*.

rmdir(2)

rmdir(2)

| | |
|---------|---|
| ENOTDIR | A component of the path prefix is not a directory. |
| ENOENT | The named directory does not exist or is the null pathname. |
| EROFS | The directory entry to be removed is part of a read-only file system. |
| ENOLINK | <i>path</i> points to a remote machine, and the link to that machine is no longer active. |

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

SEE ALSO

`mkdir(1)`, `rm(1)`, `mkdir(2)`.

NAME

rmdir - remove a directory

SYNOPSIS

```
#include <unistd.h>

int rmdir(const char *path);
```

DESCRIPTION

rmdir removes the directory named by the path name pointed to by *path*. The directory must not have any entries other than "." and "..".

If the directory's link count becomes zero and no process has the directory open, the space occupied by the directory is freed and the directory is no longer accessible. If one or more processes have the directory open when the last link is removed, the "." and ".." entries, if present, are removed before rmdir returns and no new entries may be created in the directory, but the directory is not removed until all references to the directory have been closed.

If *path* is a symbolic link, it is not followed.

Upon successful completion rmdir marks for update the st_ctime and st_mtime fields of the parent directory.

The named directory is removed unless one or more of the following are true:

| | |
|--------------|---|
| EACCES | Search permission is denied for a component of the path prefix. |
| EACCES | Write permission is denied on the directory containing the directory to be removed. |
| EACCES | The parent directory has the sticky bit set and is not owned by the user; the directory is not owned by the user and is not writable by the user; the user is not a super-user. |
| EBUSY | The directory to be removed is the mount point for a mounted file system. |
| EEXIST | The directory contains entries other than those for "." and "..". |
| EFAULT | <i>path</i> points outside the process's allocated address space. |
| EINVAL | The directory to be removed is the current directory. |
| EINVAL | The directory to be removed is the "." entry of a directory. |
| EIO | An I/O error occurred while accessing the file system. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and the file system does not allow it. |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds {PATH_MAX}, or the length of a <i>path</i> component exceeds {NAME_MAX} while _POSIX_NO_TRUNC is in effect. |

NAME

rexec - return stream to a remote command

SYNOPSIS

```
int rexec(char **ahost, u_short inport, char *user, char *passwd,
           char *cmd, int *fd2p);
```

DESCRIPTION

rexec looks up the host *ahost* using `gethostbyname` [see `gethostent(3N)`], returning -1 if the host does not exist. Otherwise *ahost* is set to the standard name of the host. If a username and password are both specified, then these are used to authenticate to the foreign host; otherwise, the user's `.netrc` file in his or her home directory is searched for appropriate information. If this fails, the user is prompted for the information.

The port *inport* specifies which well-known DARPA Internet port to use for the connection. The protocol for connection is described in detail in `rexecd`.

If the call succeeds, a socket of type `SOCK_STREAM` is returned to the caller, and given to the remote command as its standard input and standard output. If *fd2p* is non-zero, then an auxiliary channel to a control process will be setup, and a descriptor for it will be placed in *fd2p*. The control process will return diagnostic output from the command (unit 2) on this channel, and will also accept bytes on this channel as signal numbers, to be forwarded to the process group of the command. If *fd2p* is 0, then the standard error (unit 2 of the remote command) will be made the same as its standard output and no provision is made for sending arbitrary signals to the remote process, although you may be able to get its attention by using out-of-band data.

SEE ALSO

`rexecd(1M)` `gethostent(3N)`, `getservent(3N)`, `rcmd(3N)`

NOTES

There is no way to specify options to the `socket` call that `rexec` makes.

The `res_search` routine will make a query and await a response like `res_query`, but in addition, it will implement the default and search rules controlled by the `RES_DEFNAMES` and `RES_DNSRCH` options. Then it will return the first successful reply.

The remaining routines are lower-level routines used by `res_query`. The `res_mkquery` function will construct a standard query message and then place it in `buf`. It will return the size of the query or `-1` if the query is larger than `buflen`. The query type `op` usually will be `QUERY`, but it can be any of the query types defined in `<arpa/nameser.h>`. The domain name for the query is given by `dname`. The `newrr` argument is currently unused, but is intended for generating update messages.

The `res_send` routine will send a pre-formatted query and then return an answer. It will call `res_init` if `RES_INIT` is not set, send the query to the local name server, and then handle any timeouts and retries. The length of the reply message will be returned or `-1` if there were any errors.

The `dn_comp` function will compress the domain name `exp_dn` and then store it in `comp_dn`. The size of the compressed name will be returned or `-1` if there were any errors. The size of the array pointed to by `comp_dn` will be given by `length`. The compression will use an array of pointers `dnptrs` to previously-compressed names in the current message. The first pointer will point to the beginning of the message; the list will end with `NULL`. The limit to the array will be specified by `lastdnptr`. A side effect of `dn_comp` will be to update the list of pointers for labels inserted into the message as the name is compressed. If `dnptr` is `NULL`, the names will not be compressed. If `lastdnptr` is `NULL`, the list of labels will not be updated.

The `dn_expand` entry will expand the compressed domain name `comp_dn` to a full domain name. The compressed name will be contained in a query or reply message; `msg` will be a pointer to the beginning of the message. The uncompressed name will be placed in the buffer indicated by `exp_dn` which will be of size `length`. The size of the compressed name will be returned or `-1` if there was an error.

USER CONSIDERATIONS

Any program which uses one of the above resolver functions must be linked dynamically with either `/usr/lib/libsocket.so` or `/usr/lib/libresolv.so`.

FILES

```
/etc/resolv.conf
/usr/include/arpa/nameserv.h
/usr/include/netinet/in.h
/usr/include/resolv.h
/usr/include/sys/types.h
/usr/lib/libresolv.so
/usr/lib/libsocket.so
```

SEE ALSO

`named(1M)`, `gethostbyname(3N)`, `resolv.conf(4)`.
RFC 1032, RFC 1033, RFC 1034, RFC 1035, RFC 974.

The structure `_res` contains the global configuration and state information that is used by the `resolver` routines. Most of the values have reasonable defaults and can be ignored.

The options are stored as a simple bit mask containing the bitwise “or” of the options enabled. The options stored in `_res.options` are defined in `/usr/include/resolv.h` and are as follows:

`RES_INIT` True if the initial name server address and default domain name are initialized (i.e., `res_init` has been called).

`RES_DEBUG` Print the debugging messages.

`RES_AAONLY` Accept authoritative answers only. With this option, `res_send` should continue until it finds an authoritative answer or finds an error. Currently this is not implemented.

`RES_USEVC` Use TCP connections for queries instead of UDP datagrams.

`RES_STAYOPEN` Used with `RES_USEVC` to keep the TCP connection open between queries. This is useful only in programs that regularly do many queries. UDP should be the normal mode used.

`RES_IGNTC` Unused currently (ignore truncation errors, i.e., don’t retry with TCP).

`RES_RECURSE` Set the recursion-desired bit in queries. This is the default value. `res_send` will not do iterative queries and thus will expect the name server to handle recursion.

`RES_DEFNAMES` If set, `res_search` will append the default domain name to the “single-component” names (that is, those that do not contain a dot). This option is enabled by default.

`RES_DNSRCH` If this option is set, `res_search` will search for host names in the current domain and in parent domains [see `hostname(7)`]. This will be used by the standard host lookup routine `gethostbyname(3N)`. This option is enabled by default.

The `res_init` routine will read the configuration file `/etc/resolv.conf` [if any; see `resolv.conf` (4)] to get the default domain name, search list and the Internet address of the local name server(s). If no server is configured, the host running the resolver will be tried. The current domain name will be defined by the `hostname` if not specified in the configuration file; it can be overridden by the environment variable `LOCALDOMAIN`. The initialization normally occurs on the first call to one of the following routines.

The `res_query` function provides an interface to the server query mechanism. It will construct a query, send it to the local server, await a response, and then make some preliminary checks on the reply. The query requests information of the specified `type` and `class` for the specified fully-qualified domain name `dname`. The reply message will be left in the `answer` buffer with length `anslen` supplied by the caller.

NAME

resolver: res_query, res_search, res_mkquery, res_send, res_init, dn_comp, dn_expand - resolver routines

SYNOPSIS

```
#include <sys/types.h>
#include <netinet/in.h>
#include <arpa/nameser.h>
#include <resolv.h>

"res_query(dname, class, type, answer, anslen)"
char *dname;
int class, type;
u_char *answer;
int anslen;

"res_search(dname, class, type, answer, anslen)"
char *dname;
int class, type;
u_char *answer;
int anslen;

"res_mkquery(op, dname, class, type, data, datalen, newrr, buf,
buflen)"
int op;
char *dname;
int class, type;
char *data;
int datalen;
struct rrec *newrr;
char *buf;
int buflen;

res_send(msg, msglen, answer, anslen)
char *msg;
int msglen;
char *answer;
int anslen;

res_init()

dn_comp(exp_dn, comp_dn, length, dnptrs, lastdnptr)
char *exp_dn, *comp_dn;
int length;
char **dnptrs, **lastdnptr;

dn_expand(msg, eomorig, comp_dn, exp_dn, length)
char *msg, *eomorig, *comp_dn, exp_dn;
int length;
```

DESCRIPTION

These routines are used for making, sending, and for interpreting query and reply messages pertaining to Internet domain name servers.

rename(2)

rename(2)

| | |
|--------------|--|
| EISDIR | <i>new</i> points to a directory but <i>old</i> points to a file that is not a directory. |
| ELOOP | Too many symbolic links were encountered in translating <i>old</i> or <i>new</i> . |
| EMULTIHOP | Components of pathnames require hopping to multiple remote machines and the file system type does not allow it. |
| ENAMETOOLONG | The length of the <i>old</i> or <i>new</i> argument exceeds {PATH_MAX}, or the length of a <i>old</i> or <i>new</i> component exceeds {NAME_MAX} while _POSIX_NO_TRUNC is in effect. |
| ENOENT | A component of either <i>old</i> or <i>new</i> does not exist, or the file referred to by either <i>old</i> or <i>new</i> does not exist. |
| ENOLINK | Pathnames point to a remote machine and the link to that machine is no longer active. |
| ENOSPC | The directory that would contain <i>new</i> is out of space. |
| ENOTDIR | A component of either path prefix is not a directory; or the <i>old</i> parameter names a directory and the <i>new</i> parameter names a file. |
| EROFS | The requested operation requires writing in a directory on a read-only file system. |
| EXDEV | The links named by <i>old</i> and <i>new</i> are on different file systems. |

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NOTES

The system can deadlock if there is a loop in the file system graph. Such a loop takes the form of an entry in directory *a*, say *a/foo*, being a hard link to directory *b*, and an entry in directory *b*, say *b/bar*, being a hard link to directory *a*. When such a loop exists and two separate processes attempt to perform `rename a/foo b/bar` and `rename b/bar a/foo`, respectively, the system may deadlock attempting to lock both directories for modification. The system administrator should replace hard links to directories by symbolic links.

SEE ALSO

`link(2)`, `unlink(2)`

rename (2)

rename (2)

NAME

rename - change the name of a file

SYNOPSIS

```
#include <stdio.h>

int rename(const char *old, const char *new);
```

DESCRIPTION

rename renames a file. *old* is a pointer to the pathname of the file or directory to be renamed. *new* is a pointer to the new pathname of the file or directory. Both *old* and *new* must be of the same type (either both files, or both directories) and must reside on the same file system.

If *new* already exists, it is removed. Thus, if *new* names an existing directory, the directory must not have any entries other than, possibly, "." and "..". When renaming directories, the *new* pathname must not name a descendant of *old*. The implementation of rename ensures that upon successful completion a link named *new* will always exist.

If the final component of *old* is a symbolic link, the symbolic link is renamed, not the file or directory to which it points.

Write permission is required for both the directory containing *old* and the directory containing *new*. Furthermore, if *old* and *new* are directories, write permission is required for the directory named by *old*, and if it exists, the directory named by *new*. rename fails, *old* is not changed, and no *new* file is created if one or more of the following are true:

| | |
|--------|---|
| EACCES | A component of either path prefix denies search permission; one of the directories containing <i>old</i> or <i>new</i> denies write permission; or one of the directories pointed to by <i>old</i> or <i>new</i> denies write permission. |
| EBUSY | <i>new</i> is a directory and the mount point for a mounted file system. |
| EDQUOT | The directory in which the entry for the new name is being placed cannot be extended because the user's quota of disk blocks on the file system containing the directory has been exhausted. |
| EEXIST | The link named by <i>new</i> is a directory containing entries other than "." and "..". |
| EFAULT | <i>old</i> or <i>new</i> points outside the process's allocated address space. |
| EINVAL | <i>old</i> is a parent directory of <i>new</i> , or an attempt is made to rename "." or "..". |
| EINTR | A signal was caught during execution of the rename system call. |
| EIO | An I/O error occurred while making or updating a directory entry. |

remove(3C)

remove(3C)

NAME

remove - remove file

SYNOPSIS

```
#include <stdio.h>

int remove(const char *path);
```

DESCRIPTION

remove causes the file or empty directory whose name is the string pointed to by *path* to be no longer accessible by that name. A subsequent attempt to open that file using that name will fail, unless the file is created anew.

For files, remove is identical to unlink. For directories, remove is identical to rmdir.

See rmdir(2) and unlink(2) for a detailed list of failure conditions.

SEE ALSO

rmdir(2), unlink(2)

RETURN VALUE

Upon successful completion, remove returns a value of 0; otherwise, it returns a value of -1 and sets errno to indicate an error.

EXAMPLES

The following is similar to the regular expression code from `grep`:

```
#include <regexpr.h>

. . .
if(compile(*argv, (char *)0, (char *)0) == (char *)0)
    regerr(regerno);

. . .
if (step(linebuf, expbuf))
    succeed();
```

SEE ALSO

`ed(1)`, `grep(1)`, `sed(1)`, `regexp(5)`.

| ERROR | MEANING |
|-------|---------------------------------------|
| 11 | Range endpoint too large. |
| 16 | Bad number. |
| 25 | “ <i>digit</i> ” out of range. |
| 36 | Illegal or missing delimiter. |
| 41 | No remembered search string. |
| 42 | \(\) imbalance. |
| 43 | Too many \(. |
| 44 | More than 2 numbers given in \{ \}. |
| 45 | } expected after \. |
| 46 | First number exceeds second in \{ \}. |
| 49 | [] imbalance. |
| 50 | Regular expression overflow. |

The call to `step` is as follows:

```
step (string, expbuf)
```

The first parameter to `step` is a pointer to a string of characters to be checked for a match. This string should be null-terminated.

The parameter `expbuf` is the compiled regular expression obtained by a call of the function `compile`.

The function `step` returns non-zero if the given string matches the regular expression, and zero if the expressions do not match. If there is a match, two external character pointers are set as a side effect to the call to `step`. The variable set in `step` is `loc1`. `loc1` is a pointer to the first character that matched the regular expression. The variable `loc2` points to the character after the last character that matches the regular expression. Thus if the regular expression matches the entire line, `loc1` points to the first character of *string* and `loc2` points to the null at the end of *string*.

The purpose of `step` is to step through the *string* argument until a match is found or until the end of *string* is reached. If the regular expression begins with `^`, `step` tries to match the regular expression at the beginning of the string only.

The function `advance` has the same arguments and side effects as `step`, but it always restricts matches to the beginning of the string.

If one is looking for successive matches in the same string of characters, `locs` should be set equal to `loc2`, and `step` should be called with *string* equal to `loc2`. `locs` is used by commands like `ed` and `sed` so that global substitutions like `s/y*/g` do not loop forever, and is `NULL` by default.

The external variable `nbra` is used to determine the number of subexpressions in the compiled regular expression. `braslist` and `braelist` are arrays of character pointers that point to the start and end of the `nbra` subexpressions in the matched string. For example, after calling `step` or `advance` with *string* `sabcdefg` and regular expression `\(abcdef\)`, `braslist[0]` will point at `a` and `braelist[0]` will point at `g`. These arrays are used by commands like `ed` and `sed` for substitute replacement patterns that contain the `\n` notation for subexpressions.

Note that it isn't necessary to use the external variables `regerrno`, `nbra`, `loc1`, `loc2`, `locs`, `braelist`, and `braslist` if one is only checking whether or not a string matches a regular expression.

NAME

regexpr: compile, step, advance - regular expression compile and match routines

SYNOPSIS

```
cc [flag ...] file ... -lgen [library ...]
#include <regexpr.h>
char *compile (const char *instring, char *expbuf, char *endbuf);
int step (const char *string, char *expbuf);
int advance (const char *string, char *expbuf);
extern char *loc1, *loc2, *locs;
extern int nbra, regerrno, reglength;
extern char *braslist[], *braelist[];
```

DESCRIPTION

These routines are used to compile regular expressions and match the compiled expressions against lines. The regular expressions compiled are in the form used by `ed`.

The syntax of the `compile` routine is as follows:

```
compile (instring, expbuf, endbuf)
```

The parameter *instring* is a null-terminated string representing the regular expression.

The parameter *expbuf* points to the place where the compiled regular expression is to be placed. If *expbuf* is `NULL`, `compile` uses `malloc` to allocate the space for the compiled regular expression. If an error occurs, this space is freed. It is the user's responsibility to free unneeded space after the compiled regular expression is no longer needed.

The parameter *endbuf* is one more than the highest address where the compiled regular expression may be placed. This argument is ignored if *expbuf* is `NULL`. If the compiled expression cannot fit in (*endbuf-expbuf*) bytes, `compile` returns `NULL` and `regerrno` (see below) is set to 50.

If `compile` succeeds, it returns a non-`NULL` pointer whose value depends on *expbuf*. If *expbuf* is non-`NULL`, `compile` returns a pointer to the byte after the last byte in the compiled regular expression. The length of the compiled regular expression is stored in `reglength`. Otherwise, `compile` returns a pointer to the space allocated by `malloc`.

If an error is detected when compiling the regular expression, a `NULL` pointer is returned from `compile` and `regerrno` is set to one of the non-zero error numbers indicated below:

in the string at sometime during the backing up process, advance will break out of the loop that backs up and will return zero.

The external variables `circf`, `sed`, and `nbra` are reserved.

DIAGNOSTICS

The function `compile` uses the macro `RETURN` on success and the macro `ERROR` on failure (see above). The functions `step` and `advance` return non-zero on a successful match and zero if there is no match. Errors are:

- 11 range endpoint too large.
- 16 bad number.
- 25 \ *digit* out of range.
- 36 illegal or missing delimiter.
- 41 no remembered search string.
- 42 \(\) imbalance.
- 43 too many \(.
- 44 more than 2 numbers given in \{ \}.
- 45 } expected after \.
- 46 first number exceeds second in \{ \}.
- 49 [] imbalance.
- 50 regular expression overflow.

EXAMPLE

The following is an example of how the regular expression macros and calls might be defined by an application program:

```
#define INIT      register char *sp = instring;
#define GETC      (*sp++)
#define PEEKC     (*sp)
#define UNGETC(c) (--sp)
#define RETURN(*c) return;
#define ERROR(c)  regerr

#include <regexp.h>

. . .
    (void) compile(*argv, expbuf, &expbuf[ESIZE], '\0');
. . .
    if (step(linebuf, expbuf))
        succeed;
```

`ERROR(val)` This macro is the abnormal return from the `compile` routine. The argument *val* is an error number [see ERRORS below for meanings]. This call should never return.

The syntax of the `compile` routine is as follows:

```
compile(instring, expbuf, endbuf, eof)
```

The first parameter, *instring*, is never used explicitly by the `compile` routine but is useful for programs that pass down different pointers to input characters. It is sometimes used in the `INIT` declaration (see below). Programs which call functions to input characters or have characters in an external array can pass down a value of `(char *)0` for this parameter.

The next parameter, *expbuf*, is a character pointer. It points to the place where the compiled regular expression will be placed.

The parameter *endbuf* is one more than the highest address where the compiled regular expression may be placed. If the compiled expression cannot fit in `(endbuf-expbuf)` bytes, a call to `ERROR(50)` is made.

The parameter *eof* is the character which marks the end of the regular expression. This character is usually a `.`

Each program that includes the `regex.h` header file must have a `#define` statement for `INIT`. It is used for dependent declarations and initializations. Most often it is used to set a register variable to point to the beginning of the regular expression so that this register variable can be used in the declarations for `GETC`, `PEEKC`, and `UNGETC`. Otherwise it can be used to declare external variables that might be used by `GETC`, `PEEKC` and `UNGETC`. [See EXAMPLE below.]

The first parameter to the `step` and `advance` functions is a pointer to a string of characters to be checked for a match. This string should be null terminated.

The second parameter, *expbuf*, is the compiled regular expression which was obtained by a call to the function `compile`.

The function `step` returns non-zero if some substring of *string* matches the regular expression in *expbuf* and zero if there is no match. If there is a match, two external character pointers are set as a side effect to the call to `step`. The variable `loc1` points to the first character that matched the regular expression; the variable `loc2` points to the character after the last character that matches the regular expression. Thus if the regular expression matches the entire input string, `loc1` will point to the first character of *string* and `loc2` will point to the null at the end of *string*.

The function `advance` returns non-zero if the initial substring of *string* matches the regular expression in *expbuf*. If there is a match, an external character pointer, `loc2`, is set as a side effect. The variable `loc2` points to the next character in *string* after the last character that matched.

When `advance` encounters a `*` or `\{ \}` sequence in the regular expression, it will advance its pointer to the string to be matched as far as possible and will recursively call itself trying to match the rest of the string to the rest of the regular expression. As long as there is no match, `advance` will back up along the string until it finds a match or reaches the point in the string that initially matched the `*` or `\{ \}`. It is sometimes desirable to stop this backing up before the initial point in the string is reached. If the external character pointer `locs` is equal to the point

- `rx` the occurrence of regular expression *r* followed by the occurrence of regular expression *x*. (Concatenation)
- `r\{m,n\}` any number of *m* through *n* successive occurrences of the regular expression *r*. The regular expression `r\{m\}` matches exactly *m* occurrences; `r\{m,\}` matches at least *m* occurrences.
- `\(r\)` the regular expression *r*. When `\n` (where *n* is a number greater than zero) appears in a constructed regular expression, it stands for the regular expression *x* where *x* is the *n*th regular expression enclosed in `\(` and `\)` that appeared earlier in the constructed regular expression. For example, `\(r\)x\ (y\)z\2` is the concatenation of regular expressions *rxzyzy*.

Characters that have special meaning except when they appear within square brackets (`[]`) or are preceded by `\` are: `.`, `*`, `[`, `\`. Other special characters, such as `$` have special meaning in more restricted contexts.

The character `^` at the beginning of an expression permits a successful match only immediately after a newline, and the character `$` at the end of an expression requires a trailing newline.

Two characters have special meaning only when used within square brackets. The character `-` denotes a range, `[c-c]`, unless it is just after the open bracket or before the closing bracket, `[-c]` or `[c-]` in which case it has no special meaning. When used within brackets, the character `^` has the meaning *complement of* if it immediately follows the open bracket (example: `^[c]`); elsewhere between brackets (example: `[c^]`) it stands for the ordinary character `^`.

The special meaning of the `\` operator can be escaped only by preceding it with another `\`, for example, `\\`.

Programs must have the following five macros declared before the `#include regexp.h` statement. These macros are used by the `compile` routine. The macros `GETC`, `PEEKC`, and `UNGETC` operate on the regular expression given as input to `compile`.

- `GETC` This macro returns the value of the next character (byte) in the regular expression pattern. Successive calls to `GETC` should return successive characters of the regular expression.
- `PEEKC` This macro returns the next character (byte) in the regular expression. Immediately successive calls to `PEEKC` should return the same character, which should also be the next character returned by `GETC`.
- `UNGETC` This macro causes the argument `c` to be returned by the next call to `GETC` and `PEEKC`. No more than one character of pushback is ever needed and this character is guaranteed to be the last character read by `GETC`. The return value of the macro `UNGETC(c)` is always ignored.
- `RETURN(ptr)` This macro is used on normal exit of the `compile` routine. The value of the argument `ptr` is a pointer to the character after the last character of the compiled regular expression. This is useful to programs which have memory allocation to manage.

NAME

regexp: compile, step, advance - regular expression compile and match routines

SYNOPSIS

```
#define INIT declarations
#define GETC(void) getc code
#define PEEKC(void) peekc code
#define UNGETC(void) ungetc code
#define RETURN(ptr) return code
#define ERROR(val) error code

#include <regexp.h>

char *compile(char *instring, char *expbuf, char *endbuf, int eof);
int step(char *string, char *expbuf);
int advance(char *string, char *expbuf);
extern char *loc1, *loc2, *locs;
```

DESCRIPTION

These functions are general purpose regular expression matching routines to be used in programs that perform regular expression matching. These functions are defined by the `regexp.h` header file.

The functions `step` and `advance` do pattern matching given a character string and a compiled regular expression as input.

The function `compile` takes as input a regular expression as defined below and produces a compiled expression that can be used with `step` or `advance`.

A regular expression specifies a set of character strings. A member of this set of strings is said to be matched by the regular expression. Some characters have special meaning when used in a regular expression; other characters stand for themselves.

The regular expressions available for use with the `regexp` functions are constructed as follows:

| <i>Expression</i> | <i>Meaning</i> |
|-------------------|--|
| <i>c</i> | the character <i>c</i> where <i>c</i> is not a special character. |
| <i>\c</i> | the character <i>c</i> where <i>c</i> is any character, except a digit in the range 1-9. |
| <i>^</i> | the beginning of the line being compared. |
| <i>\$</i> | the end of the line being compared. |
| <i>.</i> | any character in the input. |
| <i>[s]</i> | any character in the set <i>s</i> , where <i>s</i> is a sequence of characters and/or a range of characters, for example, <i>[c-c]</i> . |
| <i>[^s]</i> | any character not in the set <i>s</i> , where <i>s</i> is defined as above. |
| <i>r*</i> | zero or more successive occurrences of the regular expression <i>r</i> . The longest leftmost match is chosen. |

NAME

regex, re_comp, re_exec - regular expression handler

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
```

```
char *re_comp(s)
```

```
char *s;
```

```
re_exec(s)
```

```
char *s;
```

DESCRIPTION

re_comp compiles a string into an internal form suitable for pattern matching.

re_exec checks the argument string against the last string passed to re_comp.

re_comp returns a NULL pointer if the string *s* was compiled successfully; otherwise a string containing an error message is returned. If re_comp is passed 0 or a NULL string, it returns without changing the currently compiled regular expression.

re_exec returns 1 if the string *s* matches the last compiled regular expression, 0 if the string *s* failed to match the last compiled regular expression, and -1 if the compiled regular expression was invalid (indicating an internal error).

The strings passed to both re_comp and re_exec may have trailing or embedded NEWLINE characters; they are terminated by NULL characters. The regular expressions recognized are described in the manual page entry for ed(1), given the above difference.

SEE ALSO

ed(1), ex(1), grep(1), regcmp(1), regexpr(3G), regcmp(3X), regexpr(5).

RETURN VALUE

re_exec returns -1 for an internal error.

re_comp returns one of the following strings if an error occurs:

```
No previous regular expression
```

```
Regular expression too long
```

```
unmatched \(
```

```
missing ]
```

```
too many \(\) pairs
```

```
unmatched \)
```

(. . .) Parentheses are used for grouping. An operator, for example, *, +, {}, can work on a single character or a regular expression enclosed in parentheses. For example, (a*(cb+))*\$0.

By necessity, all the above defined symbols are special. They must, therefore, be escaped with a \ (backslash) to be used as themselves.

EXAMPLES

The following example matches a leading newline in the subject string pointed at by cursor.

```
char *cursor, *newcursor, *ptr;
. . .
newcursor = regex((ptr = regcmp("^\\n", (char *)0)), cursor);
free(ptr);
```

The following example matches through the string Testing3 and returns the address of the character after the last matched character (the "4"). The string Testing3 is copied to the character array ret0.

```
char ret0[9];
char *newcursor, *name;
. . .
name = regcmp("[A-Za-z][A-Za-z0-9]{0,7})$0", (char *)0);
newcursor = regex(name, "012Testing345", ret0);
```

The following example applies a precompiled regular expression in file.i [see regcmp(1)] against *string*.

```
#include "file.i"
char *string, *newcursor;
. . .
newcursor = regex(name, string);
```

SEE ALSO

regcmp(1), ed(1), malloc(3C).

NOTES

The user program may run out of memory if regcmp is called iteratively without freeing the vectors no longer required.

NAME

regcmp, regex - compile and execute regular expression

SYNOPSIS

```
#include <libgen.h>
cc [flag...]file...-lgen [library...]
char *regcmp(const char *string1 /*, char *string2, ...*/, (char *)0);
char *regex(const char *re, const char *subject /*, char *ret0, ...*/);
extern char *__loc1;
```

DESCRIPTION

regcmp compiles a regular expression (consisting of the concatenated arguments) and returns a pointer to the compiled form. malloc(3C) is used to create space for the compiled form. It is the user's responsibility to free unneeded space so allocated. A NULL return from regcmp indicates an incorrect argument. regcmp(1) has been written to generally preclude the need for this routine at execution time. regcmp is located in library libform.

regex executes a compiled pattern against the subject string. Additional arguments are passed to receive values back. regex returns NULL on failure or a pointer to the next unmatched character on success. A global character pointer __loc1 points to where the match began. regcmp and regex were mostly borrowed from the editor, ed(1); however, the syntax and semantics have been changed slightly. The following are the valid symbols and associated meanings.

- [] * . ^ These symbols retain their meaning in ed(1).
- \$ Matches the end of the string; \n matches a newline.
- Within brackets the minus means through. For example, [a-z] is equivalent to [abcd...xyz]. The - can appear as itself only if used as the first or last character. For example, the character class expression []- matches the characters] and -.
- + A regular expression followed by + means one or more times. For example, [0-9]+ is equivalent to [0-9][0-9]*.
- {m} {m,} {m,u} Integer values enclosed in { } indicate the number of times the preceding regular expression is to be applied. The value m is the minimum number and u is a number, less than 256, which is the maximum. If only m is present (that is, {m}), it indicates the exact number of times the regular expression is to be applied. The value {m,} is analogous to {m,infinitiy}. The plus (+) and star (*) operations are equivalent to {1,} and {0,} respectively.
- (...)\$n The value of the enclosed regular expression is to be returned. The value will be stored in the (n+1)th argument following the subject argument. At most, ten enclosed regular expressions are allowed. regex makes its assignments unconditionally.

RETURN VALUE

These calls return the number of bytes received, or -1 if an error occurred.

ERRORS

The calls fail if:

| | |
|-------------|---|
| EBADF | <i>s</i> is an invalid descriptor. |
| ENOTSOCK | <i>s</i> is a descriptor for a file, not a socket. |
| EINTR | The operation was interrupted by delivery of a signal before any data was available to be received. |
| EWOULDBLOCK | The socket is marked non-blocking and the requested operation would block. |
| ENOMEM | There was insufficient user memory available for the operation to complete. |
| ENOSR | There were insufficient STREAMS resources available for the operation to complete. |

SEE ALSO

`fcntl(2)`, `ioctl(2)`, `read(2)`, `connect(3N)`, `getsockopt(3N)`, `send(3N)`, `socket(3N)`.

NOTES

The type of address structure passed to `recv` depends on the address family. UNIX domain sockets (address family `AF_UNIX`) require a `socketaddr_un` structure as defined in `sys/un.h`; Internet domain sockets (address family `AF_INET`) require a `sockaddr_in` structure as defined in `netinet/in.h`. Other address families may require other structures. Use the structure appropriate to the address family; cast the structure address to a generic `caddr_t` in the call to `recv` and pass the size of the structure in the *fromlen* argument.

NAME

recv, recvfrom, recvmsg - receive a message from a socket

SYNOPSIS

```
#include <sys/types.h>

int recv(int s, char *buf, int len, int flags);

int recvfrom(int s, char *buf, int len, int flags, caddr_t from,
             int *fromlen);

int recvmsg(int s, struct msghdr *msg, int flags);
```

DESCRIPTION

s is a socket created with `socket`. `recv`, `recvfrom`, and `recvmsg` are used to receive messages from another socket. `recv` may be used only on a *connected* socket [see `connect(3N)`], while `recvfrom` and `recvmsg` may be used to receive data on a socket whether it is in a connected state or not.

If *from* is not a `NULL` pointer, the source address of the message is filled in. *fromlen* is a value-result parameter, initialized to the size of the buffer associated with *from*, and modified on return to indicate the actual size of the address stored there. The length of the message is returned. If a message is too long to fit in the supplied buffer, excess bytes may be discarded depending on the type of socket the message is received from [see `socket(3N)`].

If no messages are available at the socket, the receive call waits for a message to arrive, unless the socket is nonblocking [see `fcntl(2)`] in which case `-1` is returned with the external variable `errno` set to `EWOULDBLOCK`.

The `select` call may be used to determine when more data arrives.

The *flags* parameter is formed by ORing one or more of the following:

| | |
|----------|--|
| MSG_OOB | Read any out-of-band data present on the socket rather than the regular in-band data. |
| MSG_PEEK | Peek at the data present on the socket; the data is returned, but not consumed, so that a subsequent receive operation will see the same data. |

The `recvmsg()` call uses a `msghdr` structure to minimize the number of directly supplied parameters. This structure is defined in `sys/socket.h` and includes the following members:

```
caddr_t      msg_name;           /* optional address */
int          msg_namelen;       /* size of address */
struct iovec *msg_iov;         /* scatter/gather array */
int          msg_iovlen;       /* # elements in msg_iov */
caddr_t      msg_accrightrights; /* access rights sent/received */
int          msg_accrightrightslen;
```

Here `msg_name` and `msg_namelen` specify the destination address if the socket is unconnected; `msg_name` may be given as a `NULL` pointer if no names are desired or required. The `msg_iov` and `msg_iovlen` describe the scatter-gather locations, as described in `read`. A buffer to receive any access rights sent along with the message is specified in `msg_accrightrights`, which has length `msg_accrightrightslen`.

NAME

reboot - reboot system or halt processor

SYNOPSIS

```
/usr/ucb/cc [flag...] file...
#include <sys/reboot.h>
reboot(howto, [ bootargs ] )
int howto;
char *bootargs;
```

DESCRIPTION

reboot reboots the system, and is invoked automatically in the event of unrecoverable system failures. *howto* is a mask of options passed to the bootstrap program. The system call interface permits only RB_HALT or RB_AUTOBOOT to be passed to the reboot program; the other flags are used in scripts stored on the console storage media, or used in manual bootstrap procedures. When none of these options (for instance RB_AUTOBOOT) is given, the system is rebooted from file /stand/unix. An automatic consistency check of the disks is then normally performed.

The bits of *howto* that are used are:

| | |
|------------|---|
| RB_HALT | the processor is simply halted; no reboot takes place. RB_HALT should be used with caution. |
| RB_ASKNAME | Interpreted by the bootstrap program itself, causing it to inquire as to what file should be booted. Normally, the system is booted from the file /stand/unix without asking. |

RETURN VALUE

If successful, this call never returns. Otherwise, a -1 is returned and an error is returned in the global variable `errno`.

ERRORS

| | |
|-------|-----------------------------------|
| EPERM | The caller is not the super-user. |
|-------|-----------------------------------|

FILES

/vmunix

SEE ALSO

halt(1M) init(1M) reboot(1M)
intro(1M), crash(1M).

NOTES

Any other *howto* argument causes /stand/unix to boot.
Only the super-user may reboot a machine.

NAME

realpath - returns the real file name

SYNOPSIS

```
#include <stdlib.h>
#include <sys/param.h>

char *realpath (char * file_name, char * resolved_name);
```

DESCRIPTION

realpath resolves all links and references to "." and ".." in *file_name* and stores it in *resolved_name*.

It can handle both relative and absolute path names. For absolute path names and the relative names whose resolved name cannot be expressed relatively (for example, ../../reldir), it returns the *resolved absolute* name. For the other relative path names, it returns the *resolved relative* name.

resolved_name must be big enough (MAXPATHLEN) to contain the fully resolved path name.

SEE ALSO

getcwd(3C)

DIAGNOSTICS

If there is no error, realpath returns a pointer to the *resolved_name*. Otherwise it returns a null pointer and places the name of the offending file in *resolved_name*. The global variable *errno* is set to indicate the error.

NOTES

realpath operates on null-terminated strings.

One should have execute permission on all the directories in the given and the resolved path.

realpath may fail to return to the current directory if an error occurs.

NAME

readlink - read the value of a symbolic link

SYNOPSIS

```
#include <unistd.h>
```

```
int readlink(const char *path, void *buf, size_t bufsiz);
```

DESCRIPTION

readlink places the contents of the symbolic link referred to by *path* in the buffer *buf*, which has size *bufsiz*. The contents of the link are not null-terminated when returned.

readlink fails and the buffer remains unchanged if:

| | |
|--------------|--|
| EACCES | Search permission is denied for a component of the path prefix of <i>path</i> . |
| EFAULT | <i>path</i> or <i>buf</i> extends outside the allocated address space of the process. |
| EINVAL | The named file is not a symbolic link. |
| EIO | An I/O error occurs while reading from or writing to the file system. |
| ELOOP | Too many symbolic links are encountered in translating <i>path</i> . |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds {PATH_MAX}, or the length of a <i>path</i> component exceeds {NAME_MAX} while _POSIX_NO_TRUNC is in effect. |
| ENOENT | The named file does not exist. |
| ENOSYS | The file system does not support symbolic links. |

DIAGNOSTICS

Upon successful completion readlink returns the number of characters placed in the buffer; otherwise, it returns -1 and places an error code in *errno*.

SEE ALSO

lstat(2), stat(2), symlink(2)

read (2)

read (2)

| | |
|--------|---|
| EFAULT | <i>iov</i> points outside the allocated address space. |
| EINVAL | <i>iovcnt</i> was less than or equal to 0 or greater than 16. |
| EINVAL | The sum of the <i>iov_len</i> values in the <i>iov</i> array overflowed a 32-bit integer. |

A `read` from a STREAMS file also fails if an error message is received at the stream head. In this case, `errno` is set to the value returned in the error message. If a hangup occurs on the stream being read, `read` continues to operate normally until the stream head read queue is empty. Thereafter, it returns 0.

SEE ALSO

`creat(2)`, `dup(2)`, `fcntl(2)`, `getmsg(2)`, `intro(2)`, `ioctl(2)`, `open(2)`, `pipe(2)`, `streamio(7)`, `termio(7)`.

DIAGNOSTICS

On success a non-negative integer is returned indicating the number of bytes actually read. Otherwise, a -1 is returned and `errno` is set to indicate the error.

the zero-byte message back on the stream to be retrieved by the next `read` or `getmsg` [see `getmsg(2)`]. In the two other modes, a zero-byte message returns a value of 0 and the message is removed from the stream. When a zero-byte message is read as the first message on a stream, a value of 0 is returned regardless of the read mode.

A `read` or `readv` from a STREAMS file returns the data in the message at the front of the stream head read queue, regardless of the priority band of the message.

Normally, a `read` from a STREAMS file can only process messages with data and without control information. The `read` fails if a message containing control information is encountered at the stream head. This default action can be changed by placing the stream in either control-data mode or control-discard mode with the `I_SRDOPT` `ioctl(2)`. In control-data mode, control messages are converted to data messages by `read`. In control-discard mode, control messages are discarded by `read`, but any data associated with the control messages is returned to the user.

`read` and `readv` fail if one or more of the following are true:

| | |
|---------|---|
| EAGAIN | Mandatory file/record locking was set, <code>O_NDELAY</code> or <code>O_NONBLOCK</code> was set, and there was a blocking record lock. |
| EAGAIN | Total amount of system memory available when reading via raw I/O is temporarily insufficient. |
| EAGAIN | No data is waiting to be read on a file associated with a tty device and <code>O_NONBLOCK</code> was set. |
| EAGAIN | No message is waiting to be read on a stream and <code>O_NDELAY</code> or <code>O_NONBLOCK</code> was set. |
| EBADF | <i>fdes</i> is not a valid file descriptor open for reading. |
| EBADMSG | Message waiting to be read on a stream is not a data message. |
| EDEADLK | The <code>read</code> was going to go to sleep and cause a deadlock to occur. |
| EFAULT | <i>buf</i> points outside the allocated address space. |
| EINTR | A signal was caught during the <code>read</code> or <code>readv</code> system call. |
| EINVAL | Attempted to read from a stream linked to a multiplexor. |
| EIO | A physical I/O error has occurred, or the process is in a background process group and is attempting to read from its controlling terminal, and either the process is ignoring or blocking the <code>SIGTTIN</code> signal or the process group of the process is orphaned. |
| ENOLCK | The system record lock table was full, so the <code>read</code> or <code>readv</code> could not go to sleep until the blocking record lock was removed. |
| ENOLINK | <i>fdes</i> is on a remote machine and the link to that machine is no longer active. |
| ENXIO | The device associated with <i>fdes</i> is a block special or character special file and the value of the file pointer is out of range. |

In addition, `readv` may return one of the following errors:

is no more data to be retrieved. Byte-stream mode usually ignores message boundaries.

In STREAMS message-nondiscard mode, `read` and `readv` retrieve data until they have read *nbyte* bytes, or until they reach a message boundary. If `read` or `readv` does not retrieve all the data in a message, the remaining data is replaced on the stream and can be retrieved by the next `read` or `readv` call. Message-discard mode also retrieves data until it has retrieved *nbyte* bytes, or it reaches a message boundary. However, unread data remaining in a message after the `read` or `readv` returns is discarded, and is not available for a subsequent `read`, `readv`, or `getmsg` [see `getmsg(2)`].

When attempting to read from a regular file with mandatory file/record locking set [see `chmod(2)`], and there is a write lock owned by another process on the segment of the file to be read:

If `O_NDELAY` or `O_NONBLOCK` is set, `read` returns -1 and sets `errno` to `EAGAIN`.

If `O_NDELAY` and `O_NONBLOCK` are clear, `read` sleeps until the blocking record lock is removed.

When attempting to read from an empty pipe (or FIFO):

If no process has the pipe open for writing, `read` returns 0 to indicate end-of-file.

If some process has the pipe open for writing and `O_NDELAY` is set, `read` returns 0.

If some process has the pipe open for writing and `O_NONBLOCK` is set, `read` returns -1 and sets `errno` to `EAGAIN`.

If `O_NDELAY` and `O_NONBLOCK` are clear, `read` blocks until data is written to the pipe or the pipe is closed by all processes that had opened the pipe for writing.

When attempting to read a file associated with a terminal that has no data currently available:

If `O_NDELAY` is set, `read` returns 0.

If `O_NONBLOCK` is set, `read` returns -1 and sets `errno` to `EAGAIN`.

If `O_NDELAY` and `O_NONBLOCK` are clear, `read` blocks until data becomes available.

When attempting to read a file associated with a stream that is not a pipe or FIFO, or terminal, and that has no data currently available:

If `O_NDELAY` or `O_NONBLOCK` is set, `read` returns -1 and sets `errno` to `EAGAIN`.

If `O_NDELAY` and `O_NONBLOCK` are clear, `read` blocks until data becomes available.

When reading from a STREAMS file, handling of zero-byte messages is determined by the current read mode setting. In byte-stream mode, `read` accepts data until it has read *nbyte* bytes, or until there is no more data to read, or until a zero-byte message block is encountered. `read` then returns the number of bytes read, and places

NAME

read - read from file

SYNOPSIS

```
#include <sys/types.h>
#include <sys/uio.h>
#include <unistd.h>

int read(int fildes, void *buf, unsigned nbyte);
int readv(int fildes, struct iovec *iov, int iovcnt);
```

DESCRIPTION

read attempts to read *nbyte* bytes from the file associated with *fildes* into the buffer pointed to by *buf*. If *nbyte* is zero, read returns zero and has no other results. *fildes* is a file descriptor obtained from a `creat`, `open`, `dup`, `fcntl`, `pipe`, or `ioctl` system call.

On devices capable of seeking, the read starts at a position in the file given by the file pointer associated with *fildes*. On return from read, the file pointer is incremented by the number of bytes actually read.

Devices that are incapable of seeking always read from the current position. The value of a file pointer associated with such a file is undefined.

`readv` performs the same action as `read`, but places the input data into the *iovcnt* buffers specified by the members of the *iov* array: *iov*[0], *iov*[1], ..., *iov*[*iovcnt*-1].

For `readv`, the `iovec` structure contains the following members:

```
addr_t    iov_base;
size_t    iov_len;
```

Each `iovec` entry specifies the base address and length of an area in memory where data should be placed. `readv` always fills one buffer completely before proceeding to the next.

On success, `read` and `readv` return the number of bytes actually read and placed in the buffer; this number may be less than *nbyte* if the file is associated with a communication line [see `ioctl(2)` and `termio(7)`], or if the number of bytes left in the file is less than *nbyte*, or if the file is a pipe or a special file. A value of 0 is returned when an end-of-file has been reached.

`read` reads data previously written to a file. If any portion of an ordinary file prior to the end of file has not been written, `read` returns the number of bytes read as 0. For example, the `lseek` routine allows the file pointer to be set beyond the end of existing data in the file. If additional data is written at this point, subsequent reads in the gap between the previous end of data and newly written data return bytes with a value of 0 until data is written into the gap.

A `read` or `readv` from a STREAMS [see `intro(2)`] file can operate in three different modes: byte-stream mode, message-nondiscard mode, and message-discard mode. The default is byte-stream mode. This can be changed using the `I_SRDOPT` `ioctl(2)` request [see `streamio(7)`], and can be tested with the `I_GRDOPT` `ioctl(2)` request. In byte-stream mode, `read` and `readv` usually retrieve data from the stream until they have retrieved *nbyte* bytes, or until there

NAME

rdchk - check to see if there is data to be read

SYNOPSIS

```
cc [flag...] file ... -lx
rdchk(int fdes);
```

DESCRIPTION

rdchk checks to see if a process will block if it attempts to read the file designated by *fdes*. rdchk returns 1 if there is data to be read or if it is the end of the file (EOF). In this context, the proper sequence of calls using rdchk is:

```
if(rdchk(fildes) > 0)
    read(fildes, buffer, nbytes);
```

DIAGNOSTICS

rdchk returns -1 if an error occurs (for example, EBADF), 0 if the process will block if it issues a read and 1 if it is okay to read. EBADF is returned if a rdchk is done on a semaphore file or if the file specified doesn't exist.

SEE ALSO

read(2)

/etc/hosts.equiv
.rhosts

SEE ALSO

rlogin(1C), rsh(1C), rexecd(1M), rlogind(1M), rshd(1M), intro(2),
gethostent(3N), rexec(3N)

DIAGNOSTICS

`rcmd` returns a valid socket descriptor on success. It returns -1 on error and prints a diagnostic message on the standard error.

`rresvport` returns a valid, bound socket descriptor on success. It returns -1 on error with the global value `errno` set according to the reason for failure. The error code `EAGAIN` is overloaded to mean: All network ports in use.

NAME

rcmd, rresvport, ruserok - routines for returning a stream to a remote command

SYNOPSIS

```
int rcmd(char **ahost, unsigned short inport, char *locuser, char *remuser,
         char *cmd, int *fd2p);

int rresvport(int *port);

ruserok(char *rhost, int super-user, char *ruser, char *luser);
```

DESCRIPTION

rcmd is a routine used by a privileged user to execute a command on a remote machine using an authentication scheme based on reserved port numbers. rresvport is a routine which returns a descriptor to a socket with an address in the privileged port space. ruserok is a routine used by servers to authenticate clients requesting service with rcmd. All three functions are present in the same file and are used by the rshd server (among others).

rcmd looks up the host **ahost* using `gethostbyname` (see `gethostent[3N]`), returning -1 if the host does not exist. Otherwise **ahost* is set to the standard name of the host and a connection is established to a server residing at the well-known Internet port *inport*.

If the connection succeeds, a socket in the Internet domain of type `SOCK_STREAM` is returned to the caller, and given to the remote command as its standard input (file descriptor 0) and standard output (file descriptor 1). If *fd2p* is non-zero, then an auxiliary channel to a control process will be set up, and a descriptor for it will be placed in **fd2p*. The control process will return diagnostic output from the command (file descriptor 2) on this channel, and will also accept bytes on this channel as signal numbers, to be forwarded to the process group of the command. If *fd2p* is 0, then the standard error (file descriptor 2) of the remote command will be made the same as its standard output and no provision is made for sending arbitrary signals to the remote process, although you may be able to get its attention by using out-of-band data.

The protocol is described in detail in `rshd` (see `rshd[1M]`).

The `rresvport` routine is used to obtain a socket with a privileged address bound to it. This socket is suitable for use by `rcmd` and several other routines. Privileged Internet ports are those in the range 0 to 1023. Only a user with appropriate privileges is allowed to bind an address of this sort to a socket.

`ruserok` takes a remote host's name, as returned by a `gethostbyaddr` (see `gethostent[3N]`) routine, two user names and a flag indicating whether the local user's name is that of the privileged user. It then checks the files `/etc/hosts.equiv` and, possibly, `.rhosts` in the local user's home directory to see if the request for service is allowed. A 0 is returned if the machine name is listed in the `/etc/hosts.equiv` file, or the host and remote user name are found in the `.rhosts` file; otherwise `ruserok` returns -1. If the privileged user flag is 1, the checking of the `/etc/hosts.equiv` file is bypassed.

FILES

Once a state array has been initialized, it may be restarted at a different point either by calling `initstate` (with the desired seed, the state array, and its size) or by calling both `setstate` (with the state array) and `srandom` (with the desired seed). The advantage of calling both `setstate` and `srandom` is that the size of the state array does not have to be remembered after it is initialized.

With 256 bytes of state information, the period of the random number generator is greater than 2^{69} , which should be sufficient for most purposes.

EXAMPLE

```

/* Initialize an array and pass it in to initstate. */
static long state1[32] = {
    3,
    0x9a319039, 0x32d9c024, 0x9b663182, 0x5da1f342,
    0x7449e56b, 0xbdb1dbb0, 0xab5c5918, 0x946554fd,
    0x8c2e680f, 0xeb3d799f, 0xb11ee0b7, 0x2d436b86,
    0xda672e2a, 0x1588ca88, 0xe369735d, 0x904f35f7,
    0xd7158fd6, 0x6fa6f051, 0x616e6b96, 0xac94efdc,
    0xde3b81e0, 0xdf0a6fb5, 0xf103bc02, 0x48f340fb,
    0x36413f93, 0xc622c298, 0xf5a42ab8, 0x8a88d77b,
    0xf5ad9d0e, 0x8999220b, 0x27fb47b9
};

main()
{
    unsigned seed;
    int n;
    seed = 1;
    n = 128;
    initstate(seed, state1, n);
    setstate(state1);
    printf("%d0, random());
}

```

SEE ALSO

`rand(3C)`
`drand48(2)`, `drand(3C)`, `rand(3C)`, `srand(3C)`

RETURN VALUE

If `initstate` is called with less than 8 bytes of state information, or if `setstate` detects that the state information has been garbled, error messages are printed on the standard error output.

NOTES

About two-thirds the speed of `rand(3C)`.

NAME

random, srandom, initstate, setstate - better random number generator; routines for changing generators

SYNOPSIS

```
/usr/ucb/cc [flag...] file...
long random()
srandom(seed)
int seed;

char *initstate(seed, state, n)
unsigned seed;
char *state;
int n;

char *setstate(state)
char *state;
```

DESCRIPTION

random uses a non-linear additive feedback random number generator employing a default table of size 31 long integers to return successive pseudo-random numbers in the range from 0 to $2^{31}-1$. The period of this random number generator is very large, approximately $16 \times (2^{31}-1)$.

random/srandom have (almost) the same calling sequence and initialization properties as rand/srand [see rand(3C)]. The difference is that rand(3C) produces a much less random sequence—in fact, the low dozen bits generated by rand go through a cyclic pattern. All the bits generated by random are usable. For example,

```
random() & 01
```

will produce a random binary value.

Unlike srand, srandom does not return the old seed because the amount of state information used is much more than a single word. Two other routines are provided to deal with restarting/changing random number generators. Like rand(3C), however, random will, by default, produce a sequence of numbers that can be duplicated by calling srandom with 1 as the seed.

The initstate routine allows a state array, passed in as an argument, to be initialized for future use. *n* specifies the size of *state* in bytes. initstate uses *n* to decide how sophisticated a random number generator it should use—the more state, the better the random numbers will be. Current “optimal” values for the amount of state information are 8, 32, 64, 128, and 256 bytes; other amounts will be rounded down to the nearest known amount. Using less than 8 bytes will cause an error. The seed for the initialization (which specifies a starting point for the random number sequence, and provides for restarting at the same point) is also an argument. initstate returns a pointer to the previous state information array.

Once a state has been initialized, the setstate routine provides for rapid switching between states. setstate returns a pointer to the previous state array; its argument state array is used for further random number generation until the next call to initstate or setstate.

NAME

rand, srand - simple random number generator

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...  
srand(seed)  
int seed;  
rand()
```

DESCRIPTION

rand uses a multiplicative congruential random number generator with period 2^{32} to return successive pseudo-random numbers in the range from 0 to $2^{31} - 1$.

srand can be called at any time to reset the random-number generator to a random starting point. The generator is initially seeded with a value of 1.

SEE ALSO

drand48(2), drand(3C), rand(3C), random(3), srand(3C).

NOTES

The spectral properties of rand leave a great deal to be desired. drand48(2) and random(3) provide much better, though more elaborate, random-number generators.

The low bits of the numbers generated are not very random; use the middle bits. In particular the lowest bit alternates between 0 and 1.

NAME

rand, srand - simple random-number generator

SYNOPSIS

```
#include <stdlib.h>
int rand (void);
void srand (unsigned int seed);
```

DESCRIPTION

rand uses a multiplicative congruent random-number generator with period 2^{32} that returns successive pseudo-random numbers in the range from 0 to `RAND_MAX` (defined in `stdlib.h`).

The function `srand` uses the argument *seed* as a seed for a new sequence of pseudo-random numbers to be returned by subsequent calls to the function `rand`. If the function `srand` is then called with the same *seed* value, the sequence of pseudo-random numbers will be repeated. If the function `rand` is called before any calls to `srand` have been made, the same sequence will be generated as when `srand` is first called with a *seed* value of 1.

NOTES

The spectral properties of `rand` are limited. `drand48(3C)` provides a much better, though more elaborate, random-number generator.

SEE ALSO

`drand48(3C)`

NAME

raise - send signal to program

SYNOPSIS

```
#include <signal.h>
int raise (int sig);
```

DESCRIPTION

raise sends the signal *sig* to the executing program.

raise returns zero if the operation succeeds. Otherwise, raise returns -1 and `errno` is set to indicate the error. raise uses `kill` to send the signal to the executing program:

```
kill(getpid(), sig);
```

See `kill(2)` for a detailed list of failure conditions. See `signal(2)` for a list of signals.

SEE ALSO

`getpid(2)`, `kill(2)`, `signal(2)`

NAME

qsort - quicker sort

SYNOPSIS

```
#include <stdlib.h>

void qsort (void* base, size_t nel, size_t width, int (*compar)
            (const void *, const void *));
```

DESCRIPTION

qsort is an implementation of the quicker-sort algorithm. It sorts a table of data in place. The contents of the table are sorted in ascending order according to the user-supplied comparison function.

base points to the element at the base of the table. *nel* is the number of elements in the table. *width* specifies the size of each element in bytes. *compar* is the name of the comparison function, which is called with two arguments that point to the elements being compared. The function must return an integer less than, equal to, or greater than zero to indicate if the first argument is to be considered less than, equal to, or greater than the second.

The contents of the table are sorted in ascending order according to the user supplied comparison function.

SEE ALSO

sort(1), bsearch(3C), lsearch(3C), string(3C).

NOTES

The comparison function need not compare every byte, so arbitrary data may be contained in the elements in addition to the values being compared.

The relative order in the output of two items that compare as equal is unpredictable.

NAME

putws, fputws - put a `wchar_t` string on a stream

SYNOPSIS

```
#include <stdio.h>
#include <wchar.h>

int putws(const wchar_t *s);

int fputws(const wchar_t *s, FILE *stream);
```

DESCRIPTION (International Functions)

`putws()` transforms the `wchar_t` null-terminated `wchar_t` string pointed to by `s` into a byte string in EUC, and writes the string followed by a new-line character to *stdout*.

`fputws()` transforms the `wchar_t` null-terminated `wchar_t` string pointed to by `s` into a byte string in EUC, and writes the string to the named output stream.

Neither function writes the terminating `wchar_t` null character.

DIAGNOSTICS

On success both functions return the number of `wchar_t` characters transformed and written (not including the new-line character in the case of `putws()`); Otherwise they return EOF.

NOTES

`putws()` appends a new-line character while `fputws()` does not.

SEE ALSO

`ferror(3S)`, `fopen(3S)`, `fread(3S)`, `printf(3W)`, `putwc(3W)`, `printf(3S)`, `stdio(3S)`, `widec(3W)`.

NAME

putwc, putwchar, fputwc - put wchar_t character on a stream

SYNOPSIS

```
#include <stdio.h>
#include <wchar.h>

int putwc(wchar_t c, FILE *stream);
int putwchar(wchar_t c);
int fputwc(wchar_t c, FILE *stream);
```

DESCRIPTION (International Functions)

putwc() transforms the `wchar_t` character `c` into EUC, and writes it onto the output stream (at the position where the file pointer, if defined, is pointing). The `putwchar(c)` is defined as `putwc(c, stdout)`. `putwc()` and `putwchar()` are macros.

`fputwc()` behaves like `putwc()`, but is a function rather than a macro.

DIAGNOSTICS

On success, each of these functions return the value they have written. On failure, they return the constant EOF.

SEE ALSO

`fclose(3S)`, `ferror(3S)`, `fopen(3S)`, `fread(3S)`, `printf(3W)`, `putws(3W)`, `printf(3S)`, `setbuf(3S)`, `stdio(3S)`, `widec(3W)`.

putspent (3C)

putspent (3C)

NAME

putspent - write shadow password file entry

SYNOPSIS

```
#include <shadow.h>
int putsent (const struct spwd *p, FILE *fp);
```

DESCRIPTION

The putsent routine is the inverse of getsent. Given a pointer to a spwd structure created by the getsent routine (or the getspnam routine), the putsent routine writes a line on the stream *fp*, which matches the format of */etc/shadow*.

If the *sp_min*, *sp_max*, *sp_lstchg*, *sp_warn*, *sp_inact*, or *sp_expire* field of the spwd structure is -1, or if *sp_flag* is 0, the corresponding */etc/shadow* field is cleared.

SEE ALSO

getsent(3C), getpwent(3C), putpwent(3C)

DIAGNOSTICS

The putsent routine returns non-zero if an error was detected during its operation, otherwise zero.

NOTES

This routine is for internal use only, compatibility is not guaranteed.

NAME

puts, fputs - put a string on a stream

SYNOPSIS

```
#include <stdio.h>
int puts (const char *s);
int fputs (const char *s, FILE *stream);
```

DESCRIPTION

puts writes the string pointed to by *s*, followed by a new-line character, to the standard output stream `stdout` [see `intro(3)`].

fputs writes the null-terminated string pointed to by *s* to the named output *stream*.

Neither function writes the terminating null character.

SEE ALSO

`exit(2)`, `lseek(2)`, `write(2)`, `abort(3C)`, `fclose(3S)`, `ferror(3S)`, `fopen(3S)`, `fread(3S)`, `printf(3S)`, `putc(3S)`, `stdio(3S)`

DIAGNOSTICS

On success both routines return the number of characters written; otherwise they return EOF.

NOTES

puts appends a new-line character while fputs does not.

NAME

putpwent - write password file entry

SYNOPSIS

```
#include <pwd.h>

int putpwent (const struct passwd *p, FILE *f);
```

DESCRIPTION

putpwent is the inverse of getpwent(3C). Given a pointer to a passwd structure created by getpwent (or getpwuid or getpwnam), putpwent writes a line on the stream *f*, which matches the format of /etc/passwd.

SEE ALSO

getpwent(3C)

DIAGNOSTICS

putpwent returns non-zero if an error was detected during its operation, otherwise zero.

and sets `errno` to `EINVAL`. If `flags` is set to `MSG_BAND`, then a message is sent in the priority band specified by `band`. If a control part and data part are not specified and `flags` is set to `MSG_BAND`, no message is sent and 0 is returned.

Normally, `putmsg()` will block if the stream write queue is full due to internal flow control conditions. For high-priority messages, `putmsg()` does not block on this condition. For other messages, `putmsg()` does not block when the write queue is full and `O_NDELAY` or `O_NONBLOCK` is set. Instead, it fails and sets `errno` to `EAGAIN`.

`putmsg` or `putpmsg` also blocks, unless prevented by lack of internal resources, waiting for the availability of message blocks in the stream, regardless of priority or whether `O_NDELAY` or `O_NONBLOCK` has been specified. No partial message is sent.

`putmsg` fails if one or more of the following are true:

| | |
|---------------------|--|
| <code>EAGAIN</code> | A non-priority message was specified, the <code>O_NDELAY</code> or <code>O_NONBLOCK</code> flag is set and the stream write queue is full due to internal flow control conditions. |
| <code>EBADF</code> | <code>fd</code> is not a valid file descriptor open for writing. |
| <code>EFAULT</code> | <code>ctlptr</code> or <code>dataptr</code> points outside the allocated address space. |
| <code>EINTR</code> | A signal was caught during the <code>putmsg</code> system call. |
| <code>EINVAL</code> | An undefined value was specified in <code>flags</code> , or <code>flags</code> is set to <code>RS_HIPRI</code> and no control part was supplied. |
| <code>EINVAL</code> | The stream referenced by <code>fd</code> is linked below a multiplexor. |
| <code>EINVAL</code> | For <code>putpmsg</code> , if <code>flags</code> is set to <code>MSG_HIPRI</code> and <code>band</code> is nonzero. |
| <code>ENOSR</code> | Buffers could not be allocated for the message that was to be created due to insufficient STREAMS memory resources. |
| <code>ENOSTR</code> | A stream is not associated with <code>fd</code> . |
| <code>ENXIO</code> | A hangup condition was generated downstream for the specified stream, or the other end of the pipe is closed. |
| <code>ERANGE</code> | The size of the data part of the message does not fall within the range specified by the maximum and minimum packet sizes of the topmost stream module. This value is also returned if the control part of the message is larger than the maximum configured size of the control part of a message, or if the data part of a message is larger than the maximum configured size of the data part of a message. |

`putmsg` also fails if a STREAMS error message had been processed by the stream head before the call to `putmsg`. The error returned is the value contained in the STREAMS error message.

SEE ALSO

`getmsg(2)`, `intro(2)`, `poll(2)`, `putmsg(2)`, `read(2)`, `write(2)`.

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

putmsg - send a message on a stream

SYNOPSIS

```
#include <stropts.h>

int putmsg(int fd, const struct strbuf *ctlptr,
           const struct strbuf *dataptr, int flags);

int putpmsg(int fd, const struct strbuf *ctlptr,
            const struct strbuf *dataptr, int band, int flags);
```

DESCRIPTION

putmsg creates a message from user-specified buffer(s) and sends the message to a STREAMS file. The message may contain either a data part, a control part, or both. The data and control parts to be sent are distinguished by placement in separate buffers, as described below. The semantics of each part is defined by the STREAMS module that receives the message.

The function putpmsg does the same thing as putmsg, but provides the user the ability to send messages in different priority bands. Except where noted, all information pertaining to putmsg also pertains to putpmsg.

fd specifies a file descriptor referencing an open stream. *ctlptr* and *dataptr* each point to a strbuf structure, which contains the following members:

```
int maxlen;      /* not used */
int len;         /* length of data */
void *buf;       /* ptr to buffer */
```

ctlptr points to the structure describing the control part, if any, to be included in the message. The *buf* field in the strbuf structure points to the buffer where the control information resides, and the *len* field indicates the number of bytes to be sent. The *maxlen* field is not used in putmsg [see getmsg(2)]. In a similar manner, *dataptr* specifies the data, if any, to be included in the message. *flags* indicates what type of message should be sent and is described later.

To send the data part of a message, *dataptr* must not be NULL and the *len* field of *dataptr* must have a value of 0 or greater. To send the control part of a message, the corresponding values must be set for *ctlptr*. No data (control) part is sent if either *dataptr* (*ctlptr*) is NULL or the *len* field of *dataptr* (*ctlptr*) is set to -1.

For putmsg(), if a control part is specified, and *flags* is set to RS_HIPRI, a high priority message is sent. If no control part is specified, and *flags* is set to RS_HIPRI, putmsg fails and sets *errno* to EINVAL. If *flags* is set to 0, a normal (non-priority) message is sent. If no control part and no data part are specified, and *flags* is set to 0, no message is sent, and 0 is returned.

The stream head guarantees that the control part of a message generated by putmsg is at least 64 bytes in length.

For putpmsg, the flags are different. *flags* is a bitmask with the following mutually-exclusive flags defined: MSG_HIPRI and MSG_BAND. If *flags* is set to 0, putpmsg fails and sets *errno* to EINVAL. If a control part is specified and *flags* is set to MSG_HIPRI and *band* is set to 0, a high-priority message is sent. If *flags* is set to MSG_HIPRI and either no control part is specified or *band* is set to a non-zero value, putpmsg() fails

NAME

putenv - change or add value to environment

SYNOPSIS

```
#include <stdlib.h>
int putenv (char *string);
```

DESCRIPTION

string points to a string of the form "*name=value*." putenv makes the value of the environment variable *name* equal to *value* by altering an existing variable or creating a new one. In either case, the string pointed to by *string* becomes part of the environment, so altering the string will change the environment. The space used by *string* is no longer used once a new string-defining *name* is passed to putenv. Because of this limitation, *string* should be declared static if it is declared within a function.

SEE ALSO

exec(2), getenv(3C), malloc(3C), environ(5)

DIAGNOSTICS

putenv returns non-zero if it was unable to obtain enough space via malloc for an expanded environment, otherwise zero.

NOTES

putenv manipulates the environment pointed to by *environ*, and can be used in conjunction with *getenv*. However, *envp* (the third argument to *main*) is not changed.

This routine uses *malloc(3C)* to enlarge the environment.

After putenv is called, environmental variables are not in alphabetical order. A potential error is to call the function putenv with a pointer to an automatic variable as the argument and to then exit the calling function while *string* is still part of the environment.

NAME

putc, putchar, fputc, putw - put character or word on a stream

SYNOPSIS

```
#include <stdio.h>

int putc (int c, FILE *stream);

int putchar (int c);

int fputc (int c, FILE *stream);

int putw (int w, FILE *stream);
```

DESCRIPTION

putc writes *c* (converted to an unsigned char) onto the output *stream* [see intro(3)] at the position where the file pointer (if defined) is pointing, and advances the file pointer appropriately. If the file cannot support positioning requests, or *stream* was opened with append mode, the character is appended to the output *stream*. putchar(*c*) is defined as putc(*c*, stdout). putc and putchar are macros.

fputc behaves like putc, but is a function rather than a macro. fputc runs more slowly than putc, but it takes less space per invocation and its name can be passed as an argument to a function.

putw writes the word (that is, integer) *w* to the output *stream* (where the file pointer, if defined, is pointing). The size of a word is the size of an integer and varies from machine to machine. putw neither assumes nor causes special alignment in the file.

SEE ALSO

exit(2), lseek(2), write(2), abort(3C), fclose(3S), ferror(3S), fopen(3S), fread(3S), printf(3S), puts(3S), setbuf(3S), stdio(3S)

DIAGNOSTICS

On success, these functions (with the exception of putw) each return the value they have written. putw returns ferror (*stream*). On failure, they return the constant EOF. This result will occur, for example, if the file *stream* is not open for writing or if the output file cannot grow.

NOTES

Because it is implemented as a macro, putc evaluates a *stream* argument more than once. In particular, putc(*c*, *f++); doesn't work sensibly. fputc should be used instead.

Because of possible differences in word length and byte ordering, files written using putw are machine-dependent, and may not be read using getw on a different processor.

Functions exist for all the above defined macros. To get the function form, the macro name must be undefined (for example, #undef putc).

NAME

publickey: getpublickey, getsecretkey - retrieve public or secret key

SYNOPSIS

```
#include <rpc/rpc.h>
#include <rpc/key_prot.h>

getpublickey(const char netname[MAXNETNAMELEN],
             char publickey[HEXKEYBYTES]);

getsecretkey(const char netname[MAXNETNAMELEN],
             char secretkey[HEXKEYBYTES], const char *passwd);
```

DESCRIPTION

getpublickey and getsecretkey get public and secret keys for *netname* from the publickey(4) database.

getsecretkey has an extra argument, *passwd*, used to decrypt the encrypted secret key stored in the database.

Both routines return 1 if they are successful in finding the key, 0 otherwise. The keys are returned as NULL-terminated, hexadecimal strings. If the password supplied to getsecretkey fails to decrypt the secret key, the routine will return 1 but the *secretkey* argument will be a NULL string.

SEE ALSO

publickey(4)

ptsname(3C)

ptsname(3C)

NAME

ptsname - get name of the slave pseudo-terminal device

SYNOPSIS

```
#include <stdio.h>
char *ptsname(int fildes);
```

DESCRIPTION

The function `ptsname()` returns the name of the slave pseudo-terminal device associated with a master pseudo-terminal device. *fildes* is a file descriptor returned from a successful `open` of the master device. `ptsname()` returns a pointer to a string containing the null-terminated path name of the slave device of the form `/dev/pts/N`, where *N* is an integer between 0 and 255.

RETURN VALUE

Upon successful completion, the function `ptsname()` returns a pointer to a string which is the name of the pseudo-terminal slave device. This value points to a static data area that is overwritten by each call to `ptsname()`. Upon failure, `ptsname()` returns `NULL`. This could occur if *fildes* is an invalid file descriptor or if the slave device name does not exist in the file system.

SEE ALSO

`open(2)`, `grantpt(3C)`, `ttyname(3C)`, `unlockpt(3C)`.

- address of a word. On failure a value of -1 is returned to the parent process and the parent's *errno* is set to `EIO`.
- 6 With this request, some of the process state of the child process can be written. *data* gives the value that is to be written. On 68k, *addr* is the address of an entry in the user area. On 88k, *addr* is an offset into the `ptrace_user` struct. (See request 3 above.) The few entries that can be written are the general registers and the condition codes of the Processor Status Word.
- 7 This request causes the child to resume execution. If the *data* argument is 0, all pending signals including the one that caused the child to stop are canceled before it resumes execution. If the *data* argument is a valid signal number, the child resumes execution as if it had incurred that signal, and any other pending signals are canceled. The *addr* argument must be equal to 1 for this request. On success, the value of *data* is returned to the parent. This request fails if *data* is not 0 or a valid signal number, in which case a value of -1 is returned to the parent process and the parent's *errno* is set to `EIO`.
- 8 This request causes the child to terminate with the same consequences as `exit(2)`.
- 9 This request sets the trace bit in the Processor Status Word of the child and then executes the same steps as listed above for request 7. The trace bit causes an interrupt on completion of one machine instruction. This effectively allows single stepping of the child.

To forestall possible fraud, `ptrace` inhibits the set-user-ID facility on subsequent `exec(2)` calls. If a traced process calls `exec(2)`, it stops before executing the first instruction of the new image showing signal `SIGTRAP`. `ptrace` in general fails if one or more of the following are true:

- | | |
|--------------------|---|
| <code>EIO</code> | <i>request</i> is an illegal number. |
| <code>ESRCH</code> | <i>pid</i> identifies a child that does not exist or has not executed a <code>ptrace</code> with request 0. |
| <code>EPERM</code> | the invoking subject does not have the appropriate privileges. |

SEE ALSO

`tbx(1)`, `exec(2)`, `signal(2)`, `wait(2)`

NAME

ptrace - process trace

SYNOPSIS

```
#include <unistd.h>
#include <sys/types.h>

int ptrace(int request, pid_t pid, int addr, int data);
```

DESCRIPTION

ptrace allows a parent process to control the execution of a child process. Its primary use is for the implementation of breakpoint debugging. The child process behaves normally until it encounters a signal [see [signal\(5\)](#)], at which time it enters a stopped state and its parent is notified via the [wait\(2\)](#) system call. When the child is in the stopped state, its parent can examine and modify its “core image” using [ptrace](#). Also, the parent can cause the child either to terminate or continue, with the possibility of ignoring the signal that caused it to stop.

The *request* argument determines the action to be taken by [ptrace](#) and is one of the following:

- 0 This request must be issued by the child process if it is to be traced by its parent. It turns on the child’s trace flag that stipulates that the child should be left in a stopped state on receipt of a signal rather than the state specified by *func* [see [signal\(2\)](#)]. The *pid*, *addr*, and *data* arguments are ignored, and a return value is not defined for this request. Peculiar results ensue if the parent does not expect to trace the child.

The remainder of the requests can only be used by the parent process. For each, *pid* is the process ID of the child. The child must be in a stopped state before these requests are made.

- 1, 2 With these requests, the word at location *addr* in the address space of the child is returned to the parent process. If instruction and data space are separated, request 1 returns a word from instruction space, and request 2 returns a word from data space. If instruction and data space are not separated, either request 1 or request 2 may be used with equal results. The *data* argument is ignored. These two requests fail if *addr* is not the start address of a word, in which case a value of -1 is returned to the parent process and the parent’s *errno* is set to [EIO](#).
- 3 This request returns a word of information about the child process to the parent process. On 68k, *addr* is the address of a location in the child’s user area in the system’s address space [see [<sys/user.h>](#)]. On 88k, *addr* is the offset of an entry in a `ptrace_user` struct [see [<sys/ptrace.h>](#)]. The *data* argument is ignored. The request fails if *addr* is not word aligned or is outside the appropriate address range, in which case a value of -1 is returned to the parent process and the parent’s *errno* is set to [EIO](#).
- 4, 5 With these requests, the value given by the *data* argument is written into the address space of the child at location *addr*. If instruction and data space are separated, request 4 writes a word into instruction space, and request 5 writes a word into data space. If instruction and data space are not separated, either request 4 or request 5 may be used with equal results. On success, the value written into the address space of the child is returned to the parent. These two requests fail if *addr* is not the start

NAME

psignal, sys_siglist - system signal messages

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...  
psignal(sig, s)  
unsigned sig;  
char *s;  
char *sys_siglist[];
```

DESCRIPTION

psignal produces a short message on the standard error file describing the indicated signal. First the argument string *s* is printed, then a colon, then the name of the signal and a NEWLINE. Most usefully, the argument string is the name of the program which incurred the signal. The signal number should be from among those found in <signal.h>.

To simplify variant formatting of signal names, the vector of message strings *sys_siglist* is provided; the signal number can be used as an index in this table to get the signal name without the newline. The define *NSIG* defined in <signal.h> is the number of messages provided for in the table; it should be checked because new signals may be added to the system before they are added to the table.

SEE ALSO

signal(3), perror(3C).

NAME

psignal, psigninfo - system signal messages

SYNOPSIS

```
#include <siginfo.h>
void psignal (int sig, const char *s);
void psigninfo (siginfo_t *pinfo, char *s);
```

DESCRIPTION

psignal and psigninfo produce messages on the standard error output describing a signal. *sig* is a signal that may have been passed as the first argument to a signal handler. *pinfo* is a pointer to a siginfo structure that may have been passed as the second argument to an enhanced signal handler [see sigaction(2)]. The argument string *s* is printed first, then a colon and a blank, then the message and a newline.

SEE ALSO

sigaction(2), perror(3), siginfo(5), signal(5)

profil(2)

profil(2)

bufsiz can be computed as (*size_of_region_to_be_profiled* * *RATIO*).

SEE ALSO

prof(1), times(2), monitor(3C)

NOTES

Profiling is turned off by giving a *scale* of 0 or 1, and is rendered ineffective by giving a *bufsiz* of 0. Profiling is turned off when an `exec(2)` is executed, but remains on in both child and parent processes after a `fork(2)`. Profiling is turned off if a *buff* update would cause a memory fault.

NAME

profil - execution time profile

SYNOPSIS

```
#include <unistd.h>

void profil(unsigned short *buff, size_t bufsiz, int offset,
            unsigned scale);
```

DESCRIPTION

profil provides CPU-use statistics by profiling the amount of CPU time expended by a program. profil generates the statistics by creating an execution histogram for a current process. The histogram is defined for a specific region of program code to be profiled, and the identified region is logically broken up into a set of equal size subdivisions, each of which corresponds to a count in the histogram. With each clock tick, the current subdivision is identified and its corresponding histogram count is incremented. These counts establish a relative measure of how much time is being spent in each code subdivision. The resulting histogram counts for a profiled region can be used to identify those functions that consume a disproportionately high percentage of CPU time.

buff is a buffer of *bufsiz* bytes in which the histogram counts are stored in an array of unsigned short int.

offset, *scale*, and *bufsiz* specify the region to be profiled.

offset is effectively the start address of the region to be profiled.

scale, broadly speaking, is a contraction factor that indicates how much smaller the histogram buffer is than the region to be profiled. More precisely, *scale* is interpreted as an unsigned 16-bit fixed-point fraction with the decimal point implied on the left. Its value is the reciprocal of the number of bytes in a subdivision, per byte of histogram buffer. Since there are two bytes per histogram counter, the effective ratio of subdivision bytes per counter is one half the scale.

Several observations can be made:

- the maximal value of *scale*, 0xffff (approximately 1), maps subdivisions 2 bytes long to each counter.

- the minimum value of *scale* (for which profiling is performed), 0x0002 (1/32,768), maps subdivision 65,536 bytes long to each counter.

- the default value of *scale* (currently used by cc -qp), 0x4000, maps subdivisions 8 bytes long to each counter.

The values are used within the kernel as follows: when the process is interrupted for a clock tick, the value of *offset* is subtracted from the current value of the program counter (pc), and the remainder is multiplied by *scale* to derive a result. That result is used as an index into the histogram array to locate the cell to be incremented. Therefore, the cell count represents the number of times that the process was executing code in the subdivision associated with that cell when the process was interrupted.

scale can be computed as ($RATIO * 0200000L$), where *RATIO* is the desired ratio of *bufsiz* to profiled region size, and has a value between 0 and 1. Qualitatively speaking, the closer *RATIO* is to 1, the higher the resolution of the profile information.

NAME

prof - profile within a function

SYNOPSIS

```
#define MARK
#include <prof.h>

void MARK (name);
```

DESCRIPTION

MARK introduces a mark called *name* that is treated the same as a function entry point. Execution of the mark adds to a counter for that mark, and program-counter time spent is accounted to the immediately preceding mark or to the function if there are no preceding marks within the active function.

name may be any combination of letters, numbers, or underscores. Each *name* in a single compilation must be unique, but may be the same as any ordinary program symbol.

For marks to be effective, the symbol MARK must be defined before the header file prof.h is included, either by a preprocessor directive as in the synopsis, or by a command line argument:

```
cc -p -DMARK foo.c
```

If MARK is not defined, the MARK(*name*) statements may be left in the source files containing them and are ignored. prof -g must be used to get information on all labels.

EXAMPLE

In this example, marks can be used to determine how much time is spent in each loop. Unless this example is compiled with MARK defined on the command line, the marks are ignored.

```
#include <prof.h>
foo( )
{
    int i, j;
    . . .
    MARK(loop1);
    for (i = 0; i < 2000; i++) {
        . . .
    }
    MARK(loop2);
    for (j = 0; j < 2000; j++) {
        . . .
    }
}
```

SEE ALSO

prof(1), profil(2), monitor(3C)

NAME

processor_info - get information about one processor

SYNOPSIS

```
#include <sys/types.h>
#include <sys/processor.h>
```

```
int processor_info (processorid_t processorid, processor_info_t
*infop)
```

DESCRIPTION

processor_info obtains information about a single processor in the system. The information is returned in the processor_info_t structure pointed to by infop. This structure contains the following fields:

| | |
|----------------------------|---|
| int pi_state | Either P_ONLINE or P_OFFLINE. If the processor is offline, the other fields are meaningless. |
| char pi_processor_type[16] | A null terminated ASCII string specifying the type of processor; one of P_88100, P_88110, P_68040, or P_68030. |
| char pi_fputypes[32] | A null terminated ASCII string specifying the type of floating point hardware available. The string consists of the floating point identifier string P_FPU. |
| int pi_clock | The frequency of the processor clock, in megahertz, rounded to the nearest integer. |

DIAGNOSTICS

processor_info returns 0 on success, or -1 on failure. Failure may result from:

| | |
|--------|---|
| EFAULT | The infop pointer points to an invalid memory address. |
| EINVAL | The processorid does not refer to an existing processor. |
| EIO | The processor to which processorid refers is not operational. |

SEE ALSO

pinfo(1M)

processor_bind(2)

(Multiprocessing)

processor_bind(2)

EFAULT obind is non-NULL and points to an invalid address.

EIO The specified processor is not operational.

SEE ALSO

pbind(1M), pexbind(1M)

NAME

processor_bind - bind a process to a processor

SYNOPSIS

```
#include <sys/types.h>
#include <sys/procset.h>
#include <sys/processor.h>
```

```
int processor_bind(idtype_t idtype, id_t pid,
processorid_t processorid, processorid_t *obind);
```

DESCRIPTION

processor_bind binds a process to a specific processor. idtype must be set to P_PID and pid is a process ID specifying the process to be bound. When the process identified by pid has been bound, it will execute only on the processor specified by processorid (even if other processors are available), except briefly, if the process requires a resource which only another processor can provide. The processor may continue to run other processes in addition to the one specified by pid. The processor_bind call will fail if the process specified by pid is bound exclusively to another processor or if there are already processes exclusively bound to the processor specified by processorid.

The processor_bind call is not guaranteed to be synchronous with the binding operation. If the binding operation cannot be completed immediately the call may return before the operation completes. Any delay between the return of the function and the completion of the operation will, typically, be of very short duration.

If processorid is PBIND_NONE, the specified process is unbound; that is, it is made free to run on any processor.

If the process specified by pid is already bound to a different processor, the binding for that process will be changed to the processor specified by processorid. If obind is not NULL and the process is currently bound to a processor, that processorid is returned by obind.

The bind state of a process is inherited by any children created by a fork(2) call, and does not change across a call to exec(2).

In order to bind or unbind a process, the real or effective user ID of the caller must match the real or saved [from exec(2)] user ID of the process being bound or unbound, or the caller must have superuser privileges.

DIAGNOSTICS

Returns a value of zero on success, or a negative value on failure. Failure may result from:

| | |
|--------|--|
| EPERM | The calling process does not have appropriate privileges. |
| EINVAL | An invalid idtype or processorid was specified, or the specified processor is currently offline. |
| ESRCH | No process can be found with a process ID corresponding to pid. |
| EBUSY | The process specified by pid is bound exclusively to another processor or there are already processes exclusively bound to the processor specified by processorid. |

prioctlset (2)

prioctlset (2)

DIAGNOSTICS

prioctlset has the same return values and errors as prioctl.

SEE ALSO

prioctl(1), prioctl(2).

NAME

prctlset - generalized process scheduler control

SYNOPSIS

```
#include <sys/types.h>
#include <sys/procset.h>
#include <sys/prctl.h>
#include <sys/rtpriocntl.h>
#include <sys/tpsriocntl.h>

long prctlset(procset_t *psp, int cmd, ... /* arg */);
```

DESCRIPTION

prctlset changes the scheduling properties of running processes. prctlset has the same functions as the prctl system call, but a more general way of specifying the set of processes whose scheduling properties are to be changed.

cmd specifies the function to be performed. *arg* is a pointer to a structure whose type depends on *cmd*. See prctl(2) for the valid values of *cmd* and the corresponding *arg* structures.

psp is a pointer to a procset structure, which prctlset uses to specify the set of processes whose scheduling properties are to be changed.

```
typedef struct procset {
    idop_t    p_op;        /* operator connecting left/right sets */
    idtype_t  p_lidtype;   /* left set ID type */
    id_t      p_lid;       /* left set ID */
    idtype_t  p_ridtype;   /* right set ID type */
    id_t      p_rid;       /* right set ID */
} procset_t;
```

p_lidtype and *p_lid* specify the ID type and ID of one ("left") set of processes; *p_ridtype* and *p_rid* specify the ID type and ID of a second ("right") set of processes. ID types and IDs are specified just as for the prctl system call. *p_op* specifies the operation to be performed on the two sets of processes to get the set of processes the system call is to apply to. The valid values for *p_op* and the processes they specify are:

| | |
|----------|--|
| POP_DIFF | set difference: processes in left set and not in right set |
| POP_AND | set intersection: processes in both left and right sets |
| POP_OR | set union: processes in either left or right sets or both |
| POP_XOR | set exclusive-or: processes in left or right set but not in both |

The following macro, which is defined in `procset.h`, offers a convenient way to initialize a procset structure:

```
#define setprocset(psp, op, ltype, lid, rtype, rid) \
    (psp)->p_op = (op), \
    (psp)->p_lidtype = (ltype), \
    (psp)->p_lid = (lid), \
    (psp)->p_ridtype = (rtype), \
    (psp)->p_rid = (rid),
```

prionctl(2)

prionctl(2)

The time-sharing user priority and user priority limit are inherited across the `fork` and `exec` system calls.

RETURN VALUE

Unless otherwise noted above, `prionctl` returns a value of 0 on success. `prionctl` returns -1 on failure and sets `errno` to indicate the error.

ERRORS

`prionctl` fails if one or more of the following are true :

| | |
|--------|--|
| EPERM | The calling process does not have the required permissions as explained above. |
| EINVAL | The argument <i>cmd</i> was invalid, an invalid or unconfigured class was specified, or one of the parameters specified was invalid. |
| ERANGE | The requested time quantum is out of range. |
| ESRCH | None of the specified processes exist. |
| EFAULT | All or part of the area pointed to by one of the data pointers is outside the process's address space. |
| ENOMEM | An attempt to change the class of a process failed because of insufficient memory. |
| EAGAIN | An attempt to change the class of a process failed because of insufficient resources other than memory (for example, class-specific kernel data structures). |

SEE ALSO

`dispadm(1M)`, `exec(2)`, `fork(2)`, `nice(2)`, `prionctl(1)`, `prionctlset(2)`, `rt_dptbl(4)`, `ts_dptbl(4)`

```
typedef struct {
    short    ts_maxupri;    /* Limits of user priority range */
} tsinfo_t;
```

The prioctl PC_GETCID and PC_GETCLINFO commands return time-sharing class attributes in the pc_clinfo buffer in this format.

ts_maxupri specifies the configured maximum user priority value for the time-sharing class. If ts_maxupri is *x*, the valid range for both user priorities and user priority limits is from *-x* to *+x*.

The following structure (defined in sys/tsprioctl.h) defines the format used to specify the time-sharing class-specific scheduling parameters of a process.

```
typedef struct {
    short    ts_uprilm;    /* Time-Sharing user priority limit */
    short    ts_upri;     /* Time-Sharing user priority */
} tsparms_t;
```

When using the prioctl PC_SETPARMS or PC_GETPARMS commands, if pc_cid specifies the time-sharing class, the data in the pc_clparms buffer is in this format.

For the prioctl PC_GETPARMS command, if pc_cid specifies the time-sharing class and more than one time-sharing process is specified, the scheduling parameters of the time-sharing process with the highest ts_upri value among the specified processes is returned and the process ID of this process is returned by the prioctl call. If there is more than one process sharing the highest user priority, the one returned is implementation-dependent.

Any time-sharing process may lower its own ts_uprilm (or that of another process with the same user ID). Only a time-sharing process with super-user privileges may raise a ts_uprilm. When changing the class of a process to time-sharing from some other class, super-user privileges are required in order to set the initial ts_uprilm to a value greater than zero. Attempts by a non-super-user process to raise a ts_uprilm or set an initial ts_uprilm greater than zero fail with a return value of -1 and errno set to EPERM.

Any time-sharing process may set its own ts_upri (or that of another process with the same user ID) to any value less than or equal to the process's ts_uprilm. Attempts to set the ts_upri above the ts_uprilm (and/or set the ts_uprilm below the ts_upri) result in the ts_upri being set equal to the ts_uprilm.

Either of the ts_uprilm or ts_upri fields may be set to the special value TS_NOCHANGE (defined in sys/tsprioctl.h) in order to set one of the values without affecting the other. Specifying TS_NOCHANGE for the ts_upri when the ts_uprilm is being set to a value below the current ts_upri causes the ts_upri to be set equal to the ts_uprilm being set. Specifying TS_NOCHANGE for a parameter when changing the class of a process to time-sharing (from some other class) causes the parameter to be set to a default value. The default value for the ts_uprilm is 0 and the default for the ts_upri is to set it equal to the ts_uprilm which is being set.

prionctl(2)

prionctl(2)

| | |
|-------------|--|
| RT_TQINF | Set an infinite time quantum. |
| RT_TQDEF | Set the time quantum to the default for this priority [see <code>rt_dptbl(4)</code>]. |
| RT_NOCHANGE | Don't set the time quantum. This value is useful when you wish to change the real-time priority of a process without affecting the time quantum. Specifying this value when changing the class of a process to real-time from some other class is equivalent to specifying <code>RT_TQDEF</code> . |

In order to change the class of a process to real-time (from any other class) the process invoking `prionctl` must have super-user privileges. In order to change the priority or time quantum setting of a real-time process the process invoking `prionctl` must have super-user privileges or must itself be a real-time process whose real or effective user ID matches the real or effective user ID of the target process.

The real-time priority and time quantum are inherited across the `fork(2)` and `exec(2)` system calls.

TIME-SHARING CLASS

The time-sharing scheduling policy provides for a fair and effective allocation of the CPU resource among processes with varying CPU consumption characteristics. The objectives of the time-sharing policy are to provide good response time to interactive processes and good throughput to CPU-bound jobs while providing a degree of user/application control over scheduling.

The time-sharing class has a range of time-sharing user priority (see `ts_upri` below) values that may be assigned to processes within the class. A `ts_upri` value of zero is defined as the default base priority for the time-sharing class. User priorities range from $-x$ to $+x$ where the value of x is configurable and can be determined for a specific installation by using the `prionctl PC_GETCID` or `PC_GETCLINFO` command.

The purpose of the user priority is to provide some degree of user/application control over the scheduling of processes in the time-sharing class. Raising or lowering the `ts_upri` value of a process in the time-sharing class raises or lowers the scheduling priority of the process. It is not guaranteed, however, that a process with a higher `ts_upri` value will run before one with a lower `ts_upri` value. This is because the `ts_upri` value is just one factor used to determine the scheduling priority of a time-sharing process. The system may dynamically adjust the internal scheduling priority of a time-sharing process based on other factors such as recent CPU usage.

In addition to the system-wide limits on user priority (returned by the `PC_GETCID` and `PC_GETCLINFO` commands) there is a per process user priority limit (see `ts_uprilim` below), which specifies the maximum `ts_upri` value that may be set for a given process; by default, `ts_uprilim` is zero.

The following structure (defined in `sys/tspriocntl.h`) defines the format used for the attribute data for the time-sharing class.

```

short   rt_pri;           /* Real-Time priority */
ulong   rt_tqsecs;       /* Seconds in time quantum */
long    rt_tqnsecs;      /* Additional nanoseconds in quantum */
} rtparms_t;

```

When using the `prioctl PC_SETPARMS` or `PC_GETPARMS` commands, if `pc_cid` specifies the real-time class, the data in the `pc_clparms` buffer is in this format.

The above commands can be used to set the real-time priority to the specified value or get the current `rt_pri` value. Setting the `rt_pri` value of a process that is currently running or runnable (not sleeping) causes the process to be placed at the back of the scheduling queue for the specified priority. The process is placed at the back of the appropriate queue regardless of whether the priority being set is different from the previous `rt_pri` value of the process. Note that a running process can voluntarily release the CPU and go to the back of the scheduling queue at the same priority by resetting its `rt_pri` value to its current real-time priority value. In order to change the time quantum of a process without setting the priority or affecting the process's position on the queue, the `rt_pri` field should be set to the special value `RT_NOCHANGE` (defined in `sys/rtprioctl.h`). Specifying `RT_NOCHANGE` when changing the class of a process to real-time from some other class results in the real-time priority being set to zero.

For the `prioctl PC_GETPARMS` command, if `pc_cid` specifies the real-time class and more than one real-time process is specified, the scheduling parameters of the real-time process with the highest `rt_pri` value among the specified processes are returned and the process ID of this process is returned by the `prioctl` call. If there is more than one process sharing the highest priority, the one returned is implementation-dependent.

The `rt_tqsecs` and `rt_tqnsecs` fields are used for getting or setting the time quantum associated with a process or group of processes. `rt_tqsecs` is the number of seconds in the time quantum and `rt_tqnsecs` is the number of additional nanoseconds in the quantum. For example setting `rt_tqsecs` to 2 and `rt_tqnsecs` to 500,000,000 (decimal) would result in a time quantum of two and one-half seconds. Specifying a value of 1,000,000,000 or greater in the `rt_tqnsecs` field results in an error return with `errno` set to `EINVAL`. Although the resolution of the `tq_nsecs` field is very fine, the specified time quantum length is rounded up by the system to the next integral multiple of the system clock's resolution. For example, the finest resolution currently available on a system is 10 milliseconds (1 "tick"). Setting `rt_tqsecs` to 0 and `rt_tqnsecs` to 34,000,000 would specify a time quantum of 34 milliseconds, which would be rounded up to 4 ticks (40 milliseconds) on that system. The maximum time quantum that can be specified is implementation-specific and equal to `LONG_MAX` ticks (defined in `limits.h`). Requesting a quantum greater than this maximum results in an error return with `errno` set to `ERANGE` (although infinite quanta may be requested using a special value as explained below). Requesting a time quantum of zero (setting both `rt_tqsecs` and `rt_tqnsecs` to 0) results in an error return with `errno` set to `EINVAL`.

The `rt_tqnsecs` field can also be set to one of the following special values (defined in `sys/rtprioctl.h`), in which case the value of `rt_tqsecs` is ignored.

For processes in the real-time class, the `rt_pri` value is, for all practical purposes, equivalent to the scheduling priority of the process. The `rt_pri` value completely determines the scheduling priority of a real-time process relative to other processes within its class. Numerically higher `rt_pri` values represent higher priorities. Since the real-time class controls the highest range of scheduling priorities in the system it is guaranteed that the runnable real-time process with the highest `rt_pri` value is always selected to run before any other process in the system.

In addition to providing control over priority, `prioctl` provides for control over the length of the time quantum allotted to processes in the real-time class. The time quantum value specifies the maximum amount of time a process may run assuming that it does not complete or enter a resource or event wait state (`sleep`). Note that if another process becomes runnable at a higher priority the currently running process may be preempted before receiving its full time quantum.

The system's process scheduler keeps the runnable real-time processes on a set of scheduling queues. There is a separate queue for each configured real-time priority and all real-time processes with a given `rt_pri` value are kept together on the appropriate queue. The processes on a given queue are ordered in FIFO order (that is, the process at the front of the queue has been waiting longest for service and receives the CPU first). Real-time processes that wake up after sleeping, processes which change to the real-time class from some other class, processes which have used their full time quantum, and runnable processes whose priority is reset by `prioctl` are all placed at the back of the appropriate queue for their priority. A process that is preempted by a higher priority process remains at the front of the queue (with whatever time is remaining in its time quantum) and runs before any other process at this priority. Following a `fork(2)` system call by a real-time process, the parent process continues to run while the child process (which inherits its parent's `rt_pri` value) is placed at the back of the queue.

The following structure (defined in `sys/rtprioctl.h`) defines the format used for the attribute data for the real-time class.

```
typedef struct {
    short    rt_maxpri;    /* Maximum real-time priority */
} rtinfo_t;
```

The `prioctl PC_GETCID` and `PC_GETCLINFO` commands return real-time class attributes in the `pc_clinfo` buffer in this format.

`rt_maxpri` specifies the configured maximum `rt_pri` value for the real-time class (if `rt_maxpri` is `x`, the valid real-time priorities range from 0 to `x`).

The following structure (defined in `sys/rtprioctl.h`) defines the format used to specify the real-time class-specific scheduling parameters of a process.

```
typedef struct {
```

When setting parameters for a set of processes, `prioctl` acts on the processes in the set in an implementation-specific order. If `prioctl` encounters an error for one or more of the target processes, it may or may not continue through the set of processes, depending on the nature of the error. If the error is related to permissions (`EPERM`), `prioctl` continues through the process set, resetting the parameters for all target processes for which the calling process has appropriate permissions. `prioctl` then returns -1 with `errno` set to `EPERM` to indicate that the operation failed for one or more of the target processes. If `prioctl` encounters an error other than permissions, it does not continue through the set of target processes but returns the error immediately.

PC_GETPARMS

Get the class and/or class-specific scheduling parameters of a process. *arg* points to a structure of type `pcparms_t`.

If `pc_cid` specifies a configured class and a single process belonging to that class is specified by the *idtype* and *id* values or the `procset` structure, then the scheduling parameters of that process are returned in the `pc_clparms` buffer. If the process specified does not exist or does not belong to the specified class, the `prioctl` call returns -1 with `errno` set to `ESRCH`.

If `pc_cid` specifies a configured class and a set of processes is specified, the scheduling parameters of one of the specified processes belonging to the specified class are returned in the `pc_clparms` buffer and the `prioctl` call returns the process ID of the selected process. The criteria for selecting a process to return in this case is class dependent. If none of the specified processes exist or none of them belong to the specified class the `prioctl` call returns -1 with `errno` set to `ESRCH`.

If `pc_cid` is `PC_CLNULL` and a single process is specified the class of the specified process is returned in `pc_cid` and its scheduling parameters are returned in the `pc_clparms` buffer.

PC_ADMIN

This command provides functionality needed for the implementation of the `dispadm(1M)` command. It is not intended for general use by other applications.

REAL-TIME CLASS

The real-time class provides a fixed priority preemptive scheduling policy for those processes requiring fast and deterministic response and absolute user/application control of scheduling priorities. If the real-time class is configured in the system it should have exclusive control of the highest range of scheduling priorities on the system. This ensures that a runnable real-time process is given CPU service before any process belonging to any other class.

The real-time class has a range of real-time priority (`rt_pri`) values that may be assigned to processes within the class. Real-time priorities range from 0 to *x*, where the value of *x* is configurable and can be determined for a specific installation by using the `prioctl` `PC_GETCID` or `PC_GETCLINFO` command.

The real-time scheduling policy is a fixed priority policy. The scheduling priority of a real-time process is never changed except as the result of an explicit request by the user/application to change the `rt_pri` value of the process.

prionctl(2)

prionctl(2)

```
    id_t    pc_cid;                /* Process class */
    long    pc_clparms[PC_CLPARMSZ]; /* Class-specific params */
} pcparms_t;
```

`pc_cid` is a class ID (returned by `prionctl PC_GETCID`). The special class ID `PC_CLNULL` can also be assigned to `pc_cid` when using the `PC_GETPARMS` command as explained below.

The `pc_clparms` buffer holds class-specific scheduling parameters. The format of this parameter data for a particular class is described under the appropriate heading below. `PC_CLPARMSZ` is the length of the `pc_clparms` buffer and is defined in `sys/prionctl.h`.

Commands

Available `prionctl` commands are:

PC_GETCID

Get class ID and class attributes for a specific class given class name. The *idtype* and *id* arguments are ignored. If *arg* is non-null, it points to a structure of type `pcinfo_t`. The `pc_clname` buffer contains the name of the class whose attributes you are getting.

On success, the class ID is returned in `pc_cid`, the class attributes are returned in the `pc_clinfo` buffer, and the `prionctl` call returns the total number of classes configured in the system (including the `sys` class). If the class specified by `pc_clname` is invalid or is not currently configured the `prionctl` call returns -1 with `errno` set to `EINVAL`. The format of the attribute data returned for a given class is defined in the `sys/rtpriocntl.h` or `sys/tpriocntl.h` header file and described under the appropriate heading below.

If *arg* is a NULL pointer, no attribute data is returned but the `prionctl` call still returns the number of configured classes.

PC_GETCLINFO

Get class name and class attributes for a specific class given class ID. The *idtype* and *id* arguments are ignored. If *arg* is non-null, it points to a structure of type `pcinfo_t`. `pc_cid` is the class ID of the class whose attributes you are getting.

On success, the class name is returned in the `pc_clname` buffer, the class attributes are returned in the `pc_clinfo` buffer, and the `prionctl` call returns the total number of classes configured in the system (including the `sys` class). The format of the attribute data returned for a given class is defined in the `sys/rtpriocntl.h` or `sys/tpriocntl.h` header file and described under the appropriate heading below.

If *arg* is a NULL pointer, no attribute data is returned but the `prionctl` call still returns the number of configured classes.

PC_SETPARMS

Set the class and class-specific scheduling parameters of the specified process(es). *arg* points to a structure of type `pcparms_t`. `pc_cid` specifies the class you are setting and the `pc_clparms` buffer contains the class-specific parameters you are setting. The format of the class-specific parameter data is defined in the `sys/rtpriocntl.h` or `sys/tpriocntl.h` header file and described under the appropriate class heading below.

`P_ALL` The `prionctl` system call applies to all existing processes. The value of `id` is ignored. The permission restrictions described below still apply.

An `id` value of `P_MYID` can be used in conjunction with the `idtype` value to specify the calling process's process ID, parent process ID, process group ID, session ID, class ID, user ID, or group ID.

In order to change the scheduling parameters of a process (using the `PC_SETPARMS` command as explained below) the real or effective user ID of the process calling `prionctl` must match the real or effective user ID of the receiving process or the effective user ID of the calling process must be super-user. These are the minimum permission requirements enforced for all classes. An individual class may impose additional permissions requirements when setting processes to that class and/or when setting class-specific scheduling parameters.

A special `sys` scheduling class exists for the purpose of scheduling the execution of certain special system processes (such as the swapper process). It is not possible to change the class of any process to `sys`. In addition, any processes in the `sys` class that are included in a specified set of processes are disregarded by `prionctl`. For example, an `idtype` of `P_UID` and an `id` value of zero would specify all processes with a user ID of zero except processes in the `sys` class and (if changing the parameters using `PC_SETPARMS`) the `init` process.

The `init` process is a special case. In order for a `prionctl` call to change the class or other scheduling parameters of the `init` process (process ID 1), it must be the only process specified by `idtype` and `id`. The `init` process may be assigned to any class configured on the system, but the time-sharing class is almost always the appropriate choice. Other choices may be highly undesirable.

The data type and value of `arg` are specific to the type of command specified by `cmd`.

The following structure is used by the `PC_GETCID` and `PC_GETCLINFO` commands.

```
typedef struct {
    id_t    pc_cid;                /* Class id */
    char    pc_clname[PC_CLNMSZ]; /* Class name */
    long    pc_clinfo[PC_CLINFOSZ]; /* Class information */
} pcinfo_t;
```

`pc_cid` is a class ID returned by `prionctl PC_GETCID`. `pc_clname` is a buffer of size `PC_CLNMSZ` (defined in `sys/prionctl.h`) used to hold the class name (RT for real-time or TS for time-sharing).

`pc_clinfo` is a buffer of size `PC_CLINFOSZ` (defined in `sys/prionctl.h`) used to return data describing the attributes of a specific class. The format of this data is class-specific and is described under the appropriate heading (REAL-TIME CLASS or TIME-SHARING CLASS) below.

The following structure is used by the `PC_SETPARMS` and `PC_GETPARMS` commands.

```
typedef struct {
```

NAME

prionctl - process scheduler control

SYNOPSIS

```
#include <sys/types.h>
#include <sys/prionctl.h>
#include <sys/procset.h>
#include <sys/rtpriocntl.h>
#include <sys/tspriocntl.h>

long prionctl(idtype_t idtype, id_t id, int cmd, ... /* arg */);
```

DESCRIPTION

prionctl provides for control over the scheduling of active processes.

Processes fall into distinct classes with a separate scheduling policy applied to each class. The two classes currently supported are the real-time class and the time-sharing class. The characteristics of these classes are described under the corresponding headings below. The class attribute of a process is inherited across the fork and exec(2) system calls. prionctl can be used to dynamically change the class and other scheduling parameters associated with a running process or set of processes given the appropriate permissions as explained below.

In the default configuration, a runnable real-time process runs before any other process. Therefore, inappropriate use of real-time processes can have a dramatic negative impact on system performance.

prionctl provides an interface for specifying a process or set of processes to which the system call is to apply. The prionctlset system call provides the same functions as prionctl, but allows a more general interface for specifying the set of processes to which the system call is to apply.

For prionctl, the *idtype* and *id* arguments are used together to specify the set of processes. The interpretation of *id* depends on the value of *idtype*. The possible values for *idtype* and corresponding interpretations of *id* are as follows:

| | |
|--------|--|
| P_PID | <i>id</i> is a process ID specifying a single process to which the prionctl system call is to apply. |
| P_PPID | <i>id</i> is a parent process ID. The prionctl system call applies to all processes with the specified parent process ID. |
| P_PGID | <i>id</i> is a process group ID. The prionctl system call applies to all processes in the specified process group. |
| P_SID | <i>id</i> is a session ID. The prionctl system call applies to all processes in the specified session. |
| P_CID | <i>id</i> is a class ID (returned by prionctl PC_GETCID as explained below). The prionctl system call applies to all processes in the specified class. |
| P_UID | <i>id</i> is a user ID. The prionctl system call applies to all processes with this effective user ID. |
| P_GID | <i>id</i> is a group ID. The prionctl system call applies to all processes with this effective group ID. |

printf(3)

(BSD Compatibility Package)

printf(3)

```
printf("%s, %s %i, %d:%.2d", weekday, month, day, hour, min);
```

To print π to 5 decimal places:

```
printf("pi = %.5f", 4 * atan(1. 0));
```

SEE ALSO

`econvert(3)` `putc(3S)`, `scanf(3S)`, `vprintf(3S)`, `varargs(5)`.

NOTES

Very wide fields (>128 characters) fail.

precision is 1. The result of converting a zero value with a precision of zero is a NULL string.

- f The float or double *arg* is converted to decimal notation in the style [-]ddd.ddd where the number of digits after the decimal point is equal to the precision specification. If the precision is missing, 6 digits are given; if the precision is explicitly 0, no digits and no decimal point are printed.
- e,E The float or double *arg* is converted in the style [-]d.dde±ddd, where there is one digit before the decimal point and the number of digits after it is equal to the precision; when the precision is missing, 6 digits are produced; if the precision is zero, no decimal point appears. The E format code will produce a number with E instead of e introducing the exponent. The exponent always contains at least two digits.
- g,G The float or double *arg* is printed in style f or e (or in style E in the case of a G format code), with the precision specifying the number of significant digits. The style used depends on the value converted: style e or E will be used only if the exponent resulting from the conversion is less than -4 or greater than the precision. Trailing zeroes are removed from the result; a decimal point appears only if it is followed by a digit.

The e, E, f, g, and G formats print IEEE indeterminate values (infinity or not-a-number) as "Infinity" or "NaN" respectively.

- c The character *arg* is printed.
- s The *arg* is taken to be a string (character pointer) and characters from the string are printed until a NULL character (\0) is encountered or until the number of characters indicated by the precision specification is reached. If the precision is missing, it is taken to be infinite, so all characters up to the first NULL character are printed. A NULL value for *arg* will yield undefined results.
- % Print a %; no argument is converted.

In no case does a non-existent or small field width cause truncation of a field; if the result of a conversion is wider than the field width, the field is simply expanded to contain the conversion result. Padding takes place only if the specified field width exceeds the actual width. Characters generated by printf and fprintf are printed as if putc(3S) had been called.

RETURN VALUE

Upon success, printf and fprintf return the number of characters transmitted, excluding the null character. vprintf and vfprintf return the number of characters transmitted. sprintf and vsprintf always return s. If an output error is encountered, printf, fprintf, vprintf, and vfprintf, return EOF.

EXAMPLE

To print a date and time in the form "Sunday, July 3, 10:02," where *weekday* and *month* are pointers to NULL-terminated strings:

with blanks unless the field width digit string starts with a zero, in which case the padding is with zeros.

A *precision* that gives the minimum number of digits to appear for the *d*, *i*, *o*, *u*, *x*, or *X* conversions, the number of digits to appear after the decimal point for the *e*, *E*, and *f* conversions, the maximum number of significant digits for the *g* and *G* conversion, or the maximum number of characters to be printed from a string in *s* conversion. The precision takes the form of a period (.) followed by a decimal digit string; a NULL digit string is treated as zero. Padding specified by the precision overrides the padding specified by the field width.

An optional *l* (ell) specifying that a following *d*, *i*, *o*, *u*, *x*, or *X* conversion character applies to a long integer *arg*. An *l* before any other conversion character is ignored.

A character that indicates the type of conversion to be applied.

A field width or precision or both may be indicated by an asterisk (*) instead of a digit string. In this case, an integer *arg* supplies the field width or precision. The *arg* that is actually converted is not fetched until the conversion letter is seen, so the *args* specifying field width or precision must appear *before* the *arg* (if any) to be converted. A negative field width argument is taken as a '-' flag followed by a positive field width. If the precision argument is negative, it will be changed to zero.

The flag characters and their meanings are:

- The result of the conversion will be left-justified within the field.
- + The result of a signed conversion will always begin with a sign (+ or -).
- blank If the first character of a signed conversion is not a sign, a blank will be prefixed to the result. This implies that if the blank and + flags both appear, the blank flag will be ignored.
- # This flag specifies that the value is to be converted to an "alternate form." For *c*, *d*, *i*, *s*, and *u* conversions, the flag has no effect. For *o* conversion, it increases the precision to force the first digit of the result to be a zero. For *x* or *X* conversion, a non-zero result will have *0x* or *0X* prefixed to it. For *e*, *E*, *f*, *g*, and *G* conversions, the result will always contain a decimal point, even if no digits follow the point (normally, a decimal point appears in the result of these conversions only if a digit follows it). For *g* and *G* conversions, trailing zeroes will *not* be removed from the result (which they normally are).

The conversion characters and their meanings are:

- d,i,o,u,x,X* The integer *arg* is converted to signed decimal (*d* or *i*), unsigned octal (*o*), unsigned decimal (*u*), or unsigned hexadecimal notation (*x* and *X*), respectively; the letters *abcdef* are used for *x* conversion and the letters *ABCDEF* for *X* conversion. The precision specifies the minimum number of digits to appear; if the value being converted can be represented in fewer digits, it will be expanded with leading zeroes. (For compatibility with older versions, padding with leading zeroes may alternatively be specified by prepending a zero to the field width. This does not imply an octal value for the field width.) The default

NAME

printf, fprintf, sprintf, vprintf, vfprintf, vsprintf - formatted output conversion

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
#include <stdio.h>
int printf(format [ , arg ] ... )
char *format;

int fprintf(stream, format [ , arg ] ... )
FILE *stream;
char *format;

char *sprintf(s, format [ , arg ] ... )
char *s, *format;

int vprintf(format, ap)
char *format;
va_list ap;

int vfprintf(stream, format, ap)
FILE *stream;
char *format;
va_list ap;

char *vsprintf(s, format, ap)
char *s, *format;
va_list ap;
```

DESCRIPTION

printf places output on the standard output stream stdout. fprintf places output on the named output stream. sprintf places "output," followed by the NULL character (\0), in consecutive bytes starting at *s; it is the user's responsibility to ensure that enough storage is available.

vprintf, vfprintf, and vsprintf are the same as printf, fprintf, and sprintf respectively, except that instead of being called with a variable number of arguments, they are called with an argument list as defined by varargs(5).

Each of these functions converts, formats, and prints its args under control of the format. The format is a character string which contains two types of objects: plain characters, which are simply copied to the output stream, and conversion specifications, each of which causes conversion and printing of zero or more args. The results are undefined if there are insufficient args for the format. If the format is exhausted while args remain, the excess args are simply ignored.

Each conversion specification is introduced by the character %. After the %, the following appear in sequence:

Zero or more flags, which modify the meaning of the conversion specification.

An optional decimal digit string specifying a minimum field width. If the converted value has fewer characters than the field width, it will be padded on the left (or right, if the left-adjustment flag '-', described below, has been given) to the field width. The padding is

NAME

printf, fprintf, sprintf - print formatted output

SYNOPSIS

```
#include <stdio.h>
#include <wchar.h>

int printf (const char *format [, arg] ... );
int fprintf (FILE *stream, const char *format [, arg] ... );
int sprintf (char *s, const char *format [, arg] ... );
```

DESCRIPTION (International Functions)

printf() places output on the standard output stream *stdout*. fprintf() places output on the named output stream. sprintf() places output followed by the NULL character in a character array pointed to by *s*. Each function returns the number of bytes transmitted (not including the NULL character in the case of *sprintf*), or a negative value if an output error was encountered.

Each of these functions converts, formats and prints its *args* under control of the *format*. The *format* is a character string that contains two types of object: plain characters, including ASCII characters and characters in supplementary code sets which are simply copied to the output stream, and conversion specifications which can contain only ASCII characters, each of which results in the fetching of zero or more *args*.

wc and *ws* are the new conversion specifications for *wchar_t* character control. Both *wc* and *ws* may be used in all three functions.

wc The *wchar_t* character *arg* is transformed into EUC, and then printed. If a field width is specified and the transformed EUC has fewer bytes than the field width, it will be padded to the given width. A precision specification is ignored, if specified.

ws The *arg* is taken to be a *wchar_t* string and the *wchar_t* characters from the string are transformed into EUC, and printed until a *wchar_t* null character is encountered or the number of bytes indicated by the precision specification is printed. If the precision specification is missing, it is taken to be infinite, and all *wchar_t* characters up to the first *wchar_t* null character are transformed into EUC and printed. If a field width is specified and the transformed EUC have fewer bytes than the field width, they are padded to the given width.

The ASCII space character (0x20) is used as a padding characters.

DIAGNOSTICS

printf, fprintf, and sprintf returns the number of bytes transmitted, or return a negative value if an error was encountered.

SEE ALSO

printf(3S), scanf(3W), stdio(3S), vprintf(3W), widec(3W).

printf(3S)

printf(3S)

In no case does a non-existent or small field width cause truncation of a field; if the result of a conversion is wider than the field width, the field is simply expanded to contain the conversion result. Characters generated by `printf` and `fprintf` are printed as if the `putc` routine had been called.

EXAMPLE

To print a date and time in the form `Sunday, July 3, 10:02`, where `weekday` and `month` are pointers to null-terminated strings:

```
printf("%s, %s %i, %d:%.2d",
       weekday, month, day, hour, min);
```

To print π to 5 decimal places:

```
printf("pi = %.5f", 4 * atan(1.0));
```

SEE ALSO

`exit(2)`, `lseek(2)`, `write(2)`, `abort(3C)`, `ecvt(3C)`, `putc(3S)`, `scanf(3S)`, `setlocale(3C)`, `stdio(3S)`.

DIAGNOSTICS

`printf`, `fprintf`, and `sprintf` return the number of characters transmitted, or return a negative value if an error was encountered.

- e,E* The double *args* is converted to the style `[-]d.ddde±dd`, where there is one digit before the decimal-point character (which is non-zero if the argument is non-zero) and the number of digits after it is equal to the precision. When the precision is missing, six digits are produced; if the precision is zero and the # flag is not specified, no decimal-point character appears. The *E* conversion character will produce a number with *E* instead of *e* introducing the exponent. The exponent always contains at least two digits. The value is rounded to the appropriate number of digits.
- g,G* The double *args* is printed in style *f* or *e* (or in style *E* in the case of a *G* conversion character), with the precision specifying the number of significant digits. If the precision is zero, it is taken as one. The style used depends on the value converted: style *e* (or *E*) will be used only if the exponent resulting from the conversion is less than -4 or greater than or equal to the precision. Trailing zeros are removed from the fractional part of the result. A decimal-point character appears only if it is followed by a digit.
- c* The *int args* is converted to an unsigned *char*, and the resulting character is printed.
- s* The *args* is taken to be a string (character pointer) and characters from the string are written up to (but not including) a terminating null character; if the precision is specified, no more than that many characters are written. If the precision is not specified, it is taken to be infinite, so all characters up to the first null character are printed. A *NULL* value for *args* will yield undefined results.
- p* The *args* should be a pointer to *void*. The value of the pointer is converted to an implementation-defined set of sequences of printable characters, which should be the same as the set of sequences that are matched by the *%p* conversion of the *scanf* function.
- n* The argument should be a pointer to an integer into which is written the number of characters written to the output standard I/O stream so far by this call to *printf*, *fprintf*, or *sprintf*. No argument is converted.
- %* Print a *%*; no argument is converted.

If the character after the *%* or *%digits\$* sequence is not a valid conversion character, the results of the conversion are undefined.

If a floating-point value is the internal representation for infinity, the output is `[±]inf`, where *inf* is either *inf* or *INF*, depending on the conversion character. Printing of the sign follows the rules described above.

If a floating-point value is the internal representation for "not-a-number," the output is `[±]nan0xm`. Depending on the conversion character, *nan* is either *nan* or *NAN*. Additionally, *0xm* represents the most significant part of the mantissa. Again depending on the conversion character, *x* will be *x* or *X*, and *m* will use the letters *abcdef* or *ABCDEF*. Printing of the sign follows the rules described above.

The *flag* characters and their meanings are:

- The result of the conversion will be left-justified within the field. (It will be right-justified if this flag is not specified.)
- + The result of a signed conversion will always begin with a sign (+ or -). (It will begin with a sign only when a negative value is converted if this flag is not specified.)
- space If the first character of a signed conversion is not a sign, a space will be placed before the result. This means that if the space and + flags both appear, the space flag will be ignored.
- # The value is to be converted to an alternate form. For c, d, i, s, and u conversions, the flag has no effect. For an o conversion, it increases the precision to force the first digit of the result to be a zero. For x (or X) conversion, a non-zero result will have 0x (or 0X) prepended to it. For e, E, f, g, and G conversions, the result will always contain a decimal-point character, even if no digits follow the point (normally, a decimal point appears in the result of these conversions only if a digit follows it). For g and G conversions, trailing zeros will not be removed from the result as they normally are.
- 0 For d, i, o, u, x, X, e, E, f, g, and G conversions, leading zeros (following any indication of sign or base) are used to pad to the field width; no space padding is performed. If the 0 and flags both appear, the 0 flag will be ignored. For d, i, o, u, x, and X conversions, if a precision is specified, the 0 flag will be ignored. For other conversions, the behavior is undefined.

Each conversion character results in fetching zero or more *args*. The results are undefined if there are insufficient *args* for the format. If the format is exhausted while *args* remain, the excess *args* are ignored.

The conversion characters and their meanings are:

- d,i,o,u,x,X The integer *arg* is converted to signed decimal (d or i), (unsigned octal (o), unsigned decimal (u), or unsigned hexadecimal notation (x and X). The x conversion uses the letters abcdef and the X conversion uses the letters ABCDEF. The precision specifies the minimum number of digits to appear. If the value being converted can be represented in fewer digits than the specified minimum, it will be expanded with leading spaces or zeros. The default precision is 1. The result of converting a zero value with a precision of zero is no characters.
- f The double *args* is converted to decimal notation in the style [-]ddd.ddd, where the number of digits after the decimal-point character [see `setlocale(3C)`] is equal to the precision specification. If the precision is omitted from *arg*, six digits are output; if the precision is explicitly zero and the # flag is not specified, no decimal-point character appears. If a decimal-point character appears, at least 1 digit appears before it. The value is rounded to the appropriate number of digits.

An optional field, consisting of a decimal digit string followed by a \$, specifying the next *args* to be converted. If this field is not provided, the *args* following the last *args* converted will be used.

Zero or more *flags*, which modify the meaning of the conversion specification.

An optional string of decimal digits to specify a minimum *field width*. If the converted value has fewer characters than the field width, it will be padded on the left (or right, if the left-adjustment flag (-), described below, has been given) to the field width.

An optional precision that gives the minimum number of digits to appear for the *d*, *i*, *o*, *u*, *x*, or *X* conversions (the field is padded with leading zeros), the number of digits to appear after the decimal-point character for the *e*, *E*, and *f* conversions, the maximum number of significant digits for the *g* and *G* conversions, or the maximum number of characters to be printed from a string in *s* conversion. The precision takes the form of a period (.) followed by a decimal digit string; a null digit string is treated as zero. Padding specified by the precision overrides the padding specified by the field width.

An optional *h* specifies that a following *d*, *i*, *o*, *u*, *x*, or *X* conversion specifier applies to a short *int* or unsigned short *int* argument (the argument will be promoted according to the integral promotions and its value converted to short *int* or unsigned short *int* before printing); an optional *h* specifies that a following *n* conversion specifier applies to a pointer to a short *int* argument. An optional *l* (*ell*) specifies that a following *d*, *i*, *o*, *u*, *x*, or *X* conversion specifier applies to a long *int* or unsigned long *int* argument; an optional *l* (*ell*) specifies that a following *n* conversion specifier applies to a pointer to long *int* argument. An optional *L* specifies that a following *e*, *E*, *f*, *g*, or *G* conversion specifier applies to a long *double* argument. If an *h*, *l*, or *L* appears before any other conversion specifier, the behavior is undefined.

A conversion character (see below) that indicates the type of conversion to be applied.

A field width or precision may be indicated by an asterisk (*) instead of a digit string. In this case, an integer *args* supplies the field width or precision. The *args* that is actually converted is not fetched until the conversion letter is seen, so the *args* specifying field width or precision must appear before the *args* (if any) to be converted. If the *precision* argument is negative, it will be changed to zero. A negative field width argument is taken as a - flag, followed by a positive field width.

In format strings containing the **digits*\$ form of a conversion specification, a field width or precision may also be indicated by the sequence **digits*\$, giving the position in the argument list of an integer *args* containing the field width or precision.

When numbered argument specifications are used, specifying the *N*th argument requires that all the leading arguments, from the first to the (*N*-1)th, be specified in the format string.

printf(3S)

printf(3S)

NAME

printf, fprintf, sprintf - print formatted output

SYNOPSIS

```
#include <stdio.h>

int printf(const char *format, . . . /* args */);
int fprintf(FILE *strm, const char *format, . . . /* args */);
int sprintf(char *s, const char *format, . . . /* args */);
```

DESCRIPTION

printf places output on the standard output stream stdout.

fprintf places output on *strm*.

sprintf places output, followed by the null character (\0), in consecutive bytes starting at *s*. It is the user's responsibility to ensure that enough storage is available. Each function returns the number of characters transmitted (not including the \0 in the case of sprintf) or a negative value if an output error was encountered.

Each of these functions converts, formats, and prints its *args* under control of the *format*. The *format* is a character string that contains three types of objects defined below:

1. plain characters that are simply copied to the output stream;
2. escape sequences that represent non-graphic characters;
3. conversion specifications.

The following escape sequences produce the associated action on display devices capable of the action:

- \a Alert. Ring the bell.
- \b Backspace. Move the printing position to one character before the current position, unless the current position is the start of a line.
- \f Form feed. Move the printing position to the initial printing position of the next logical page.
- \n Newline. Move the printing position to the start of the next line.
- \r Carriage return. Move the printing position to the start of the current line.
- \t Horizontal tab. Move the printing position to the next implementation-defined horizontal tab position on the current line.
- \v Vertical tab. Move the printing position to the start of the next implementation-defined vertical tab position.

All forms of the printf functions allow for the insertion of a language-dependent decimal-point character. The decimal-point character is defined by the program's locale (category LC_NUMERIC). In the C locale, or in a locale where the decimal-point character is not defined, the decimal-point character defaults to a period (.).

Each conversion specification is introduced by the character %. After the character %, the following appear in sequence:

A security hole exists through the `IFS` and `PATH` environment variables. Full path-names should be used (or `PATH` reset) and `IFS` should be set to space and tab (" \t").

NAME

popen, pclose - initiate pipe to/from a process

SYNOPSIS

```
#include <stdio.h>
FILE *popen (const char *command, const char *type);
int pclose (FILE *stream);
```

DESCRIPTION

popen creates a pipe between the calling program and the command to be executed. The arguments to popen are pointers to null-terminated strings. *command* consists of a shell command line. *type* is an I/O mode, either *r* for reading or *w* for writing. The value returned is a stream pointer such that one can write to the standard input of the command, if the I/O mode is *w*, by writing to the file *stream* [see intro(3)]; and one can read from the standard output of the command, if the I/O mode is *r*, by reading from the file *stream*.

A stream opened by popen should be closed by pclose, which waits for the associated process to terminate and returns the exit status of the command.

Because open files are shared, a type *r* command may be used as an input filter and a type *w* as an output filter.

EXAMPLE

Here is an example of a typical call:

```
#include <stdio.h>
#include <stdlib.h>

main()
{
    char *cmd = "/usr/bin/ls *.c";
    char buf[BUFSIZ];
    FILE *ptr;

    if ((ptr = popen(cmd, "r")) != NULL)
        while (fgets(buf, BUFSIZ, ptr) != NULL)
            (void) printf("%s", buf);
    return 0;
}
```

This program will print on the standard output [see stdio(3S)] all the file names in the current directory that have a *.c* suffix.

SEE ALSO

pipe(2), wait(2), fclose(3S), fopen(3S), stdio(3S), system(3S)

DIAGNOSTICS

popen returns a null pointer if files or processes cannot be created.

pclose returns -1 if *stream* is not associated with a popened command.

NOTES

If the original and popened processes concurrently read or write a common file, neither should use buffered I/O. Problems with an output filter may be forestalled by careful buffer flushing, e.g., with fflush [see fclose(3S)].

poll(2)

poll(2)

POLLNVAL The specified `fd` value does not belong to an open file. This flag is only valid in the `revents` field; it is not used in the `events` field.

For each element of the array pointed to by `fds`, `poll` examines the given file descriptor for the event(s) specified in `events`. The number of file descriptors to be examined is specified by `nfds`.

If the value `fd` is less than zero, `events` is ignored and `revents` is set to 0 in that entry on return from `poll`.

The results of the `poll` query are stored in the `revents` field in the `pollfd` structure. Bits are set in the `revents` bitmask to indicate which of the requested events are true. This event only examines bands that have been written to at least once. If none are true, none of the specified bits are set in `revents` when the `poll` call returns. The event flags `POLLHUP`, `POLLERR`, and `POLLNVAL` are always set in `revents` if the conditions they indicate are true; this occurs even though these flags were not present in `events`.

If none of the defined events have occurred on any selected file descriptor, `poll` waits at least `timeout` milliseconds for an event to occur on any of the selected file descriptors. On a computer where millisecond timing accuracy is not available, `timeout` is rounded up to the nearest legal value available on that system. If the value `timeout` is 0, `poll` returns immediately. If the value of `timeout` is `INFTIM` (or -1), `poll` blocks until a requested event occurs or until the call is interrupted. `poll` is not affected by the `O_NDELAY` and `O_NONBLOCK` flags.

`poll` fails if one or more of the following are true:

| | |
|--------|--|
| EAGAIN | Allocation of internal data structures failed, but the request may be attempted again. |
| EFAULT | Some argument points outside the allocated address space. |
| EINTR | A signal was caught during the <code>poll</code> system call. |
| EINVAL | The argument <code>nfds</code> is greater than <code>{OPEN_MAX}</code> . |

SEE ALSO

`intro(2)`, `getmsg(2)`, `getrlimit(2)`, `putmsg(2)`, `read(2)`, `write(2)`.

DIAGNOSTICS

Upon successful completion, a non-negative value is returned. A positive value indicates the total number of file descriptors that has been selected (that is, file descriptors for which the `revents` field is non-zero). A value of 0 indicates that the call timed out and no file descriptors have been selected. Upon failure, a value of -1 is returned and `errno` is set to indicate the error.

poll(2)

poll(2)

NAME

poll - input/output multiplexing

SYNOPSIS

```
#include <stropts.h>
#include <poll.h>
```

```
int poll(struct poll *fds, size_t nfds, int timeout);
```

DESCRIPTION

`poll` provides users with a mechanism for multiplexing input/output over a set of file descriptors that reference open files. `poll` identifies those files on which a user can send or receive messages, or on which certain events have occurred.

`fds` specifies the file descriptors to be examined and the events of interest for each file descriptor. It is a pointer to an array with one element for each open file descriptor of interest. The array's elements are `pollfd` structures, which contain the following members:

```
int fd;                /* file descriptor */
short events;          /* requested events */
short revents;         /* returned events */
```

`fd` specifies an open file descriptor and `events` and `revents` are bitmasks constructed by an OR of any combination of the following event flags:

| | |
|------------|---|
| POLLIN | Data other than high priority data may be read without blocking. For STREAMS, this flag is set even if the message is of zero length. |
| POLLRDNORM | Normal data (priority band = 0) may be read without blocking. For STREAMS, this flag is set even if the message is of zero length. |
| POLLRDBAND | Data from a non-zero priority band may be read without blocking. For STREAMS, this flag is set even if the message is of zero length. |
| POLLPRI | High priority data may be received without blocking. For STREAMS, this flag is set even if the message is of zero length. |
| POLLOUT | Normal data may be written without blocking. |
| POLLWRNORM | The same as POLLOUT. |
| POLLWRBAND | Priority data (priority band > 0) may be written. |
| POLLMSG | An <code>M_SIG</code> or <code>M_PCSIG</code> message containing the <code>SIGPOLL</code> signal has reached the front of the stream head read queue. |
| POLLERR | An error has occurred on the device or stream. This flag is only valid in the <code>revents</code> bitmask; it is not used in the <code>events</code> field. |
| POLLHUP | A hangup has occurred on the stream. This event and <code>POLLOUT</code> are mutually exclusive; a stream can never be writable if a hangup has occurred. However, this event and <code>POLLIN</code> , <code>POLLRDNORM</code> , <code>POLLRDBAND</code> , or <code>POLLPRI</code> are not mutually exclusive. This flag is only valid in the <code>revents</code> bitmask; it is not used in the <code>events</code> field. |

plock(2)

plock(2)

NAME

plock - lock into memory or unlock process, text, or data

SYNOPSIS

```
#include <sys/lock.h>
int plock(int op);
```

DESCRIPTION

plock allows the calling process to lock into memory or unlock its text segment (text lock), its data segment (data lock), or both its text and data segments (process lock). Locked segments are immune to all routine swapping. The effective user ID of the calling process must be super-user to use this call. plock performs the function specified by *op*:

| | |
|----------|---|
| PROCLOCK | Lock text and data segments into memory (process lock). |
| TXTLCK | Lock text segment into memory (text lock). |
| DATLOCK | Lock data segment into memory (data lock). |
| UNLOCK | Remove locks. |

plock fails and does not perform the requested operation if one or more of the following are true:

| | |
|--------|---|
| EPERM | The effective user ID of the calling process is not super-user. |
| EINVAL | <i>op</i> is equal to PROCLOCK and a process lock, a text lock, or a data lock already exists on the calling process. |
| EINVAL | <i>op</i> is equal to TXTLCK and a text lock, or a process lock already exists on the calling process. |
| EINVAL | <i>op</i> is equal to DATLOCK and a data lock, or a process lock already exists on the calling process. |
| EINVAL | <i>op</i> is equal to UNLOCK and no lock exists on the calling process. |
| EAGAIN | Not enough memory. |

SEE ALSO

exec(2), exit(2), fork(2), memcntl(2)

DIAGNOSTICS

Upon successful completion, a value of 0 is returned to the calling process. Otherwise, a value of -1 is returned and *errno* is set to indicate the error.

NOTES

memcntl is the preferred interface to process locking.

pipe(2)

pipe(2)

NAME

pipe - create an interprocess channel

SYNOPSIS

```
#include <unistd.h>
int pipe(int fildes[2]);
```

DESCRIPTION

pipe creates an I/O mechanism called a pipe and returns two file descriptors, *fildes*[0] and *fildes*[1]. The files associated with *fildes*[0] and *fildes*[1] are streams and are both opened for reading and writing. The `O_NDELAY` and `O_NONBLOCK` flags are cleared.

A read from *fildes*[0] accesses the data written to *fildes*[1] on a first-in-first-out (FIFO) basis and a read from *fildes*[1] accesses the data written to *fildes*[0] also on a FIFO basis.

The `FD_CLOEXEC` flag will be clear on both file descriptors.

Upon successful completion pipe marks for update the `st_atime`, `st_ctime`, and `st_mtime` fields of the pipe.

pipe fails if:

| | |
|--------|--|
| EMFILE | If <code>{OPEN_MAX}-1</code> or more file descriptors are currently open for this process. |
| ENFILE | A file table entry could not be allocated. |

SEE ALSO

`sh(1)`, `fcntl(2)`, `getmsg(2)`, `poll(2)`, `putmsg(2)`, `read(2)`, `write(2)`, `streamio(7)`.

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NOTES

Since a pipe is bi-directional, there are two separate flows of data. Therefore, the size (`st_size`) returned by a call to `fstat(2)` with argument *fildes*[0] or *fildes*[1] is the number of bytes available for reading from *fildes*[0] or *fildes*[1] respectively. Previously, the size (`st_size`) returned by a call to `fstat()` with argument *fildes*[1] (the write-end) was the number of bytes available for reading from *fildes*[0] (the read-end).

RETURN VALUE

Upon success, `pfmt()` returns the number of bytes transmitted. Upon failure, it returns a negative value:

-1 write error to *stream*.

EXAMPLES

Example 1:

```
setlabel("UX:test");
pfmt(stderr, MM_ERROR, "test:2:Cannot open file: %s\n", strerror(errno));
```

displays the message:

```
UX:test: ERROR: Cannot open file: No such file or directory
```

Example 2:

```
setlabel("UX:test");
setcat("test");
pfmt(stderr, MM_ERROR, ":10:Syntax error\n");
pfmt(stderr, MM_ACTION, "55:Usage ... \n");
```

displays the message

```
UX:test: ERROR: Syntax error
UX:test: TO FIX: Usage ...
```

SEE ALSO

`addsev(3C)`, `environ(5)`, `gettext(3C)`, `lfmt(3C)`, `pfmt(1)`, `printf(3C)`, `setcat(3C)`, `setlabel(3C)`, `setlocale(3C)`.

MM_STD Output using the standard message format (default, value 0).

Catalog access control

MM_NOGET Do not retrieve a localized version of *format*. In this case, only the *<defmsg>* part of the *format* is specified.

MM_GET Retrieve a localized version of *format*, from the *<catalog>*, using *<msgid>* as the index and *<defmsg>* as the default message (default, value 0).

Severity (standard message format only)

MM_HALT generates a localized version of HALT.

MM_ERROR generates a localized version of ERROR (default, value 0).

MM_WARNING generates a localized version of WARNING.

MM_INFO generates a localized version of INFO.

Additional severities can be defined. Add-on severities can be defined with number-string pairs with numeric values from the range [5-255], using `addsev()`. The numeric value ORed with other *flags* will generate the specified severity.

If the severity is not defined, `pfmt()` used the string `SEV=N` where *N* is replaced by the integer severity value passed in *flags*.

Multiple severities passed in *flags* will not be detected as an error. Any combination of severities will be summed and the numeric value will cause the display of either a severity string (if defined) or the string `SEV=N` (if undefined).

Action

MM_ACTION specifies an action message. Any severity value is superseded and replaced by a localized version of TO FIX.

STANDARD ERROR MESSAGE FORMAT

`pfmt()` displays error messages in the following format:

label: severity: text

If no *label* was defined by a call to `setLabel()`, the message is displayed in the format:

severity: text

If `pfmt()` is called twice to display an error message and a helpful *action* or recovery message, the output can look like:

label: severity: text

label: TO FIX: text

NAME

pfmt - display error message in standard format

SYNOPSIS

```
#include <pfmt.h>
```

```
int pfmt(FILE *stream, long flags, char *format, ... /* arg */);
```

DESCRIPTION

pfmt() retrieves a format string from a locale-specific message database (unless MM_NOGET is specified) and uses it for printf() style formatting of args. The output is displayed on stream.

pfmt() encapsulates the output in the standard error message format (unless MM_NOSTD is specified, in which case the output is simply printf() like).

If the printf() format string is to be retrieved from a message database, the format argument must have the following structure:

```
<catalog> : <msgnum> : <defmsg>.
```

If MM_NOGET is specified, only the <defmsg> part must be specified.

<catalog> is used to indicate the message database that contains the localized version of the format string. <catalog> must be limited to 14 characters. These characters must be selected from a set of all characters values, excluding \0 (null) and the ASCII codes for / (slash) and : (colon).

<msgnum> is a positive number that indicates the index of the string into the message database.

If the catalog does not exist in the locale (specified by the last call to setlocale() using the LC_ALL or LC_MESSAGES categories), or if the message number is out of bound, pfmt() will attempt to retrieve the message from the C locale. If this second retrieval fails, pfmt() uses the <defmsg> part of the format argument.

If <catalog> is omitted, pfmt() will attempt to retrieve the string from the default catalog specified by the last call to setcat(). In this case, the format argument has the following structure:

```
: <msgnum> : <defmsg>.
```

pfmt() will output Message not found!!\n as format string if <catalog> is not a valid catalog name, if no catalog is specified (either explicitly or via setcat()), if <msgnum> is not a valid number, or if no message could be retrieved from the message databases, and <defmsg> was omitted.

The flags determine the type of output (i.e. whether the format should be interpreted as is or encapsulated in the standard message format), and the access to message catalogs to retrieve a localized version of format.

The flags are composed of several groups, and can take the following values (one from each group): *Output format control*

| | |
|----------|---|
| MM_NOSTD | Do not use the standard message format, interpret format as a printf() format. Only catalog access control flags should be specified if MM_NOSTD is used; all other flags will be ignored |
|----------|---|

NAME

perror - print system error messages

SYNOPSIS

```
#include <stdio.h>
void perror (const char *s);
```

DESCRIPTION

`perror` produces a message on the standard error output (file descriptor 2), describing the last error encountered during a call to a system or library function. The argument string *s* is printed first, then a colon and a blank, then the message and a newline. (However, if *s* is a null pointer or points to a null string, the colon is not printed.) To be of most use, the argument string should include the name of the program that incurred the error. The error number is taken from the external variable `errno`, which is set when errors occur but not cleared when non-erroneous calls are made.

SEE ALSO

`intro(2)`, `fmtmsg(3C)`, `strerror(3C)`

NAME

pause - suspend process until signal

SYNOPSIS

```
#include <unistd.h>
int pause(void);
```

DESCRIPTION

pause suspends the calling process until it receives a signal. The signal must be one that is not currently set to be ignored by the calling process.

If the signal causes termination of the calling process, pause does not return.

If the signal is caught by the calling process and control is returned from the signal-catching function [see [signal\(2\)](#)], the calling process resumes execution from the point of suspension; with a return value of -1 from pause and `errno` set to `EINTR`.

SEE ALSO

[alarm\(2\)](#), [kill\(2\)](#), [signal\(2\)](#), [sigpause\(2\)](#), [wait\(2\)](#)

NAME

pathfind - search for named file in named directories

SYNOPSIS

```
cc [flag ...] file ... -lgen [library ...]
#include <libgen.h>
char *pathfind (const char *path, const char *name, const char
               *mode);
```

DESCRIPTION

pathfind searches the directories named in *path* for the file *name*. The directories named in *path* are separated by semicolons. *mode* is a string of option letters chosen from the set `rxwfbcdpugks`:

| Letter | Meaning |
|--------|-------------------|
| r | readable |
| w | writable |
| x | executable |
| f | normal file |
| b | block special |
| c | character special |
| d | directory |
| p | FIFO (pipe) |
| u | set user ID bit |
| g | set group ID bit |
| k | sticky bit |
| s | size nonzero |

Options read, write, and execute are checked relative to the real (not the effective) user ID and group ID of the current process.

If the file *name*, with all the characteristics specified by *mode*, is found in any of the directories specified by *path*, then pathfind returns a pointer to a string containing the member of *path*, followed by a slash character (/), followed by *name*.

If *name* begins with a slash, it is treated as an absolute path name, and *path* is ignored.

An empty *path* member is treated as the current directory. ./ is not prepended at the occurrence of the first match; rather, the unadorned *name* is returned.

EXAMPLES

To find the `ls` command using the `PATH` environment variable:

```
pathfind (getenv ("PATH"), "ls", "rx")
```

SEE ALSO

sh(1), test(1), access(2), mknod(2), stat(2), getenv(3C).

DIAGNOSTICS

If no match is found, pathfind returns a null pointer, ((char *) 0).

NOTES

The string pointed to by the returned pointer is stored in a static area that is reused on subsequent calls to pathfind.

panels (3X)

panels (3X)

NOTES

The header file `panel.h` automatically includes the header file `curses.h`.

SEE ALSO

`curses(3X)`, and 3X pages whose names begin with `panel_` for detailed routine descriptions.

NAME

panels - character based panels package

SYNOPSIS

```
#include <panel.h>
```

DESCRIPTION

The panel library is built using the curses library, and any program using panels routines must call one of the curses initialization routines such as `initscr`. A program using these routines must be compiled with `-lpanel` and `-lcurses` on the `cc` command line.

The panels package gives the applications programmer a way to have depth relationships between curses windows; a curses window is associated with every panel. The panels routines allow curses windows to overlap without making visible the overlapped portions of underlying windows. The initial curses window, `stdscr`, lies beneath all panels. The set of currently visible panels is the *deck* of panels.

The panels package allows the applications programmer to create panels, fetch and set their associated windows, shuffle panels in the deck, and manipulate panels in other ways.

Routine Name Index

The following table lists each panels routine and the name of the manual page on which it is described.

| panels Routine Name | Manual Page Name |
|--------------------------------|--------------------------------|
| <code>bottom_panel</code> | <code>panel_top(3X)</code> |
| <code>del_panel</code> | <code>panel_new(3X)</code> |
| <code>hide_panel</code> | <code>panel_show(3X)</code> |
| <code>move_panel</code> | <code>panel_move(3X)</code> |
| <code>new_panel</code> | <code>panel_new(3X)</code> |
| <code>panel_above</code> | <code>panel_above(3X)</code> |
| <code>panel_below</code> | <code>panel_above(3X)</code> |
| <code>panel_hidden</code> | <code>panel_show(3X)</code> |
| <code>panel_userptr</code> | <code>panel_userptr(3X)</code> |
| <code>panel_window</code> | <code>panel_window(3X)</code> |
| <code>replace_panel</code> | <code>panel_window(3X)</code> |
| <code>set_panel_userptr</code> | <code>panel_userptr(3X)</code> |
| <code>show_panel</code> | <code>panel_show(3X)</code> |
| <code>top_panel</code> | <code>panel_top(3X)</code> |
| <code>update_panels</code> | <code>panel_update(3X)</code> |

RETURN VALUE

Each panels routine that returns a pointer to an object returns `NULL` if an error occurs. Each panel routine that returns an integer, returns `OK` if it executes successfully and `ERR` if it does not.

panel_window(3X)

panel_window(3X)

NAME

`panel_window`: `panel_window`, `replace_panel` - get or set the current window of a panels `panel`

SYNOPSIS

```
#include <panel.h>
```

```
WINDOW *panel_window(PANEL *panel);
```

```
int replace_panel(PANEL *panel, WINDOW *win);
```

DESCRIPTION

`panel_window` returns a pointer to the window of *panel*.

`replace_panel` replaces the current window of *panel* with *win*.

RETURN VALUE

`panel_window` returns NULL on failure.

`replace_panel` returns OK on successful completion, ERR otherwise.

NOTES

The header file `panel.h` automatically includes the header file `curses.h`.

SEE ALSO

`curses(3X)`, `panels(3X)`

panel_userptr(3X)

panel_userptr(3X)

NAME

`panel_userptr`: `set_panel_userptr`, `panel_userptr` - associate application data with a panels `panel`

SYNOPSIS

```
#include <panel.h>

int set_panel_userptr(PANEL *panel, char *ptr);
char * panel_userptr(PANEL *panel);
```

DESCRIPTION

Each panel has a user pointer available for maintaining relevant information.

`set_panel_userptr` sets the user pointer of *panel* to *ptr*.

`panel_userptr` returns the user pointer of *panel*.

RETURN VALUE

`set_panel_userptr` returns OK if successful, ERR otherwise.

`panel_userptr` returns NULL if there is no user pointer assigned to *panel*.

NOTES

The header file `panel.h` automatically includes the header file `curses.h`.

SEE ALSO

`curses(3X)`, `panels(3X)`

panel_update (3X)

panel_update (3X)

NAME

panel_update: update_panels - panels virtual screen refresh routine

SYNOPSIS

```
#include <panel.h>
```

```
void update_panels(void);
```

DESCRIPTION

update_panels refreshes the virtual screen to reflect the depth relationships between the panels in the deck. The user must use the curses library call douupdate [see curs_refresh(3X)] to refresh the physical screen.

NOTES

The header file panel.h automatically includes the header file curses.h.

SEE ALSO

curses(3X), panels(3X), curs_refresh(3X)

panel_top(3X)

panel_top(3X)

NAME

panel_top: top_panel, bottom_panel - panels deck manipulation routines

SYNOPSIS

```
#include <panel.h>

int top_panel(PANEL *panel);
int bottom_panel(PANEL *panel);
```

DESCRIPTION

top_panel pulls *panel* to the top of the desk of panels. It leaves the size, location, and contents of its associated window unchanged.

bottom_panel puts *panel* at the bottom of the desk of panels. It leaves the size, location, and contents of its associated window unchanged.

RETURN VALUE

All of these routines return the integer OK upon successful completion or ERR upon error.

NOTES

The header file panel.h automatically includes the header file curses.h.

SEE ALSO

curses(3X), panels(3X), panel_update(3X)

panel_show(3X)

panel_show(3X)

NAME

panel_show: show_panel, hide_panel, panel_hidden - panels deck manipulation routines

SYNOPSIS

```
#include <panel.h>

int show_panel(PANEL *panel);
int hide_panel(PANEL *panel);
int panel_hidden(PANEL *panel);
```

DESCRIPTION

show_panel makes *panel*, previously hidden, visible and places it on top of the deck of panels.

hide_panel removes *panel* from the panel deck and, thus, hides it from view. The internal data structure of the panel is retained.

panel_hidden returns TRUE (1) or FALSE (0) indicating whether or not *panel* is in the deck of panels.

RETURN VALUE

show_panel and hide_panel return the integer OK upon successful completion or ERR upon error.

NOTES

The header file panel.h automatically includes the header file curses.h.

SEE ALSO

curses(3X), panels(3X), panel_update(3X)

panel_new(3X)

panel_new(3X)

NAME

panel_new: new_panel, del_panel - create and destroy panels

SYNOPSIS

```
#include <panel.h>
```

```
PANEL *new_panel(WINDOW *win);
```

```
int del_panel(PANEL *panel);
```

DESCRIPTION

`new_panel` creates a new panel associated with *win* and returns the panel pointer. The new panel is placed on top of the panel deck.

`del_panel` destroys *panel*, but not its associated window.

RETURN VALUE

`new_panel` returns NULL if an error occurs.

`del_win` returns OK if successful, ERR otherwise.

NOTES

The header file `panel.h` automatically includes the header file `curses.h`.

SEE ALSO

`curses(3X)`, `panels(3X)`, `panel_update(3X)`

panel_move(3X)

panel_move(3X)

NAME

panel_move: move_panel - move a panels window on the virtual screen

SYNOPSIS

```
#include <panel.h>
```

```
int move_panel(PANEL *panel, int starty, int startx);
```

DESCRIPTION

`move_panel` moves the curses window associated with *panel* so that its upper left-hand corner is at *starty*, *startx*. See usage note, below.

RETURN VALUE

OK is returned if the routine completes successfully, otherwise ERR is returned.

NOTES

For panels windows, use `move_panel` instead of the `mvwin` curses routine. Otherwise, `update_panels` will not properly update the virtual screen.

The header file `panel.h` automatically includes the header file `curses.h`.

SEE ALSO

`curses(3X)`, `panels(3X)`, `panel_update(3X)`

panel_above(3X)

panel_above(3X)

NAME

panel_above: panel_above, panel_below - panels deck traversal primitives

SYNOPSIS

```
#include <panel.h>

PANEL *panel_above(PANEL *panel);
PANEL *panel_below(PANEL *panel);
```

DESCRIPTION

panel_above returns a pointer to the panel just above *panel*, or NULL if *panel* is the top panel. panel_below returns a pointer to the panel just below *panel*, or NULL if *panel* is the bottom panel.

If NULL is passed for *panel*, panel_above returns a pointer to the bottom panel in the deck, and panel_below returns a pointer to the top panel in the deck.

RETURN VALUE

NULL is returned if an error occurs.

NOTES

These routines allow traversal of the deck of currently visible panels.

The header file panel.h automatically includes the header file curses.h.

SEE ALSO

curses(3X), panels(3X)

NAME

p_online - turn a processor online or offline

SYNOPSIS

```
#include <sys/types.h>
#include <sys/processor.h>
```

```
p_online (processorid_t processorid, int flag);
```

DESCRIPTION

p_online brings a processor online or takes it offline. When a processor is online, it is performing normal operations, scheduling and executing processes, and servicing any I/O devices to which it has access.

If flag is P_ONLINE, the named processor is brought online. If the processor was already online, nothing is done. The previous state of the processor (P_ONLINE or P_OFFLINE) is returned.

If flag is P_OFFLINE, the named processor is shut down and taken offline. If the processor was already offline, nothing is done. The previous state of the processor is returned. An attempt to take a processor offline may fail for several reasons:

One or more processes are bound to the processor.

The processor is the only online processor.

The processor performs some essential system function which cannot be taken over by another processor.

The calling process must have superuser privileges to bring a processor online or take it offline.

DIAGNOSTICS

p_online returns P_ONLINE or P_OFFLINE on success, or -1 on failure. Failure may result from:

| | |
|--------|--|
| EPERM | The calling process does not have appropriate privileges. |
| EINVAL | The processorid does not refer to an existing processor, or the processor for P_OFFLINE cannot be taken offline, or the flag has an invalid value. |
| EBUSY | The processorid for P_OFFLINE refers to a processor with processes bound to it. |
| EIO | The processor to which processorid refers is non-operational. |

SEE ALSO

offline(1M), online(1M)

NOTES

Buffered writes on `fp[0]` can make it appear that the command is not listening. Judiciously placed `fflush` calls or unbuffering `fp[0]` can be a big help; see `fclose(3S)`.

Many commands use buffered output when connected to a pipe. That, too, can make it appear as if things are not working.

Usage is not the same as for `popen`, although it is closely related.

NAME

p2open, p2close - open, close pipes to and from a command

SYNOPSIS

```
cc [flag ...] file ... -lgen [library ...]
#include <libgen.h>
int p2open (const char *cmd, FILE *fp[2]);
int p2close (FILE *fp[2]);
```

DESCRIPTION

p2open forks and execs a shell running the command line pointed to by *cmd*. On return, fp[0] points to a FILE pointer to write the command's standard input and fp[1] points to a FILE pointer to read from the command's standard output. In this way the program has control over the input and output of the command.

The function returns 0 if successful; otherwise it returns -1.

p2close is used to close the file pointers that p2open opened. It waits for the process to terminate and returns the process status. It returns 0 if successful; otherwise it returns -1.

EXAMPLES

```
#include <stdio.h>
#include <libgen.h>

main(argc, argv)
int argc;
char **argv;
{
    FILE *fp[2];
    pid_t pid;
    char buf[16];

    pid=p2open("/usr/bin/cat", fp);
    if ( pid == 0 ) {
        fprintf(stderr, "p2open failed\n");
        exit(1);
    }
    write(fileno(fp[0]), "This is a test\n", 16);
    if(read(fileno(fp[1]), buf, 16) <=0)
        fprintf(stderr, "p2open failed\n");
    else
        write(1, buf, 16);
    (void)p2close(fp);
}
```

SEE ALSO

fclose(3S), popen(3S), setbuf(3S)

DIAGNOSTICS

A common problem is having too few file descriptors. p2close returns -1 if the two file pointers are not from the same p2open.

NAME

opensem - open a semaphore

SYNOPSIS

```
cc [flag ...] file ... -lx
int opensem(char *sem_name);
```

DESCRIPTION

opensem opens a semaphore named by *sem_name* and returns the unique semaphore identification number *sem_num* used by waitsem and sigsem. creatsem should always be called to initialize the semaphore before the first attempt to open it.

DIAGNOSTICS

opensem returns a value of -1 if an error occurs. If the semaphore named does not exist, errno is set to ENOENT. If the file specified is not a semaphore file (that is, a file previously created by a process using a call to creatsem), errno is set to ENOTNAM. If the semaphore has become invalid due to inappropriate use, errno is set to ENAVAIL.

SEE ALSO

creatsem(2), sigsem(2), waitsem(2)

NOTES

It is not advisable to open the same semaphore more than once. Although it is possible to do this, it may result in a deadlock.

open (2)

open (2)

| | |
|---------|---|
| ENOTDIR | A component of the path prefix is not a directory. |
| ENXIO | The named file is a character special or block special file, and the device associated with this special file does not exist. |
| ENXIO | O_NDELAY or O_NONBLOCK is set, the named file is a FIFO, O_WRONLY is set, and no process has the file open for reading. |
| ENXIO | A STREAMS module or driver open routine failed. |
| EROFS | The named file resides on a read-only file system and either O_WRONLY, O_RDWR, O_CREAT, or O_TRUNC is set in <i>oflag</i> (if the file does not exist). |

NOTE

On some previous versions of the UNIX operating system an application could not open a file for writing which was the executable for a running process. System V Release 4 does not enforce that restriction.

SEE ALSO

intro(2), chmod(2), close(2), creat(2), dup(2), exec(2), fcntl(2), getrlimit(2), lseek(2), read(2), getmsg(2), putmsg(2), stat(2), umask(2), write(2), stat(5)

DIAGNOSTICS

Upon successful completion, the file descriptor is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

open(2)

open(2)

The named file is opened unless one or more of the following are true:

| | |
|--------------|--|
| EACCES | The file does not exist and write permission is denied by the parent directory of the file to be created. |
| EACCES | O_TRUNC is specified and write permission is denied |
| EACCES | A component of the path prefix denies search permission. |
| EACCES | <i>oflag</i> permission is denied for an existing file. |
| EAGAIN | The file exists, mandatory file/record locking is set, and there are outstanding record locks on the file [see <code>chmod(2)</code>]. |
| EAGAIN | O_NDELAY or O_NONBLOCK is set, the named file is a STREAMS device and there is another process trying to open it at the same time. |
| EEXIST | O_CREAT and O_EXCL are set, and the named file exists. |
| EFAULT | <i>path</i> points outside the allocated address space of the process. |
| EINTR | A signal was caught during the <code>open</code> system call. |
| EIO | A hangup or error occurred during the open of the STREAMS-based device. |
| EISDIR | The named file is a directory and <i>oflag</i> is write or read/write. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMFILE | The process has too many open files [see <code>getrlimit(2)</code>]. |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and the file system does not allow it. |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds {PATH_MAX}, or the length of a <i>path</i> component exceeds {NAME_MAX} while {_POSIX_NO_TRUNC} is in effect. |
| ENFILE | The system file table is full. |
| ENOENT | O_CREAT is not set and the named file does not exist. |
| ENOENT | O_CREAT is set and a component of the path prefix does not exist or is the null pathname. |
| ENOLINK | <i>path</i> points to a remote machine, and the link to that machine is no longer active. |
| ENOMEM | The system is unable to allocate a send descriptor. |
| ENOSPC | O_CREAT and O_EXCL are set, and the file system is out of inodes. |
| ENOSPC | O_CREAT is set and the directory that would contain the file cannot be extended. |
| ENOSR | Unable to allocate a stream. |

open(2)

open(2)

- O_CREAT** If the file exists, this flag has no effect, except as noted under **O_EXCL** below. Otherwise, the file is created and the owner ID of the file is set to the effective user ID of the process, the group ID of the file is set to the effective group ID of the process, or if the **S_ISGID** bit is set in the directory in which the file is being created, the file's group ID is set to the group ID of its parent directory. If the group ID of the new file does not match the effective group ID or one of the supplementary groups IDs, the **S_ISGID** bit is cleared. The access permission bits of the file mode are set to the value of *mode*, modified as follows [see **creat(2)**]:
- All bits set in the file mode creation mask of the process are cleared [see **umask(2)**].
 - The "save text image after execution bit" of the mode is cleared [see **chmod(2)**].
- O_TRUNC** If the file exists, its length is truncated to 0 and the mode and owner are unchanged. **O_TRUNC** has no effect on FIFO special files or directories.
- O_EXCL** If **O_EXCL** and **O_CREAT** are set, **open** will fail if the file exists. The check for the existence of the file and the creation of the file if it does not exist is atomic with respect to other processes executing **open** naming the same filename in the same directory with **O_EXCL** and **O_CREAT** set.

When opening a STREAMS file, *oflag* may be constructed from **O_NDELAY** or **O_NONBLOCK** OR-ed with either **O_RDONLY**, **O_WRONLY** , or **O_RDWR**. Other flag values are not applicable to STREAMS devices and have no effect on them. The values of **O_NDELAY** and **O_NONBLOCK** affect the operation of STREAMS drivers and certain system calls [see **read(2)**, **getmsg(2)**, **putmsg(2)**, and **write(2)**]. For drivers, the implementation of **O_NDELAY** and **O_NONBLOCK** is device specific. Each STREAMS device driver may treat these options differently.

When **open** is invoked to open a named stream, and the **connld** module [see **connld(7)**] has been pushed on the pipe, **open** blocks until the server process has issued an **I_RECVFD** *ioctl* [see **streamio(7)**] to receive the file descriptor.

If *path* is a symbolic link and **O_CREAT** and **O_EXCL** are set, the link is not followed.

The file pointer used to mark the current position within the file is set to the beginning of the file.

The new file descriptor is the lowest numbered file descriptor available and is set to remain open across **exec** system calls [see **fcntl(2)**].

Certain flag values can be set following **open** as described in **fcntl(2)**.

If **O_CREAT** is set and the file did not previously exist, upon successful completion **open** marks for update the **st_atime**, **st_ctime** and **st_mtime** fields of the file and the **st_ctime** and **st_mtime** fields of the parent directory.

If **O_TRUNC** is set and the file did previously exist, upon successful completion **open** marks for update the **st_ctime** and **st_mtime** fields of the file.

open(2)

open(2)

NAME

open - open for reading or writing

SYNOPSIS

```
#include <sys/types.h>
#include <sys/stat.h>
#include <fcntl.h>

int open (const char *path, int oflag, ... /* mode_t mode */);
```

DESCRIPTION

path points to a path name naming a file. `open` opens a file descriptor for the named file and sets the file status flags according to the value of *oflag*. *oflag* values are constructed by OR-ing flags from the following list (only one of the first three flags below may be used):

`O_RDONLY` Open for reading only.
`O_WRONLY` Open for writing only.
`O_RDWR` Open for reading and writing.

`O_NDELAY` or `O_NONBLOCK`

These flags may affect subsequent reads and writes [see `read(2)` and `write(2)`]. If both `O_NDELAY` and `O_NONBLOCK` are set, `O_NONBLOCK` will take precedence.

When opening a FIFO with `O_RDONLY` or `O_WRONLY` set:

If `O_NDELAY` or `O_NONBLOCK` is set: An open for reading-only will return without delay; an open for writing-only will return an error if no process currently has the file open for reading.

If `O_NDELAY` and `O_NONBLOCK` are clear: An open for reading-only will block until a process opens the file for writing; an open for writing-only will block until a process opens the file for reading.

When opening a block-special or character-special file:

If `O_NDELAY` or `O_NONBLOCK` is set: The open will return without waiting for the device to be ready or available; subsequent behavior of the device is device specific.

If `O_NDELAY` and `O_NONBLOCK` are clear: The open will block until the device is ready or available.

`O_APPEND` If set, the file pointer will be set to the end of the file prior to each write.

`O_SYNC` When opening a regular file, this flag affects subsequent writes. If set, each `write(2)` will wait for both the file data and file status to be physically updated.

`O_NOCTTY` If set and the file is a terminal, the terminal will not be allocated as the calling process's controlling terminal.

NAME

offsetof - offset of structure member

SYNOPSIS

```
#include <stddef.h>
size_t offsetof (type, member-designator);
```

DESCRIPTION

offsetof is a macro defined in `stddef.h` which expands to an integral constant expression that has type `size_t`, the value of which is the offset in bytes, to the structure member (designated by *member-designator*), from the beginning of its structure (designated by *type*).

NAME

nlsrequest - format and send listener service request message

SYNOPSIS

```
#include <listen.h>

int nlsrequest (int fd, char *service_code);

extern int _nlslog, t_errno;
extern char *_nlsrmsg;
```

DESCRIPTION

Given a virtual circuit to a listener process (*fd*) and a service code of a server process, nlsrequest formats and sends a *service request message* to the remote listener process requesting that it start the given service. nlsrequest waits for the remote listener process to return a *service request response message*, which is made available to the caller in the static, null terminated data buffer pointed to by *_nlsrmsg*. The *service request response message* includes a success or failure code and a text message. The entire message is printable.

SEE ALSO

nlsadmin(1), t_error(3)

FILES

/usr/lib/libnls.a
/usr/lib/libnls_s.a

DIAGNOSTICS

The success or failure code is the integer return code from nlsrequest. Zero indicates success, other negative values indicate nlsrequest failures as follows:

-1: Error encountered by nlsrequest, see t_errno.

Positive values are error return codes from the *listener* process. Mnemonics for these codes are defined in <listen.h>.

- 2: Request message not interpretable.
- 3: Request service code unknown.
- 4: Service code known, but currently disabled.

If non-null, *_nlsrmsg* contains a pointer to a static, null terminated character buffer containing the *service request response message*. Note that both *_nlsrmsg* and the data buffer are overwritten by each call to nlsrequest.

If *_nlslog* is non-zero, nlsrequest prints error messages on stderr. Initially, *_nlslog* is zero.

NOTES

nlsrequest cannot always be certain that the remote server process has been successfully started. In this case, nlsrequest returns with no indication of an error and the caller will receive notification of a disconnect event via a T_LOOK error before or during the first t_snd or t_rcv call.

NAME

nlsprovider - get name of transport provider

SYNOPSIS

```
char *nlsprovider();
```

DESCRIPTION

nlsprovider returns a pointer to a null terminated character string which contains the name of the transport provider as placed in the environment by the listener process. If the variable is not defined in the environment, a NULL pointer is returned.

The environment variable is only available to server processes started by the listener process.

SEE ALSO

nlsadmin(1M)

DIAGNOSTICS

If the variable is not defined in the environment, a NULL pointer is returned.

FILES

```
/usr/lib/libnls.a  
/usr/lib/libnsl_s.a
```

NAME

nlsgetcall - get client's data passed via the listener

SYNOPSIS

```
#include <sys/tiuser.h>
struct t_call *nlsgetcall (int fd);
```

DESCRIPTION

nlsgetcall allows server processes started by the listener process to access the client's `t_call` structure, that is, the `sndcall` argument of `t_connect(3N)`.

The `t_call` structure returned by `nlsgetcall` can be released using `t_free(3N)`.

`nlsgetcall` returns the address of an allocated `t_call` structure or `NULL` if a `t_call` structure cannot be allocated. If the `t_alloc` succeeds, undefined environment variables are indicated by a negative `len` field in the appropriate `netbuf` structure. A `len` field of zero in the `netbuf` structure is valid and means that the original buffer in the listener's `t_call` structure was `NULL`.

NOTES

The `len` field in the `netbuf` structure is defined as being unsigned. In order to check for error returns, it should first be cast to an int.

The listener process limits the amount of user data (`udata`) and options data (`opt`) to 128 bytes each. Address data `addr` is limited to 64 bytes. If the original data was longer, no indication of overflow is given.

Server processes must call `t_sync(3N)` before calling this routine.

DIAGNOSTICS

A `NULL` pointer is returned if a `t_call` structure cannot be allocated by `t_alloc`. `t_errno` can be inspected for further error information. Undefined environment variables are indicated by a negative length field (`len`) in the appropriate `netbuf` structure.

FILES

```
/usr/lib/libnsl_s.a
/usr/lib/libnls.a
```

SEE ALSO

`nlsadmin(1)`, `getenv(3)`, `t_connect(3N)`, `t_alloc(3N)`, `t_free(3N)`, `t_error(3N)`

NAME

nlist - get entries from symbol table

SYNOPSIS

```
/usr/ucb/cc [flag...]file...  
  
#include <nlist.h>  
  
int nlist(filename, nl)  
char *filename;  
struct nlist *nl;
```

DESCRIPTION

nlist examines the symbol table from the executable image whose name is pointed to by *filename*, and selectively extracts a list of values and puts them in the array of nlist structures pointed to by *nl*. The name list pointed to by *nl* consists of an array of structures containing names, types and values. The *n_name* field of each such structure is taken to be a pointer to a character string representing a symbol name. The list is terminated by an entry with a NULL pointer (or a pointer to a NULL string) in the *n_name* field. For each entry in *nl*, if the named symbol is present in the executable image's symbol table, its value and type are placed in the *n_value* and *n_type* fields. If a symbol cannot be located, the corresponding *n_type* field of *nl* is set to zero.

RETURN VALUE

Upon normal completion, nlist returns the number of symbols that were not located in the symbol table. If an error occurs, nlist returns -1 and sets all of the *n_type* fields in members of the array pointed to by *nl* to zero.

SEE ALSO

a.out(4).

NAME

nlist - get entries from name list

SYNOPSIS

```
cc [flag ...] file ... -lself [library ...]
#include <nlist.h>
int nlist (const char *filename, struct nlist *nl);
```

DESCRIPTION

nlist examines the name list in the executable file whose name is pointed to by *filename*, and selectively extracts a list of values and puts them in the array of nlist structures pointed to by *nl*. The name list *nl* consists of an array of structures containing names of variables, types, and values. The list is terminated with a null name, that is, a null string is in the name position of the structure. Each variable name is looked up in the name list of the file. If the name is found, the type, value, storage class, and section number of the name are inserted in the other fields. The type field may be set to 0 if the file was not compiled with the `-g` option to `cc(1)`. nlist will always return the information for an external symbol of a given name if the name exists in the file. If an external symbol does not exist, and there is more than one symbol with the specified name in the file (such as static symbols defined in separate files), the values returned will be for the last occurrence of that name in the file. If the name is not found, all fields in the structure except `n_name` are set to 0.

This function is useful for examining the system name list kept in the file `/stand/unix`. In this way programs can obtain system addresses that are up to date.

SEE ALSO

`a.out(4)`

DIAGNOSTICS

All value entries are set to 0 if the file cannot be read or if it does not contain a valid name list.

nlist returns 0 on success, -1 on error.

NAME

nl_types - native language data types

SYNOPSIS

```
#include <nl_types.h>
```

DESCRIPTION

This header file contains the following definitions:

| | |
|-------------|--|
| nl_catd | used by the message catalog functions <code>catopen</code> , <code>catgets</code> and <code>catclose</code> to identify a catalog |
| nl_item | used by <code>nl_langinfo</code> to identify items of <code>langinfo</code> data. Values for objects of type <code>nl_item</code> are defined in <code>langinfo.h</code> |
| NL_SETD | used by <code>gencat</code> when no <code>\$set</code> directive is specified in a message text source file. This constant can be used in subsequent calls to <code>catgets</code> as the value of the set identifier parameter. |
| NL_MGSMAX | maximum number of messages per set |
| NL_SETMAX | maximum number of sets per catalog |
| NL_TEXTMAX | maximum size of a message |
| DEF_NLSPATH | the default search path for locating catalogs |

SEE ALSO

`gencat(1M)`, `catgets(3C)`, `catopen(3C)`, `nl_langinfo(3C)`, `langinfo(5)`.

NAME

nl_langinfo - language information

SYNOPSIS

```
#include <nl_types.h>
#include <langinfo.h>
char *nl_langinfo (nl_item item);
```

DESCRIPTION

nl_langinfo returns a pointer to a null-terminated string containing information relevant to a particular language or cultural area defined in the programs locale. The manifest constant names and values of *item* are defined by langinfo.h.

For example:

```
nl_langinfo (ABDAY_1);
```

would return a pointer to the string "Dim" if the identified language was French and a French locale was correctly installed; or "Sun" if the identified language was English.

SEE ALSO

gettext(3C), localeconv(3C), setlocale(3C), strftime(3C), langinfo(5), nl_types(5)

DIAGNOSTICS

If setlocale has not been called successfully, or if langinfo data for a supported language is either not available or *item* is not defined therein, then nl_langinfo returns a pointer to the corresponding string in the C locale. In all locales, nl_langinfo returns a pointer to an empty string if *item* contains an invalid setting.

NOTES

The array pointed to by the return value should not be modified by the program. Subsequent calls to nl_langinfo may overwrite the array.

The nl_langinfo function is built upon the functions localeconv, strftime, and gettext [see langinfo(5)]. Where possible users are advised to use these interfaces to the required data instead of using calls to nl_langinfo.

NAME

nice - change priority of a process

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
```

```
int nice(incr)
int incr;
```

DESCRIPTION

The scheduling priority of the process is augmented by *incr*. Positive priorities get less service than normal. Priority 10 is recommended to users who wish to execute long-running programs without undue impact on system performance.

Negative increments are illegal, except when specified by the privileged user. The priority is limited to the range -20 (most urgent) to 20 (least). Requests for values above or below these limits result in the scheduling priority being set to the corresponding limit.

The priority of a process is passed to a child process by `fork(2)`. For a privileged process to return to normal priority from an unknown state, `nice` should be called successively with arguments -40 (goes to priority -20 because of truncation), 20 (to get to 0), then 0 (to maintain compatibility with previous versions of this call).

RETURN VALUE

Upon successful completion, `nice` returns 0. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

ERRORS

The priority is not changed if:

`EACCES` The value of *incr* specified was negative, and the effective user ID is not the privileged user.

SEE ALSO

`nice(1)`, `renice(1M)`, `prctl(2)`, `fork(2)`, `getpriority(2)`, `prctl(2)`.

nice(2)

nice(2)

NAME

nice - change priority of a time-sharing process

SYNOPSIS

```
#include <unistd.h>
int nice(int incr);
```

DESCRIPTION

nice allows a process in the time-sharing scheduling class to change its priority. The `prctl` system call is a more general interface to scheduler functions.

nice adds the value of *incr* to the nice value of the calling process. A process's nice value is a non-negative number for which a more positive value results in lower CPU priority.

A maximum nice value of 39 and a minimum nice value of 0 are imposed by the system. (The default nice value is 20.) Requests for values above or below these limits result in the nice value being set to the corresponding limit.

`EPERM` nice fails and does not change the nice value if *incr* is negative or greater than 39 and the effective user ID of the calling process is not super-user.

`EINVAL` nice fails if called by a process in a scheduling class other than time-sharing.

SEE ALSO

nice(1), exec(2), prctl(2).

DIAGNOSTICS

Upon successful completion, nice returns the new nice value minus 20. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

The specific actions of each option follow.

ND_SET_BROADCAST Sets the transport provider up to allow broadcast, if the transport supports broadcast. *fd* is a file descriptor into the transport (that is, the result of a `t_open` of `/dev/udp`). *pointer_to_args* is not used. If this completes, broadcast operations may be performed on file descriptor *fd*.

ND_SET_RESERVEDPORT Allows the application to bind to a reserved port, if that concept exists for the transport provider. *fd* is a file descriptor into the transport (it must not be bound to an address). If *pointer_to_args* is `NULL`, *fd* will be bound to a reserved port. If *pointer_to_args* is a pointer to a `netbuf` structure, an attempt will be made to bind to a reserved port on the specified address.

ND_CHECK_RESERVEDPORT Used to verify that an address corresponds to a reserved port, if that concept exists for the transport provider. *fd* is not used. *pointer_to_args* is a pointer to a `netbuf` structure that contains an address. This option returns 0 only if the address specified in *pointer_to_args* is reserved.

ND_MERGEADDR Used to take a "local address" (like the 0.0.0.0 address that TCP uses) and return a "real address" that client machines can connect to. *fd* is not used. *pointer_to_args* is a pointer to a `struct nd_mergearg`, which has the following members:

```
char *s_uaddr; /* server's universal address */
char *c_uaddr; /* client's universal address */
char *m_uaddr; /* merged universal address */
```

s_uaddr is something like 0.0.0.0.1.12, and, if the call is successful, *m_uaddr* will be set to something like 192.11.109.89.1.12. For most transports, *m_uaddr* is exactly what *s_uaddr* is.

The `netdir_perror()` routine prints an error message on the standard output stating why one of the name-to-address mapping routines failed. The error message is preceded by the string given as an argument.

The `netdir_serror` routine returns a string containing an error message stating why one of the name-to-address mapping routines failed.

SEE ALSO

`getnetpath(3N)`.

- HOST_SELF** Represents the address to which local programs will bind their endpoints. **HOST_SELF** differs from the host name provided by `gethostname()`, which represents the address to which *remote* programs will bind their endpoints.
- HOST_ANY** Represents any host accessible by this transport provider. **HOST_ANY** allows applications to specify a required service without specifying a particular host name.
- HOST_BROADCAST** Represents the address for all hosts accessible by this transport provider. Network requests to this address will be received by all machines.

All fields of the `nd_hostserv` structure must be initialized.

To find all available transports, call the `netdir_getbyname` routine with each `netconfig` structure returned by the `getnetpath` call.

The `netdir_getbyaddr` routine maps addresses to service names. This routine returns a list of host and service pairs that would yield this address. If more than one tuple of host and service name is returned then the first tuple contains the preferred host and service names. The `nd_hostservlist` structure contains the following members:

```
int    h_cnt;           /* the number of nd_hostservs */
struct hostserv *h_hostservs; /* the entries */
```

The `netdir_free` structure is used to free the structures allocated by the name to address translation routines.

The `netdir_options` routine is used by a network service to return an optimized network addresses to a client. This routine takes the universal address of the endpoint that the service has bound to, which is pointed to by the `s_uaddr` parameter, and the address of the endpoint that a request came in on, which is pointed to by the `c_uaddr` parameter, to create an optimized address for communication with the service. The service address should be an address returned by the `netdir_getbyname` call, specified with the special host name `HOST_SELF`.

The `taddr2uaddr` and `uaddr2taddr` routines support translation between universal addresses and TLI type netbufs. They take and return character string pointers. The `taddr2uaddr` routine returns a pointer to a string that contains the universal address and returns `NULL` if the conversion is not possible. This is not a fatal condition as some transports may not support a universal address form.

option, *fd*, and *pointer_to_args* are passed to the `netdir_options` routine for the transport specified in `netconfigp`. There are four values for *option*:

```
ND_SET_BROADCAST
ND_SET_RESERVEDPORT
ND_CHECK_RESERVEDPORT
ND_MERGEADDR
```

If a transport provider does not support an option, `netdir_options` returns `-1` and sets `_nderror` to `ND_NOCTRL`.

NAME

netdir_getbyname, netdir_getbyaddr, netdir_free, taddr2uaddr, uaddr2taddr, netdir_perror, netdir_sperror - generic transport name-to-address translation

SYNOPSIS

```
#include <netdir.h>

int netdir_getbyname(struct netconfig *config, struct nd_hostserv
    *service, struct nd_addrlist **addrs);

int netdir_getbyaddr(struct netconfig *config, struct
    nd_hostservlist **service, struct netbuf *netaddr);

void netdir_free(void *ptr, int ident);

char *taddr2uaddr(struct netconfig *config, struct netbuf *addr);
struct netbuf *uaddr2taddr(struct netconfig *config, char *uaddr);
int netdir_options(struct netconfig *netconfig, int option, int fd,
    char *pointer_to_args);

void netdir_perror(char *s);
char *netdir_sperror(void);
```

DESCRIPTION

These routines provide a generic interface for name-to-address mapping that will work with all transport protocols. This interface provides a generic way for programs to convert transport specific addresses into common structures and back again.

The `netdir_getbyname` routine maps the machine name and service name in the `nd_hostserv` structure to a collection of addresses of the type understood by the transport identified in the `netconfig` structure. This routine returns all addresses that are valid for that transport in the `nd_addrlist` structure. The `netconfig` structure is described on the `netconfig(4)` manual page. The `nd_hostserv` and `nd_addrlist` structures have the following elements.

```
nd_addrlist structure:
    int      n_cnt;          /* number of netbufs */
    struct netbuf *n_addrs; /* the netbufs */

nd_hostserv structure:
    char *h_host; /* the host name */
    char *h_serv; /* the service name */
```

`netdir_getbyname` accepts some special-case host names. These host names are hints to the underlying mapping routines that define the intent of the request. This information is required for some transport provider developers to provide the correct information back to the caller. The host names are defined in `netdir.h`. The currently defined host names are:

```
for (key = dbm_firstkey(db); key.dptr != NULL; key = dbm_nextkey(db))
dbm_error returns non-zero when an error has occurred reading or writing the
data base. dbm_clearerr resets the error condition on the named data base.
```

SEE ALSO

open(2), dbm(3X)

RETURN VALUE

All functions that return an `int` indicate errors with negative values. A zero return indicates no error. Routines that return a `datum` indicate errors with a `NULL` (0) `dptr`. If `dbm_store` is called with a `flags` value of `DBM_INSERT` and finds an existing entry with the same key, it returns 1.

NOTES

The `.pag` file will contain holes so that its apparent size is about four times its actual content. Older versions of the UNIX operating system may create real file blocks for these holes when touched. These files cannot be copied by normal means [that is, `cp(1)`, `cat(1)`, `tar(1)`, `ar(1)`] without filling in the holes.

`dptr` pointers returned by these subroutines point into static storage that is changed by subsequent calls.

The sum of the sizes of a `key/content` pair must not exceed the internal block size (currently 4096 bytes). Moreover all `key/content` pairs that hash together must fit on a single block. `dbm_store` will return an error in the event that a disk block fills with inseparable data.

`dbm_delete` does not physically reclaim file space, although it does make it available for reuse.

The order of keys presented by `dbm_firstkey` and `dbm_nextkey` depends on a hashing function.

There are no interlocks and no reliable cache flushing; thus concurrent updating and reading is risky.

NAME

ndbm: dbm_clearerr, dbm_close, dbm_delete, dbm_error, dbm_fetch, dbm_firstkey, dbm_nextkey, dbm_open, dbm_store - data base subroutines

SYNOPSIS

```
/usr/ucb/cc [flag...] file

#include <ndbm.h>

typedef struct {
    char *dptr;
    int dsize;
} datum;

int dbm_clearerr(DBM *db);
void dbm_close(DBM *db);
int dbm_delete(DBM *db, datum key);
int dbm_error(DBM *db);
datum dbm_fetch(DBM *db, datum key);
datum dbm_firstkey(DBM *db);
datum dbm_nextkey(DBM *db);
DBM *dbm_open(char *file, int flags, int mode);
int dbm_store(DBM *db, datum key, datum content, int flags);
```

DESCRIPTION

These functions maintain *key/content* pairs in a data base. The functions will handle very large (a billion blocks) data base and will access a keyed item in one or two file system accesses. This package replaces the earlier dbm(3X) library, which managed only a single data base.

keys and *contents* are described by the datum typedef. A datum specifies a string of *dsize* bytes pointed to by *dptr*. Arbitrary binary data, as well as normal ASCII strings, are allowed. The data base is stored in two files. One file is a directory containing a bit map and has *.dir* as its suffix. The second file contains all data and has *.pag* as its suffix.

Before a data base can be accessed, it must be opened by `dbm_open`. This will open and/or create the files *file.dir* and *file.pag* depending on the *flags* parameter [see `open(2)`].

A data base is closed by calling `dbm_close`.

Once open, the data stored under a key is accessed by `dbm_fetch` and data is placed under a key by `dbm_store`. The *flags* field can be either `DBM_INSERT` or `DEM_REPLACE`. `DBM_INSERT` will only insert new entries into the data base and will not change an existing entry with the same key. `DEM_REPLACE` will replace an existing entry if it has the same key. A key (and its associated contents) is deleted by `dbm_delete`. A linear pass through all keys in a data base may be made, in an (apparently) random order, by use of `dbm_firstkey` and `dbm_nextkey`. `dbm_firstkey` will return the first key in the data base. `dbm_nextkey` will return the next key in the data base. This code will traverse the data base:

NAME

nap - suspends execution for a short interval

SYNOPSIS

```
cc [flag . . .] file...-lx
int nap (long period);
```

DESCRIPTION

The current process is suspended from execution for at least the number of milliseconds specified by *period*, or until a signal is received.

DIAGNOSTICS

On successful completion, a long integer indicating the number of milliseconds actually slept is returned. If the process received a signal while napping, the return value will be -1, and `errno` will be set to `EINTR`.

SEE ALSO

`sleep(2)`

NOTES

This function is driven by the system clock, which in most cases has a granularity of tens of milliseconds.

munmap(2)

munmap(2)

NAME

munmap - unmap pages of memory

SYNOPSIS

```
#include <sys/types.h>
#include <sys/mman.h>

int munmap(caddr_t addr, size_t len);
```

DESCRIPTION

The function `munmap` removes the mappings for pages in the range [*addr*, *addr + len*). Further references to these pages will result in the delivery of a SIGSEGV signal to the process.

The function `mmap` often performs an implicit `munmap`.

RETURN VALUE

Upon successful completion, the function `munmap` returns a value of 0; otherwise, it returns a value of -1 and sets `errno` to indicate an error.

ERRORS

Under the following conditions, the function `munmap` fails and sets `errno` to:

- EINVAL if *addr* is not a multiple of the page size as returned by `sysconf`.
- EINVAL if addresses in the range [*addr*, *addr + len*) are outside the valid range for the address space of a process.
- EINVAL The argument *len* has a value less than or equal to 0.

SEE ALSO

`mmap(2)`, `sysconf(3C)`

NAME

msync - synchronize memory with physical storage

SYNOPSIS

```
#include <sys/types.h>
#include <sys/mman.h>

int msync(caddr_t addr, size_t len, int flags);
```

DESCRIPTION

The function `msync` writes all modified copies of pages over the range `[addr, addr + len)` to their backing storage locations. `msync` optionally invalidates any copies so that further references to the pages will be obtained by the system from their backing storage locations. The backing storage for a modified `MAP_SHARED` mapping is the file the page is mapped to; the backing storage for a modified `MAP_PRIVATE` mapping is its swap area.

flags is a bit pattern built from the following values:

| | |
|----------------------------|-----------------------------|
| <code>MS_ASYNC</code> | perform asynchronous writes |
| <code>MS_SYNC</code> | perform synchronous writes |
| <code>MS_INVALIDATE</code> | invalidate mappings |

If `MS_ASYNC` is set, `msync` returns immediately once all write operations are scheduled; if `MS_SYNC` is set, `msync` does not return until all write operations are completed.

`MS_INVALIDATE` invalidates all cached copies of data in memory, so that further references to the pages will be obtained by the system from their backing storage locations.

The effect of `msync(addr, len, flags)` is equivalent to:

```
mencntl(addr, len, MC_SYNC, flags, 0, 0)
```

SEE ALSO

`mencntl(2)`, `mmap(2)`, `sysconf(3C)`

DIAGNOSTICS

Upon successful completion, the function `msync` returns 0; otherwise, it returns -1 and sets `errno` to indicate the error.

NOTES

`msync` should be used by programs that require a memory object to be in a known state, for example, in building transaction facilities.

| | |
|--------|---|
| EINVAL | <i>msqid</i> is not a valid message queue identifier. |
| EACCES | Operation permission is denied to the calling process. |
| EINVAL | <i>msgsz</i> is less than 0. |
| E2BIG | The length of <i>mtext</i> is greater than <i>msgsz</i> and (<i>msgflg</i> &MSG_NOERROR) is false. |
| ENOMSG | The queue does not contain a message of the desired type and (<i>msgtyp</i> &IPC_NOWAIT) is true. |
| EFAULT | <i>msgp</i> points to an illegal address. |

Upon successful completion, the following actions are taken with respect to the data structure associated with *msqid* [see intro (2)].

msg_qnum is decremented by 1.

msg_lrpId is set to the process ID of the calling process.

msg_rtime is set to the current time.

SEE ALSO

intro(2), msgctl(2), msgget(2), signal(2)

DIAGNOSTICS

If *msgsnd* or *msgrcv* return due to the receipt of a signal, a value of -1 is returned to the calling process and *errno* is set to EINTR. If they return due to removal of *msqid* from the system, a value of -1 is returned and *errno* is set to EIDRM.

Upon successful completion, the return value is as follows:

msgsnd returns a value of 0.

msgrcv returns the number of bytes actually placed into *mtext*.

Otherwise, a value of -1 is returned and *errno* is set to indicate the error.

| | |
|--------|---|
| EACCES | Operation permission is denied to the calling process [see <code>intro(2)</code>]. |
| EINVAL | <i>mtype</i> is less than 1. |
| EAGAIN | The message cannot be sent for one of the reasons cited above and (<i>msgflg</i> &IPC_NOWAIT) is true. |
| EINVAL | <i>msgsz</i> is less than zero or greater than the system-imposed limit. |
| EFAULT | <i>msgp</i> points to an illegal address. |

Upon successful completion, the following actions are taken with respect to the data structure associated with *msqid* [see `intro(2)`].

`msg_qnum` is incremented by 1.

`msg_lspid` is set to the process ID of the calling process.

`msg_stime` is set to the current time.

`msgrcv` reads a message from the queue associated with the message queue identifier specified by *msqid* and places it in the user defined structure pointed to by *msgp*. The structure must contain a message type field followed by the area for the message text (see the structure `mymsg` above). *mtype* is the received message's type as specified by the sending process. *mtext* is the text of the message. *msgsz* specifies the size in bytes of *mtext*. The received message is truncated to *msgsz* bytes if it is larger than *msgsz* and (*msgflg*&MSG_NOERROR) is true. The truncated part of the message is lost and no indication of the truncation is given to the calling process.

msgtyp specifies the type of message requested as follows:

If *msgtyp* is 0, the first message on the queue is received.

If *msgtyp* is greater than 0, the first message of type *msgtyp* is received.

If *msgtyp* is less than 0, the first message of the lowest type that is less than or equal to the absolute value of *msgtyp* is received.

msgflg specifies the action to be taken if a message of the desired type is not on the queue. These are as follows:

If (*msgflg*&IPC_NOWAIT) is true, the calling process returns immediately with a return value of -1 and sets `errno` to ENOMSG.

If (*msgflg*&IPC_NOWAIT) is false, the calling process suspends execution until one of the following occurs:

A message of the desired type is placed on the queue.

msqid is removed from the system. When this occurs, `errno` is set to EIDRM, and a value of -1 is returned.

The calling process receives a signal that is to be caught. In this case a message is not received and the calling process resumes execution in the manner prescribed in `signal(2)`.

`msgrcv` fails and receives no message if one or more of the following are true:

NAME

msgop: msgsnd, msgrcv - message operations

SYNOPSIS

```
#include <sys/types.h>
#include <sys/ipc.h>
#include <sys/msg.h>

int msgsnd(int msqid, const void *msgp,
           size_t msgsz, int msgflg);

int msgrcv(int msqid, void *msgp,
           size_t msgsz, long msgtyp, int msgflg);
```

DESCRIPTION

`msgsnd` sends a message to the queue associated with the message queue identifier specified by *msqid*. *msgp* points to a user defined buffer that must contain first a field of type long integer that will specify the type of the message, and then a data portion that will hold the text of the message. The following is an example of members that might be in a user defined buffer.

```
long mtype;    /* message type */
char mtext[]; /* message text */
```

mtype is a positive integer that can be used by the receiving process for message selection. *mtext* is any text of length *msgsz* bytes. *msgsz* can range from 0 to a system imposed maximum.

msgflg specifies the action to be taken if one or more of the following are true:

The number of bytes already on the queue is equal to `msg_qbytes` [see `intro(2)`].

The total number of messages on all queues system-wide is equal to the system-imposed limit.

These actions are as follows:

If (*msgflg* & `IPC_NOWAIT`) is true, the message is not sent and the calling process returns immediately.

If (*msgflg* & `IPC_NOWAIT`) is false, the calling process suspends execution until one of the following occurs:

The condition responsible for the suspension no longer exists, in which case the message is sent.

msqid is removed from the system [see `msgctl(2)`]. When this occurs, `errno` is set to `EIDRM`, and a value of -1 is returned.

The calling process receives a signal that is to be caught. In this case the message is not sent and the calling process resumes execution in the manner prescribed in `signal(2)`.

`msgsnd` fails and sends no message if one or more of the following are true:

`EINVAL` *msqid* is not a valid message queue identifier.

msgget(2)

msgget(2)

NAME

msgget - get message queue

SYNOPSIS

```
#include <sys/types.h>
#include <sys/ipc.h>
#include <sys/msg.h>

int msgget(key_t key, int msgflg);
```

DESCRIPTION

msgget returns the message queue identifier associated with *key*.

A message queue identifier and associated message queue and data structure [see intro(2)] are created for *key* if one of the following are true:

key is IPC_PRIVATE.

key does not already have a message queue identifier associated with it, and (*msgflg*&IPC_CREAT) is true.

On creation, the data structure associated with the new message queue identifier is initialized as follows:

msg_perm.cuid, msg_perm.uid, msg_perm.cgid, and msg_perm.gid are set to the effective user ID and effective group ID, respectively, of the calling process.

The low-order 9 bits of msg_perm.mode are set to the low-order 9 bits of *msgflg*.

msg_qnum, msg_lspid, msg_lrpid, msg_stime, and msg_rtime are set to 0.

msg_ctime is set to the current time.

msg_qbytes is set to the system limit.

msgget fails if one or more of the following are true:

| | |
|--------|--|
| EACCES | A message queue identifier exists for <i>key</i> , but operation permission [see intro(2)] as specified by the low-order 9 bits of <i>msgflg</i> would not be granted. |
| ENOENT | A message queue identifier does not exist for <i>key</i> and (<i>msgflg</i> &IPC_CREAT) is false. |
| ENOSPC | A message queue identifier is to be created but the system-imposed limit on the maximum number of allowed message queue identifiers system wide would be exceeded. |
| EEXIST | A message queue identifier exists for <i>key</i> but (<i>msgflg</i> &IPC_CREAT) and (<i>msgflg</i> &IPC_EXCL) are both true. |

SEE ALSO

intro(2), msgctl(2), msgop(2), stdipc(3C)

DIAGNOSTICS

Upon successful completion, a non-negative integer, namely a message queue identifier, is returned. Otherwise, a value of -1 is returned and *errno* is set to indicate the error.

msgctl(2)

msgctl(2)

EPERM

cmd is `IPC_SET`, an attempt is being made to increase to the value of `msg_qbytes`, and the effective user ID of the calling process is not that of super user.

SEE ALSO

`intro(2)`, `msgget(2)`, `msgop(2)`

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

msgctl - message control operations

SYNOPSIS

```
#include <sys/types.h>
#include <sys/ipc.h>
#include <sys/msg.h>

int msgctl(int msqid, int cmd, .../* struct msqid_ds *buf */);
```

DESCRIPTION

msgctl provides a variety of message control operations as specified by *cmd*. The following *cmds* are available:

IPC_STAT Place the current value of each member of the data structure associated with *msqid* into the structure pointed to by *buf*. The contents of this structure are defined in *intro(2)*.

IPC_SET Set the value of the following members of the data structure associated with *msqid* to the corresponding value found in the structure pointed to by *buf*:

```
msg_perm.uid
msg_perm.gid
msg_perm.mode /* only access permission bits */
msg_qbytes
```

This *cmd* can only be executed by a process that has an effective user ID equal to either that of super user, or to the value of *msg_perm.cuid* or *msg_perm.uid* in the data structure associated with *msqid*. Only super user can raise the value of *msg_qbytes*.

IPC_RMID Remove the message queue identifier specified by *msqid* from the system and destroy the message queue and data structure associated with it. This *cmd* can only be executed by a process that has an effective user ID equal to either that of super user, or to the value of *msg_perm.cuid* or *msg_perm.uid* in the data structure associated with *msqid*.

msgctl fails if one or more of the following are true:

EACCES *cmd* is *IPC_STAT* and operation permission is denied to the calling process [see *intro(2)*].

EFAULT *buf* points to an illegal address.

EINVAL *msqid* is not a valid message queue identifier.

EINVAL *cmd* is not a valid command.

EINVAL *cmd* is *IPC_SET* and *msg_perm.uid* or *msg_perm.gid* is not valid.

EOVERFLOW *cmd* is *IPC_STAT* and *uid* or *gid* is too large to be stored in the structure pointed to by *buf*.

EPERM *cmd* is *IPC_RMID* or *IPC_SET*. The effective user ID of the calling process is not that of super user, or the value of *msg_perm.cuid* or *msg_perm.uid* in the data structure associated with *msqid*.

NAME

mprotect - set protection of memory mapping

SYNOPSIS

```
#include <sys/types.h>
#include <sys/mman.h>

int mprotect(caddr_t addr, size_t len, int prot);
```

DESCRIPTION

The function `mprotect` changes the access protections on the mappings specified by the range `[addr, addr + len)` to be that specified by `prot`. Legitimate values for `prot` are the same as those permitted for `mmap` and are defined in `sys/mman.h` as:

```
PROT_READ           /* page can be read */
PROT_WRITE          /* page can be written */
PROT_EXEC           /* page can be executed */
PROT_NONE           /* page can not be accessed */
```

See the *System V Application Binary Interface* for further information concerning combinations of the `PROT_READ`, `PROT_WRITE`, and `PROT_EXEC` flags.

RETURN VALUE

Upon successful completion, the function `mprotect` returns a value of 0; otherwise, it returns a value of -1 and sets `errno` to indicate an error.

ERRORS

Under the following conditions, the function `mprotect` fails and sets `errno` to:

- `EACCES` if `prot` specifies a protection that violates the access permission the process has to the underlying memory object.
- `EAGAIN` if `prot` specifies `PROT_WRITE` over a `MAP_PRIVATE` mapping and there are insufficient memory resources to reserve for locking the private page.
- `EINVAL` if `addr` is not a multiple of the page size as returned by `sysconf`.
- `EINVAL` The argument `len` has a value less than or equal to 0.
- `ENOMEM` if addresses in the range `[addr, addr + len)` are invalid for the address space of a process, or specify one or more pages which are not mapped.

When `mprotect` fails for reasons other than `EINVAL`, the protections on some of the pages in the range `[addr, addr + len)` may have been changed. If the error occurs on some page at `addr2`, then the protections of all whole pages in the range `[addr, addr2]` will have been modified.

SEE ALSO

`mcntl(2)`, `mmap(2)`, `plock(2)`, `mlock(3C)`, `mlockall(3C)`, `sysconf(3C)`

DESCRIPTION

These routines perform arithmetic on integers of arbitrary length. The integers are stored using the defined type MINT. Pointers to a MINT should be initialized using the function `itom`, which sets the initial value to n . Alternatively, `xtom` may be used to initialize a MINT from a string of hexadecimal digits. `mfree` may be used to release the storage allocated by the `itom` and `xtom` routines.

`madd`, `msub` and `mult` assign to their third arguments the sum, difference, and product, respectively, of their first two arguments. `mdiv` assigns the quotient and remainder, respectively, to its third and fourth arguments. `sdiv` is like `mdiv` except that the divisor is an ordinary integer. `msqrt` produces the square root and remainder of its first argument. `mcmp` compares the values of its arguments and returns 0 if the two values are equal, >0 if the first argument is greater than the second, and <0 if the second argument is greater than the first. `rpow` calculates a raised to the power b , while `pow` calculates this reduced modulo m . `min` and `mout` do decimal input and output. `gcd` finds the greatest common divisor of the first two arguments, returning it in the third argument. `mtox` provides the inverse of `xtom`. To release the storage allocated by `mtox`, use `free` [see `malloc(3)`].

Use the `-libmp` loader option to obtain access to these functions.

RETURN VALUE

Illegal operations and running out of memory produce messages and core images.

FILES

`/usr/ucblib/libmp.a`

SEE ALSO

`malloc(3)`

NAME

mp: madd, msub, mult, mdiv, mcmp, min, mout, pow, gcd, rpow, msqrt, sdiv, itom, xtom, mtox, mfree - **multiple precision integer arithmetic**

SYNOPSIS

```
cc [flag...] file... -lmp
#include <mp.h>

madd(a, b, c)
MINT *a, *b, *c;

msub(a, b, c)
MINT *a, *b, *c;

mult(a, b, c)
MINT *a, *b, *c;

mdiv(a, b, q, r)
MINT *a, *b, *q, *r;

mcmp(a,b)
MINT *a, *b;

min(a)
MINT *a;

mout(a)
MINT *a;

pow(a, b, c, d)
MINT *a, *b, *c, *d;

gcd(a, b, c)
MINT *a, *b, *c;

rpow(a, n, b)
MINT *a, *b;
short n;

msqrt(a, b, r)
MINT *a, *b, *r;

sdiv(a, n, q, r)
MINT *a, *q;
short n, *r;

MINT *itom(n)
short n;

MINT *xtom(s)
char *s;

char *mtox(a)
MINT *a;

void mfree(a)
MINT *a;
```

mount(2)

mount(2)

| | |
|-----------|---|
| ENOENT | None of the named files exists or is a null pathname. |
| ENOTDIR | A component of a path prefix is not a directory. |
| EPERM | The effective user ID is not super-user. |
| EREMOTE | <i>spec</i> is remote and cannot be mounted. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and the file system type does not allow it. |
| ENOTBLK | <i>spec</i> is not a block special device. |
| ENXIO | The device associated with <i>spec</i> does not exist. |
| ENOTDIR | <i>dir</i> is not a directory. |
| EROFS | <i>spec</i> is write protected and <i>mflag</i> requests write permission. |
| ENOSPC | The file system state in the super-block is not FSOKAY and <i>mflag</i> requests write permission. |

SEE ALSO

mount(1M), sysfs(2), umount(2), fs(4).

DIAGNOSTICS

Upon successful completion a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

mount - mount a file system

SYNOPSIS

```
#include <sys/types.h>
#include <sys/mount.h>

int mount (const char *spec, const char *dir, int mflag,
          .../* char *fstyp, const char *dataptr, int datalen*/);
```

DESCRIPTION

mount requests that a removable file system contained on the block special file identified by *spec* be mounted on the directory identified by *dir*. *spec* and *dir* are pointers to path names. *fstyp* is the file system type number. The `sysfs(2)` system call can be used to determine the file system type number. If both the `MS_DATA` and `MS_FSS` flag bits of *mflag* are off, the file system type defaults to the root file system type. Only if either flag is on is *fstyp* used to indicate the file system type.

If the `MS_DATA` flag is set in *mflag* the system expects the *dataptr* and *datalen* arguments to be present. Together they describe a block of file-system specific data at address *dataptr* of length *datalen*. This is interpreted by file-system specific code within the operating system and its format depends on the file system type. If a particular file system type does not require this data, *dataptr* and *datalen* should both be zero. Note that `MS_FSS` is obsolete and is ignored if `MS_DATA` is also set, but if `MS_FSS` is set and `MS_DATA` is not, *dataptr* and *datalen* are both assumed to be zero.

After a successful call to `mount`, all references to the file *dir* refer to the root directory on the mounted file system.

The low-order bit of *mflag* is used to control write permission on the mounted file system: if 1, writing is forbidden; otherwise writing is permitted according to individual file accessibility.

`mount` may be invoked only by the super-user. It is intended for use only by the `mount` utility.

`mount` fails if one or more of the following are true:

| | |
|--------------|--|
| EBUSY | <i>dir</i> is currently mounted on, is someone's current working directory, or is otherwise busy. |
| EBUSY | The device associated with <i>spec</i> is currently mounted. |
| EBUSY | There are no more mount table entries. |
| EFAULT | <i>spec</i> , <i>dir</i> , or <i>datalen</i> points outside the allocated address space of the process. |
| EINVAL | The super block has an invalid magic number or the <i>fstyp</i> is invalid. |
| ELOOP | Too many symbolic links were encountered in translating <i>spec</i> or <i>dir</i> . |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds <code>{PATH_MAX}</code> , or the length of a <i>path</i> component exceeds <code>{NAME_MAX}</code> while <code>_POSIX_NO_TRUNC</code> is in effect. |

The default call to `monitor` is shown below:

```
monitor (&eprol, &etext, wbuf, wbufsz, 600);
```

where:

`eprol` is the beginning of the user's program when linked with `cc -p` [see `end(3C)`];

`etext` is the end of the user's program [see `end(3C)`];

`wbuf` is an array of `WORD` with `wbufsz` elements;

`wbufsz` is computed using the `bufsize` formula shown above with `BARSIZE` of 8;

600 is the number of call count cells that have been reserved in `buffer`.

These parameter settings establish the computation of an execution-time distribution histogram that uses `profil` for the entire program, initially reserves room for 600 call count cells in `buffer`, and provides for enough histogram cells to generate significant distribution-measurement results. [For more information on the effects of `bufsize` on execution-distribution measurements, see `profil(2)`.]

To stop execution monitoring and write the results to a file, use the following:

```
monitor((int (*)())0, (int (*)())0, (WORD *)0, 0, 0);
```

Use `prof` to examine the results.

FILES

`mon.out`

SEE ALSO

`cc(1)`, `prof(1)`, `profil(2)`, `end(3C)`

NOTE

Additional calls to `monitor` after `main` has been called and before `exit` has been called will add to the function-call count capacity, but such calls will also replace and restart the `profil` histogram computation.

The name of the file written by `monitor` is controlled by the environment variable `PROFDIR`. If `PROFDIR` does not exist, the file `mon.out` is created in the current directory. If `PROFDIR` exists but has no value, `monitor` does no profiling and creates no output file. If `PROFDIR` is `dirname`, and `monitor` is called automatically by compilation with `cc -p`, the file created is `dirname/pid.progname` where `progname` is the name of the program.

NAME

monitor - prepare execution profile

SYNOPSIS

```
#include <mon.h>

void monitor (int (*lowpc)(), int (*highpc)(), WORD *buffer,
             size_t bufsize, size_t nfunc);
```

DESCRIPTION

monitor is an interface to `profil`, and is called automatically with default parameters by any program created by `cc -p`. Except to establish further control over profiling activity, it is not necessary to explicitly call `monitor`.

When used, `monitor` is called at least at the beginning and the end of a program. The first call to `monitor` initiates the recording of two different kinds of execution-profile information: execution-time distribution and function call count. Execution-time distribution data is generated by `profil` and the function call counts are generated by code supplied to the object file (or files) by `cc -p`. Both types of information are collected as a program executes. The last call to `monitor` writes this collected data to the output file `mon.out`.

lowpc and *highpc* are the beginning and ending addresses of the region to be profiled.

buffer is the address of a user-supplied array of `WORD` (`WORD` is defined in the header file `mon.h`). *buffer* is used by `monitor` to store the histogram generated by `profil` and the call counts.

bufsize identifies the number of array elements in *buffer*.

nfunc is the number of call count cells that have been reserved in *buffer*. Additional call count cells will be allocated automatically as they are needed.

bufsize should be computed using the following formula:

```
size_of_buffer =
    sizeof(struct hdr) +
    nfunc * sizeof(struct cnt) +
    ((highpc-lowpc)/BARSIZE) * sizeof(WORD) +
    sizeof(WORD) - 1 ;

bufsize = (size_of_buffer / sizeof(WORD)) ;
```

where:

lowpc, *highpc*, *nfunc* are the same as the arguments to `monitor`;

`BARSIZE` is the number of program bytes that correspond to each histogram bar, or cell, of the `profil` buffer;

the `hdr` and `cnt` structures and the type `WORD` are defined in the header file `mon.h`.

mmap(2)

mmap(2)

ENOMEM MAP_FIXED was specified and the range [*addr*, *addr + len*) exceeds that allowed for the address space of a process, or MAP_FIXED was not specified and there is insufficient room in the address space to effect the mapping.

NOTES

mmap allows access to resources via address space manipulations instead of the read/write interface. Once a file is mapped, all a process has to do to access it is use the data at the address to which the object was mapped. Consider the following pseudo-code:

```
fd = open(...)
lseek(fd, offset)
read(fd, buf, len)
/* use data in buf */
```

Here is a rewrite using mmap:

```
fd = open(...)
address = mmap((caddr_t) 0, len, (PROT_READ | PROT_WRITE),
              MAP_PRIVATE, fd, offset)
/* use data at address */
```

SEE ALSO

fcntl(2), fork(2), mprotect(2), munmap(2), plock(2), sysconf(2), lockf(3C), mlockall(3C)

Note that the private copy is not created until the first write; until then, other users who have the object mapped `MAP_SHARED` can change the object.

`MAP_FIXED` informs the system that the value of *pa* must be *addr*, exactly. The use of `MAP_FIXED` is discouraged, as it may prevent an implementation from making the most effective use of system resources.

When `MAP_FIXED` is not set, the system uses *addr* in an implementation-defined manner to arrive at *pa*. The *pa* so chosen will be an area of the address space which the system deems suitable for a mapping of *len* bytes to the specified object. All implementations interpret an *addr* value of zero as granting the system complete freedom in selecting *pa*, subject to constraints described below. A non-zero value of *addr* is taken to be a suggestion of a process address near which the mapping should be placed. When the system selects a value for *pa*, it will never place a mapping at address 0, nor will it replace any extant mapping, nor map into areas considered part of the potential data or stack segments.

The parameter *off* is constrained to be aligned and sized according to the value returned by `sysconf`. When `MAP_FIXED` is specified, the parameter *addr* must also meet these constraints. The system performs mapping operations over whole pages. Thus, while the parameter *len* need not meet a size or alignment constraint, the system will include, in any mapping operation, any partial page specified by the range [*pa*, *pa* + *len*).

The system will always zero-fill any partial page at the end of an object. Further, the system will never write out any modified portions of the last page of an object which are beyond its end. References to whole pages following the end of an object will result in the delivery of a `SIGBUS` signal. `SIGBUS` signals may also be delivered on various file system conditions, including quota exceeded errors.

RETURN VALUE

On success, `mmap` returns the address at which the mapping was placed (*pa*). On failure it returns `(caddr_t)-1` and sets `errno` to indicate an error.

ERRORS

Under the following conditions, `mmap` fails and sets `errno` to:

| | |
|---------------------|--|
| <code>EAGAIN</code> | The mapping could not be locked in memory. |
| <code>EBADF</code> | <i>fd</i> is not open. |
| <code>EACCES</code> | <i>fd</i> is not open for read, regardless of the protection specified, or <i>fd</i> is not open for write and <code>PROT_WRITE</code> was specified for a <code>MAP_SHARED</code> type mapping. |
| <code>EINVAL</code> | Addresses in the range [<i>off</i> , <i>off</i> + <i>len</i>) are invalid for <i>fd</i> . |
| <code>EINVAL</code> | The arguments <i>addr</i> (if <code>MAP_FIXED</code> was specified) or <i>off</i> are not multiples of the page size as returned by <code>sysconf</code> . |
| <code>EINVAL</code> | The field in <i>flags</i> is invalid (neither <code>MAP_PRIVATE</code> or <code>MAP_SHARED</code>). |
| <code>EINVAL</code> | The argument <i>len</i> has a value less than or equal to 0. |
| <code>ENODEV</code> | <i>fd</i> refers to an object for which <code>mmap</code> is meaningless, such as a terminal. |

NAME

mmap - map pages of memory

SYNOPSIS

```
#include <sys/types.h>
#include <sys/mman.h>

caddr_t mmap(caddr_t addr, size_t len, int prot,
             int flags, int fd, off_t off);
```

DESCRIPTION

The function `mmap` establishes a mapping between a process's address space and a virtual memory object. The format of the call is as follows:

```
pa = mmap(addr, len, prot, flags, fd, off);
```

`mmap` establishes a mapping between the process's address space at an address *pa* for *len* bytes to the memory object represented by the file descriptor *fd* at offset *off* for *len* bytes. The value of *pa* is an implementation-dependent function of the parameter *addr* and values of *flags*, further described below. A successful `mmap` call returns *pa* as its result. The address ranges covered by [*pa*, *pa + len*) and [*off*, *off + len*) must be legitimate for the possible (not necessarily current) address space of a process and the object in question, respectively. `mmap` cannot grow a file.

The mapping established by `mmap` replaces any previous mappings for the process's pages in the range [*pa*, *pa + len*).

The parameter *prot* determines whether read, write, execute, or some combination of accesses are permitted to the pages being mapped. The protection options are defined in `sys/mman.h` as:

| | |
|-------------------------|---------------------------|
| <code>PROT_READ</code> | Page can be read. |
| <code>PROT_WRITE</code> | Page can be written. |
| <code>PROT_EXEC</code> | Page can be executed. |
| <code>PROT_NONE</code> | Page can not be accessed. |

Not all implementations literally provide all possible combinations. `PROT_WRITE` is often implemented as `PROT_READ | PROT_WRITE` and `PROT_EXEC` as `PROT_READ | PROT_EXEC`. However, no implementation will permit a write to succeed where `PROT_WRITE` has not been set. The behavior of `PROT_WRITE` can be influenced by setting `MAP_PRIVATE` in the *flags* parameter, described below. See the *System V Application Binary Interface* for further information concerning combinations of the `PROT_READ`, `PROT_WRITE`, and `PROT_EXEC` flags.

The parameter *flags* provides other information about the handling of the mapped pages. The options are defined in `sys/mman.h` as:

| | |
|--------------------------|--------------------------------|
| <code>MAP_SHARED</code> | Share changes. |
| <code>MAP_PRIVATE</code> | Changes are private. |
| <code>MAP_FIXED</code> | Interpret <i>addr</i> exactly. |

`MAP_SHARED` and `MAP_PRIVATE` describe the disposition of write references to the memory object. If `MAP_SHARED` is specified, write references will change the memory object. If `MAP_PRIVATE` is specified, the initial write reference will create a private copy of the memory object page and redirect the mapping to the copy. Either `MAP_SHARED` or `MAP_PRIVATE` must be specified, but not both. The mapping type is retained across a `fork(2)`.

NAME

mlockall, munlockall - lock or unlock address space

SYNOPSIS

```
#include <sys/mman.h>
int mlockall(int flags);
int munlockall(void);
```

DESCRIPTION

The function `mlockall` causes all pages mapped by an address space to be locked in memory. The effect of `mlockall(flags)` is equivalent to:

```
memcntl(0, 0, MC_LOCKAS, flags, 0, 0)
```

The value of *flags* determines whether the pages to be locked are those currently mapped by the address space, those that will be mapped in the future, or both:

| | |
|-------------|-----------------------|
| MCL_CURRENT | Lock current mappings |
| MCL_FUTURE | Lock future mappings |

The function `munlockall` removes address space locks and locks on mappings in the address space. The effect of `munlockall` is equivalent to:

```
memcntl(0, 0, MC_UNLOCKAS, 0, 0, 0)
```

Locks established with `mlockall` are not inherited by a child process after a `fork` and are not nested.

SEE ALSO

`fork(2)`, `memcntl(2)`, `mlock(3C)`, `mmap(2)`, `plock(2)`, `sysconf(3C)`

DIAGNOSTICS

Upon successful completion, the functions `mlockall` and `munlockall` return 0; otherwise, they return -1 and set `errno` to indicate the error.

NOTES

Use of `mlockall` and `munlockall` requires that the user have appropriate privileges.

mlock(3C)

mlock(3C)

NAME

mlock, munlock - lock (or unlock) pages in memory

SYNOPSIS

```
#include <sys/types.h>
int mlock(caddr_t addr, size_t len);
int munlock(caddr_t addr, size_t len);
```

DESCRIPTION

The function `mlock` uses the mappings established for the address range [*addr*, *addr* + *len*) to identify pages to be locked in memory. The effect of `mlock(addr, len)` is equivalent to `mlockentl(addr, len, MC_LOCK, 0, 0, 0)`.

`munlock` removes locks established with `mlock`. The effect of `munlock(addr, len)` is equivalent to `mlockentl(addr, len, MC_UNLOCK, 0, 0, 0)`.

Locks established with `mlock` are not inherited by a child process after a `fork` and are not nested.

SEE ALSO

`fork(2)`, `mlockentl(2)`, `mmap(2)`, `mlockall(3C)`, `pthread_mutex(3)`, `sysconf(3C)`

DIAGNOSTICS

Upon successful completion, the functions `mlock` and `munlock` return 0; otherwise, they return -1 and set `errno` to indicate the error.

NOTES

Use of `mlock` and `munlock` requires that the user have appropriate privileges.

```
#include <time.h>

static char *const wday[] = {
    "Sunday", "Monday", "Tuesday", "Wednesday",
    "Thursday", "Friday", "Saturday", "-unknown-"
};
struct tm time_str;
/*...*/
time_str.tm_year= 2001 - 1900;
time_str.tm_mon = 7 - 1;
time_str.tm_mday= 4;
time_str.tm_hour= 0;
time_str.tm_min = 0;
time_str.tm_sec  = 1;
time_str.tm_isdst = -1;
if (mktime(&time_str)== -1)
    time_str.tm_wday=7;
printf("%s\n", wday[time_str.tm_wday]);
```

SEE ALSO

ctime(3C), getenv(3C), timezone(4)

NOTES

tm_year of the tm structure must be for year 1970 or later. Calendar times before 00:00:00 UTC, January 1, 1970 or after 03:14:07 UTC, January 19, 2038 cannot be represented.

NAME

mktime - converts a tm structure to a calendar time

SYNOPSIS

```
#include <time.h>

time_t mktime (struct tm *timeptr);
```

DESCRIPTION

mktime converts the time represented by the tm structure pointed to by *timeptr* into a calendar time (the number of seconds since 00:00:00 UTC, January 1, 1970).

The tm structure has the following format.

```
struct    tm {
    int    tm_sec;    /* seconds after the minute [0, 61] */
    int    tm_min;    /* minutes after the hour [0, 59] */
    int    tm_hour;   /* hour since midnight [0, 23] */
    int    tm_mday;   /* day of the month [1, 31] */
    int    tm_mon;    /* months since January [0, 11] */
    int    tm_year;   /* years since 1900 */
    int    tm_wday;   /* days since Sunday [0, 6] */
    int    tm_yday;   /* days since January 1 [0, 365] */
    int    tm_isdst;  /* flag for daylight savings time */
};
```

In addition to computing the calendar time, mktime normalizes the supplied tm structure. The original values of the tm_wday and tm_yday components of the structure are ignored, and the original values of the other components are not restricted to the ranges indicated in the definition of the structure. On successful completion, the values of the tm_wday and tm_yday components are set appropriately, and the other components are set to represent the specified calendar time, but with their values forced to be within the appropriate ranges. The final value of tm_mday is not set until tm_mon and tm_year are determined.

The original values of the components may be either greater than or less than the specified range. For example, a tm_hour of -1 means 1 hour before midnight, tm_mday of 0 means the day preceding the current month, and tm_mon of -2 means 2 months before January of tm_year.

If tm_isdst is positive, the original values are assumed to be in the alternate timezone. If it turns out that the alternate timezone is not valid for the computed calendar time, then the components are adjusted to the main timezone. Likewise, if tm_isdst is zero, the original values are assumed to be in the main timezone and are converted to the alternate timezone if the main timezone is not valid. If tm_isdst is negative, the correct timezone is determined and the components are not adjusted.

Local timezone information is used as if mktime had called tzset.

mktime returns the specified calendar time. If the calendar time cannot be represented, the function returns the value (time_t)-1.

EXAMPLE

What day of the week is July 4, 2001?

```
#include <stdio.h>
```

NAME

mktemp - make a unique file name

SYNOPSIS

```
#include <stdlib.h>
char *mktemp(char *template);
```

DESCRIPTION

mktemp replaces the contents of the string pointed to by *template* with a unique file name, and returns *template*. The string in *template* should look like a file name with six trailing Xs; mktemp will replace the Xs with a character string that can be used to create a unique file name.

SEE ALSO

tmpfile(3S), tmpnam(3S)

DIAGNOSTIC

mktemp will assign to *template* the empty string if it cannot create a unique name.

NOTES

mktemp can create only 26 unique file names per process for each unique *template*.

NAME

mkstemp - make a unique file name

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...  
mkstemp(template)  
char *template;
```

DESCRIPTION

mkstemp creates a unique file name, typically in a temporary filesystem, by replacing *template* with a unique file name, and returns a file descriptor for the template file open for reading and writing. The string in *template* should contain a file name with six trailing Xs; mkstemp replaces the Xs with a letter and the current process ID. The letter will be chosen so that the resulting name does not duplicate an existing file. mkstemp avoids the race between testing whether the file exists and opening it for use.

SEE ALSO

getpid(2), open(2), tmpfile(3S), tmpnam(3S).

RETURN VALUE

mkstemp returns -1 if no suitable file could be created.

NOTES

It is possible to run out of letters.

mkstemp actually changes the template string which you pass; this means that you cannot use the same template string more than once — you need a fresh template for every unique file you want to open.

When mkstemp is creating a new unique filename it checks for the prior existence of a file with that name. This means that if you are creating more than one unique filename, it is bad practice to use the same root template for multiple invocations of mkstemp.

Note: broadcast file descriptors are limited in size to the maximum transfer size of that transport. For Ethernet, this value is 1500 bytes.

```
enum clnt_stat
rpc_call(const char *host, const u_long prognum,
         const u_long versnum, const u_long procnum,
         const xdrproc_t inproc, const xdrproc_t outproc,
         const char *in, char *out, const char *nettype);
```

Call the remote procedure associated with *prognum*, *versnum*, and *procnum* on the machine, *host*. The parameter *in* is the address of the procedure's argument(s), and *out* is the address of where to place the result(s); *inproc* is used to encode the procedure's parameters, and *outproc* is used to decode the procedure's results. *nettype* can be any of the values listed on [rpc\(3N\)](#). If *nettype* is NULL, it defaults to *netpath*. This routine returns 0 if it succeeds, or the value of `enum clnt_stat` cast to an integer if it fails. Use the `clnt_perrno` routine to translate failure statuses into messages.

Note: `rpc_call` uses the first available transport belonging to the class *nettype*, on which it can create a connection. You do not have control of timeouts or authentication using this routine. There is also no way to destroy the client handle.

SEE ALSO

[printf\(3S\)](#), [rpc\(3N\)](#), [rpc_clnt_auth\(3N\)](#), [rpc_clnt_create\(3N\)](#)

NAME

rpc_clnt_create: clnt_control, clnt_create, clnt_destroy, clnt_dg_create, clnt_pcreateerror, clnt_raw_create, clnt_spcreateerror, clnt_tli_create, clnt_tp_create, clnt_vc_create - library routines for dealing with creation and manipulation of CLIENT handles

DESCRIPTION

RPC library routines allow C language programs to make procedure calls on other machines across the network. First a CLIENT handle is created and then the client calls a procedure to send a data packet to the server. Upon receipt of the packet, the server calls a dispatch routine to perform the requested service, and then sends back a reply.

Routines

See rpc(3N) for the definition of the CLIENT data structure.

```
#include <rpc/rpc.h>
```

```
bool_t
```

```
clnt_control(CLIENT *clnt, const u_int req, char *info);
```

A function macro used to change or retrieve various information about a client object. *req* indicates the type of operation, and *info* is a pointer to the information. For both connectionless and connection-oriented transports, the supported values of *req* and their argument types and what they do are:

| | | |
|---------------|----------------|-------------------|
| CLSET_TIMEOUT | struct timeval | set total timeout |
| CLGET_TIMEOUT | struct timeval | get total timeout |

Note: if you set the timeout using clnt_control, the timeout parameter passed to clnt_call will be ignored in all future calls.

| | | |
|-----------------|---------------|--|
| CLGET_FD | int | get the associated file descriptor |
| CLGET_SVC_ADDR | struct netbuf | get servers address |
| CLSET_FD_CLOSE | int | close the file descriptor when destroying the client handle [see clnt_destroy] |
| CLSET_FD_NCLOSE | int | do not close the file descriptor when destroying the client handle |

The following operations are valid for connectionless transports only:

| | | |
|---------------------|----------------|-----------------------|
| CLSET_RETRY_TIMEOUT | struct timeval | set the retry timeout |
| CLGET_RETRY_TIMEOUT | struct timeval | get the retry timeout |

The retry timeout is the time that RPC waits for the server to reply before retransmitting the request.

clnt_control returns 1 on success and 0 on failure.

rpc_clnt_create(3N)

rpc_clnt_create(3N)

CLIENT *

```
clnt_create(const char *host, const u_long prognum,  
            const u_long versnum, const char *nettype);
```

Generic client creation routine for program *prognum* and version *versnum*. *host* identifies the name of the remote host where the server is located. *nettype* indicates the class of transport protocol to use. The transports are tried in left to right order in NETPATH variable or in top to down order in the netconfig database.

clnt_create tries all the transports of the *nettype* class available from the NETPATH environment variable and the the netconfig database, and chooses the first successful one. Default timeouts are set, but can be modified using *clnt_control*.

```
void  
clnt_destroy(CLIENT *clnt);
```

A function macro that destroys the client's RPC handle. Destruction usually involves deallocation of private data structures, including *clnt* itself. Use of *clnt* is undefined after calling *clnt_destroy*. If the RPC library opened the associated file descriptor, or CLSET_FD_CLOSE was set using *clnt_control*, it will be closed.

CLIENT *

```
clnt_dg_create(const int fd, const struct netbuf *svcaddr,  
              const u_long prognum, const u_long versnum,  
              const u_int sendsz, const u_int recvsz);
```

This routine creates an RPC client for the remote program *prognum* and version *versnum*; the client uses a connectionless transport. The remote program is located at address *svcaddr*. The parameter *fd* is an open and bound file descriptor. This routine will resend the call message in intervals of 15 seconds until a response is received or until the call times out. The total time for the call to time out is specified by *clnt_call* [see *clnt_call* in *rpc_clnt_calls(3N)*]. This routine returns NULL if it fails. The retry time out and the total time out periods can be changed using *clnt_control*. The user may set the size of the send and receive buffers with the parameters *sendsz* and *recvsz*; values of 0 choose suitable defaults.

```
void  
clnt_pcreateerror(const char *s);
```

Print a message to standard error indicating why a client RPC handle could not be created. The message is prepended with the string *s* and a colon, and appended with a newline.

CLIENT *

```
clnt_raw_create(const u_long prognum, const u_long versnum);
```

This routine creates a toy RPC client for the remote program *prognum* and version *versnum*. The transport used to pass messages to the service is a buffer within the process's address space, so the corresponding RPC server should live in the same address space; [see *svc_raw_create* in *rpc_clnt_calls(3N)*]. This allows simulation of RPC and acquisition of RPC overheads, such as round trip times, without any kernel interference. This routine returns NULL if it fails. *clnt_raw_create* should be called after *svc_raw_create*.

char *

```
clnt_spcreateerror(const char *s);
```

Like *clnt_pcreateerror*, except that it returns a string instead of printing to the standard error. A newline is not appended to the message in this case.

Note: returns a pointer to static data that is overwritten on each call.

CLIENT *

```
clnt_tli_create(const int fd, const struct netconfig *netconf,
               const struct netbuf *svcaddr, u const_long prognum,
               const u_long versnum, const u_int sendsz,
               const u_int recvsz);
```

This routine creates an RPC client handle for the remote program *prognum* and version *versnum*. The remote program is located at address *svcaddr*. If *svcaddr* is NULL and it is connection-oriented, it is assumed that the file descriptor is connected. For connectionless transports, if *svcaddr* is NULL, *RPC_UNKNOWNAADDR* error is set. *fd* is a file descriptor which may be open, bound and connected. If it is *RPC_ANYFD*, it opens a file descriptor on the transport specified by *netconf*. If *netconf* is NULL, a *RPC_UNKNOWNPROTO* error is set. If *fd* is unbound, then it will attempt to bind the descriptor. The user may specify the size of the buffers with the parameters *sendsz* and *recvsz*; values of 0 choose suitable defaults. Depending upon the type of the transport (connection-oriented or connectionless), *clnt_tli_create* calls appropriate client creation routines. This routine returns NULL if it fails. The *clnt_pcreateerror* routine can be used to print the reason for failure. The remote *rpcbind* service [see *rpcbind(1M)*] will not be consulted for the address of the remote service.

CLIENT *

```
clnt_tp_create(const char *host, const u_long prognum,
               const u_long versnum, const struct netconfig *netconf);
```

clnt_tp_create creates a client handle for the transport specified by *netconf*. Default options are set, which can be changed using *clnt_control* calls. The remote *rpcbind* service on the host *host* is consulted for the address of the remote service. This routine returns NULL if it fails. The *clnt_pcreateerror* routine can be used to print the reason for failure.

rpc_clnt_create(3N)

rpc_clnt_create(3N)

CLIENT *

```
clnt_vc_create(const int fd, const struct netbuf *svcaddr,  
               const u_long prognum, const u_long versnum,  
               const u_int sendsz, const u_int recvsz);
```

This routine creates an RPC client for the remote program *prognum* and version *versnum*; the client uses a connection-oriented transport. The remote program is located at address *svcaddr*. The parameter *fd* is an open and bound file descriptor. The user may specify the size of the send and receive buffers with the parameters *sendsz* and *recvsz*; values of 0 choose suitable defaults. This routine returns `NULL` if it fails.

The address *svcaddr* should not be `NULL` and should point to the actual address of the remote program. `clnt_vc_create` will not consult the remote `rpcbind` service for this information.

SEE ALSO

`rpcbind(1M)`, `rpc(3N)`, `rpc_clnt_auth(3N)`, `rpc_clnt_calls(3N)`

NAME

rpc_svc_calls: rpc_reg, svc_reg, svc_unreg, xpirt_register, xpirt_unregister - library routines for registering servers

DESCRIPTION

These routines are a part of the RPC library which allows the RPC servers to register themselves with rpcbnd [see rpcbnd(1M)], and it associates the given program and version number with the dispatch function.

Routines

See rpc(3N) for the definition of the SVCXPRT data structure.

```
#include <rpc/rpc.h>
```

```
int
```

```
rpc_reg(const u_long prognum, const u_long versnum,
        const u_long procnum, const char *(*procname),
        const xdrproc_t inproc, const xdrproc_t outproc,
        const char *nettype);
```

Register program *prognum*, procedure *procname*, and version *versnum* with the RPC service package. If a request arrives for program *prognum*, version *versnum*, and procedure *procnum*, *procname* is called with a pointer to its parameter(s); *procname* should return a pointer to its static result(s); *inproc* is used to decode the parameters while *outproc* is used to encode the results. Procedures are registered on all available transports of the class *nettype*. *nettype* defines a class of transports which can be used for a particular application. If *nettype* is NULL, it defaults to *netpath*. This routine returns 0 if the registration succeeded, -1 otherwise.

```
int
```

```
svc_reg(const SVCXPRT *xpirt, const u_long prognum, const u_long versnum,
        const void (*dispatch), const struct netconfig *netconf);
```

Associates *prognum* and *versnum* with the service dispatch procedure, *dispatch*. If *netconf* is NULL, the service is not registered with the rpcbnd service. If *netconf* is non-zero, then a mapping of the triple [*prognum*, *versnum*, *netconf*->nc_netid] to *xpirt*->xp_ltaddr is established with the local rpcbnd service.

The *svc_reg* routine returns 1 if it succeeds, and 0 otherwise

```
void
```

```
svc_unreg(const u_long prognum, const u_long versnum);
```

Remove, from the rpcbnd service, all mappings of the double [*prognum*, *versnum*] to dispatch routines, and of the triple [*prognum*, *versnum*, *] to network address.

rpc_svc_calls(3N)

rpc_svc_calls(3N)

```
void  
xprt_register(const SVCXPRT *xprt);
```

After RPC service transport handle *xprt* is created, it is registered with the RPC service package. This routine modifies the global variable *svc_fds*. Service implementors usually do not need this routine.

```
void  
xprt_unregister(const SVCXPRT *xprt);
```

Before an RPC service transport handle *xprt* is destroyed, it unregisters itself with the RPC service package. This routine modifies the global variable *svc_fds*. Service implementors usually do not need this routine.

SEE ALSO

[rpcbind\(1M\)](#), [rpcbind\(3N\)](#), [rpc\(3N\)](#), [rpc_svc_err\(3N\)](#), [rpc_svc_create\(3N\)](#),
[rpc_svc_reg\(3N\)](#)

NAME

rpc_svc_create: svc_create, svc_destroy, svc_dg_create, svc_fd_create, svc_raw_create, svc_tli_create, svc_tp_create, svc_vc_create - library routines for dealing with the creation of server handles

DESCRIPTION

These routines are part of the RPC library which allows C language programs to make procedure calls on servers across the network. These routines deal with the creation of service handles. Once the handle is created, the server can be invoked by calling `svc_run`.

Routines

See `rpc(3N)` for the definition of the `SVCXPRT` data structure.

```
#include <rpc/rpc.h>
```

```
int
```

```
svc_create(
```

```
    const void (*dispatch)(const struct svc_req *, const SVCXPRT *),
    const u_long prognum, const u_long versnum,
    const char *nettype);
```

`svc_create` creates server handles for all the transports belonging to the class *nettype*.

nettype defines a class of transports which can be used for a particular application. The transports are tried in left to right order in `NETPATH` variable or in top to down order in the netconfig database.

If *nettype* is `NULL`, it defaults to `netpath`. `svc_create` registers itself with the `rpcbind` service [see `rpcbind(1M)`]. *dispatch* is called when there is a remote procedure call for the given *prognum* and *versnum*; this requires calling `svc_run` [see `svc_run` in `rpc_svc_reg(3N)`]. If it succeeds, `svc_create` returns the number of server handles it created, otherwise it returns 0 and the error message is logged.

```
void
```

```
svc_destroy(SVCXPRT *xpvt);
```

A function macro that destroys the RPC service transport handle *xprt*. Destruction usually involves deallocation of private data structures, including *xprt* itself. Use of *xprt* is undefined after calling this routine.

```
SVCXPRT *
```

```
svc_dg_create(const int fd, const u_int sendsz, const u_int recvsz);
```

This routine creates a connectionless RPC service handle, and returns a pointer to it. This routine returns `NULL` if it fails, and an error message is logged. *sendsz* and *recvsz* are parameters used to specify the size of the buffers. If they are 0, suitable defaults are chosen. The file descriptor *fd* should be open and bound.

Note: since connectionless-based RPC messages can only hold limited amount of encoded data, this transport cannot be used for procedures that take large arguments or return huge results.

rpc_svc_create(3N)

rpc_svc_create(3N)

```
SVCXPRT *
svc_fd_create(const int fd, const u_int sendsz, const u_int recvsz);
```

This routine creates a service on top of any open and bound descriptor, and returns the handle to it. Typically, this descriptor is a connected file descriptor for a connection-oriented transport. *sendsz* and *recvsz* indicate sizes for the send and receive buffers. If they are 0, a reasonable default is chosen. This routine returns `NULL`, if it fails, and an error message is logged.

```
SVCXPRT *
svc_raw_create(void);
```

This routine creates a toy RPC service transport, to which it returns a pointer. The transport is really a buffer within the process's address space, so the corresponding RPC client should live in the same address space; [see `clnt_raw_create` in `rpc_clnt_create`]. This routine allows simulation of RPC and acquisition of RPC overheads (such as round trip times), without any kernel interference. This routine returns `NULL` if it fails, and an error message is logged.

```
SVCXPRT *
svc_tli_create(const int fd, const struct netconfig *netconf,
const struct t_bind *bindaddr, const u_int sendsz,
const u_int recvsz);
```

This routine creates an RPC server handle, and returns a pointer to it. *fd* is the file descriptor on which the service is listening. If *fd* is `RPC_ANYFD`, it opens a file descriptor on the transport specified by *netconf*. If the file descriptor is unbound, it is bound to the address specified by *bindaddr*, if *bindaddr* is non-null, otherwise it is bound to a default address chosen by the transport. In the case where the default address is chosen, the number of outstanding connect requests is set to 8 for connection-oriented transports. The user may specify the size of the send and receive buffers with the parameters *sendsz* and *recvsz*; values of 0 choose suitable defaults. This routine returns `NULL` if it fails, and an error message is logged.

```
SVCXPRT *
svc_tp_create(const void (*dispatch)(const RQSTP *, const SVCXPRT *),
const u_long prognum, const u_long versnum,
const struct netconfig *netconf);
```

`svc_tp_create` creates a server handle for the network specified by *netconf*, and registers itself with the `rpcbind` service. *dispatch* is called when there is a remote procedure call for the given *prognum* and *versnum*; this requires calling `svc_run`. `svc_tp_create` returns the service handle if it succeeds, otherwise a `NULL` is returned, and an error message is logged.

rpc_svc_create(3N)

rpc_svc_create(3N)

```
SVCXPRT *  
svc_vc_create(const int fd, const u_int sendsz, const u_int recvsz);
```

This routine creates a connection-oriented RPC service and returns a pointer to it. This routine returns `NULL` if it fails, and an error message is logged. The users may specify the size of the send and receive buffers with the parameters *sendsz* and *recvsz*; values of 0 choose suitable defaults. The file descriptor *fd* should be open and bound.

SEE ALSO

`rpcbind(1M)`, `rpc(3N)`, `rpc_svc_calls(3N)`, `rpc_svc_err(3N)`,
`rpc_svc_reg(3N)`

NAME

rpc_svc_err: svcerr_auth, svcerr_decode, svcerr_noproc, svcerr_noprogram, svcerr_progvers, svcerr_systemerr, svcerr_weakauth - library routines for server side remote procedure call errors

DESCRIPTION

These routines are part of the RPC library which allows C language programs to make procedure calls on other machines across the network.

These routines can be called by the server side dispatch function if there is any error in the transaction with the client.

Routines

See `rpc(3N)` for the definition of the `SVCXPRT` data structure.

```
#include <rpc/rpc.h>
```

```
void
```

```
svcerr_auth(const SVCXPRT *xprt, const enum auth_stat why);
```

Called by a service dispatch routine that refuses to perform a remote procedure call due to an authentication error.

```
void
```

```
svcerr_decode(const SVCXPRT *xprt);
```

Called by a service dispatch routine that cannot successfully decode the remote parameters [see `svc_getargs` in `rpc_svc_reg(3N)`].

```
void
```

```
svcerr_noproc(const SVCXPRT *xprt);
```

Called by a service dispatch routine that does not implement the procedure number that the caller requests.

```
void
```

```
svcerr_noprogram(const SVCXPRT *xprt);
```

Called when the desired program is not registered with the RPC package. Service implementors usually do not need this routine.

```
void
```

```
svcerr_progvers(const SVCXPRT *xprt);
```

Called when the desired version of a program is not registered with the RPC package. Service implementors usually do not need this routine.

```
void
```

```
svcerr_systemerr(const SVCXPRT *xprt);
```

Called by a service dispatch routine when it detects a system error not covered by any particular protocol. For example, if a service can no longer allocate storage, it may call this routine.

rpc_svc_err(3N)**rpc_svc_err(3N)**

```
void  
svcerr_weakauth(const SVCXPRT *xprt);
```

Called by a service dispatch routine that refuses to perform a remote procedure call due to insufficient (but correct) authentication parameters. The routine calls `svcerr_auth(xprt, AUTH_TOOWEAK)`.

SEE ALSO

`rpc(3N)`, `rpc_svc_calls(3N)`, `rpc_svc_create(3N)`, `rpc_svc_reg(3N)`

NAME

rpc_svc_reg: svc_freeargs, svc_getargs, svc_getreqset, svc_getrpccaller, svc_run, svc_sendreply - library routines for RPC servers

DESCRIPTION

These routines are part of the RPC library which allows C language programs to make procedure calls on other machines across the network.

These routines are associated with the server side of the RPC mechanism. Some of them are called by the server side dispatch function, while others [such as `svc_run`] are called when the server is initiated.

Routines

```
#include <rpc/rpc.h>
```

```
int
```

```
svc_freeargs(const SVCXPRT *xpvt, const xdrproc_t inproc, char *in);
```

A function macro that frees any data allocated by the RPC/XDR system when it decoded the arguments to a service procedure using `svc_getargs`. This routine returns 1 if the results were successfully freed, and 0 otherwise.

```
int
```

```
svc_getargs(const SVCXPRT *xpvt, const xdrproc_t inproc, caddr_t *in);
```

A function macro that decodes the arguments of an RPC request associated with the RPC service transport handle `xpvt`. The parameter `in` is the address where the arguments will be placed; `inproc` is the XDR routine used to decode the arguments. This routine returns 1 if decoding succeeds, and 0 otherwise.

```
void
```

```
svc_getreqset(fd_set *rdfs);
```

This routine is only of interest if a service implementor does not call `svc_run`, but instead implements custom asynchronous event processing. It is called when `poll` has determined that an RPC request has arrived on some RPC file descriptors; `rdfs` is the resultant read file descriptor bit mask. The routine returns when all file descriptors associated with the value of `rdfs` have been serviced

```
struct netbuf *
```

```
svc_getrpccaller(const SVCXPRT *xpvt);
```

The approved way of getting the network address of the caller of a procedure associated with the RPC service transport handle `xpvt`.

```
void
```

```
svc_run(void);
```

This routine never returns. It waits for RPC requests to arrive, and calls the appropriate service procedure using `svc_getreqset` when one arrives. This procedure is usually waiting for a `poll` library call to return.

rpc_svc_reg(3N)

rpc_svc_reg(3N)

```
int
svc_sendreply(const SVCXPRT *xprt, const xdrproc_t outproc,
              const caddr_t *out);
```

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 1 if it succeeds, 0 otherwise.

SEE ALSO

poll(2), rpc(3N), rpc_svc_calls(3N), rpc_svc_create(3N), rpc_svc_err(3N)

NAME

rpc_xdr: xdr_accepted_reply, xdr_authsys_parms, xdr_callhdr, xdr_callmsg, xdr_opaque_auth, xdr_rejected_reply, xdr_replymsg - XDR library routines for remote procedure calls

DESCRIPTION

These routines are used for describing the RPC messages in XDR language. They should normally be used by those who do not want to use the RPC package.

Routines

See rpc(3N) for the definition of the XDR data structure.

```
#include <rpc/rpc.h>
```

```
bool_t
```

```
xdr_accepted_reply(XDR *xdrs, const struct accepted_reply *ar);
```

Used for encoding RPC reply messages. It encodes the status of the RPC call in the XDR language format, and in the case of success, it encodes the call results also.

```
bool_t
```

```
xdr_authsys_parms(XDR *xdrs, const struct authsys_parms *aupp);
```

Used for describing operating system credentials. It includes machine-name, uid, gid list, etc.

```
void
```

```
xdr_callhdr(XDR *xdrs, const struct rpc_msg *chdr);
```

Used for describing RPC call header messages. It encodes the static part of the call message header in the XDR language format. It includes information such as transaction ID, RPC version number, program and version number.

```
bool_t
```

```
xdr_callmsg(XDR *xdrs, const struct rpc_msg *cmsg);
```

Used for describing RPC call messages. This includes all the RPC call information such as transaction ID, RPC version number, program number, version number, authentication information, etc. This is normally used by servers to determine information about the client RPC call.

```
bool_t
```

```
xdr_opaque_auth(XDR *xdrs, const struct opaque_auth *ap);
```

Used for describing RPC opaque authentication information messages.

```
bool_t
```

```
xdr_rejected_reply(XDR *xdrs, const struct rejected_reply *rr);
```

Used for describing RPC reply messages. It encodes the rejected RPC message in the XDR language format. The message could be rejected either because of version number mis-match or because of authentication errors.

rpc_xdr(3N)**rpc_xdr(3N)**

```
bool_t  
xdr_replymsg(XDR *xdrs, const struct rpc_msg *rmsg);
```

Used for describing RPC reply messages. It encodes all the RPC reply message in the XDR language format This reply could be either an acceptance, rejection or NULL.

SEE ALSO

rpc(3N)

NAME

rpcbind: `rpcb_getmaps`, `rpcb_getaddr`, `rpcb_gettime`, `rpcb_rmtcall`, `rpcb_set`, `rpcb_unset` - library routines for RPC bind service

DESCRIPTION

These routines allow client C programs to make procedure calls to the RPC binder service. `rpcbind` [see `rpcbind(1M)`] maintains a list of mappings between programs and their universal addresses.

Routines

```
#include <rpc/rpc.h>
struct rpcblist *
rpcb_getmaps(const struct netconfig *netconf, const char *host);
```

A user interface to the `rpcbind` service, which returns a list of the current RPC program-to-address mappings on the host named. It uses the transport specified through `netconf` to contact the remote `rpcbind` service on host `host`. This routine will return `NULL`, if the remote `rpcbind` could not be contacted.

```
bool_t
rpcb_getaddr(const u_long prognum, const u_long versnum,
             const struct netconfig *netconf, struct netbuf *svcaddr,
             const char *host);
```

A user interface to the `rpcbind` service, which finds the address of the service on `host` that is registered with program number `prognum`, version `versnum`, and speaks the transport protocol associated with `netconf`. The address found is returned in `svcaddr`. `svcaddr` should be preallocated. This routine returns 1 if it succeeds. A return value of 0 means that the mapping does not exist or that the RPC system failed to contact the remote `rpcbind` service. In the latter case, the global variable `rpc_createerr` contains the RPC status.

```
bool_t
rpcb_gettime(const char *host, time_t *timep);
```

This routine returns the time on `host` in `timep`. If `host` is `NULL`, `rpcb_gettime` returns the time on its own machine. This routine returns 1 if it succeeds, 0 if it fails. `rpcb_gettime` can be used to synchronize the time between the client and the remote server. This routine is particularly useful for secure RPC.

rpcbind(3N)

rpcbind(3N)

```
enum clnt_stat
rpcb_rmtcall(const struct netconfig *netconf, const char *host,
             const u_long prognum, const u_long versnum, const u_long procnum,
             const xdrproc_t inproc, const caddr_t in,
             const xdrproc_t outproc, const caddr_t out,
             const struct timeval tout, struct netbuf *svcaddr);
```

A user interface to the `rpcbind` service, which instructs `rpcbind` on *host* to make an RPC call on your behalf to a procedure on that host. The parameter *svcaddr* will be modified to the server's address if the procedure succeeds [see `rpc_call` and `clnt_call` in `rpc_clnt_calls(3N)` for the definitions of other parameters]. This procedure should normally be used for a ping and nothing else [see `rpc_broadcast` in `rpc_clnt_calls(3N)`]. This routine allows programs to do lookup and call, all in one step.

```
bool_t
rpcb_set(const u_long prognum, const u_long versnum,
         const struct netconfig *netconf, const struct netbuf *svcaddr);
```

A user interface to the `rpcbind` service, which establishes a mapping between the triple [*prognum*, *versnum*, *netconf*->*nc_netid*] and *svcaddr* on the machine's `rpcbind` service. The value of *transport* must correspond to a network token that is defined by the `netconfig` database. This routine returns 1 if it succeeds, 0 otherwise. [See also `svc_reg` in `rpc_svc_calls(3N)`].

```
bool_t
rpcb_unset(const u_long prognum, const u_long versnum,
           const struct netconfig *netconf);
```

A user interface to the `rpcbind` service, which destroys all mapping between the triple [*prognum*, *versnum*, *netconf*->*nc_netid*] and the address on the machine's `rpcbind` service. If *netconf* is NULL, `rpcb_unset` destroys all mapping between the triple [*prognum*, *versnum*, *] and the addresses on the machine's `rpcbind` service. This routine returns 1 if it succeeds, 0 otherwise. [See also `svc_unreg` in `rpc_svc_calls(3N)`].

SEE ALSO

`rpc_clnt_calls(3N)`, `rpc_svc_calls(3N)`, `rpcbind(1M)`, `rpcinfo(1M)`

rusers(3N)

rusers(3N)

NAME

rusers - return information about users on remote machines

SYNOPSIS

```
#include <rpcsvc/rusers.h>
```

```
int rusers(char *host, struct utmpidlearr *up);
```

rusers fills the utmpidlearr structure with data about *host*, and returns 0 if successful. The function will fail if the underlying transport does not support broadcast mode.

SEE ALSO

rusers(1)

NAME

rwall - write to specified remote machines

SYNOPSIS

```
#include <rpcsvc/rwall.h>
rwall(char *host, char *msg);
```

DESCRIPTION

rwall executes wall(1M) on *host*. *host* prints the string *msg* to all its users. It returns 0 if successful.

SEE ALSO

rwall(1M), rwalld(1M)

NAME

scandir, alphasort - scan a directory

SYNOPSIS

```
/usr/ucb/cc [flag...] file...  
#include <sys/types.h>  
#include <sys/dir.h>  
  
scandir(dirname, &namelist, select, compar)  
char *dirname;  
struct direct **namelist;  
int (*select)();  
int (*compar)();  
  
alphasort(d1, d2)  
struct direct **d1, **d2;
```

DESCRIPTION

scandir reads the directory *dirname* and builds an array of pointers to directory entries using `malloc(3C)`. The second parameter is a pointer to an array of structure pointers. The third parameter is a pointer to a routine which is called with a pointer to a directory entry and should return a non zero value if the directory entry should be included in the array. If this pointer is `NULL`, then all the directory entries will be included. The last argument is a pointer to a routine which is passed to `qsort(3C)` to sort the completed array. If this pointer is `NULL`, the array is not sorted. `alphasort` is a routine which will sort the array alphabetically.

scandir returns the number of entries in the array and a pointer to the array through the parameter *namelist*.

SEE ALSO

`getdents(2)`, `directory(3C)`, `malloc(3C)`, `qsort(3C)`.

RETURN VALUE

Returns -1 if the directory cannot be opened for reading or if `malloc(3C)` cannot allocate enough memory to hold all the data structures.

NAME

scanf, fscanf, sscanf - convert formatted input

SYNOPSIS

```
#include <stdio.h>

int scanf(const char *format, . . .);

int fscanf(FILE *strm, const char *format, . . .);

int sscanf(const char *s, const char *format, . . .);
```

DESCRIPTION

scanf reads from the standard input stream, `stdin`.

fscanf reads from the stream `strm`.

sscanf reads from the character string `s`.

Each function reads characters, interprets them according to a format, and stores the results in its arguments. Each expects, as arguments, a control string, *format*, described below and a set of pointer arguments indicating where the converted input should be stored. If there are insufficient arguments for the format, the behavior is undefined. If the format is exhausted while arguments remain, the excess arguments are simply ignored.

The control string usually contains conversion specifications, which are used to direct interpretation of input sequences. The control string may contain:

1. White-space characters (blanks, tabs, new-lines, or form-feeds) that, except in two cases described below, cause input to be read up to the next non-white-space character.
2. An ordinary character (not %) that must match the next character of the input stream.
3. Conversion specifications consisting of the character % or the character sequence *%digitsS*, an optional assignment suppression character *, a decimal digit string that specifies an optional numerical maximum field width, an optional letter *l* (ell), *L*, or *h* indicating the size of the receiving object, and a conversion code. The conversion specifiers *d*, *i*, and *n* should be preceded by *h* if the corresponding argument is a pointer to short `int` rather than a pointer to `int`, or by *l* if it is a pointer to long `int`. Similarly, the conversion specifiers *o*, *u*, and *x* should be preceded by *h* if the corresponding argument is a pointer to unsigned short `int` rather than a pointer to unsigned `int`, or by *l* if it is a pointer to unsigned long `int`. Finally, the conversion specifiers *e*, *f*, and *g* should be preceded by *l* if the corresponding argument is a pointer to double rather than a pointer to `float`, or by *L* if it is a pointer to long double. The *h*, *l*, or *L* modifier is ignored with any other conversion specifier.

A conversion specification directs the conversion of the next input field; the result is placed in the variable pointed to by the corresponding argument unless assignment suppression was indicated by the character *. The suppression of assignment provides a way of describing an input field that is to be skipped. An input field is defined as a string of non-space characters; it extends to the next inappropriate character or until the maximum field width, if one is specified, is exhausted. For all

descriptors except the character `[]` and the character `c`, white space leading an input field is ignored.

Conversions can be applied to the *n*th argument in the argument list, rather than to the next unused argument. In this case, the conversion character `%` (see above) is replaced by the sequence `%digits$` where *digits* is a decimal integer *n*, giving the position of the argument in the argument list. The first such argument, `%1$`, immediately follows *format*. The control string can contain either form of a conversion specification, i.e., `%` or `%digits$`, although the two forms cannot be mixed within a single control string.

The conversion code indicates the interpretation of the input field; the corresponding pointer argument must usually be of a restricted type. For a suppressed field, no pointer argument is given. The following conversion codes are valid:

- `%` A single `%` is expected in the input at this point; no assignment is done.
- `d` Matches an optionally signed decimal integer, whose format is the same as expected for the subject sequence of the `strtol` function with the value 10 for the *base* argument. The corresponding argument should be a pointer to integer.
- `u` Matches an optionally signed decimal integer, whose format is the same as expected for the subject sequence of the `strtoul` function with the value 10 for the *base* argument. The corresponding argument should be a pointer to unsigned integer.
- `o` Matches an optionally signed octal integer, whose format is the same as expected for the subject sequence of the `strtoul` function with the value 8 for the *base* argument. The corresponding argument should be a pointer to unsigned integer.
- `x` Matches an optionally signed hexadecimal integer, whose format is the same as expected for the subject sequence of the `strtoul` function with the value 16 for the *base* argument. The corresponding argument should be a pointer to unsigned integer.
- `i` Matches an optionally signed integer, whose format is the same as expected for the subject sequence of the `strtol` function with the value 0 for the *base* argument. The corresponding argument should be a pointer to integer.
- `n` No input is consumed. The corresponding argument should be a pointer to integer into which is to be written the number of characters read from the input stream so far by the call to the function. Execution of a `%n` directive does not increment the assignment count returned at the completion of execution of the function.
- `e,f,g` Matches an optionally signed floating point number, whose format is the same as expected for the subject string of the `strtod` function. The corresponding argument should be a pointer to floating.
- `s` A character string is expected; the corresponding argument should be a character pointer pointing to an array of characters large enough to accept the string and a terminating `\0`, which will be added automatically. The input field is terminated by a white-space character.

- c Matches a sequence of characters of the number specified by the field width (1 if no field width is present in the directive). The corresponding argument should be a pointer to the initial character of an array large enough to accept the sequence. No null character is added. The normal skip over white space is suppressed.
- [Matches a nonempty sequence of characters from a set of expected characters (the *scanset*). The corresponding argument should be a pointer to the initial character of an array large enough to accept the sequence and a terminating null character, which will be added automatically. The conversion specifier includes all subsequent characters in the *format* string, up to and including the matching right bracket (]). The characters between the brackets (the *scanlist*) comprise the scanset, unless the character after the left bracket is a circumflex (^), in which case the scanset contains all characters that do not appear in the scanlist between the circumflex and the right bracket. If the conversion specifier begins with [] or [^], the right bracket character is in the scanlist and the next right bracket character is the matching right bracket that ends the specification; otherwise the first right bracket character is the one that ends the specification.

A range of characters in the scanset may be represented by the construct *first - last*; thus [0123456789] may be expressed [0-9]. Using this convention, *first* must be lexically less than or equal to *last*, or else the dash will stand for itself. The character - will also stand for itself whenever it is the first or the last character in the scanlist. To include the right bracket as an element of the scanset, it must appear as the first character (possibly preceded by a circumflex) of the scanlist and in this case it will not be syntactically interpreted as the closing bracket. At least one character must match for this conversion to be considered successful.
- p Matches an implementation-defined set of sequences, which should be the same as the set of sequences that may be produced by the %p conversion of the printf function. The corresponding argument should be a pointer to void. The interpretation of the input item is implementation-defined. If the input item is a value converted earlier during the same program execution, the pointer that results shall compare equal to that value; otherwise, the behavior of the %p conversion is undefined.

If an invalid conversion character follows the %, the results of the operation may not be predictable.

The conversion specifiers E, G, and X are also valid and, under the -Xa and -Xc compilation modes [see cc(1)], behave the same as e, g, and x, respectively. Under the -Xt compilation mode, E, G, and X behave the same as le, lg, and lx, respectively.

Each function allows for detection of a language-dependent decimal point character in the input string. The decimal point character is defined by the program's locale (category LC_NUMERIC). In the "C" locale, or in a locale where the decimal point character is not defined, the decimal point character defaults to a period (.).

The scanf conversion terminates at end of file, at the end of the control string, or when an input character conflicts with the control string.

scanf(3S)

scanf(3S)

If end-of-file is encountered during input, conversion is terminated. If end-of-file occurs before any characters matching the current directive have been read (other than leading white space, where permitted), execution of the current directive terminates with an input failure; otherwise, unless execution of the current directive is terminated with a matching failure, execution of the following directive (if any) is terminated with an input failure.

If conversion terminates on a conflicting input character, the offending input character is left unread in the input stream. Trailing white space (including new-line characters) is left unread unless matched by a directive. The success of literal matches and suppressed assignments is not directly determinable other than via the `%n` directive.

EXAMPLES

The call to the function `scanf`:

```
int i, n; float x; char name[50];
n = scanf ("%d%f%s", &i, &x, name);
```

with the input line:

```
25 54.32E-1 thompson
```

will assign to `n` the value 3, to `i` the value 25, to `x` the value 5.432, and `name` will contain `thompson\0`.

The call to the function `scanf`:

```
int i; float x; char name[50];
(void) scanf ("%2d%f%*d %[0-9]", &i, &x, name);
```

with the input line:

```
56789 0123 56a72
```

will assign 56 to `i`, 789.0 to `x`, skip 0123, and place the characters 56\0 in `name`. The next character read from `stdin` will be `a`.

SEE ALSO

`cc(1)`, `printf(3S)`, `strtod(3C)`, `strtol(3C)`, `strtoul(3C)`

DIAGNOSTICS

These routines return the number of successfully matched and assigned input items; this number can be zero in the event of an early matching failure between an input character and the control string. If the input ends before the first matching failure or conversion, EOF is returned.

NAME

scanf, fscanf, sscanf - convert formatted input

SYNOPSIS

```
#include <stdio.h>
#include <wchar.h>

int scanf(const char *format [, pointer] ... );
int fscanf(FILE *stream, const char *format [, pointer] ... );
int sscanf(char *s, const char *format [, pointer] ... );
```

DESCRIPTION (International Functions)

scanf() reads from the standard input stream *stdin*. fscanf() reads from the named input stream. sscanf() reads from the character string *s*. Each function reads characters (bytes), interprets them according to a control string *format*, and stores the results in its arguments.

The control string usually contains conversion specification, which are used to direct interpretation of input sequences. The control string may contain:

- A. White-space characters (characters are defined in `isspace()` of `ctype(3C)`). Except in two cases described below, these cause input to be read up to the next non-white-space character.
- B. An ordinary character (any EUC character, except the ASCII character `%`), which must match the next byte of the input stream.
- C. Conversion specifications which direct the conversion of the next input field. Only ASCII characters are allowed as conversion characters.

The conversion code indicates the interpretation of the input field, and the corresponding pointer argument must match the type being read. `wc` and `ws` are the new conversion specifications for `wchar_t` character control, and both may be used in all three functions.

- `wc` A `wchar_t` character is expected; the character, which should be in EUC, is transformed into a `wchar_t` character, and stored in the location pointed to by the corresponding argument which should be a `wchar_t` pointer. The normal skip over white space is suppressed in this case. To read the next non-space character as the `wchar_t` character, `%1ws` should be used. If a field width is given, the corresponding argument should refer to a `wchar_t` array; the indicated number of `wchar_t` characters are read.
- `ws` A `wchar_t` string is expected; characters in EUC are transformed into `wchar_t` characters and stored in the location pointed to by the corresponding argument. The corresponding argument should be a pointer pointing to a `wchar_t` array large enough to accept the string and a terminating `wchar_t` null character, which is added automatically. `wchar_t` characters are read until the number of `wchar_t` characters specified in the field width, if supplied, or a white-space character is read.

The conversion of these functions terminate at EOF or a NULL character in the case of `sscanf()`, at the end of the control string, or when an input character conflicts with the control string. In the last case, the offending character is left unread in the input stream.

scanf(3W)

scanf(3W)

These functions return the number of successfully matched and assigned input items; this number can be zero in the event of an early conflict between an input character and the control string. If the input ends before the first conflict or conversion, EOF is returned.

WARNING

A character from a supplementary code set in a **scanset** enclosed in a pair of square brackets is simply interpreted as a byte string. Each byte of the input field is compared to the byte in the **scanset**.

SEE ALSO

printf(3W), scanf(3S), stdio(3S), vprintf(3W), widec(3W).

NAME

scenter, sdleave - synchronize access to a shared data segment

SYNOPSIS

```
cc [flag...] file... -lx
#include <sys/sd.h>
int scenter(char *addr, int flags);
int sdleave(char *addr);
```

DESCRIPTION

scenter is used to indicate that the current process is about to access the contents of a shared data segment. The actions performed depend on the value of *flags*. *flags* values are formed by OR-ing together entries from the following list:

SD_NOWAIT If another process has called scenter but not sdleave for the indicated segment, and the segment was not created with the SD_UNLOCK flag set, return an ENAVAIL error instead of waiting for the segment to become free.

SD_WRITE Indicates that the process wants to write data to the shared data segment. A process that has attached to a shared data segment with the SD_RDONLY flag set will not be allowed to enter with the SD_WRITE flag set.

sdleave is used to indicate that the current process is done modifying the contents of a shared data segment.

Only changes made between invocations of scenter and sdleave are guaranteed to be reflected in other processes. scenter and sdleave are very fast; consequently, it is recommended that they be called frequently rather than leave scenter in effect for any period of time. In particular, system calls should be avoided between scenter and sdleave calls.

The fork system call is forbidden between calls to scenter and sdleave if the segment was created without the SD_UNLOCK flag.

DIAGNOSTICS

Successful calls return 0. Unsuccessful calls return -1 and set *errno* to indicate the error. *errno* is set to EINVAL if a process does an scenter with the SD_WRITE flag set and the segment is already attached with the SD_RDONLY flag set. *errno* is set to ENAVAIL if the SD_NOWAIT flag is set for scenter and the shared data segment is not free.

SEE ALSO

sdget(2), sdgetv(2)

NAME

sdget, sdfree - attach and detach a shared data segment

SYNOPSIS

```
cc [flag ...] file... -lx
#include <sys/sd.h>

char *sdget(char *path, int flags, /* long size, int mode */);
int sdfree(char *addr);
```

DESCRIPTION

sdget attaches a shared data segment to the data space of the current process. The actions performed are controlled by the value of *flags*. *flags* values are constructed by an OR of flags from the following list:

- SD_RDONLY Attach the segment for reading only.
- SD_WRITE Attach the segment for both reading and writing.
- SD_CREAT If the segment named by *path* exists and is not in use (active), this flag will have the same effect as creating a segment from scratch. Otherwise, the segment is created according to the values of *size* and *mode*. Read and write access to the segment is granted to other processes based on the permissions passed in *mode*, and functions the same as those for regular files. Execute permission is meaningless. The segment is initialized to contain all zeroes.
- SD_UNLOCK If the segment is created because of this call, the segment will be made so that more than one process can be between *sdenter* and *sdleave* calls.

sdfree detaches the current process from the shared data segment that is attached at the specified address. If the current process has done *sdenter* but not an *sdleave* for the specified segment, *sdleave* will be done before detaching the segment.

When no process remains attached to the segment, the contents of that segment disappear, and no process can attach to the segment without creating it by using the *SD_CREAT* flag in *sdget*. *errno* is set to *EEXIST* if a process tries to create a shared data segment that exists and is in use. *errno* is set to *ENOTNAM* if a process attempts an *sdget* on a file that exists but is not a shared data type.

DIAGNOSTICS

On successful completion, the address at which the segment was attached is returned. Otherwise, -1 is returned, and *errno* is set to indicate the error. *errno* is set to *EINVAL* if a process does an *sdget* on a shared data segment to which it is already attached. *errno* is set to *EEXIST* if a process tries to create a shared data segment that exists and is in use. *errno* is set to *ENOTNAM* if a process attempts an *sdget* on a file that exists but is not a shared data type.

The mode parameter must be included on the first call of the *sdget* function.

SEE ALSO

sdenter(2), *sdgetv*(2)

NAME

sdgetv - synchronize shared data access

SYNOPSIS

```
cc [flag...]file...-lx
#include <sys/sd.h>
int sdgetv(addr)
int sdwaitv(char *addr, int vnum);
```

DESCRIPTION

sdgetv and sdwaitv may be used to synchronize cooperating processes that are using shared data segments. The return value of both routines is the version number of the shared data segment attached to the process at address *addr*. The version number of a segment changes whenever some process does an sdleave for that segment.

sdgetv simply returns the version number of the indicated segment.

sdwaitv forces the current process to sleep until the version number for the indicated segment is no longer equal to *vnum*.

DIAGNOSTICS

Upon successful completion, both sdgetv and sdwaitv return a positive integer that is the current version number for the indicated shared data segment. Otherwise, a value of -1 is returned, and errno is set to indicate the error.

SEE ALSO

sdenter(2), sdget(2)

NAME

secure_rpc: authdes_seccreate, authdes_getucred, getnetname, host2netname, key_decryptsession, key_encryptsession, key_gendes, key_setsecret, netname2host, netname2user, user2netname - library routines for secure remote procedure calls

DESCRIPTION

RPC library routines allow C programs to make procedure calls on other machines across the network. First, the client calls a procedure to send a data packet to the server. Upon receipt of the packet, the server calls a dispatch routine to perform the requested service, and then sends back a reply.

RPC supports various authentication flavors. Among them are:

| | |
|-----------|---|
| AUTH_NONE | (none) no authentication. |
| AUTH_SYS | Traditional UNIX®-style authentication. |
| AUTH_DES | DES encryption-based authentication. |

The `authdes_getucred` and `authdes_seccreate` routines implement the AUTH_DES authentication flavor. The `keyserver` daemon `keyserv` [see `keyserv(1M)`] must be running for the AUTH_DES authentication system to work.

Routines

See `rpc(3N)` for the definition of the AUTH data structure.

```
#include <rpc/rpc.h>
```

```
int
```

```
authdes_getucred(const struct authdes_cred *adc, uid_t *uidp,
                 gid_t *gidp, short *gidlenp, gid_t *gidlist);
```

`authdes_getucred` is the first of the two routines which interface to the RPC secure authentication system known as AUTH_DES. The second is `authdes_seccreate`, below. `authdes_getucred` is used on the server side for converting an AUTH_DES credential, which is operating system independent, into an AUTH_SYS credential. This routine returns 1 if it succeeds, 0 if it fails.

**uidp* is set to the user's numerical ID associated with *adc*. **gidp* is set to the numerical ID of the group to which the user belongs. **gidlist* contains the numerical IDs of the other groups to which the user belongs. **gidlenp* is set to the number of valid group ID entries in **gidlist* [see `netname2user`, below].

AUTH *

```
authdes_seccreate(const char *name, const unsigned int window,
                  const char *timehost, const des_block *ckey);
```

`authdes_seccreate`, the second of two AUTH_DES authentication routines, is used on the client side to return an authentication handle that will enable the use of the secure authentication system. The first parameter *name* is the network name, or *netname*, of the owner of the server process. This field usually represents a hostname derived from the utility routine `host2netname`, but could also represent a user name using `user2netname`, described below. The second field is *window* on the validity of the client credential, given in seconds. A small window is more secure than a large one, but choosing too small of a window will increase the frequency of resynchronizations because of clock drift. The third parameter, *timehost*, the host's name, is optional. If it is NULL, then the authentication system will assume that the local clock is always in sync with the *timehost* clock, and will not attempt resynchronizations. If a timehost is supplied, however, then the system will consult with the remote time service whenever resynchronization is required. This parameter is usually the name of the RPC server itself. The final parameter *ckey* is also optional. If it is NULL, then the authentication system will generate a random DES key to be used for the encryption of credentials. If *ckey* is supplied, then it will be used instead.

int

```
getnetname(char name[MAXNETNAMELEN+1]);
```

`getnetname` installs the unique, operating-system independent netname of the caller in the fixed-length array *name*. Returns 1 if it succeeds, and 0 if it fails.

int

```
host2netname(char name[MAXNETNAMELEN+1], const char *host,
              const char *domain);
```

Convert from a domain-specific hostname *host* to an operating-system independent netname. Return 1 if it succeeds, and 0 if it fails. Inverse of `netname2host`. If *domain* is NULL, `host2netname` uses the default domain name of the machine. If *host* is NULL, it defaults to that machine itself.

int

```
key_decryptsession(const char *remotename, des_block *deskey);
```

`key_decryptsession` is an interface to the keyserver daemon, which is associated with RPC's secure authentication system (AUTH_DES authentication). User programs rarely need to call it, or its associated routines `key_encryptsession`, `key_gendes` and `key_setsecret`.

`key_decryptsession` takes a server netname *remotename* and a DES key *deskey*, and decrypts the key by using the the public key of the the server and the secret key associated with the effective UID of the calling process. It is the inverse of `key_encryptsession`.

```
int
key_encryptsession(const char *remotename, des_block *deskey);
```

`key_encryptsession` is a keyserver interface routine. It takes a server netname *remotename* and a DES key *deskey*, and encrypts it using the public key of the the server and the secret key associated with the effective UID of the calling process. It is the inverse of `key_decryptsession`. This routine returns 0 if it succeeds, -1 if it fails.

```
int
key_gendes(des_block *deskey);
```

`key_gendes` is a keyserver interface routine. It is used to ask the keyserver for a secure conversation key. Choosing one at random is usually not good enough, because the common ways of choosing random numbers, such as using the current time, are very easy to guess.

```
int
key_setsecret(const char *key);
```

`key_setsecret` is a keyserver interface routine. It is used to set the key for the effective UID of the calling process. this routine returns 0 if it succeeds, -1 if it fails.

```
int
netname2host(const char *name, char *host, const int hostlen);
```

Convert from an operating-system independent netname *name* to a domain-specific hostname *host*. *hostlen* is the maximum size of *host*. Returns 1 if it succeeds, and 0 if it fails. Inverse of `host2netname`.

```
int
netname2user(const char *name, uid_t *uidp, gid_t *gidp,
int *gidlenp, gid_t gidlist[NGROUPS]);
```

Convert from an operating-system independent netname to a domain-specific user ID. Returns 1 if it succeeds, and 0 if it fails. Inverse of `user2netname`.

**uidp* is set to the user's numerical ID associated with *name*. **gidp* is set to the numerical ID of the group to which the user belongs. *gidlist* contains the numerical IDs of the other groups to which the user belongs. **gidlenp* is set to the number of valid group ID entries in *gidlist*.

```
int
user2netname(char name[MAXNETNAMELEN+1], const uid_t uid,
const char *domain);
```

Convert from a domain-specific username to an operating-system independent netname. Returns 1 if it succeeds, and 0 if it fails. Inverse of `netname2user`.

SEE ALSO

`chkey(1)`, `keyserv(1M)`, `newkey(1M)`, `rpc(3N)`, `rpc_clnt_auth(3N)`

select (3C)

select (3C)

NAME

select - synchronous I/O multiplexing

SYNOPSIS

```
#include <sys/time.h>
#include <sys/types.h>

select(int nfd, fd_set *readfds, fd_set *writefds, fd_set *exceptfds, struct
        timeval *timeout);
FD_SET(int fd, fd_set fdset);
FD_CLR(int fd, fd_set fdset);
FD_ISSET(int fd, fd_set fdset);
FD_ZERO(fd_set fdset);
```

DESCRIPTION

select examines the I/O descriptor sets whose addresses are passed in *readfds*, *writefds*, and *exceptfds* to see if any of their descriptors are ready for reading, are ready for writing, or have an exceptional condition pending, respectively. *nfd* is the number of bits to be checked in each bit mask that represents a file descriptor; the descriptors from 0 to *nfd*-1 in the descriptor sets are examined. On return, select replaces the given descriptor sets with subsets consisting of those descriptors that are ready for the requested operation.

The descriptor sets are stored as bit fields in arrays of integers. The following macros are provided for manipulating such descriptor sets: `FD_ZERO(&fdset)` initializes a descriptor set *fdset* to the null set. `FD_SET(fd, &fdset)` includes a particular descriptor *fd* in *fdset*. `FD_CLR(fd, &fdset)` removes *fd* from *fdset*. `FD_ISSET(fd, &fdset)` is nonzero if *fd* is a member of *fdset*, zero otherwise. The behavior of these macros is undefined if a descriptor value is less than zero or greater than or equal to `FD_SETSIZE`. `FD_SETSIZE` is a constant defined in `sys/select.h` (included by `sys/types.h`) and is normally at least equal to the maximum number of descriptors supported by the system.

If *timeout* is not a NULL pointer, it specifies a maximum interval to wait for the selection to complete. If *timeout* is a NULL pointer, the select blocks indefinitely. To effect a poll, the *timeout* argument should be a non-NULL pointer, pointing to a zero-valued `timeval` structure.

Any of *readfds*, *writefds*, and *exceptfds* may be given as NULL pointers if no descriptors are of interest.

RETURN VALUE

select returns one of the following quantities:

- M88000 only: number of ready *readfds* descriptors + number of ready *writefds* descriptors + number of ready *exceptfds* descriptors.
- M68000 only: number of ready *readfds* descriptors + number of ready *writefds* descriptors + number of ready *exceptfds* descriptors - number of descriptors ready for both reading and writing.
- 0 if the time limit expired.
- -1 if an error occurred.

select(3C)

select(3C)

Unless `select` returns `-1`, `select` replaces the given descriptor sets with subsets consisting of those descriptors that are ready for the requested operation.

ERRORS

An error return from `select` indicates:

| | |
|--------|---|
| EBADF | One of the I/O descriptor sets specified an invalid I/O descriptor. |
| EFAULT | <i>readfds</i> , <i>writefds</i> , <i>exceptfds</i> or <i>timeout</i> point to an invalid portion of the process address space. (M88000 only) |
| EINTR | A signal was delivered before any of the selected events occurred, and before the time limit expired. |
| EINVAL | A component of the pointed-to time limit is outside the acceptable range: <i>t_sec</i> must be between 0 and 10^8 , inclusive. <i>t_usec</i> must be greater-than or equal to 0, and less than 10^6 . |

SEE ALSO

`poll(2)`, `read(2)`, `write(2)`

NOTES

The default value for `FD_SETSIZE` (currently 1024) is larger than the default limit on the number of open files. In order to accommodate programs that may use a larger number of open files with `select`, it is possible to increase this size within a program by providing a larger definition of `FD_SETSIZE` before the inclusion of `<sys/types.h>`.

In future versions of the system, `select` may return the time remaining from the original timeout, if any, by modifying the time value in place. It is thus unwise to assume that the timeout value will be unmodified by the `select` call.

The M88000 `select` as defined by the *M88000 Processor Specific ABI* emulates BSD `select` functionality and therefore differs slightly in behavior from the original SVR4 based M68000 `select`.

NAME

semctl - semaphore control operations

SYNOPSIS

```
#include <sys/types.h>
#include <sys/ipc.h>
#include <sys/sem.h>

union semun {
    int val;
    struct semid_ds *buf;
    ushort *array;
};

int semctl(int semid, int semnum, int cmd, . . . /* union semun
arg */);
```

DESCRIPTION

semctl provides a variety of semaphore control operations as specified by *cmd*.

The following *cmds* are executed with respect to the semaphore specified by *semid* and *semnum*:

- GETVAL Return the value of *semval* [see *intro(2)*]. {READ}
- SETVAL Set the value of *semval* to *arg.val*. {ALTER}. When this command is successfully executed, the *semadj* value corresponding to the specified semaphore in all processes is cleared.
- GETPID Return the value of (int) *sempid*. {READ}
- GETNCNT Return the value of *semncnt*. {READ}
- GETZCNT Return the value of *semzcnt*. {READ}

The following *cmds* return and set, respectively, every *semval* in the set of semaphores.

- GETALL Place *semvals* into array pointed to by *arg.array*. {READ}
- SETALL Set *semvals* according to the array pointed to by *arg.array*. {ALTER}. When this *cmd* is successfully executed, the *semadj* values corresponding to each specified semaphore in all processes are cleared.

The following *cmds* are also available:

- IPC_STAT Place the current value of each member of the data structure associated with *semid* into the structure pointed to by *arg.buf*. The contents of this structure are defined in *intro(2)*. {READ}
- IPC_SET Set the value of the following members of the data structure associated with *semid* to the corresponding value found in the structure pointed to by *arg.buf*:


```
sem_perm.uid
sem_perm.gid
sem_perm.mode /* only access permission bits */
```

semctl(2)

semctl(2)

This command can be executed only by a process that has an effective user ID equal to either that of super-user, or to the value of `sem_perm.cuid` or `sem_perm.uid` in the data structure associated with *semid*.

`IPC_RMID` Remove the semaphore identifier specified by *semid* from the system and destroy the set of semaphores and data structure associated with it. This command only be executed only by a process that has an effective user ID equal to either that of super-user, or to the value of `sem_perm.cuid` or `sem_perm.uid` in the data structure associated with *semid*.

`semctl` fails if one or more of the following are true:

| | |
|------------------------|---|
| <code>EACCES</code> | Operation permission is denied to the calling process [see <code>intro(2)</code>]. |
| <code>EINVAL</code> | <i>semid</i> is not a valid semaphore identifier. |
| <code>EINVAL</code> | <i>semnum</i> is less than 0 or greater than <code>sem_nsems</code> . |
| <code>EINVAL</code> | <i>cmd</i> is not a valid command. |
| <code>EINVAL</code> | <i>cmd</i> is <code>IPC_SET</code> and <code>sem_perm.uid</code> or <code>sem_perm.gid</code> is not valid. |
| <code>EOVERFLOW</code> | <i>cmd</i> is <code>IPC_STAT</code> and <i>uid</i> or <i>gid</i> is too large to be stored in the structure pointed to by <i>arg.buf</i> . |
| <code>ERANGE</code> | <i>cmd</i> is <code>SETVAL</code> or <code>SETALL</code> and the value to which <i>semval</i> is to be set is greater than the system imposed maximum. |
| <code>EPERM</code> | <i>cmd</i> is equal to <code>IPC_RMID</code> or <code>IPC_SET</code> and the effective user ID of the calling process is not equal to that of super-user, or to the value of <code>sem_perm.cuid</code> or <code>sem_perm.uid</code> in the data structure associated with <i>semid</i> . |
| <code>EFAULT</code> | <i>arg.buf</i> points to an illegal address. |

SEE ALSO

`intro(2)`, `semget(2)`, `semop(2)`

DIAGNOSTICS

Upon successful completion, the value returned depends on *cmd* as follows:

| | |
|----------------------|----------------------------------|
| <code>GETVAL</code> | the value of <i>semval</i> |
| <code>GETPID</code> | the value of (int) <i>sempid</i> |
| <code>GETNCNT</code> | the value of <i>semncnt</i> |
| <code>GETZCNT</code> | the value of <i>semzcnt</i> |
| all others | a value of 0 |

Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

semget - get set of semaphores

SYNOPSIS

```
#include <sys/types.h>
#include <sys/ipc.h>
#include <sys/sem.h>

int semget(key_t key, int nsems, int semflg);
```

DESCRIPTION

semget returns the semaphore identifier associated with *key*.

A semaphore identifier and associated data structure and set containing *nsems* semaphores [see [intro\(2\)](#)] are created for *key* if one of the following is true:

key is equal to `IPC_PRIVATE`.

key does not already have a semaphore identifier associated with it, and (*semflg*&`IPC_CREAT`) is true.

On creation, the data structure associated with the new semaphore identifier is initialized as follows:

`sem_perm.cuid`, `sem_perm.uid`, `sem_perm.cgid`, and `sem_perm.gid` are set equal to the effective user ID and effective group ID, respectively, of the calling process.

The access permission bits of `sem_perm.mode` are set equal to the access permission bits of *semflg*.

`sem_nsems` is set equal to the value of *nsems*.

`sem_otime` is set equal to 0 and `sem_ctime` is set equal to the current time.

semget fails if one or more of the following are true:

| | |
|--------|---|
| EINVAL | <i>nsems</i> is either less than or equal to zero or greater than the system-imposed limit. |
| EACCES | A semaphore identifier exists for <i>key</i> , but operation permission [see intro(2)] as specified by the low-order 9 bits of <i>semflg</i> would not be granted. |
| EINVAL | A semaphore identifier exists for <i>key</i> , but the number of semaphores in the set associated with it is less than <i>nsems</i> , and <i>nsems</i> is not equal to zero. |
| ENOENT | A semaphore identifier does not exist for <i>key</i> and (<i>semflg</i> & <code>IPC_CREAT</code>) is false. |
| ENOSPC | A semaphore identifier is to be created but the system-imposed limit on the maximum number of allowed semaphore identifiers system wide would be exceeded. |
| EEXIST | A semaphore identifier exists for <i>key</i> but both (<i>semflg</i> & <code>IPC_CREAT</code>) and (<i>semflg</i> & <code>IPC_EXCL</code>) are true. |

SEE ALSO

[intro\(2\)](#), [semctl\(2\)](#), [semop\(2\)](#), [stdipc\(3C\)](#)

semget (2)

semget (2)

DIAGNOSTICS

Upon successful completion, a non-negative integer, namely a semaphore identifier, is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

semop - semaphore operations

SYNOPSIS

```
#include <sys/types.h>
#include <sys/ipc.h>
#include <sys/sem.h>

int semop(int semid, struct sembuf *sops, size_t nsops);
```

DESCRIPTION

semop is used to perform atomically an array of semaphore operations on the set of semaphores associated with the semaphore identifier specified by *semid*. *sops* is a pointer to the array of semaphore-operation structures. *nsops* is the number of such structures in the array. The contents of each structure includes the following members:

```
short sem_num; /* semaphore number */
short sem_op; /* semaphore operation */
short sem_flg; /* operation flags */
```

Each semaphore operation specified by *sem_op* is performed on the corresponding semaphore specified by *semid* and *sem_num*.

sem_op specifies one of three semaphore operations as follows, depending on whether its value is negative, positive, or zero:

If *sem_op* is a negative integer, one of the following occurs: {ALTER}

If *semval* [see intro(2)] is greater than or equal to the absolute value of *sem_op*, the absolute value of *sem_op* is subtracted from *semval*. Also, if (*sem_flg*&SEM_UNDO) is true, the absolute value of *sem_op* is added to the calling process's *semadj* value [see exit(2)] for the specified semaphore.

If *semval* is less than the absolute value of *sem_op* and (*sem_flg*&IPC_NOWAIT) is true, semop returns immediately.

If *semval* is less than the absolute value of *sem_op* and (*sem_flg*&IPC_NOWAIT) is false, semop increments the *semncnt* associated with the specified semaphore and suspends execution of the calling process until one of the following conditions occur.

semval becomes greater than or equal to the absolute value of *sem_op*. When this occurs, the value of *semncnt* associated with the specified semaphore is decremented, the absolute value of *sem_op* is subtracted from *semval* and, if (*sem_flg*&SEM_UNDO) is true, the absolute value of *sem_op* is added to the calling process's *semadj* value for the specified semaphore.

The *semid* for which the calling process is awaiting action is removed from the system [see semctl(2)]. When this occurs, *errno* is set equal to EIDRM, and a value of -1 is returned.

The calling process receives a signal that is to be caught. When this occurs, the value of *semncnt* associated with the specified semaphore is decremented, and the calling process resumes execution in the manner prescribed in signal(2).

semop(2)

semop(2)

If *sem_op* is a positive integer, the value of *sem_op* is added to *semval* and, if (*sem_flg*&SEM_UNDO) is true, the value of *sem_op* is subtracted from the calling process's *semadj* value for the specified semaphore. {ALTER}

If *sem_op* is zero, one of the following occurs: {READ}

If *semval* is zero, *semop* returns immediately.

If *semval* is not equal to zero and (*sem_flg*&IPC_NOWAIT) is true, *semop* returns immediately.

If *semval* is not equal to zero and (*sem_flg*&IPC_NOWAIT) is false, *semop* increments the *semzcnt* associated with the specified semaphore and suspends execution of the calling process until one of the following occurs:

semval becomes zero, at which time the value of *semzcnt* associated with the specified semaphore is decremented.

The *semid* for which the calling process is awaiting action is removed from the system. When this occurs, *errno* is set equal to EIDRM, and a value of -1 is returned.

The calling process receives a signal that is to be caught. When this occurs, the value of *semzcnt* associated with the specified semaphore is decremented, and the calling process resumes execution in the manner prescribed in *signal(2)*.

semop fails if one or more of the following are true for any of the semaphore operations specified by *sops*:

| | |
|--------|---|
| EINVAL | <i>semid</i> is not a valid semaphore identifier. |
| EFBIG | <i>sem_num</i> is less than zero or greater than or equal to the number of semaphores in the set associated with <i>semid</i> . |
| E2BIG | <i>nsops</i> is greater than the system-imposed maximum. |
| EACCES | Operation permission is denied to the calling process [see <i>intro(2)</i>]. |
| EAGAIN | The operation would result in suspension of the calling process but (<i>sem_flg</i> &IPC_NOWAIT) is true. |
| ENOSPC | The limit on the number of individual processes requesting an SEM_UNDO would be exceeded. |
| EINVAL | The number of individual semaphores for which the calling process requests a SEM_UNDO would exceed the limit. |
| ERANGE | An operation would cause a <i>semval</i> to overflow the system-imposed limit. |
| ERANGE | An operation would cause a <i>semadj</i> value to overflow the system-imposed limit. |
| EFAULT | <i>sops</i> points to an illegal address. |

Upon successful completion, the value of *sempid* for each semaphore specified in the array pointed to by *sops* is set equal to the process ID of the calling process.

semop(2)

semop(2)

SEE ALSO

`intro(2)`, `exec(2)`, `exit(2)`, `fork(2)`, `semctl(2)`, `semget(2)`

DIAGNOSTICS

If `semop` returns due to the receipt of a signal, a value of -1 is returned to the calling process and `errno` is set to `EINTR`. If it returns due to the removal of a `semid` from the system, a value of -1 is returned and `errno` is set to `EIDRM`.

Upon successful completion, a value of zero is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

send(3N)

send(3N)

NAME

send, sendto, sendmsg - send a message from a socket

SYNOPSIS

```
#include <sys/types.h>

int send(int s, char *msg, int len, int flags);

int sendto(int s, char *msg, int len, int flags, caddr_t to,
           int tolen);

int sendmsg(int s, msghdr *msg, int flags);
```

DESCRIPTION

s is a socket created with `socket`. `send`, `sendto`, and `sendmsg` are used to transmit a message to another socket. `send` may be used only when the socket is in a *connected* state, while `sendto` and `sendmsg` may be used at any time.

The address of the target is given by *to* with *tolen* specifying its size. The length of the message is given by *len*. If the message is too long to pass atomically through the underlying protocol, then the error `EMSGSIZE` is returned, and the message is not transmitted.

No indication of failure to deliver is implicit in a `send`. Return values of `-1` indicate some locally detected errors.

If no buffer space is available at the socket to hold the message to be transmitted, then `send` normally blocks, unless the socket has been placed in non-blocking I/O mode [see `fcntl(2)`]. The `select` call may be used to determine when it is possible to send more data.

The *flags* parameter is formed by ORing one or more of the following:

`MSG_OOB` Send out-of-band data on sockets that support this notion. The underlying protocol must also support out-of-band data. Currently, only `SOCK_STREAM` sockets created in the `AF_INET` address family support out-of-band data.

`MSG_DONTROUTE` The `SO_DONTROUTE` option is turned on for the duration of the operation. It is used only by diagnostic or routing programs.

See `recv(3N)` for a description of the `msghdr` structure.

RETURN VALUE

These calls return the number of bytes sent, or `-1` if an error occurred.

ERRORS

The calls fail if:

| | |
|-----------------------|---|
| <code>EBADF</code> | <i>s</i> is an invalid descriptor. |
| <code>ENOTSOCK</code> | <i>s</i> is a descriptor for a file, not a socket. |
| <code>EINVAL</code> | <i>tolen</i> is not the size of a valid address for the specified address family. |
| <code>EINTR</code> | The operation was interrupted by delivery of a signal before any data could be buffered to be sent. |

send(3N)

send(3N)

| | |
|-------------|--|
| EMSGSIZE | The socket requires that message be sent atomically, and the message was too long. |
| EWOULDBLOCK | The socket is marked non-blocking and the requested operation would block. |
| ENOMEM | There was insufficient user memory available for the operation to complete. |
| ENOSR | There were insufficient STREAMS resources available for the operation to complete. |

SEE ALSO

connect(3N), getsockopt(3N), recv(3N), socket(3N) fcntl(2), write(2).

NOTES

The type of address structure passed to `accept` depends on the address family. UNIX domain sockets (address family `AF_UNIX`) require a `socketaddr_un` structure as defined in `sys/un.h`; Internet domain sockets (address family `AF_INET`) require a `sockaddr_in` structure as defined in `netinet/in.h`. Other address families may require other structures. Use the structure appropriate to the address family; cast the structure address to a generic `caddr_t` in the call to `send` and pass the size of the structure in the `toLen` argument.

NAME

setbuf, setvbuf - assign buffering to a stream

SYNOPSIS

```
#include <stdio.h>
void setbuf (FILE *stream, char *buf);
int setvbuf (FILE *stream, char *buf, int type, size_t size);
```

DESCRIPTION

setbuf may be used after a *stream* [see intro(3)] has been opened but before it is read or written. It causes the array pointed to by *buf* to be used instead of an automatically allocated buffer. If *buf* is the NULL pointer input/output will be completely unbuffered.

While there is no limitation on the size of the buffer, the constant BUFSIZ, defined in the `stdio.h` header file, is typically a good buffer size:

```
char buf[BUFSIZ];
```

setvbuf may be used after a stream has been opened but before it is read or written. *type* determines how *stream* will be buffered. Valid values for *type* (defined in `stdio.h`) are:

| | |
|---------------------|--|
| <code>_IOFBF</code> | causes input/output to be fully buffered. |
| <code>_IOLBF</code> | causes output to be line buffered; the buffer is flushed when a newline is written, the buffer is full, or input is requested. |
| <code>_IONBF</code> | causes input/output to be completely unbuffered. |

If *buf* is not the NULL pointer, the array it points to is used for buffering, instead of an automatically allocated buffer. *size* specifies the size of the buffer to be used. If input/output is unbuffered, *buf* and *size* are ignored.

For a further discussion of buffering, see `stdio(3S)`.

SEE ALSO

`fopen(3S)`, `getc(3S)`, `malloc(3C)`, `putc(3S)`, `stdio(3S)`

DIAGNOSTICS

If an invalid value for *type* is provided, `setvbuf` returns a non-zero value. Otherwise, it returns zero.

NOTES

A common source of error is allocating buffer space as an "automatic" variable in a code block, and then failing to close the stream in the same block.

Parts of *buf* are used for internal bookkeeping of the stream and, therefore, *buf* contains less than *size* bytes when full. It is recommended that the automatically allocated buffer is used when using `setvbuf`.

NAME

setbuf, setbuffer, setlinebuf, setvbuf - assign buffering to a stream

SYNOPSIS

```

/usr/ucb/cc [flag...]file...
#include <stdio.h>
setbuf(stream, buf)
FILE *stream;
char *buf;
setbuffer(stream, buf, size)
FILE *stream;
char *buf;
int size;
setlinebuf(stream)
FILE *stream;
int setvbuf(stream, buf, type, size)
FILE *stream;
char *buf;
int type, size;

```

DESCRIPTION

The three types of buffering available are unbuffered, block buffered, and line buffered. When an output stream is unbuffered, information appears on the destination file or terminal as soon as written; when it is block buffered many characters are saved up and written as a block; when it is line buffered characters are saved up until a NEWLINE is encountered or input is read from `stdin`. `fflush` (see `fclose(3S)`) may be used to force the block out early. Normally all files are block buffered. A buffer is obtained from `malloc(3C)` upon the first `getc` or `putc(3S)` on the file. If the standard stream `stdout` refers to a terminal it is line buffered. The standard stream `stderr` is unbuffered by default.

`setbuf` can be used after a stream has been opened but before it is read or written. It causes the array pointed to by `buf` to be used instead of an automatically allocated buffer. If `buf` is the `NULL` pointer, input/output will be completely unbuffered. A manifest constant `BUFSIZ`, defined in the `<stdio.h>` header file, tells how big an array is needed:

```
char buf[BUFSIZ];
```

`setbuffer`, an alternate form of `setbuf`, can be used after a stream has been opened but before it is read or written. It uses the character array `buf` whose size is determined by the `size` argument instead of an automatically allocated buffer. If `buf` is the `NULL` pointer, input/output will be completely unbuffered.

`setvbuf` can be used after a stream has been opened but before it is read or written. `type` determines how stream will be buffered. Legal values for `type` (defined in `<stdio.h>`) are:

```
_IOFBF fully buffers the input/output.
```

- `_IOLBF` line buffers the output; the buffer will be flushed when a NEWLINE is written, the buffer is full, or input is requested.
- `_IONBF` completely unbuffers the input/output.

If *buf* is not the `NULL` pointer, the array it points to will be used for buffering, instead of an automatically allocated buffer. *size* specifies the size of the buffer to be used.

`setlinebuf` is used to change the buffering on a stream from block buffered or unbuffered to line buffered. Unlike `setbuf`, `setbuffer`, and `setvbuf`, it can be used at any time that the file descriptor is active.

A file can be changed from unbuffered or line buffered to block buffered by using `freopen` (see `fopen(3S)`). A file can be changed from block buffered or line buffered to unbuffered by using `freopen` followed by `setbuf` with a buffer argument of `NULL`.

NOTE

A common source of error is allocating buffer space as an “automatic” variable in a code block, and then failing to close the stream in the same block.

SEE ALSO

`fclose(3S)`, `fopen(3S)`, `fread(3S)`, `getc(3S)`, `malloc(3C)`, `printf(3S)`, `putc(3S)`, `puts(3S)`, `setbuf(3S)`.

RETURN VALUE

If an illegal value for *type* or *size* is provided, `setvbuf` returns a non-zero value. Otherwise, the value returned will be zero.

NAME

setbuffer, setlinebuf - assign buffering to a stream

SYNOPSIS

```
/usr/ucb/cc [flag...] file...  
#include <stdio.h>  
  
setbuffer(stream, buf, size)  
FILE *stream;  
char *buf;  
int size;  
  
setlinebuf(stream)  
FILE *stream;
```

DESCRIPTION

The three types of buffering available are unbuffered, block buffered, and line buffered. When an output stream is unbuffered, information appears on the destination file or terminal as soon as written; when it is block buffered many characters are saved up and written as a block; when it is line buffered characters are saved up until a NEWLINE is encountered or input is read from any line buffered input stream. `fflush` (see `fclose(3S)`) may be used to force the block out early. Normally all files are block buffered. A buffer is obtained from `malloc(3C)` upon the first `getc` or `putc(3S)` on the file.

By default, output to a terminal is line buffered, except for output to the standard stream `stderr` which is unbuffered, and all other input/output is fully buffered.

`setbuffer` can be used after a stream has been opened but before it is read or written. It uses the character array `buf` whose size is determined by the `size` argument instead of an automatically allocated buffer. If `buf` is the `NULL` pointer, input/output will be completely unbuffered. A manifest constant `BUFSIZ`, defined in the `<stdio.h>` header file, tells how big an array is needed:

```
char buf[BUFSIZ];
```

`setlinebuf` is used to change the buffering on a stream from block buffered or unbuffered to line buffered. Unlike `setbuffer`, it can be used at any time that the file descriptor is active.

A file can be changed from unbuffered or line buffered to block buffered by using `freopen` (see `fopen(3S)`). A file can be changed from block buffered or line buffered to unbuffered by using `freopen` followed by `setbuffer` with a buffer argument of `NULL`.

SEE ALSO

`setbuf(3S)`
`fclose(3S)`, `fopen(3S)`, `fread(3S)`, `getc(3S)`, `malloc(3C)`, `printf(3S)`, `putc(3S)`, `puts(3S)`, `setbuf(3S)`.

NOTE

A common source of error is allocating buffer space as an automatic variable in a code block, and then failing to close the stream in the same block.

NAME

setcat - define default catalog

SYNOPSIS

```
#include <pfmt.h>
```

```
char *setcat(const char *catalog);
```

DESCRIPTION

The routine `setcat()` defines the default message catalog to be used by subsequent calls to `pfmt()`, `lfmt()` or `gettext()` which do not explicitly specify a message catalog.

catalog must be limited to 14 characters. These characters must be selected from a set of all characters values, excluding `\0` (null) and the ASCII codes for `/` (slash) and `:` (colon).

`setcat()` assumes that the catalog exists. No checking is done on the argument.

A NULL pointer passed as an argument will result in the return of a pointer to the current default message catalog name. A pointer to an empty string passed as an argument will cancel the default catalog.

If no default catalog is specified, or if *catalog* is an invalid catalog name, Subsequent calls to `gettext()`, `pfmt()` or `lfmt()` that do not explicitly specify a catalog name will use `Message not found!!\n` as default string.

RETURN VALUE

Upon success, `setcat()` returns a pointer to the catalog name. Upon failure, `setcat()` returns a NULL pointer.

EXAMPLE

```
setcat("test");  
gettext(":10", "hello world\n")
```

SEE ALSO

`environ(5)`, `gettext(3C)`, `lfmt(3C)`, `pfmt(3C)`, `setlocale(3C)`.

NAME

setjmp, longjmp - non-local goto

SYNOPSIS

```
#include <setjmp.h>
int setjmp (jmp_buf env);
void longjmp (jmp_buf env, int val);
```

DESCRIPTION

These functions are useful for dealing with errors and interrupts encountered in a low-level subroutine of a program.

setjmp saves its stack environment in *env* (whose type, *jmp_buf*, is defined in the `<setjmp.h>` header file) for later use by `longjmp`. It returns the value 0.

`longjmp` restores the environment saved by the last call of `setjmp` with the corresponding *env* argument. After `longjmp` is completed, program execution continues as if the corresponding call of `setjmp` had just returned the value *val*. (The caller of `setjmp` must not have returned in the interim.) `longjmp` cannot cause `setjmp` to return the value 0. If `longjmp` is invoked with a second argument of 0, `setjmp` will return 1. At the time of the second return from `setjmp`, all external and static variables have values as of the time `longjmp` is called (see example). The values of register and automatic variables are undefined.

Register or automatic variables whose value must be relied upon must be declared as `volatile`.

EXAMPLE

```
#include <stdio.h>
#include <stdlib.h>
#include <setjmp.h>

jmp_buf env;
int i = 0;
main ()
{
    void exit();

    if(setjmp(env) != 0) {
        (void) printf("value of i on 2nd return from setjmp: %d\n", i);
        exit(0);
    }
    (void) printf("value of i on 1st return from setjmp: %d\n", i);
    i = 1;
    g();
    /* NOTREACHED */
}
g()
{
    longjmp(env, 1);
    /* NOTREACHED */
}
```

If the a.out resulting from this C language code is run, the output will be:

```
value of i on 1st return from setjmp:0
```

```
value of i on 2nd return from setjmp:1
```

SEE ALSO

signal(2), sigsetjmp(3C).

NOTES

If longjmp is called even though env was never primed by a call to setjmp, or when the last such call was in a function that has since returned, absolute chaos is guaranteed.

NAME

setjmp, longjmp, _setjmp, _longjmp, sigsetjmp, siglongjmp - non-local goto

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...  
#include <setjmp.h>  
  
int setjmp(env)  
jmp_buf env;  
  
longjmp(env, val)  
jmp_buf env;  
int val;  
  
int _setjmp(env)  
jmp_buf env;  
  
_longjmp(env, val)  
jmp_buf env;  
int val;  
  
int sigsetjmp(env, savemask)  
sigjmp_buf env;  
int savemask;  
  
siglongjmp(env, val)  
sigjmp_buf env;  
int val;
```

DESCRIPTION

setjmp and longjmp are useful for dealing with errors and interrupts encountered in a low-level subroutine of a program.

setjmp saves its stack environment in *env* for later use by longjmp. A normal call to setjmp returns zero. setjmp also saves the register environment. If a longjmp call will be made, the routine which called setjmp should not return until after the longjmp has returned control (see below).

longjmp restores the environment saved by the last call of setjmp, and then returns in such a way that execution continues as if the call of setjmp had just returned the value *val* to the function that invoked setjmp; however, if *val* were zero, execution would continue as if the call of setjmp had returned one. This ensures that a "return" from setjmp caused by a call to longjmp can be distinguished from a regular return from setjmp. The calling function must not itself have returned in the interim, otherwise longjmp will be returning control to a possibly non-existent environment. All memory-bound data have values as of the time longjmp was called. The CPU and floating-point data registers are restored to the values they had at the time that setjmp was called. But, because the register storage class is only a hint to the C compiler, variables declared as register variables may not necessarily be assigned to machine registers, so their values are unpredictable after a longjmp. This is especially a problem for programmers trying to write machine-independent C routines.

setjmp and longjmp save and restore the signal mask (see sigsetmask(2)), while _setjmp and _longjmp manipulate only the C stack and registers. If the savemask flag to sigsetjmp is non-zero, the signal mask is saved, and a subsequent siglongjmp using the same env will restore the signal mask. If the savemask flag is zero, the signal mask is not saved, and a subsequent siglongjmp using the same env will not restore the signal mask. In all other ways, _setjmp and sigsetjmp function in the same way that setjmp does, and _longjmp and siglongjmp function in the same way that longjmp does.

None of these functions save or restore any floating-point status or control registers.

EXAMPLE

The following code fragment indicates the flow of control of the setjmp and longjmp combination:

function declaration

```

...
    jmp_buf    my_environment;
...
    if ( setjmp ( my_environment ) ) {
        /* register variables have unpredictable values */
        code after the return from
        ...
    } else {
        /* do not modify register vars in this leg of code */
        this is the return from
        ...
    }

```

SEE ALSO

cc(1), signal(2), setjmp(3C), signal(3), sigsetmask(3), sigvec(3).

NOTES

setjmp does not save the current notion of whether the process is executing on the signal stack. The result is that a longjmp to some place on the signal stack leaves the signal stack state incorrect.

On some systems setjmp also saves the register environment. Therefore, all data that are bound to registers are restored to the values they had at the time that setjmp was called. All memory-bound data have values as of the time longjmp was called. However, because the register storage class is only a hint to the C compiler, variables declared as register variables may not necessarily be assigned to machine registers, so their values are unpredictable after a longjmp. When using compiler options that specify automatic register allocation (see cc(1V)), the compiler will not attempt to assign variables to registers in routines that call setjmp.

longjmp never causes setjmp to return zero, so programmers should not depend on longjmp being able to cause setjmp to return zero.

NAME

setlabel - define the label for `pfmt()` and `lfmt()`.

SYNOPSIS

```
#include <pfmt.h>

int setlabel(const char *label);
```

DESCRIPTION

The routine `setlabel()` defines the label for messages produced in standard format by subsequent calls to `pfmt()` and `lfmt()`.

label is a character string no more than 25 characters in length.

No label is defined before `setlabel()` is called. A NULL pointer or an empty string passed as argument will reset the definition of the label.

RETURN VALUE

`setlabel()` returns 0 in case of success, non-zero otherwise.

EXAMPLE

The following code (without previous call to `setlabel()`):

```
pfmt(stderr, MM_ERROR, "test:2:Cannot open file\n");
setlabel("UX:test");
pfmt(stderr, MM_ERROR, "test:2:Cannot open file\n");
```

will produce the following output:

```
ERROR: Cannot open file
UX:test: ERROR: Cannot open file
```

USAGE

The label should be set once at the beginning of a utility and remain constant.

`getopt()` has been modified to report errors using the standard message format. if `setlabel()` is called before `getopt()`, `getopt()` will use that label. Otherwise, `getopt()` will use the name of the utility.

SEE ALSO

`getopt(3C)`, `lfmt(3C)`, `pfmt(3C)`.

NAME

setlocale - modify and query a program's locale

SYNOPSIS

```
#include <locale.h>

char *setlocale (int category, const char *locale);
```

DESCRIPTION

setlocale selects the appropriate piece of the program's locale as specified by the *category* and *locale* arguments. The *category* argument may have the following values: LC_CTYPE, LC_NUMERIC, LC_TIME, LC_COLLATE, LC_MONETARY, LC_MESSAGES and LC_ALL. These names are defined in the locale.h header file. LC_CTYPE affects the behavior of the character handling functions (isdigit, tolower, etc.) and the multibyte character functions (such as mbtowc and wctomb). LC_NUMERIC affects the decimal-point character for the formatted input/output functions and the string conversion functions as well as the non-monetary formatting information returned by localeconv. [See localeconv(3C).] LC_TIME affects the behavior of asctime, ctime, getdate and strftime. LC_COLLATE affects the behavior of strcoll and strxfrm. LC_MONETARY affects the monetary formatted information returned by localeconv. LC_MESSAGES affects the behavior of gettext, catopen, catclose, and catgets. [See catopen(3C) and catgets(3C).] LC_ALL names the program's entire locale.

Each category corresponds to a set of databases which contain the relevant information for each defined locale. The location of a database is given by the following path, /usr/lib/locale/*locale*/*category*, where *locale* and *category* are the names of locale and category, respectively. For example, the database for the LC_CTYPE category for the "german" locale would be found in /usr/lib/locale/german/LC_CTYPE.

A value of "C" for *locale* specifies the default environment.

A value of "" for *locale* specifies that the locale should be taken from environment variables. The order in which the environment variables are checked for the various categories is given below:

| <u>Category</u> | <u>1st Env. Var.</u> | <u>2nd Env. Var</u> |
|-----------------|----------------------|---------------------|
| LC_CTYPE: | LC_CTYPE | LANG |
| LC_COLLATE: | LC_COLLATE | LANG |
| LC_TIME: | LC_TIME | LANG |
| LC_NUMERIC: | LC_NUMERIC | LANG |
| LC_MONETARY: | LC_MONETARY | LANG |
| LC_MESSAGES: | LC_MESSAGES | LANG |

At program startup, the equivalent of

```
setlocale(LC_ALL, "C")
```

is executed. This has the effect of initializing each category to the locale described by the environment "C".

If a pointer to a string is given for *locale*, setlocale attempts to set the locale for the given category to *locale*. If setlocale succeeds, *locale* is returned. If setlocale fails, a null pointer is returned and the program's locale is not changed.

For category `LC_ALL`, the behavior is slightly different. If a pointer to a string is given for *locale* and `LC_ALL` is given for *category*, `setlocale` attempts to set the locale for all the categories to *locale*. The *locale* may be a simple locale, consisting of a single locale, or a composite locale. A composite locale is a string beginning with a "/" followed by the locale of each category separated by a "/". If `setlocale` fails to set the locale for any category, a null pointer is returned and the program's locale for all categories is not changed. Otherwise, *locale* is returned.

A null pointer for *locale* causes `setlocale` to return the current locale associated with the *category*. The program's locale is not changed.

FILES

`/usr/lib/locale/C/LC_CTYPE` - `LC_CTYPE` database for the C locale.
`/usr/lib/locale/C/LC_NUMERIC` - `LC_NUMERIC` database for the C locale.
`/usr/lib/locale/C/LC_TIME` - `LC_TIME` database for the C locale.
`/usr/lib/locale/C/LC_COLLATE` - `LC_COLLATE` database for the C locale.
`/usr/lib/locale/C/LC_MESSAGES` - `LC_MESSAGES` database for the C locale.
`/usr/lib/locale/locale/category` - files containing the locale specific information for each locale and category.

SEE ALSO

`ctime(3C)`, `ctype(3C)`, `getdate(3C)`, `gettext(3G)`, `localeconv(3C)`, `mbtowc(3C)`, `printf(3S)`, `strcoll(3C)`, `strftime(3C)`, `strtod(3C)`, `strxfrm(3C)`, `wctomb(3C)`, `environ(5)`

setpgid(2)

setpgid(2)

NAME

setpgid - set process group ID

SYNOPSIS

```
#include <sys/types.h>
#include <unistd.h>

int setpgid(pid_t pid, pid_t pgid);
```

DESCRIPTION

setpgid sets the process group ID of the process with ID *pid* to *pgid*. If *pgid* is equal to *pid*, the process becomes a process group leader. If *pgid* is not equal to *pid*, the process becomes a member of an existing process group.

If *pid* is equal to 0, the process ID of the calling process is used. If *pgid* is equal to 0, the process specified by *pid* becomes a process group leader.

setpgid fails and returns an error if one or more of the following are true:

| | |
|--------|--|
| EACCES | <i>pid</i> matches the process ID of a child process of the calling process and the child process has successfully executed an exec(2) function. |
| EINVAL | <i>pgid</i> is less than (pid_t) 0, or greater than or equal to {PID_MAX}. |
| EINVAL | The calling process has a controlling terminal that does not support job control. |
| EPERM | The process indicated by the <i>pid</i> argument is a session leader. |
| EPERM | <i>pid</i> matches the process ID of a child process of the calling process and the child process is not in the same session as the calling process. |
| EPERM | <i>pgid</i> does not match the process ID of the process indicated by the <i>pid</i> argument and there is no process with a process group ID that matches <i>pgid</i> in the same session as the calling process. |
| ESRCH | <i>pid</i> does not match the process ID of the calling process or of a child process of the calling process. |

SEE ALSO

exec(2), exit(2), fork(2), getpid(2), getpgid(2), setsid(2)

DIAGNOSTICS

Upon successful completion, setpgid returns a value of 0. Otherwise, a value of -1 is returned and errno is set to indicate the error.

setpgrp(2)

setpgrp(2)

NAME

setpgrp - set process group ID

SYNOPSIS

```
#include <sys/types.h>
#include <unistd.h>

pid_t setpgrp (void);
```

DESCRIPTION

If the calling process is not already a session leader, `setpgrp` sets the process group ID and session ID of the calling process to the process ID of the calling process, and releases the calling process's controlling terminal.

SEE ALSO

`intro(2)`, `exec(2)`, `fork(2)`, `getpid(2)`, `kill(2)`, `setsid(2)`, `signal(2)`

DIAGNOSTICS

`setpgrp` returns the value of the new process group ID.

NOTES

`setpgrp` will be phased out in favor of the `setsid(2)` function.

NAME

setregid - set real and effective group IDs

SYNOPSIS

```
/usr/ucb/cc [flag...] file...
```

```
int setregid(rgid, egid)  
int rgid, egid;
```

DESCRIPTION

setregid is used to set the real and effective group IDs of the calling process. If *rgid* is -1, the real GID is not changed; if *egid* is -1, the effective GID is not changed. The real and effective GIDs may be set to different values in the same call.

If the effective user ID of the calling process is super-user, the real GID and the effective GID can be set to any legal value.

If the effective user ID of the calling process is not super-user, either the real GID can be set to the saved setGID from `execv`, or the effective GID can either be set to the saved setGID or the real GID. Note: if a setGID process sets its effective GID to its real GID, it can still set its effective GID back to the saved setGID.

In either case, if the real GID is being changed (that is, if *rgid* is not -1), or the effective GID is being changed to a value not equal to the real GID, the saved setGID is set equal to the new effective GID.

If the real GID is changed from its current value, the old value is removed from the groups access list (see `getgroups(2)`) if it is present in that list, and the new value is added to the groups access list if it is not already present and if this would not cause the number of groups in that list to exceed `NGROUPS`, as defined in `/usr/include/sys/param.h`.

RETURN VALUE

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

ERRORS

setregid will fail and neither of the group IDs will be changed if:

| | |
|-------|---|
| EPERM | The calling process's effective UID is not the super-user and a change other than changing the real GID to the saved setGID, or changing the effective GID to the real GID or the saved GID, was specified. |
|-------|---|

SEE ALSO

`exec(2)`, `getuid(2)`, `setuid(2)`, `setreuid(3)`.

NAME

setreuid - set real and effective user IDs

SYNOPSIS

```
/usr/ucb/cc [flag...] file...  
int setreuid(ruid, euid)  
int ruid, euid;
```

DESCRIPTION

setreuid is used to set the real and effective user IDs of the calling process. If *ruid* is -1, the real user ID is not changed; if *euid* is -1, the effective user ID is not changed. The real and effective user IDs may be set to different values in the same call.

If the effective user ID of the calling process is super-user, the real user ID and the effective user ID can be set to any legal value.

If the effective user ID of the calling process is not super-user, either the real user ID can be set to the effective user ID, or the effective user ID can either be set to the saved set-user ID from `execv` or the real user ID. Note: if a set-UID process sets its effective user ID to its real user ID, it can still set its effective user ID back to the saved set-user ID.

In either case, if the real user ID is being changed (that is, if *ruid* is not -1), or the effective user ID is being changed to a value not equal to the real user ID, the saved set-user ID is set equal to the new effective user ID.

RETURN VALUE

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

ERRORS

setreuid will fail and neither of the user IDs will be changed if:

| | |
|-------|--|
| EPERM | The calling process's effective user ID is not the super-user and a change other than changing the real user ID to the effective user ID, or changing the effective user ID to the real user ID or the saved set-user ID, was specified. |
|-------|--|

SEE ALSO

`exec(2)`, `getuid(2)`, `setuid(2)`, `setregid(3)`.

NAME

setsid - set session ID

SYNOPSIS

```
#include <sys/types.h>
#include <unistd.h>

pid_t setsid(void);
```

DESCRIPTION

If the calling process is not already a process group leader, `setsid` sets the process group ID and session ID of the calling process to the process ID of the calling process, and releases the process's controlling terminal.

`setsid` will fail and return an error if the following is true:

| | |
|-------|--|
| EPERM | The calling process is already a process group leader, or there are processes other than the calling process whose process group ID is equal to the process ID of the calling process. |
|-------|--|

SEE ALSO

`intro(2)`, `exec(2)`, `exit(2)`, `fork(2)`, `getpid(2)`, `getpgid(2)`, `getsid(2)`, `setpgid(2)`, `setpgrp`, `signal(2)`, `sigsend(2)`

NOTES

If the calling process is the last member of a pipeline started by a job control shell, the shell may make the calling process a process group leader. The other processes of the pipeline become members of that process group. In this case, the call to `setsid` will fail. For this reason, a process that calls `setsid` and expects to be part of a pipeline should always first fork; the parent should exit and the child should call `setsid`, thereby insuring that the process will work reliably when started by both job control shells and non-job control shells.

DIAGNOSTICS

Upon successful completion, `setsid` returns the calling process's session ID. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

setuid, setgid - set user and group IDs

SYNOPSIS

```
#include <sys/types.h>
#include <unistd.h>

int setuid(uid_t uid);
int setgid(gid_t gid);
```

DESCRIPTION

The `setuid` system call sets the real user ID, effective user ID, and saved user ID of the calling process. The `setgid` system call sets the real group ID, effective group ID, and saved group ID of the calling process.

At login time, the real user ID, effective user ID, and saved user ID of the login process are set to the login ID of the user responsible for the creation of the process. The same is true for the real, effective, and saved group IDs; they are set to the group ID of the user responsible for the creation of the process.

When a process calls `exec(2)` to execute a file (program), the user and/or group identifiers associated with the process can change. If the file executed is a set-user-ID file, the effective and saved user IDs of the process are set to the owner of the file executed. If the file executed is a set-group-ID file, the effective and saved group IDs of the process are set to the group of the file executed. If the file executed is not a set-user-ID or set-group-ID file, the effective user ID, saved user ID, effective group ID, and saved group ID are not changed.

The following subsections describe the behavior of `setuid` and `setgid` with respect to the three types of user and group IDs.

setuid

If the effective user ID of the process calling `setuid` is the superuser, the real, effective, and saved user IDs are set to the `uid` parameter.

If the effective user ID of the calling process is not the superuser, but `uid` is either the real user ID or the saved user ID of the calling process, the effective user ID is set to `uid`.

setgid

If the effective user ID of the process calling `setgid` is the superuser, the real, effective, and saved group IDs are set to the `gid` parameter.

If the effective user ID of the calling process is not the superuser, but `gid` is either the real group ID or the saved group ID of the calling process, the effective group ID is set to `gid`.

`setuid` and `setgid` fail if one or more of the following is true:

- | | |
|--------|--|
| EPERM | For <code>setuid</code> , if the effective user ID is not the superuser, and the <code>uid</code> parameter does not match either the real or saved user IDs. For <code>setgid</code> , if the effective user ID is not the superuser, and the <code>gid</code> parameter does not match either the real or saved group IDs. |
| EINVAL | The <code>uid</code> or <code>gid</code> is out of range. |

setuid(2)

setuid(2)

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

SEE ALSO

`intro(2)`, `exec(2)`, `getgroups(2)`, `getuid(2)`, `stat(5)`

NAME

shmctl - shared memory control operations

SYNOPSIS

```
#include <sys/types.h>
#include <sys/ipc.h>
#include <sys/shm.h>

int shmctl (int shmid, int cmd, struct shm_id *buf);
```

DESCRIPTION

shmctl provides a variety of shared memory control operations as specified by *cmd*. The following *cmds* are available:

| | |
|------------|---|
| IPC_STAT | Place the current value of each member of the data structure associated with <i>shmid</i> into the structure pointed to by <i>buf</i> . The contents of this structure are defined in <code>intro(2)</code> . {READ} |
| IPC_SET | Set the value of the following members of the data structure associated with <i>shmid</i> to the corresponding value found in the structure pointed to by <i>buf</i> : <pre>shm_perm.uid shm_perm.gid shm_perm.mode /* only access permission bits */</pre> This command can be executed only by a process that has an effective user ID equal to that of super-user, or to the value of <code>shm_perm.cuid</code> or <code>shm_perm.uid</code> in the data structure associated with <i>shmid</i> . |
| IPC_RMID | Remove the shared memory identifier specified by <i>shmid</i> from the system and destroy the shared memory segment and data structure associated with it. This command can be executed only by a process that has an effective user ID equal to that of super-user, or to the value of <code>shm_perm.cuid</code> or <code>shm_perm.uid</code> in the data structure associated with <i>shmid</i> . |
| SHM_LOCK | Lock the shared memory segment specified by <i>shmid</i> in memory. This command can be executed only by a process that has an effective user ID equal to super-user. |
| SHM_UNLOCK | Unlock the shared memory segment specified by <i>shmid</i> . This command can be executed only by a process that has an effective user ID equal to super-user. |

shmctl fails if one or more of the following are true:

| | |
|--------|--|
| EACCES | <i>cmd</i> is equal to IPC_STAT and {READ} operation permission is denied to the calling process [see <code>intro(2)</code>]. |
| EINVAL | <i>shmid</i> is not a valid shared memory identifier. |
| EINVAL | <i>cmd</i> is not a valid command. |
| EINVAL | <i>cmd</i> is IPC_SET and <code>shm_perm.uid</code> or <code>shm_perm.gid</code> is not valid. |

shmctl(2)

shmctl(2)

- EOVERFLOW** *cmd* is `IPC_STAT` and *uid* or *gid* is too large to be stored in the structure pointed to by *buf*.
- EPERM** *cmd* is equal to `IPC_RMID` or `IPC_SET` and the effective user ID of the calling process is not equal to that of super-user, or to the value of `shm_perm.cuid` or `shm_perm.uid` in the data structure associated with *shmid*.
- EPERM** *cmd* is equal to `SHM_LOCK` or `SHM_UNLOCK` and the effective user ID of the calling process is not equal to that of super-user.
- EFAULT** *buf* points to an illegal address.
- ENOMEM** *cmd* is equal to `SHM_LOCK` and there is not enough memory.

SEE ALSO

`shmget(2)`, `shmop(2)`

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NOTES

The user must explicitly remove shared memory segments after the last reference to them has been removed.

NAME

shmget - get shared memory segment identifier

SYNOPSIS

```
#include <sys/types.h>
#include <sys/ipc.h>
#include <sys/shm.h>

int shmget(key_t key, int size, int shmflg);
```

DESCRIPTION

shmget returns the shared memory identifier associated with *key*.

A shared memory identifier and associated data structure and shared memory segment of at least *size* bytes [see [intro\(2\)](#)] are created for *key* if one of the following are true:

key is equal to `IPC_PRIVATE`.

key does not already have a shared memory identifier associated with it, and $(shmflg \& IPC_CREAT)$ is true.

Upon creation, the data structure associated with the new shared memory identifier is initialized as follows:

`shm_perm.cuid`, `shm_perm.uid`, `shm_perm.cgid`, and `shm_perm.gid` are set equal to the effective user ID and effective group ID, respectively, of the calling process.

The access permission bits of `shm_perm.mode` are set equal to the access permission bits of *shmflg*. `shm_segsz` is set equal to the value of *size*.

`shm_lpid`, `shm_nattch`, `shm_atime`, and `shm_dtime` are set equal to 0.

`shm_ctime` is set equal to the current time.

shmget fails if one or more of the following are true:

| | |
|--------|---|
| EINVAL | <i>size</i> is outside the range of the tunable values specified in <code>/etc/master.d/shm</code> . |
| EACCES | A shared memory identifier exists for <i>key</i> but operation permission [see intro(2)] as specified by the low-order 9 bits of <i>shmflg</i> would not be granted. |
| EINVAL | A shared memory identifier exists for <i>key</i> but the size of the segment associated with it is less than <i>size</i> and <i>size</i> is not equal to zero. |
| ENOENT | A shared memory identifier does not exist for <i>key</i> and $(shmflg \& IPC_CREAT)$ is false. |
| ENOSPC | A shared memory identifier is to be created but the system-imposed limit on the maximum number of allowed shared memory identifiers system wide would be exceeded. |
| ENOMEM | A shared memory identifier and associated shared memory segment are to be created but the amount of available memory is not sufficient to fill the request. |

shmget(2)

shmget(2)

`EEXIST` A shared memory identifier exists for *key* but both `(shmflg&IPC_CREAT)` and `(shmflg&IPC_EXCL)` are true.

SEE ALSO

`intro(2)`, `shmctl(2)`, `shmop(2)`, `stdipc(3C)`.

DIAGNOSTICS

Upon successful completion, a non-negative integer, namely a shared memory identifier is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NOTES

The user must explicitly remove shared memory segments after the last reference to them has been removed.

NAME

shmop: shmat, shmdt - shared memory operations

SYNOPSIS

```
#include <sys/types.h>
#include <sys/ipc.h>
#include <sys/shm.h>

void *shmat(int shmid, void *shmaddr, int shmflg);

int shmdt (void *shmaddr);
```

DESCRIPTION

shmat attaches the shared memory segment associated with the shared memory identifier specified by *shmid* to the data segment of the calling process. The segment is attached at the address specified by one of the following criteria:

If *shmaddr* is equal to (void *) 0, the segment is attached at the first available address as selected by the system.

If *shmaddr* is not equal to (void *) 0 and (*shmflg*&SHM_RND) is true, the segment is attached at the address given by (*shmaddr* - (*shmaddr* modulus SHMLBA)).

If *shmaddr* is not equal to (void *) 0 and (*shmflg*&SHM_RND) is false, the segment is attached at the address given by *shmaddr*.

shmdt detaches from the calling process's data segment the shared memory segment located at the address specified by *shmaddr*.

The segment is attached for reading if (*shmflg*&SHM_RDONLY) is true (READ), otherwise it is attached for reading and writing (READ/WRITE).

shmat fails and does not attach the shared memory segment if one or more of the following are true:

| | |
|--------|---|
| EINVAL | <i>shmid</i> is not a valid shared memory identifier. |
| EACCES | Operation permission is denied to the calling process [see intro(2)]. |
| ENOMEM | The available data space is not large enough to accommodate the shared memory segment. |
| EINVAL | <i>shmaddr</i> is not equal to zero, and the value of (<i>shmaddr</i> - (<i>shmaddr</i> modulus SHMLBA)) is an illegal address. |
| EINVAL | <i>shmaddr</i> is not equal to zero, (<i>shmflg</i> &SHM_RND) is false, and the value of <i>shmaddr</i> is an illegal address. |
| EMFILE | The number of shared memory segments attached to the calling process would exceed the system-imposed limit. |
| EINVAL | shmdt fails and does not detach the shared memory segment if <i>shmaddr</i> is not the data segment start address of a shared memory segment. |

SEE ALSO

[intro\(2\)](#), [exec\(2\)](#), [exit\(2\)](#), [fork\(2\)](#), [shmctl\(2\)](#), [shmget\(2\)](#).

DIAGNOSTICS

Upon successful completion, the return value is as follows:

`shmat` returns the data segment start address of the attached shared memory segment.

`shmdt` returns a value of 0.

Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NOTES

The user must explicitly remove shared memory segments after the last reference to them has been removed.

shutdown(3N)

shutdown(3N)

NAME

shutdown - shut down part of a full-duplex connection

SYNOPSIS

```
int shutdown(int s, int how);
```

DESCRIPTION

The `shutdown` call shuts down all or part of a full-duplex connection on the socket associated with `s`. If `how` is 0, then further receives will be disallowed. If `how` is 1, then further sends will be disallowed. If `how` is 2, then further sends and receives will be disallowed.

RETURN VALUE

A 0 is returned if the call succeeds, -1 if it fails.

ERRORS

The call succeeds unless:

| | |
|----------|--|
| EBADF | <code>s</code> is not a valid descriptor. |
| ENOTSOCK | <code>s</code> is a file, not a socket. |
| ENOTCONN | The specified socket is not connected. |
| ENOMEM | There was insufficient user memory available for the operation to complete. |
| ENOSR | There were insufficient STREAMS resources available for the operation to complete. |

SEE ALSO

`connect(3N)`, `socket(3N)`

NOTES

The `how` values should be defined constants.

NAME

sigaction - detailed signal management

SYNOPSIS

```
#include <signal.h>

int sigaction(int sig, const struct sigaction *act,
              struct sigaction *oact);
```

DESCRIPTION

sigaction allows the calling process to examine and/or specify the action to be taken on delivery of a specific signal. [See `signal(5)` for an explanation of general signal concepts.]

sig specifies the signal and can be assigned any of the signals specified in `signal(5)` except SIGKILL and SIGSTOP

If the argument *act* is not NULL, it points to a structure specifying the new action to be taken when delivering *sig*. If the argument *oact* is not NULL, it points to a structure where the action previously associated with *sig* is to be stored on return from sigaction.

The sigaction structure includes the following members:

```
void          (*sa_handler) ();
sigset_t      sa_mask;
int           sa_flags;
```

sa_handler specifies the disposition of the signal and may take any of the values specified in `signal(5)`.

sa_mask specifies a set of signals to be blocked while the signal handler is active. On entry to the signal handler, that set of signals is added to the set of signals already being blocked when the signal is delivered. In addition, the signal that caused the handler to be executed will also be blocked, unless the SA_NODEFER flag has been specified. SIGSTOP and SIGKILL cannot be blocked (the system silently enforces this restriction).

sa_flags specifies a set of flags used to modify the delivery of the signal. It is formed by a logical OR of any of the following values:

| | |
|--------------|---|
| SA_ONSTACK | If set and the signal is caught and an alternate signal stack has been declared with <code>sigaltstack(2)</code> , the signal is delivered to the calling process on that stack. Otherwise, the signal is delivered on the same stack as the main program. |
| SA_RESETHAND | If set and the signal is caught, the disposition of the signal is reset to SIG_DFL and the signal will not be blocked on entry to the signal handler (SIGILL, SIGTRAP, and SIGPWR cannot be automatically reset when delivered; the system silently enforces this restriction). |
| SA_NODEFER | If set and the signal is caught, the signal will not be automatically blocked by the kernel while it is being caught. |

sigaction(2)

sigaction(2)

| | |
|--------------|--|
| SA_RESTART | If set and the signal is caught, a system call that is interrupted by the execution of this signal's handler is transparently restarted by the system. Otherwise, that system call returns an EINTR error. |
| SA_SIGINFO | If cleared and the signal is caught, <i>sig</i> is passed as the only argument to the signal-catching function. If set and the signal is caught, two additional arguments are passed to the signal-catching function. If the second argument is not equal to NULL, it points to a <code>siginfo_t</code> structure containing the reason why the signal was generated [see <code>siginfo(5)</code>]; the third argument points to a <code>ucontext_t</code> structure containing the receiving process's context when the signal was delivered [see <code>ucontext(5)</code>]. |
| SA_NOCLDWAIT | If set and <i>sig</i> equals SIGCHLD, the system will not create zombie processes when children of the calling process exit. If the calling process subsequently issues a <code>wait(2)</code> , it blocks until all of the calling process's child processes terminate, and then returns a value of -1 with <code>errno</code> set to ECHILD. |
| SA_NOCLDSTOP | If set and <i>sig</i> equals SIGCHLD, <i>sig</i> will not be sent to the calling process when its child processes stop or continue. |

sigaction fails if any of the following is true:

| | |
|--------|--|
| EINVAL | The value of the <i>sig</i> argument is not a valid signal number or is equal to SIGKILL or SIGSTOP. |
| EFAULT | <i>act</i> or <i>oact</i> points outside the process's allocated address space. |

DIAGNOSTICS

On success, sigaction returns zero. On failure, it returns -1 and sets `errno` to indicate the error.

SEE ALSO

`kill(1)` `exit(2)`, `intro(2)`, `kill(2)`, `pause(2)`, `signal(2)`, `sigprocmask(2)`, `sigsend(2)`, `sigsuspend(2)`, `wait(2)`, `sigsetops(3C)`, `siginfo(5)`, `signal(5)`, `ucontext(5)`

NOTES

If the system call is reading from or writing to a terminal and the terminal's NOFLSH bit is cleared, data may be flushed [see `termio(7)`].

NAME

sigaltstack - set or get signal alternate stack context

SYNOPSIS

```
#include <signal.h>

int sigaltstack(const stack_t *ss, stack_t *oss);
```

DESCRIPTION

sigaltstack allows users to define an alternate stack area on which signals are to be processed. If *ss* is non-zero, it specifies a pointer to, and the size of a stack area on which to deliver signals, and tells the system if the process is currently executing on that stack. When a signal's action indicates its handler should execute on the alternate signal stack [specified with a `sigaction(2)` call], the system checks to see if the process is currently executing on that stack. If the process is not currently executing on the signal stack, the system arranges a switch to the alternate signal stack for the duration of the signal handler's execution.

The structure `sigaltstack` includes the following members.

```
char    *ss_sp
int     ss_size
int     ss_flags
```

If *ss* is not NULL, it points to a structure specifying the alternate signal stack that will take effect upon return from `sigaltstack`. The `ss_sp` and `ss_size` fields specify the new base and size of the stack, which is automatically adjusted for direction of growth and alignment. The `ss_flags` field specifies the new stack state and may be set to the following:

`SS_DISABLE` The stack is to be disabled and `ss_sp` and `ss_size` are ignored. If `SS_DISABLE` is not set, the stack will be enabled.

If *oss* is not NULL, it points to a structure specifying the alternate signal stack that was in effect prior to the call to `sigaltstack`. The `ss_sp` and `ss_size` fields specify the base and size of that stack. The `ss_flags` field specifies the stack's state, and may contain the following values:

`SS_ONSTACK` The process is currently executing on the alternate signal stack. Attempts to modify the alternate signal stack while the process is executing on it will fail.

`SS_DISABLE` The alternate signal stack is currently disabled.

`sigaltstack` fails if any of the following is true:

`EFAULT` Either *ss* or *oss* points outside the process's allocated address space.

`EINVAL` An attempt was made to disable an active stack or the `ss_flags` field specifies invalid flags.

`ENOMEM` The size of the alternate stack area is less than `MINSIGSTKSZ`.

NOTES

The value `SIGSTKSZ` is defined to be the number of bytes that would be used to cover the usual case when allocating an alternate stack area. The value `MINSIGSTKSZ` is defined to be the minimum stack size for a signal handler. In computing an alternate stack size, a program should add that amount to its stack requirements to allow for the operating system overhead.

sigaltstack(2)

sigaltstack(2)

The following code fragment is typically used to allocate an alternate stack.

```
if ((sigstk.ss_sp = (char *)malloc(SIGSTKSZ)) == NULL)
    /* error return */;

sigstk.ss_size = SIGSTKSZ;
sigstk.ss_flags = 0;
if (sigaltstack(&sigstk, (stack_t *)0) < 0)
    perror("sigaltstack");
```

SEE ALSO

getcontext(2), sigaction(2), sigsetjmp(3C), ucontext(5).

DIAGNOSTICS

On success, `sigaltstack` returns zero. On failure, it returns -1 and sets `errno` to indicate the error.

NAME

sigblock, sigmask - block signals

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...  
#include <signal.h>  
sigblock(mask);  
int mask;  
#define sigmask(signum)
```

DESCRIPTION

sigblock adds the signals specified in *mask* to the set of signals currently being blocked from delivery. Signals are blocked if the appropriate bit in *mask* is a 1; the macro sigmask is provided to construct the mask for a given *signum*. The previous mask is returned, and may be restored using sigsetmask(3).

It is not possible to block SIGKILL, SIGSTOP, or SIGCONT; this restriction is silently imposed by the system.

RETURN VALUE

The previous set of masked signals is returned.

SEE ALSO

kill(2), sigaction(2), sigsetmask(2), signal(2), sigvec(2).

NAME

sigfpe - signal handling for specific SIGFPE codes

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
#include <signal.h>
#include <floatingpoint.h>
sigfpe_handler_type sigfpe(code, hdl)
sigfpe_code_type code;
sigfpe_handler_type hdl;
```

DESCRIPTION

This function allows signal handling to be specified for particular SIGFPE codes. A call to sigfpe defines a new handler *hdl* for a particular SIGFPE *code* and returns the old handler as the value of the function sigfpe. Normally handlers are specified as pointers to functions; the special cases SIGFPE_IGNORE, SIGFPE_ABORT, and SIGFPE_DEFAULT allow ignoring, specifying core dump using abort(3), or default handling respectively.

For these IEEE-related codes:

| | | |
|------------|--------------|---------------------------|
| FPE_FLTRES | fp_inexact | floating inexact result |
| FPE_FLTDIV | fp_division | floating division by zero |
| FPE_FLTUND | fp_underflow | floating underflow |
| FPE_FLTOVF | fp_overflow | floating overflow |
| FPE_FLTINV | fp_invalid | floating operand error |

default handling is defined to be to call the handler specified to ieee_handler(3M).

For all other SIGFPE codes, default handling is to core dump using abort(3).

The compilation option `-ffpa` causes fpa recomputation to replace the default abort action for code FPE_FPA_ERROR. Note: SIGFPE_DEFAULT will restore abort rather than FPA recomputation for this code.

Three steps are required to intercept an IEEE-related SIGFPE code with sigfpe:

1. Set up a handler with sigfpe.
2. Enable the relevant IEEE trapping capability in the hardware, perhaps by using assembly-language instructions.
3. Perform a floating-point operation that generates the intended IEEE exception.

Unlike ieee_handler(3M), sigfpe never changes floating-point hardware mode bits affecting IEEE trapping. No IEEE-related SIGFPE signals will be generated unless those hardware mode bits are enabled.

SIGFPE signals can be handled using sigvec(2), signal(3), sigfpe(3), or ieee_handler(3M). In a particular program, to avoid confusion, use only one of these interfaces to handle SIGFPE signals.

EXAMPLE

A user-specified signal handler might look like this:

```
void sample_handler( sig, code, scp, addr )
    int sig ;                /* sig == SIGFPE always */
    int code ;
    struct sigcontext *scp ;
    char *addr ;
    {
        /*
         * Sample user-written sigfpe code handler.
         * Prints a message and continues.
         * struct sigcontext is defined in <signal.h>.
         */
        printf(" ieee exception code %x occurred at pc %X \n",
            code, scp->sc_pc);
    }
}
```

and it might be set up like this:

```
extern void sample_handler;
main
{
    sigfpe_handler_type hdl, old_handler1, old_handler2;
    /*
     * save current overflow and invalid handlers; set the new
     * overflow handler to sample_handler and set the new
     * invalid handler to SIGFPE_ABORT (abort on invalid)
     */
    hdl = (sigfpe_handler_type) sample_handler;
    old_handler1 = sigfpe(FPE_FLTOVF_TRAP, hdl);
    old_handler2 = sigfpe(FPE_FLTOPERR_TRAP, SIGFPE_ABORT);
    ...
    /*
     * restore old overflow and invalid handlers
     */
    sigfpe(FPE_FLTOVF_TRAP, old_handler1);
    sigfpe(FPE_FLTOPERR_TRAP, old_handler2);
}
}
```

FILES

```
/usr/include/floatingpoint.h
/usr/include/signal.h
```

SEE ALSO

sigvec(2), abort(3C), floatingpoint(3), ieee_handler(3M), signal(3)

RETURN VALUE

sigfpe returns BADSIG if *code* is not zero or a defined SIGFPE code.

NAME

siginfo - signal generation information

SYNOPSIS

#include <siginfo.h>

DESCRIPTION

If a process is catching a signal, it may request information that tells why the system generated that signal [see `sigaction(2)`]. If a process is monitoring its children, it may receive information that tells why a child changed state [see `waitid(2)`]. In either case, the system returns the information in a structure of type `siginfo_t`, which includes the following information:

```
int si_signo      /* signal number */
int si_errno     /* error number */
int si_code      /* signal code */
```

`si_signo` contains the system-generated signal number. (For the `waitid(2)` function, `si_signo` is always `SIGCHLD`.)

If `si_errno` is non-zero, it contains an error number associated with this signal, as defined in `errno.h`.

`si_code` contains a code identifying the cause of the signal. If the value of `si_code` is less than or equal to 0, then the signal was generated by a user process [see `kill(2)` and `sigsend(2)`] and the `siginfo` structure contains the following additional information:

```
pid_t si_pid     /* sending process ID */
uid_t si_uid     /* sending user ID */
```

Otherwise, `si_code` contains a signal-specific reason why the signal was generated, as follows:

| Signal | Code | Reason |
|---------|-------------|---------------------------------------|
| SIGILL | ILL_ILLOPC | illegal opcode |
| | ILL_PRVOPC | privileged opcode |
| | ILL_PRVREG | privileged register |
| SIGFPE | FPE_INTDIV | integer divide by zero |
| | FPE_INTOVF | integer overflow |
| | FPE_FLTDIV | floating point divide by zero |
| | FPE_FLTOVF | floating point overflow |
| | FPE_FLTUND | floating point underflow |
| | FPE_FLTRES | floating point inexact result |
| | FPE_FLTINV | invalid floating point operation |
| | FPE_FLTSUB | subscript out of range |
| | FPE_FTLNAN | FP NaN operand |
| SIGSEGV | SEGV_MAPERR | address not mapped to object |
| | SEGV_ACCERR | invalid permissions for mapped object |
| SIGBUS | BUS_ADRALN | invalid address alignment |
| | BUS_PROT | protection violation |

| | | |
|---------|--------------------|-------------------------------|
| SIGTRAP | TRAP_BRKPT | process breakpoint |
| | TRAP_TRACE | process trace trap |
| | <i>trap_number</i> | traps 504-511 |
| SIGCHLD | CLD_EXITED | child has exited |
| | CLD_KILLED | child was killed |
| | CLD_DUMPED | child terminated abnormally |
| | CLD_TRAPPED | traced child has trapped |
| | CLD_STOPPED | child has stopped |
| | CLD_CONTINUED | stopped child had continued |
| SIGPOLL | POLL_IN | data input available |
| | POLL_OUT | output buffers available |
| | POLL_MSG | input message available |
| | POLL_ERR | I/O error |
| | POLL_PRI | high priority input available |
| | POLL_HUP | device disconnected |

In addition, the following signal-dependent information is available for kernel-generated signals:

| Signal | Field | Value |
|---------|----------------------|---|
| SIGCHLD | pid_t <i>si_pid</i> | child process ID |
| | int <i>si_status</i> | exit value or signal |
| SIGPOLL | long <i>si_band</i> | band event for POLL_IN, POLL_OUT, or POLL_MSG |

NOTES

For SIGCHLD signals, if *si_code* is equal to CLD_EXITED, then *si_status* is equal to the exit value of the process; otherwise, it is equal to the signal that caused the process to change state. If *si_ncodes* is non zero, the signal was generated as a result of a machine exception. The signals that an exception may give rise to are SIGSEGV, SIGILL, SIGBUS, SIGTRAP and SIGFPE. When one of these signals is delivered as a result of a machine exception, one or more exception blocks containing relevant information is also made available through the *siginfo* structure. In that case *si_ncodes* contains the number of exception blocks available, and *si_exblks* points to an array of exception blocks containing *si_ncodes* elements. The contents of each exception block include the signal number, *eb_signo*, the exception code, *eb_code* (one of those listed above), and signal-specific information, *eb_registers*. *eb_register* contains valid information only for SIGSEGV, SIGBUS and SIGFPE. When *eb_code* is FPE_FLTINV, SEGV_MAPERR, SEGV_ACCERR, BUS_ADRERR, or BUS_OBJERR the *eb_subcode* field will contain additional information about the cause of the exception:

| Code | Subcode | Reason |
|-------------|------------------|----------------------------|
| FPE_FLTINV | FPE_FLTINV_INV | Invalid operand(s) |
| | FPE_FLTINV_NAN | Floating point NaN operand |
| SEGV_MAPERR | SEGV_MAPERR_CODE | Code access |
| | SEGV_MAPERR_DATA | Data access |

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| | | |
|-------------|-----------------------|---------------------------|
| SEGV_ACCERR | SEGV_ACCERR_CODE | Code access |
| | SEGV_ACCERR_DATA | Data access |
| BUS_ADRERR | BUS_ADRERR_VME_ERR | Non-existent VME address |
| BUS_OBJERR | BUS_OBJERR_CODE | Code access |
| | BUS_OBJERR_DATA | Data access |
| | BUS_OBJERR_PARITY_ERR | Parity error |
| | BUS_OBJERR_SB_HANG | Processor scoreboard hang |

For SIGSEGV and SIGBUS, the address, transaction and data registers of the faulting data-pipe stage are available in `eb_dma`, `eb_dmt` and `eb_dmd`, respectively.

For SIGFPE imprecise exception codes, the high and low words of the floating point result are available in `eb_fprh` and `eb_fprl`, and the floating point imprecise operation type register is available in `eb_fpit`.

SEE ALSO

`sigaction(2)`, `waitid(2)`, `signal(5)`

NAME

siginterrupt - allow signals to interrupt system calls

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...  
int siginterrupt(sig, flag)  
int sig, flag;
```

DESCRIPTION

siginterrupt is used to change the system call restart behavior when a system call is interrupted by the specified signal. If the flag is false (0), then system calls will be restarted if they are interrupted by the specified signal and no data has been transferred yet. System call restart is the default behavior when the signal(3) routine is used.

If the flag is true (1), then restarting of system calls is disabled. If a system call is interrupted by the specified signal and no data has been transferred, the system call will return -1 with errno set to EINTR. Interrupted system calls that have started transferring data will return the amount of data actually transferred.

Issuing a siginterrupt call during the execution of a signal handler will cause the new action to take place on the next signal to be caught.

NOTES

This library routine uses an extension of the sigvec(2) system call that is not available in 4.2BSD, hence it should not be used if backward compatibility is needed.

RETURN VALUE

A 0 value indicates that the call succeeded. A -1 value indicates that an invalid signal number has been supplied.

SEE ALSO

signal(2), sigblock(3), sigpause(3), sigsetmask(3), sigvec(3), signal(3).

NAME

signal, sigset, sighold, sigrelse, sigignore, sigpause - simplified signal management

SYNOPSIS

```
#include <signal.h>

void (*signal(int sig, void (*disp)(int)))(int);
void (*sigset(int sig, void (*disp)(int)))(int);
int sighold(int sig);
int sigrelse(int sig);
int sigignore(int sig);
int sigpause(int sig);
```

DESCRIPTION

These functions provide simplified signal management for application processes. See signal(5) for an explanation of general signal concepts.

signal and sigset are used to modify signal dispositions. *sig* specifies the signal, which may be any signal except SIGKILL and SIGSTOP. *disp* specifies the signal's disposition, which may be SIG_DFL, SIG_IGN, or the address of a signal handler. If signal is used, *disp* is the address of a signal handler, and *sig* is not SIGILL, SIGTRAP, or SIGPWR, the system first sets the signal's disposition to SIG_DFL before executing the signal handler. If sigset is used and *disp* is the address of a signal handler, the system adds *sig* to the calling process's signal mask before executing the signal handler; when the signal handler returns, the system restores the calling process's signal mask to its state prior to the delivery of the signal. In addition, if sigset is used and *disp* is equal to SIG_HOLD, *sig* is added to the calling process's signal mask and the signal's disposition remains unchanged.

sighold adds *sig* to the calling process's signal mask.

sigrelse removes *sig* from the calling process's signal mask.

sigignore sets the disposition of *sig* to SIG_IGN.

sigpause removes *sig* from the calling process's signal mask and suspends the calling process until a signal is received.

These functions fail if any of the following are true.

| | |
|--------|---|
| EINVAL | The value of the <i>sig</i> argument is not a valid signal or is equal to SIGKILL or SIGSTOP. |
| EINTR | A signal was caught during the system call sigpause. |

NOTES

sighold in conjunction with sigrelse or sigpause may be used to establish critical regions of code that require the delivery of a signal to be temporarily deferred.

If signal or sigset is used to set SIGCHLD's disposition to a signal handler, SIGCHLD will not be sent when the calling process's children are stopped or continued.

signal(2)

signal(2)

If any of the above functions are used to set `SIGCHLD`'s disposition to `SIG_IGN`, the calling process's child processes will not create zombie processes when they terminate [see `exit(2)`]. If the calling process subsequently waits for its children, it blocks until all of its children terminate; it then returns a value of -1 with `errno` set to `ECHILD` [see `wait(2)`, `waitid(2)`].

DIAGNOSTICS

On success, `signal` returns the signal's previous disposition. On failure, it returns `SIG_ERR` and sets `errno` to indicate the error.

On success, `sigset` returns `SIG_HOLD` if the signal had been blocked or the signal's previous disposition if it had not been blocked. On failure, it returns `SIG_ERR` and sets `errno` to indicate the error.

All other functions return zero on success. On failure, they return -1 and set `errno` to indicate the error.

SEE ALSO

`kill(2)`, `pause(2)`, `sigaction(2)`, `sigsend(2)`, `wait(2)`, `waitid(2)`, `signal(5)`

NAME

signal - simplified software signal facilities

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...
#include <signal.h>

void (*signal(sig, func))()
void (*func)();
```

DESCRIPTION

signal is a simplified interface to the more general sigvec(2) facility. Programs that use signal in preference to sigvec are more likely to be portable to all systems.

A signal is generated by some abnormal event, initiated by a user at a terminal (quit, interrupt, stop), by a program error (bus error, and so on), by request of another program (kill), or when a process is stopped because it wishes to access its control terminal while in the background [see termio(4)]. Signals are optionally generated when a process resumes after being stopped, when the status of child processes changes, or when input is ready at the control terminal. Most signals cause termination of the receiving process if no action is taken; some signals instead cause the process receiving them to be stopped, or are simply discarded if the process has not requested otherwise. Except for the SIGKILL and SIGSTOP signals, the signal call allows signals either to be ignored or to interrupt to a specified location. The following is a list of all signals with names as in the include file <signal.h>:

| | | |
|---------|---|--|
| SIGHUP | | hangup |
| SIGINT | | interrupt |
| SIGQUIT | * | quit |
| SIGILL | * | illegal instruction |
| SIGTRAP | * | trace trap |
| SIGABRT | * | abort (generated by abort(3) routine) |
| SIGEMT | * | emulator trap |
| SIGFPE | * | arithmetic exception |
| SIGKILL | | kill (cannot be caught, blocked, or ignored) |
| SIGBUS | * | bus error |
| SIGSEGV | * | segmentation violation |
| SIGSYS | * | bad argument to system call |
| SIGPIPE | | write on a pipe or other socket with no one to read it |
| SIGALRM | | alarm clock |
| SIGTERM | | software termination signal |
| SIGURG | • | urgent condition present on socket |
| SIGSTOP | † | stop (cannot be caught, blocked, or ignored) |
| SIGTSTP | † | stop signal generated from keyboard |
| SIGCONT | • | continue after stop (cannot be blocked) |
| SIGCHLD | • | child status has changed |
| SIGTTIN | † | background read attempted from control terminal |
| SIGTTOU | † | background write attempted to control terminal |
| SIGIO | • | I/O is possible on a descriptor [see fcntl(2)] |
| SIGXCPU | * | cpu time limit exceeded [see getrlimit(2)] |
| SIGXFSZ | * | file size limit exceeded [see getrlimit(2)] |

| | |
|-----------|--|
| SIGVTALRM | virtual time alarm [see <code>getitimer(2)</code>] |
| SIGPROF | profiling timer alarm [see <code>getitimer(2)</code>] |
| SIGWINCH | • window changed [see <code>termio(4)</code>] |
| SIGUSR1 | user-defined signal 1 |
| SIGUSR2 | user-defined signal 2 |

The starred signals in the list above cause a core image if not caught or ignored.

If *func* is `SIG_DFL`, the default action for signal *sig* is reinstated; this default is termination (with a core image for starred signals) except for signals marked with • or †. Signals marked with • are discarded if the action is `SIG_DFL`; signals marked with † cause the process to stop. If *func* is `SIG_IGN` the signal is subsequently ignored and pending instances of the signal are discarded. Otherwise, when the signal occurs further occurrences of the signal are automatically blocked and *func* is called.

A return from the function unblocks the handled signal and continues the process at the point it was interrupted.

If a caught signal occurs during certain system calls, terminating the call prematurely, the call is automatically restarted. In particular this can occur during a `read(2)` or `write(2)` on a slow device (such as a terminal; but not a file) and during a `wait(2)`.

The value of `signal` is the previous (or initial) value of *func* for the particular signal.

After a `fork(2)` or `vfork(2)` the child inherits all signals. An `execve(2)` resets all caught signals to the default action; ignored signals remain ignored.

NOTES

The handler routine can be declared:

```
void handler(sig, code, scp, addr)
int sig, code;
struct sigcontext *scp;
char *addr;
```

Here *sig* is the signal number; *code* is a parameter of certain signals that provides additional detail; *scp* is a pointer to the `sigcontext` structure (defined in `<signal.h>`), used to restore the context from before the signal; and *addr* is additional address information. See `sigvec(2)` for more details.

RETURN VALUE

The previous action is returned on a successful call. Otherwise, -1 is returned and `errno` is set to indicate the error.

ERRORS

`signal` will fail and no action will take place if one of the following occur:

`EINVAL` *sig* is not a valid signal number, or is `SIGKILL` or `SIGSTOP`.

SEE ALSO

`kill(1)`, `execve(2)`, `fork(2)`, `getitimer(2)`, `getrlimit(2)`, `kill(2)`, `ptrace(2)`, `read(2)`, `sigaction(2)`, `wait(2)`, `write(2)`, `setjmp(3)`, `sigblock(3)`, `sigpause(3)`, `sigsetmask(3)`, `sigstack(3)`, `sigvec(3)`, `wait(3)`, `setjmp(3C)`, `termio(7)`.

NAME

signal - base signals

SYNOPSIS

```
#include <signal.h>
```

DESCRIPTION

A signal is an asynchronous notification of an event. A signal is said to be generated for (or sent to) a process when the event associated with that signal first occurs. Examples of such events include hardware faults, timer expiration and terminal activity, as well as the invocation of the `kill` or `sigsend` system calls. In some circumstances, the same event generates signals for multiple processes. A process may request a detailed notification of the source of the signal and the reason why it was generated [see `siginfo(5)`].

Each process may specify a system action to be taken in response to each signal sent to it, called the signal's disposition. The set of system signal actions for a process is initialized from that of its parent. Once an action is installed for a specific signal, it usually remains installed until another disposition is explicitly requested by a call to either `sigaction`, `signal` or `sigset`, or until the process execs [see `sigaction(2)` and `signal(2)`]. When a process execs, all signals whose disposition has been set to catch the signal will be set to `SIG_DFL`. Alternatively, a process may request that the system automatically reset the disposition of a signal to `SIG_DFL` after it has been caught [see `sigaction(2)` and `signal(2)`].

A signal is said to be delivered to a process when the appropriate action for the process and signal is taken. During the time between the generation of a signal and its delivery, the signal is said to be pending [see `sigpending(2)`]. Ordinarily, this interval cannot be detected by an application. However, a signal can be blocked from delivery to a process [see `signal(2)` and `sigprocmask(2)`]. If the action associated with a blocked signal is anything other than to ignore the signal, and if that signal is generated for the process, the signal remains pending until either it is unblocked or the signal's disposition requests that the signal be ignored. If the signal disposition of a blocked signal requests that the signal be ignored, and if that signal is generated for the process, the signal is discarded immediately upon generation.

Each process has a signal mask that defines the set of signals currently blocked from delivery to it [see `sigprocmask(2)`]. The signal mask for a process is initialized from that of its parent.

The determination of which action is taken in response to a signal is made at the time the signal is delivered, allowing for any changes since the time of generation. This determination is independent of the means by which the signal was originally generated.

The signals currently defined in `signal.h` are as follows:

| Name | Value | Default | Event |
|-----------|-------|---------|---|
| SIGHUP | 1 | Exit | Hangup [see <code>termio(7)</code>] |
| SIGINT | 2 | Exit | Interrupt [see <code>termio(7)</code>] |
| SIGQUIT | 3 | Core | Quit [see <code>termio(7)</code>] |
| SIGILL | 4 | Core | Illegal Instruction |
| SIGTRAP | 5 | Core | Trace/Breakpoint Trap |
| SIGABRT | 6 | Core | Abort |
| SIGEMT | 7 | Core | Emulation Trap |
| SIGFPE | 8 | Core | Arithmetic Exception |
| SIGKILL | 9 | Exit | Killed |
| SIGBUS | 10 | Core | Bus Error |
| SIGSEGV | 11 | Core | Segmentation Fault |
| SIGSYS | 12 | Core | Bad System Call |
| SIGPIPE | 13 | Exit | Broken Pipe |
| SIGALRM | 14 | Exit | Alarm Clock |
| SIGTERM | 15 | Exit | Terminated |
| SIGUSR1 | 16 | Exit | User Signal 1 |
| SIGUSR2 | 17 | Exit | User Signal 2 |
| SIGCHLD | 18 | Ignore | Child Status Changed |
| SIGPWR | 19 | Ignore | Power Fail/Restart |
| SIGWINCH | 20 | Ignore | Window Size Change |
| SIGURG | 33 | Ignore | Urgent Socket Condition |
| SIGPOLL | 22 | Exit | Pollable Event [see <code>streamio(7)</code>] |
| SIGSTOP | 23 | Stop | Stopped (signal) |
| SIGTSTP | 24 | Stop | Stopped (user) [see <code>termio(7)</code>] |
| SIGCONT | 25 | Ignore | Continued |
| SIGTTIN | 26 | Stop | Stopped (tty input) [see <code>termio(7)</code>] |
| SIGTTOU | 27 | Stop | Stopped (tty output) [see <code>termio(7)</code>] |
| SIGVTALRM | 37 | Exit | Virtual Timer Expired |
| SIGPROF | 38 | Exit | Profiling Timer Expired |
| SIGXCPU | 35 | Core | CPU time limit exceeded [see <code>getrlimit(2)</code>] |
| SIGXFSZ | 36 | Core | File size limit exceeded [see <code>getrlimit(2)</code>] |
| SIGIO | 34 | Core | Socket I/O possible |

Using the `signal`, `sigset` or `sigaction` system call, a process may specify one of three dispositions for a signal: take the default action for the signal, ignore the signal, or catch the signal.

Default Action: `SIG_DFL`

A disposition of `SIG_DFL` specifies the default action. The default action for each signal is listed in the table above and is selected from the following:

- Exit When it gets the signal, the receiving process is to be terminated with all the consequences outlined in `exit(2)`.
- Core When it gets the signal, the receiving process is to be terminated with all the consequences outlined in `exit(2)`. In addition, a “core image” of the process is constructed in the current working directory.
- Stop When it gets the signal, the receiving process is to stop.

signal(5)

signal(5)

Ignore When it gets the signal, the receiving process is to ignore it. This is identical to setting the disposition to SIG_IGN.

Ignore Signal: SIG_IGN

A disposition of SIG_IGN specifies that the signal is to be ignored.

Catch Signal: *function address*

A disposition that is a function address specifies that, when it gets the signal, the receiving process is to execute the signal handler at the specified address. Normally, the signal handler is passed the signal number as its only argument; if the disposition was set with the `sigaction` function however, additional arguments may be requested [see `sigaction(2)`]. When the signal handler returns, the receiving process resumes execution at the point it was interrupted, unless the signal handler makes other arrangements. If an invalid function address is specified, results are undefined.

If the disposition has been set with the `sigset` or `sigaction` function, the signal is automatically blocked by the system while the signal catcher is executing. If a `longjmp` [see `setjmp(3C)`] is used to leave the signal catcher, then the signal must be explicitly unblocked by the user [see `signal(2)` and `sigprocmask(2)`].

If execution of the signal handler interrupts a blocked system call, the handler is executed and the interrupted system call returns a -1 to the calling process with `errno` set to `EINTR`. However, if the `SA_RESTART` flag is set the system call will be transparently restarted.

NOTES

The dispositions of the SIGKILL and SIGSTOP signals cannot be altered from their default values. The system generates an error if this is attempted.

The SIGKILL and SIGSTOP signals cannot be blocked. The system silently enforces this restriction.

If a process receives a SIGSEGV or SIGBUS resulting from an instruction access while it is blocking or ignoring that signal, the system will set the process's handler to SIG_DFL before delivering the signal, causing the process to terminate with a core file.

Whenever a process receives a SIGSTOP, SIGTSTP, SIGTTIN, or SIGTTOU signal, regardless of its disposition, any pending SIGCONT signal are discarded.

Whenever a process receives a SIGCONT signal, regardless of its disposition, any pending SIGSTOP, SIGTSTP, SIGTTIN, and SIGTTOU signals is discarded. In addition, if the process was stopped, it is continued.

SIGPOLL is issued when a file descriptor corresponding to a STREAMS [see `intro(2)`] file has a "selectable" event pending. A process must specifically request that this signal be sent using the `I_SETSIG` `ioctl` call. Otherwise, the process will never receive SIGPOLL.

If the disposition of the SIGCHLD signal has been set with `signal` or `sigset`, or with `sigaction` and the `SA_NOCLDSTOP` flag has been specified, it will only be sent to the calling process when its children exit; otherwise, it will also be sent when the calling process's children are stopped or continued due to job control.

signal(5)

signal(5)

The name `SIGCLD` is also defined in this header file and identifies the same signal as `SIGCHLD`. `SIGCLD` is provided for backward compatibility, new applications should use `SIGCHLD`.

The disposition of signals that are inherited as `SIG_IGN` should not be changed.

SEE ALSO

`exit(2)`, `getrlimit(2)`, `intro(2)`, `kill(2)`, `pause(2)`, `sigaction(2)`, `sigaltstack(2)`, `signal(2)`, `sigprocmask(2)`, `sigsend(2)`, `sigsuspend(2)`, `wait(2)`, `sigsetops(3C)`, `siginfo(5)`, `ucontext(5)`

NAME

sigpause - automatically release blocked signals and wait for interrupt

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...
```

```
sigpause(sigmask)  
int sigmask;
```

DESCRIPTION

sigpause assigns *sigmask* to the set of masked signals and then waits for a signal to arrive; on return the set of masked signals is restored. *sigmask* is usually 0 to indicate that no signals are now to be blocked. sigpause always terminates by being interrupted, returning EINTR.

In normal usage, a signal is blocked using sigblock(3), to begin a critical section, variables modified on the occurrence of the signal are examined to determine that there is no work to be done, and the process pauses awaiting work by using sigpause with the mask returned by sigblock.

SEE ALSO

signal(2), sigaction(2), sigblock(3), sigvec(3), signal(3).

sigpending(2)

sigpending(2)

NAME

sigpending - examine signals that are blocked and pending

SYNOPSIS

```
#include <signal.h>
int sigpending(sigset_t *set);
```

DESCRIPTION

The `sigpending` function retrieves those signals that have been sent to the calling process but are being blocked from delivery by the calling process's signal mask. The signals are stored in the space pointed to by the argument `set`.

`sigpending` fails if the following is true:

EFAULT The `set` argument points outside the process's allocated address space.

SEE ALSO

`sigaction(2)`, `sigprocmask(2)`, `sigsetops(3C)`

DIAGNOSTICS

On success, `sigpending` returns zero. On failure, it returns -1 and sets `errno` to indicate the error.

NAME

sigprocmask - change or examine signal mask

SYNOPSIS

```
#include <signal.h>

int sigprocmask(int how, const sigset_t *set, sigset_t *oset);
```

DESCRIPTION

The `sigprocmask` function is used to examine and/or change the calling process's signal mask. If the value is `SIG_BLOCK`, the set pointed to by the argument `set` is added to the current signal mask. If the value is `SIG_UNBLOCK`, the set pointed by the argument `set` is removed from the current signal mask. If the value is `SIG_SETMASK`, the current signal mask is replaced by the set pointed to by the argument `set`. If the argument `oset` is not `NULL`, the previous mask is stored in the space pointed to by `oset`. If the value of the argument `set` is `NULL`, the value `how` is not significant and the process's signal mask is unchanged; thus, the call can be used to enquire about currently blocked signals.

If there are any pending unblocked signals after the call to `sigprocmask`, at least one of those signals will be delivered before the call to `sigprocmask` returns.

It is not possible to block those signals that cannot be ignored [see `sigaction(2)`]; this restriction is silently imposed by the system.

If `sigprocmask` fails, the process's signal mask is not changed.

`sigprocmask` fails if any of the following is true:

| | |
|---------------------|--|
| <code>EINVAL</code> | The value of the <code>how</code> argument is not equal to one of the defined values. |
| <code>EFAULT</code> | The value of <code>set</code> or <code>oset</code> points outside the process's allocated address space. |

SEE ALSO

`sigaction(2)`, `signal(2)`, `sigsetopts(3C)`, `signal(5)`

DIAGNOSTICS

On success, `sigprocmask` returns zero. On failure, it returns -1 and sets `errno` to indicate the error.

NAME

sigsem - signal a process waiting on a semaphore

SYNOPSIS

```
cc [flag...] file...-lx
sigsem(int sem_num);
```

DESCRIPTION

sigsem signals a process that is waiting on the semaphore *sem_num* that it may proceed and use the resource governed by the semaphore. sigsem is used in conjunction with waitsem to allow synchronization of processes wishing to access a resource. One or more processes may waitsem on the given semaphore and will be put to sleep until the process which currently has access to the resource issues a sigsem call. If there are any waiting processes, sigsem causes the process which is next in line on the semaphore's queue to be rescheduled for execution. The semaphore's queue is organized in First In, First Out (FIFO) order.

DIAGNOSTICS

sigsem returns the value (int) -1 if an error occurs. If *sem_num* does not refer to a semaphore type file, errno is set to ENOTNAM. If *sem_num* has not been previously opened by opensem, errno is set to EBADF. If the process issuing a sigsem call is not the current "owner" of the semaphore (that is, if the process has not issued a waitsem call before the sigsem), errno is set to ENAVAIL.

SEE ALSO

creatsem(2), opensem(2), waitsem(2)

sigsend(2)

sigsend(2)

NAME

sigsend, sigsendset - send a signal to a process or a group of processes

SYNOPSIS

```
#include <sys/types.h>
#include <sys/signal.h>
#include <sys/procset.h>

int sigsend(idtype_t idtype, id_t id, int sig);

int sigsendset(procset_t *psp, int sig);
```

DESCRIPTION

sigsend sends a signal to the process or group of processes specified by *id* and *idtype*. The signal to be sent is specified by *sig* and is either zero or one of the values listed in `signal(5)`. If *sig* is zero (the null signal), error checking is performed but no signal is actually sent. This value can be used to check the validity of *id* and *idtype*.

The real or effective user ID of the sending process must match the real or effective user ID of the receiving process, unless the effective user ID of the sending process is super-user, or *sig* is SIGCONT and the sending process has the same session ID as the receiving process.

If *idtype* is P_PID, *sig* is sent to the process with process ID *id*.

If *idtype* is P_PGID, *sig* is sent to any process with process group ID *id*.

If *idtype* is P_SID, *sig* is sent to any process with session ID *id*.

If *idtype* is P_UID, *sig* is sent to any process with effective user ID *id*.

If *idtype* is P_GID, *sig* is sent to any process with effective group ID *id*.

If *idtype* is P_CID, *sig* is sent to any process with scheduler class ID *id* [see `pricntl(2)`].

If *idtype* is P_ALL, *sig* is sent to all processes and *id* is ignored.

If *id* is P_MYID, the value of *id* is taken from the calling process.

The process with a process ID of 0 is always excluded. The process with a process ID of 1 is excluded unless *idtype* is equal to P_PID.

sigsendset provides an alternate interface for sending signals to sets of processes. This function sends signals to the set of processes specified by *psp*. *psp* is a pointer to a structure of type `procset_t`, defined in `sys/procset.h`, which includes the following members:

| | |
|----------|------------|
| idop_t | p_op; |
| idtype_t | p_lidtype; |
| id_t | p_lid; |
| idtype_t | p_ridtype; |
| id_t | p_rid; |

`p_lidtype` and `p_lid` specify the ID type and ID of one ("left") set of processes; `p_ridtype` and `p_rid` specify the ID type and ID of a second ("right") set of processes. ID types and IDs are specified just as for the *idtype* and *id* arguments to `sigsend`. `p_op` specifies the operation to be performed on the two sets of processes to get the set of processes the system call is to apply to. The valid values for `p_op`

and the processes they specify are:

POP_DIFF set difference: processes in left set and not in right set
 POP_AND set intersection: processes in both left and right sets
 POP_OR set union: processes in either left or right set or both
 POP_XOR set exclusive-or: processes in left or right set but not in both

`sigsend` and `sigsendset` fail if one or more of the following are true:

EINVAL *sig* is not a valid signal number.
 EINVAL *idtype* is not a valid *idtype* field.
 EINVAL *sig* is SIGKILL, *idtype* is P_PID and *id* is 1 (`proc1`).
 ESRCH No process can be found corresponding to that specified by *id* and *idtype*.
 EPERM The user ID of the sending process is not super-user, and its real or effective user ID does not match the real or effective user ID of the receiving process, and the calling process is not sending SIGCONT to a process that shares the same session.

In addition, `sigsendset` fails if:

EFAULT `psp` points outside the process's allocated address space.

SEE ALSO

`kill(1)`, `getpid(2)`, `getpgrp(2)`, `kill(2)`, `prctl(2)`, `setpid(2)`, `signal(2)`, `signal(5)`.

DIAGNOSTICS

On success, `sigsend` returns zero. On failure, it returns -1 and sets `errno` to indicate the error.

sigsetjmp(3C)

sigsetjmp(3C)

NAME

sigsetjmp, siglongjmp - a non-local goto with signal state

SYNOPSIS

```
#include <setjmp.h>
int sigsetjmp (sigjmp_buf env, int savemask);
void siglongjmp (sigjmp_buf env, int val);
```

DESCRIPTION

These functions are useful for dealing with errors and interrupts encountered in a low-level subroutine of a program.

sigsetjmp saves the calling process's registers and stack environment [see sigaltstack(2)] in *env* (whose type, sigjmp_buf, is defined in the <setjmp.h> header file) for later use by siglongjmp. If *savemask* is non-zero, the calling process's signal mask [see sigprocmask(2)] and scheduling parameters [see priocntl(2)] are also saved. sigsetjmp returns the value 0.

siglongjmp restores the environment saved by the last call of sigsetjmp with the corresponding *env* argument. After siglongjmp is completed, program execution continues as if the corresponding call of sigsetjmp had just returned the value *val*. siglongjmp cannot cause sigsetjmp to return the value zero. If siglongjmp is invoked with a second argument of zero, sigsetjmp will return 1. At the time of the second return from sigsetjmp, all external and static variables have values as of the time siglongjmp is called. The values of register and automatic variables are undefined. Register or automatic variables whose value must be relied upon must be declared as volatile.

If a signal-catching function interrupts sleep and calls siglongjmp to restore an environment saved prior to the sleep call, the action associated with SIGALRM and time it is scheduled to be generated are unspecified. It is also unspecified whether the SIGALRM signal is blocked, unless the process's signal mask is restored as part of the environment.

The function siglongjmp restores the saved signal mask if and only if the *env* argument was initialized by a call to the sigsetjmp function with a non-zero *savemask* argument.

SEE ALSO

getcontext(2), priocntl(2), sigaction(2), sigaltstack(2), sigprocmask(2), setjmp(3C)

NOTES

If siglongjmp is called even though *env* was never primed by a call to sigsetjmp, or when the last such call was in a function that has since returned, the behavior is undefined.

NAME

sigsetmask - set current signal mask

SYNOPSIS

```
/usr/ucb/cc [flag...]file...  
#include <signal.h>  
sigsetmask(mask);  
int mask;  
#define sigmask(signum)
```

DESCRIPTION

sigsetmask sets the current signal mask (those signals that are blocked from delivery). Signals are blocked if the corresponding bit in *mask* is a 1; the macro sigmask is provided to construct the mask for a given *signum*.

The system quietly disallows SIGKILL, SIGSTOP, or SIGCONT from being blocked.

RETURN VALUE

The previous set of masked signals is returned.

SEE ALSO

kill(2), sigblock(3), signal(2), signal(3), sigpause(3), sigvec(3).

NAME

sigemptyset, sigfillset, sigaddset, sigdelset, sigismember - manipulate sets of signals

SYNOPSIS

```
#include <signal.h>

int sigemptyset (sigset_t *set);
int sigfillset (sigset_t *set);
int sigaddset (sigset_t *set, int signo);
int sigdelset (sigset_t *set, int signo);
int sigismember (sigset_t *set, int signo);
```

DESCRIPTION

These functions manipulate *sigset_t* data types, representing the set of signals supported by the implementation.

sigemptyset initializes the set pointed to by *set* to exclude all signals defined by the system.

sigfillset initializes the set pointed to by *set* to include all signals defined by the system.

sigaddset adds the individual signal specified by the value of *signo* to the set pointed to by *set*.

sigdelset deletes the individual signal specified by the value of *signo* from the set pointed to by *set*.

sigismember checks whether the signal specified by the value of *signo* is a member of the set pointed to by *set*.

Any object of type *sigset_t* must be initialized by applying either *sigemptyset* or *sigfillset* before applying any other operation.

sigaddset, *sigdelset* and *sigismember* will fail if the following is true:

EINVAL The value of the *signo* argument is not a valid signal number.

sigfillset will dump a core file if the *set* argument specifies an invalid address.

SEE ALSO

sigaction(2), sigprocmask(2), sigpending(2), sigsuspend(2), signal(5)

DIAGNOSTICS

Upon successful completion, the *sigismember* function returns a value of one if the specified signal is a member of the specified set, or a value of zero if it is not.

Upon successful completion, the other functions return a value of zero. Otherwise a value of -1 is returned and *errno* is set to indicate the error.

NAME

sigstack - set and/or get signal stack context

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...
#include <signal.h>
int sigstack (ss, oss)
struct sigstack *ss, *oss;
```

DESCRIPTION

sigstack allows users to define an alternate stack, called the "signal stack," on which signals are to be processed. When a signal's action indicates its handler should execute on the signal stack (specified with a sigvec(2) call), the system checks to see if the process is currently executing on that stack. If the process is not currently executing on the signal stack, the system arranges a switch to the signal stack for the duration of the signal handler's execution.

A signal stack is specified by a sigstack structure, which includes the following members:

```
char          *ss_sp;          /* signal stack pointer */
int           ss_onstack;     /* current status */
```

ss_sp is the initial value to be assigned to the stack pointer when the system switches the process to the signal stack. Note that, on machines where the stack grows downwards in memory, this is *not* the address of the beginning of the signal stack area. ss_onstack field is zero or non-zero depending on whether the process is currently executing on the signal stack or not.

If ss is not a NULL pointer, sigstack sets the signal stack state to the value in the sigstack structure pointed to by ss. Note: if ss_onstack is non-zero, the system will think that the process is executing on the signal stack. If ss is a NULL pointer, the signal stack state will be unchanged. If oss is not a NULL pointer, the current signal stack state is stored in the sigstack structure pointed to by oss.

RETURN VALUE

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and errno is set to indicate the error.

ERRORS

sigstack will fail and the signal stack context will remain unchanged if one of the following occurs.

| | |
|--------|--|
| EFAULT | Either ss or oss points to memory that is not a valid part of the process address space. |
|--------|--|

SEE ALSO

sigaltstack(2), sigvec(3), signal(3).

NOTES

Signal stacks are not "grown" automatically, as is done for the normal stack. If the stack overflows unpredictable results may occur.

sigsuspend(2)

sigsuspend(2)

NAME

sigsuspend - install a signal mask and suspend process until signal

SYNOPSIS

```
#include <signal.h>
int sigsuspend(const sigset_t *set);
```

DESCRIPTION

sigsuspend replaces the process's signal mask with the set of signals pointed to by the argument *set* and then suspends the process until delivery of a signal whose action is either to execute a signal catching function or to terminate the process.

If the action is to terminate the process, sigsuspend does not return. If the action is to execute a signal catching function, sigsuspend returns after the signal catching function returns. On return, the signal mask is restored to the set that existed before the call to sigsuspend.

It is not possible to block those signals that cannot be ignored [see signal(5)]; this restriction is silently imposed by the system.

sigsuspend fails if either of the following is true:

| | |
|--------|--|
| EINTR | A signal is caught by the calling process and control is returned from the signal catching function. |
| EFAULT | The <i>set</i> argument points outside the process's allocated address space. |

DIAGNOSTICS

Since sigsuspend suspends process execution indefinitely, there is no successful completion return value. On failure, it returns -1 and sets *errno* to indicate the error.

SEE ALSO

sigaction(2), sigprocmask(2), sigpause(2), sigsetops(3C), signal(5)

NAME

sigvec - software signal facilities

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
#include <signal.h>
int sigvec(sig, vec, ovec)
int sig;
struct sigvec *vec, *ovec;
```

DESCRIPTION

The system defines a set of signals that may be delivered to a process. Signal delivery resembles the occurrence of a hardware interrupt: the signal is blocked from further occurrence, the current process context is saved, and a new one is built. A process may specify a *handler* to which a signal is delivered, or specify that a signal is to be *blocked* or *ignored*. A process may also specify that a default action is to be taken by the system when a signal occurs. Normally, signal handlers execute on the current stack of the process. This may be changed, on a per-handler basis, so that signals are taken on a special *signal stack*.

All signals have the same *priority*. Signal routines execute with the signal that caused their invocation to be *blocked*, but other signals may yet occur. A global *signal mask* defines the set of signals currently blocked from delivery to a process. The signal mask for a process is initialized from that of its parent (normally 0). It may be changed with a `sigblock(3)` or `sigsetmask(3)` call, or when a signal is delivered to the process.

A process may also specify a set of *flags* for a signal that affect the delivery of that signal.

When a signal condition arises for a process, the signal is added to a set of signals pending for the process. If the signal is not currently *blocked* by the process then it is delivered to the process. When a signal is delivered, the current state of the process is saved, a new signal mask is calculated (as described below), and the signal handler is invoked. The call to the handler is arranged so that if the signal handling routine returns normally the process will resume execution in the context from before the signal's delivery. If the process wishes to resume in a different context, then it must arrange to restore the previous context itself.

When a signal is delivered to a process a new signal mask is installed for the duration of the process' signal handler (or until a `sigblock` or `sigsetmask` call is made). This mask is formed by taking the current signal mask, adding the signal to be delivered, and ORing in the signal mask associated with the handler to be invoked.

The action to be taken when the signal is delivered is specified by a `sigvec` structure, which includes the following members:

```
void    (*sv_handler)();      /* signal handler */
int     sv_mask;              /* signal mask to apply */
int     sv_flags;            /* see signal options */
```

```
#define SV_ONSTACK /* take signal on signal stack */
#define SV_INTERRUPT /* do not restart system on signal return */
#define SV_RESETHAND /* reset handler to SIG_DFL when signal taken */
```

If the `SV_ONSTACK` bit is set in the flags for that signal, the system will deliver the signal to the process on the signal stack specified with `sigstack(2)`, rather than delivering the signal on the current stack.

If `vec` is not a `NULL` pointer, `sigvec` assigns the handler specified by `sv_handler`, the mask specified by `sv_mask`, and the flags specified by `sv_flags` to the specified signal. If `vec` is a `NULL` pointer, `sigvec` does not change the handler, mask, or flags for the specified signal.

The mask specified in `vec` is not allowed to block `SIGKILL`, `SIGSTOP`, or `SIGCONT`. The system enforces this restriction silently.

If `vec` is not a `NULL` pointer, the handler, mask, and flags in effect for the signal before the call to `sigvec` are returned to the user. A call to `sigvec` with `vec` a `NULL` pointer and `ovec` not a `NULL` pointer can be used to determine the handling information currently in effect for a signal without changing that information.

The following is a list of all signals with names as in the include file `/usr/include/signal.h`:

| | |
|------------------------|--|
| <code>SIGHUP</code> | hangup |
| <code>SIGINT</code> | interrupt |
| <code>SIGQUIT</code> | * quit |
| <code>SIGILL</code> | * illegal instruction |
| <code>SIGTRAP</code> | * trace trap |
| <code>SIGABRT</code> | * abort (generated by <code>abort(3)</code> routine) |
| <code>SIGEMT</code> | * emulator trap |
| <code>SIGFPE</code> | * arithmetic exception |
| <code>SIGKILL</code> | kill (cannot be caught, blocked, or ignored) |
| <code>SIGBUS</code> | * bus error |
| <code>SIGSEGV</code> | * segmentation violation |
| <code>SIGSYS</code> | * bad argument to system call |
| <code>SIGPIPE</code> | write on a pipe or other socket with no one to read it |
| <code>SIGALRM</code> | alarm clock |
| <code>SIGTERM</code> | software termination signal |
| <code>SIGURG</code> | • urgent condition present on socket |
| <code>SIGSTOP</code> | † stop (cannot be caught, blocked, or ignored) |
| <code>SIGTSTP</code> | † stop signal generated from keyboard |
| <code>SIGCONT</code> | • continue after stop (cannot be blocked) |
| <code>SIGCHLD</code> | • child status has changed |
| <code>SIGTTIN</code> | † background read attempted from control terminal |
| <code>SIGTTOU</code> | † background write attempted to control terminal |
| <code>SIGIO</code> | • I/O is possible on a descriptor [see <code>fcntl(2)</code>] |
| <code>SIGXCPU</code> | cpu time limit exceeded [see <code>setrlimit(2)</code>] |
| <code>SIGXFSZ</code> | file size limit exceeded [see <code>setrlimit(2)</code>] |
| <code>SIGVTALRM</code> | virtual time alarm [see <code>setitimer(2)</code>] |
| <code>SIGPROF</code> | profiling timer alarm [see <code>setitimer(2)</code>] |
| <code>SIGWINCH</code> | • window changed [see <code>termio(4)</code>] |

| | |
|---------|-----------------------|
| SIGUSR1 | user-defined signal 1 |
| SIGUSR2 | user-defined signal 2 |

The starred signals in the list above cause a core image if not caught or ignored.

Once a signal handler is installed, it remains installed until another `sigvec` call is made, or an `execve(2)` is performed, unless the `SV_RESETHAND` bit is set in the flags for that signal. In that case, the value of the handler for the caught signal will be set to `SIG_DFL` before entering the signal-catching function, unless the signal is `SIGILL`, `SIGPWR`, or `SIGTRAP`. Also, if this bit is set, the bit for that signal in the signal mask will not be set; unless the signal mask associated with that signal blocks that signal, further occurrences of that signal will not be blocked. The `SV_RESETHAND` flag is not available in 4.2BSD, hence it should not be used if backward compatibility is needed.

The default action for a signal may be reinstated by setting the signal's handler to `SIG_DFL`; this default is termination except for signals marked with `•` or `†`. Signals marked with `•` are discarded if the action is `SIG_DFL`; signals marked with `†` cause the process to stop. If the process is terminated, a "core image" will be made in the current working directory of the receiving process if the signal is one for which an asterisk appears in the above list [see `core(4)`].

If the handler for that signal is `SIG_IGN`, the signal is subsequently ignored, and pending instances of the signal are discarded.

If a caught signal occurs during certain system calls, the call is normally restarted. The call can be forced to terminate prematurely with an `EINTR` error return by setting the `SV_INTERRUPT` bit in the flags for that signal. The `SV_INTERRUPT` flag is not available in 4.2BSD, hence it should not be used if backward compatibility is needed. The affected system calls are `read(2)` or `write(2)` on a slow device (such as a terminal or pipe or other socket, but not a file) and during a `wait(2)`.

After a `fork(2)` or `vfork(2)` the child inherits all signals, the signal mask, the signal stack, and the `restart/interrupt` and `reset-signal-handler` flags.

The `execve(2)` call resets all caught signals to default action and resets all signals to be caught on the user stack. Ignored signals remain ignored; the signal mask remains the same; signals that interrupt system calls continue to do so.

The accuracy of `addr` is machine dependent. For example, certain machines may supply an address that is on the same page as the address that caused the fault. If an appropriate `addr` cannot be computed it will be set to `SIG_NOADDR`.

RETURN VALUE

A 0 value indicates that the call succeeded. A -1 return value indicates that an error occurred and `errno` is set to indicate the reason.

ERRORS

`sigvec` will fail and no new signal handler will be installed if one of the following occurs:

| | |
|--------|--|
| EFAULT | Either <code>vec</code> or <code>ovect</code> is not a <code>NULL</code> pointer and points to memory that is not a valid part of the process address space. |
|--------|--|

EINVAL *Sig* is not a valid signal number, or, SIGKILL, or SIGSTOP.

SEE ALSO

exec(2), fcntl(2), fork(2), getrlimit(2), getitimer(2), ioctl(2), kill(2), ptrace(2), read(2), sigblock(2), signal(2), sigstack(2), umask(2), wait(2), write(2), setjmp(3), signal(3), sigpause(3), sigsetmask(3), wait(3), streamio(7), termio(7).

NOTES

SIGPOLL is a synonym for SIGIO. A SIGIO will be issued when a file descriptor corresponding to a STREAMS [see intro(2)] file has a "selectable" event pending. Unless that descriptor has been put into asynchronous mode [see fcntl(2)], a process must specifically request that this signal be sent using the I_SETSIG ioctl call [see streamio(4)]. Otherwise, the process will never receive SIGPOLL.

The handler routine can be declared:

```
void handler(sig, code, scp, addr)
int sig, code;
struct sigcontext *scp;
char *addr;
```

Here *sig* is the signal number; *code* is a parameter of certain signals that provides additional detail; *scp* is a pointer to the sigcontext structure (defined in signal.h), used to restore the context from before the signal; and *addr* is additional address information.

The signals SIGKILL, SIGSTOP, and SIGCONT cannot be ignored.

NAME

sinh, sinh, cosh, coshf, tanh, tanhf, asinh, acosh, atanh - hyperbolic functions

SYNOPSIS

```
cc [flag ...] file ... -lm [library ...]
#include <math.h>
double sinh (double x);
float  sinhf (float x);
double cosh (double x);
float  coshf (float x);
double tanh (double x);
float  tanhf (float x);
double asinh (double x);
double acosh (double x);
double atanh (double x);
```

DESCRIPTION

sinh, cosh, and tanh and the single-precision versions sinh, coshf, and tanhf return, respectively, the hyperbolic sine, cosine, and tangent of their argument.

asinh, acosh, and atanh return, respectively, the inverse hyperbolic sine, cosine, and tangent of their argument.

SEE ALSO

matherr(3M)

DIAGNOSTICS

sinh, sinh, cosh, and coshf return HUGE (and sinh and sinh may return -HUGE for negative x) when the correct value would overflow and set `errno` to `ERANGE`.

acosh returns NaN and sets `errno` to `EDOM` when the argument x is less than 1. A message indicating `DOMAIN` error is printed on the standard error output.

atanh returns NaN and sets `errno` to `EDOM` if $|x| \geq 1$. If $|x| = 1$, a message indicating `SING` error is printed on the standard error output; if $|x| > 1$ the message will indicate `DOMAIN` error.

Except when the `-Xc` compilation option is used, these error-handling procedures may be changed with the function `matherr`. When the `-Xa` or `-Xc` compilation options are used, `HUGE_VAL` is returned instead of `HUGE` and no error messages are printed.

NAME

sleep - suspend execution for interval

SYNOPSIS

```
#include <unistd.h>
```

```
unsigned sleep (unsigned seconds);
```

DESCRIPTION

The current process is suspended from execution for the number of *seconds* specified by the argument. The actual suspension time may be less than that requested because any caught signal will terminate the `sleep` following execution of that signal's catching routine. Also, the suspension time may be longer than requested by an arbitrary amount because of the scheduling of other activity in the system. The value returned by `sleep` will be the "unslept" amount (the requested time minus the time actually slept) in case the caller had an alarm set to go off earlier than the end of the requested `sleep` time, or premature arousal because of another caught signal.

The routine is implemented by setting an alarm signal and pausing until it (or some other signal) occurs. The previous state of the alarm signal is saved and restored. The calling program may have set up an alarm signal before calling `sleep`. If the `sleep` time exceeds the time until such alarm signal, the process sleeps only until the alarm signal would have occurred. The caller's alarm catch routine is executed just before the `sleep` routine returns. But if the `sleep` time is less than the time till such alarm, the prior alarm time is reset to go off at the same time it would have without the intervening `sleep`.

SEE ALSO

alarm(2), pause(2), signal(2), wait(2)

sleep(3)

(BSD Compatibility Package)

sleep(3)

NAME

sleep - suspend execution for interval

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...
```

```
sleep(seconds)
```

```
unsigned seconds;
```

DESCRIPTION

sleep suspends the current process from execution for the number of seconds specified by the argument. The actual suspension time may be up to 1 second less than that requested, because scheduled wakeups occur at fixed 1-second intervals, and may be an arbitrary amount longer because of other activity in the system.

sleep is implemented by setting an interval timer and pausing until it expires. The previous state of this timer is saved and restored. If the sleep time exceeds the time to the expiration of the previous value of the timer, the process sleeps only until the timer would have expired, and the signal which occurs with the expiration of the timer is sent one second later.

SEE ALSO

getitimer(2), sigpause(3), usleep(3).

socket (3N)

socket (3N)

NAME

socket - create an endpoint for communication

SYNOPSIS

```
#include <sys/types.h>
#include <sys/socket.h>

int socket(int domain, int type, int protocol);
```

DESCRIPTION

socket creates an endpoint for communication and returns a descriptor.

The *domain* parameter specifies a communications domain within which communication will take place; this selects the protocol family which should be used. The protocol family generally is the same as the address family for the addresses supplied in later operations on the socket. These families are defined in the include file `sys/socket.h`. There must be an entry in the `netconfig(4)` file for at least each protocol family and type required. If *protocol* has been specified, but no exact match for the tuple family, type, protocol is found, then the first entry containing the specified family and type with zero for protocol will be used. The currently understood formats are:

| | |
|---------|--------------------------------|
| PF_UNIX | UNIX system internal protocols |
| PF_INET | ARPA Internet protocols |

The socket has the indicated *type*, which specifies the communication semantics. Currently defined types are:

```
SOCK_STREAM
SOCK_DGRAM
SOCK_RAW
SOCK_SEQPACKET
SOCK_RDM
```

A `SOCK_STREAM` type provides sequenced, reliable, two-way connection-based byte streams. An out-of-band data transmission mechanism may be supported. A `SOCK_DGRAM` socket supports datagrams (connectionless, unreliable messages of a fixed (typically small) maximum length). A `SOCK_SEQPACKET` socket may provide a sequenced, reliable, two-way connection-based data transmission path for datagrams of fixed maximum length; a consumer may be required to read an entire packet with each read system call. This facility is protocol specific, and presently not implemented for any protocol family. `SOCK_RAW` sockets provide access to internal network interfaces. The types `SOCK_RAW`, which is available only to the super-user, and `SOCK_RDM`, for which no implementation currently exists, are not described here.

protocol specifies a particular protocol to be used with the socket. Normally only a single protocol exists to support a particular socket type within a given protocol family. However, multiple protocols may exist, in which case a particular protocol must be specified in this manner. The protocol number to use is particular to the communication domain in which communication is to take place. If a protocol is specified by the caller, then it will be packaged into a socket level option request and sent to the underlying protocol layers.

Sockets of type `SOCK_STREAM` are full-duplex byte streams, similar to pipes. A stream socket must be in a *connected* state before any data may be sent or received on it. A connection to another socket is created with a `connect` call. Once connected, data may be transferred using `read` and `write` calls or some variant of the `send` and `recv` calls. When a session has been completed, a `close` may be performed. Out-of-band data may also be transmitted as described on the `send(3N)` manual page and received as described on the `recv(3N)` manual page.

The communications protocols used to implement a `SOCK_STREAM` insure that data is not lost or duplicated. If a piece of data for which the peer protocol has buffer space cannot be successfully transmitted within a reasonable length of time, then the connection is considered broken and calls will indicate an error with `-1` returns and with `ETIMEDOUT` as the specific code in the global variable `errno`. The protocols optionally keep sockets warm by forcing transmissions roughly every minute in the absence of other activity. An error is then indicated if no response can be elicited on an otherwise idle connection for an extended period (for instance 5 minutes). A `SIGPIPE` signal is raised if a process sends on a broken stream; this causes naive processes, which do not handle the signal, to exit.

`SOCK_SEQPACKET` sockets employ the same system calls as `SOCK_STREAM` sockets. The only difference is that `read` calls will return only the amount of data requested, and any remaining in the arriving packet will be discarded.

`SOCK_DGRAM` and `SOCK_RAW` sockets allow datagrams to be sent to correspondents named in `sendto` calls. Datagrams are generally received with `recvfrom`, which returns the next datagram with its return address.

An `fcntl` call can be used to specify a process group to receive a `SIGURG` signal when the out-of-band data arrives. It may also enable non-blocking I/O and asynchronous notification of I/O events with `SIGIO` signals.

The operation of sockets is controlled by socket level *options*. These options are defined in the file `sys/socket.h`. `setsockopt` and `getsockopt` are used to set and get options, respectively.

RETURN VALUE

A `-1` is returned if an error occurs. Otherwise the return value is a descriptor referencing the socket.

ERRORS

The socket call fails if:

| | |
|------------------------------|---|
| <code>EPROTONOSUPPORT</code> | The protocol type or the specified protocol is not supported within this domain. |
| <code>EMFILE</code> | The per-process descriptor table is full. |
| <code>EACCESS</code> | Permission to create a socket of the specified type and/or protocol is denied. |
| <code>ENOMEM</code> | Insufficient user memory is available. |
| <code>ENOSR</code> | There were insufficient <code>STREAMS</code> resources available to complete the operation. |

socket(3N)

socket(3N)

SEE ALSO

close(2), fcntl(2), ioctl(2), read(2), write(2), accept(3N), bind(3N), connect(3N), getsockname(3N), getsockopt(3N), listen(3N), recv(3N), send(3N), shutdown(3N), socketpair(3N).

socketpair(3N)

socketpair(3N)

NAME

socketpair - create a pair of connected sockets

SYNOPSIS

```
#include <sys/types.h>
#include <sys/socket.h>

int socketpair(int d, int type, int protocol, int sv[2]);
```

DESCRIPTION

The `socketpair` library call creates an unnamed pair of connected sockets in the specified address family *d*, of the specified *type*, and using the optionally specified *protocol*. The descriptors used in referencing the new sockets are returned in *sv*[0] and *sv*[1]. The two sockets are indistinguishable.

RETURN VALUE

`socketpair` returns a -1 on failure, otherwise it returns the number of the second file descriptor it creates.

ERRORS

The call succeeds unless:

| | |
|-----------------|--|
| EMFILE | Too many descriptors are in use by this process. |
| EAFNOSUPPORT | The specified address family is not supported on this machine. |
| EPROTONOSUPPORT | The specified protocol is not supported on this machine. |
| EOPNOSUPPORT | The specified protocol does not support creation of socket pairs. |
| ENOMEM | There was insufficient user memory for the operation to complete. |
| ENOSR | There were insufficient STREAMS resources for the operation to complete. |

SEE ALSO

`pipe(2)`, `read(2)`, `write(2)`.

NOTES

This call is currently implemented only for the `AF_UNIX` address family.

NAME

spray - scatter data in order to check the network

SYNOPSIS

```
#include <rpcsvc/spray.h>
```

DESCRIPTION

The spray protocol sends packets to a given machine to test the speed and reliability of communications with that machine.

The spray protocol is not a C function interface, per se, but can be accessed using the generic remote procedure calling interface `clnt_call()` [see `rpc_clnt_calls(3N)`]. The protocol sends a packet to the called host. The host acknowledges receipt of the packet. The protocol counts the number of acknowledgments and can return that count.

The spray protocol currently supports the following procedures, which should be called in the order given:

```
SPRAYPROC_CLEAR   This procedure clears the counter.
SPRAYPROC_SPRAY   This procedure sends the packet.
SPRAYPROC_GET     This procedure returns the count and the amount of time
                  since the last SPRAYPROC_CLEAR.
```

The following XDR routines are available in `librpcsvc`:

```
xdr_sprayarr
xdr_spraycumul
```

EXAMPLE

The following code fragment demonstrates how the spray protocol is used:

```
#include <rpc/rpc.h>
#include <rpcsvc/spray.h>

. . .
spraycumul spray_result;
sprayarr spray_data;
char buf[100];          /* arbitrary data */
int loop = 1000;
CLIENT *clnt;
struct timeval timeout0 = {0, 0};
struct timeval timeout25 = {25, 0};

spray_data.sprayarr_len = (u_int)100;
spray_data.sprayarr_val = buf;

clnt = clnt_create("somehost", SPRAYPROC, SPRAYVERS, "netpath");
if (clnt == (CLIENT *)NULL) {
    /* handle this error */
}
if (clnt_call(clnt, SPRAYPROC_CLEAR,
             xdr_void, NULL, xdr_void, NULL, timeout25)) {
    /* handle this error */
}
```

spray(3N)

spray(3N)

```
while (loop-- > 0) {
    if (clnt_call(clnt, SPRAYPROC_SPRAY,
                 xdr_sprayarr, &spray_data, xdr_void, NULL, timeout0)) {
        /* handle this error */
    }
}
if (clnt_call(clnt, SPRAYPROC_GET,
              xdr_void, NULL, xdr_spraycumul, &spray_result, timeout25)) {
    /* handle this error */
}
printf("Acknowledged %ld of 1000 packets in %d secs %d usecs\n",
       spray_result.counter,
       spray_result.clock.sec,
       spray_result.clock.usec);
```

SEE ALSO

rpc_clnt_calls(3N), spray(1M), sprayd(1M)

NAME

sputl, sgetl - access long integer data in a machine-independent fashion

SYNOPSIS

```
cc [flag ...]file ... -lld [library ...]
#include <ldfcn.h>
void sputl (long value, char *buffer);
long sgetl (const char *buffer);
```

DESCRIPTION

sputl takes the four bytes of the long integer *value* and places them in memory starting at the address pointed to by *buffer*. The ordering of the bytes is the same across all machines.

sgetl retrieves the four bytes in memory starting at the address pointed to by *buffer* and returns the long integer value in the byte ordering of the host machine.

The combination of sputl and sgetl provides a machine-independent way of storing long numeric data in a file in binary form without conversion to characters.

NAME

ssignal, gsignal - software signals

SYNOPSIS

```
#include <signal.h>
int (*ssignal (int sig, int (*action) (int))) (int);
int gsignal (int sig);
```

DESCRIPTION

ssignal and gsignal implement a software facility similar to signal(2). This facility is made available to users for their own purposes.

Software signals made available to users are associated with integers in the inclusive range 1 through 17. A call to ssignal associates a procedure, *action*, with the software signal *sig*; the software signal, *sig*, is raised by a call to gsignal. Raising a software signal causes the action established for that signal to be *taken*.

The first argument to ssignal is a number identifying the type of signal for which an action is to be established. The second argument defines the action; it is either the name of a (user-defined) *action function* or one of the manifest constants SIG_DFL (default) or SIG_IGN (ignore). ssignal returns the action previously established for that signal type; if no action has been established or the signal number is illegal, ssignal returns SIG_DFL.

gsignal raises the signal identified by its argument, *sig*:

If an action function has been established for *sig*, then that action is reset to SIG_DFL and the action function is entered with argument *sig*. gsignal returns the value returned to it by the action function.

If the action for *sig* is SIG_IGN, gsignal returns the value 1 and takes no other action.

If the action for *sig* is SIG_DFL, gsignal returns the value 0 and takes no other action.

If *sig* has an illegal value or no action was ever specified for *sig*, gsignal returns the value 0 and takes no other action.

SEE ALSO

signal(2), sigset(2), raise(3C)

NAME

stat, lstat, fstat - get file status

SYNOPSIS

```
#include <sys/types.h>
#include <sys/stat.h>

int stat(const char *path, struct stat *buf);
int lstat(const char *path, struct stat *buf);
int fstat(int fildes, struct stat *buf);
```

DESCRIPTION

path points to a path name naming a file. Read, write, or execute permission of the named file is not required, but all directories listed in the path name leading to the file must be searchable. *stat* obtains information about the named file. Note that in a Remote File Sharing environment, the information returned by *stat* depends on the user/group mapping set up between the local and remote computers.

lstat obtains file attributes similar to *stat*, except when the named file is a symbolic link; in that case *lstat* returns information about the link, while *stat* returns information about the file the link references.

fstat obtains information about an open file known by the file descriptor *fildes*, obtained from a successful *open*, *creat*, *dup*, *fcntl*, or *pipe* system call.

buf is a pointer to a *stat* structure into which information is placed concerning the file. The contents of the structure pointed to by *buf* include the following members:

```
dev_t      st_dev;          /* ID of device containing */
                                /* a directory entry for this file */
ino_t      st_ino;         /* Inode number */
mode_t     st_mode;        /* File mode [see mknod(2)] */
nlink_t    st_nlink;       /* Number of links */
uid_t      st_uid;         /* User ID of the file's owner */
gid_t      st_gid;         /* Group ID of the file's group */
dev_t      st_rdev;        /* ID of device */
                                /* This entry is defined only for */
                                /* char special or block special files */
off_t      st_size;        /* File size in bytes */
time_t     st_atime;        /* Time of last access in seconds */
ulong_t    st_ausec;       /* microsecond extension to st_atime (88k only) */
time_t     st_mtime;       /* Time of last modify in seconds */
ulong_t    st_musec;       /* microsecond extension to st_mtime (88k only) */
time_t     st_ctime;       /* Time of last status change in secs */
ulong_t    st_cusec;       /* microsecond extension to st_ctime (88k only) */
timestruct_t st_atim;     /* Time of last access */
timestruct_t st_mtim;     /* Time of last data modification */
timestruct_t st_ctim;     /* Time of last file status change */
                                /* Times measured in seconds since */
                                /* 00:00:00 UTC, Jan. 1, 1970 */
long       st_blksize;     /* Preferred I/O block size */
long       st_blocks;      /* Number st_blksize blocks allocated */
char       st_fstype[ST_FSTYPSZ]; /* File system type name */
```

stat(2)

stat(2)

| | |
|---|---|
| <code>st_dev</code> | This field uniquely identifies the file system that contains the file. Its value may be used as input to the <code>ustat</code> system call to determine more information about this file system. No other meaning is associated with this value. |
| <code>st_ino</code> | This field uniquely identifies the file in a given file system. The pair <code>st_ino</code> and <code>st_dev</code> uniquely identifies regular files. |
| <code>st_mode</code> | The mode of the file as described in <code>mknod(2)</code> . In addition to the modes described in <code>mknod(2)</code> , the mode of a file may also be <code>S_IFLNK</code> if the file is a symbolic link. (Note that <code>S_IFLNK</code> may only be returned by <code>lstat</code> .) |
| <code>st_nlink</code> | This field should be used only by administrative commands. |
| <code>st_uid</code> | The user ID of the file's owner. |
| <code>st_gid</code> | The group ID of the file's group. |
| <code>st_rdev</code> | This field should be used only by administrative commands. It is valid only for block special or character special files and only has meaning on the system where the file was configured. |
| <code>st_size</code> | For regular files, this is the address of the end of the file. For block special or character special, this is not defined. See also <code>pipe(2)</code> . |
| <code>st_atim</code> | Time (in seconds and microseconds) when file data was last accessed. Changed by the following system calls: <code>creat</code> , <code>mknod</code> , <code>pipe</code> , <code>utime</code> , and <code>read</code> . |
| <code>st_mtim</code> | Time (in seconds and microseconds) when data was last modified. Changed by the following system calls: <code>creat</code> , <code>mknod</code> , <code>pipe</code> , <code>utime</code> , and <code>write</code> . |
| <code>st_ctim</code> | Time (in seconds and microseconds) when file status was last changed. Changed by the following system calls: <code>chmod</code> , <code>chown</code> , <code>creat</code> , <code>link</code> , <code>mknod</code> , <code>pipe</code> , <code>unlink</code> , <code>utime</code> , and <code>write</code> . |
| <code>st_atime</code> , <code>st_mtime</code> , <code>st_ctime</code> | These are supplied for backward compatibility and are the same as <code>st_atim.tv_sec</code> , <code>st_mtim.tv_sec</code> , and <code>st_ctim.tv_sec</code> , respectively. Note that on 68k machines these are <code>#defines</code> whereas on 88k machines they are part of the <code>stat</code> structure. |
| <code>st_ausec</code> , <code>st_musec</code> , <code>st_cusec</code> | These are only in the 88k <code>stat</code> structure and correspond to <code>st_atim.tv_nsec</code> , <code>st_mtim.tv_nsec</code> , and <code>st_ctim.tv_nsec</code> , respectively. |
| <code>st_blksize</code> | A hint as to the "best" unit size for I/O operations. This field is not defined for block-special or character-special files. |
| <code>st_blocks</code> | The total number of physical blocks of size 512 bytes actually allocated on disk. This field is not defined for block-special or character-special files. |

st_fstype

File system type name of file system associated with the file.

stat and lstat fail if one or more of the following are true:

| | |
|--------------|--|
| EACCES | Search permission is denied for a component of the path prefix. |
| EFAULT | <i>buf</i> or <i>path</i> points to an invalid address. |
| EINTR | A signal was caught during the stat or lstat system call. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and the file system does not allow it. |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds {PATH_MAX}, or the length of a <i>path</i> component exceeds {NAME_MAX} while _POSIX_NO_TRUNC is in effect. |
| ENOENT | The named file does not exist or is the null pathname. |
| ENOTDIR | A component of the path prefix is not a directory. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| EOVERFLOW | A component is too large to store in the structure pointed to by <i>buf</i> . |

fstat fails if one or more of the following are true:

| | |
|-----------|--|
| EBADF | <i>fildev</i> is not a valid open file descriptor. |
| EFAULT | <i>buf</i> points to an invalid address. |
| EINTR | A signal was caught during the fstat system call. |
| ENOLINK | <i>fildev</i> points to a remote machine and the link to that machine is no longer active. |
| EOVERFLOW | A component is too large to store in the structure pointed to by <i>buf</i> . |

SEE ALSO

chmod(2), chown(2), creat(2), link(2), mknod(2), pipe(2), read(2), time(2), unlink(2), utime(2), write(2), fattach(3C), stat(5).

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and *errno* is set to indicate the error.

NAME

stat - data returned by stat system call

SYNOPSIS

```
#include <sys/types.h>
#include <sys/stat.h>
```

DESCRIPTION

The system calls stat, lstat and fstat return data in a stat structure, which is defined in stat.h.

The constants used in the st_mode field are also defined in this file:

```
#define S_IFMT /* type of file */
#define S_IAMB /* access mode bits */
#define S_IFIFO /* fifo */
#define S_IFCHR /* character special */
#define S_IFDIR /* directory */
#define S_IFNAM /* XENIX special named file */
#define S_INSEM /* XENIX semaphore subtype of IFNAM */
#define S_INSHD /* XENIX shared data subtype of IFNAM */
#define S_IFBLK /* block special */
#define S_IFREG /* regular */
#define S_IFLNK /* symbolic link */
#define S_ISUID /* set user id on execution */
#define S_ISGID /* set group id on execution */
#define S_ISVTX /* save swapped text even after use */
#define S_IREAD /* read permission, owner */
#define S_IWRITE /* write permission, owner */
#define S_IEXEC /* execute/search permission, owner */
#define S_ENFMT /* record locking enforcement flag */
#define S_IRWXU /* read, write, execute: owner */
#define S_IRUSR /* read permission: owner */
#define S_IWUSR /* write permission: owner */
#define S_IXUSR /* execute permission: owner */
#define S_IRWXG /* read, write, execute: group */
#define S_IRGRP /* read permission: group */
#define S_IWGRP /* write permission: group */
#define S_IXGRP /* execute permission: group */
#define S_IRWXO /* read, write, execute: other */
#define S_IROTH /* read permission: other */
#define S_IWOTH /* write permission: other */
#define S_IXOTH /* execute permission: other */
```

stat(5)

stat(5)

The following macros are for POSIX conformance:

| | | |
|---------|----------------|------------------------|
| #define | S_ISBLK(mode) | block special file |
| #define | S_ISCHR(mode) | character special file |
| #define | S_ISDIR(mode) | directory file |
| #define | S_ISFIFO(mode) | pipe or fifo file |
| #define | S_ISREG(mode) | regular file |

SEE ALSO

stat(2), types(5)

NAME

stat, lstat, fstat - get file status

SYNOPSIS

```
cc [flag...] file... -lx
#include <sys/types.h>
#include <sys/stat.h>

int stat (const char *path, struct stat *buf);
int lstat (const char *path, struct stat *buf);
int fstat (int fildes, struct stat *buf);
```

DESCRIPTION

path points to a path name naming a file. Read, write, or execute permission of the named file is not required, but all directories listed in the path name leading to the file must be searchable. *stat* obtains information about the named file.

Note that in a Remote File Sharing environment, the information returned by *stat* depends on the user/group mapping set up between the local and remote computers. [See *idload(1M)*.]

lstat obtains file attributes similar to *stat*, except when the named file is a symbolic link; in that case *lstat* returns information about the link, while *stat* returns information about the file the link references.

fstat obtains information about an open file known by the file descriptor *fildes*, obtained from a successful *open*, *creat*, *dup*, *fcntl*, or *pipe* system call.

buf is a pointer to a *stat* structure into which information is placed concerning the file.

The contents of the structure pointed to by *buf* include the following members:

```
mode_t  st_mode;    /* File mode [see mknod(2)] */
ino_t   st_ino;    /* Inode number */
dev_t   st_dev;    /* ID of device containing */
          /* a directory entry for this file */
dev_t   st_rdev;   /* ID of device */
          /* This entry is defined only for */
          /* character special files */,
          /* XENIX special named files or block
          /* special files */
nlink_t st_nlink;  /* Number of links */
uid_t   st_uid;    /* User ID of the file's owner */
gid_t   st_gid;    /* Group ID of the file's group */
off_t   st_size;   /* File size in bytes */
time_t  st_atime;  /* Time of last access */
time_t  st_mtime;  /* Time of last data modification */
time_t  st_ctime;  /* Time of last file status change */
          /* Times measured in seconds since */
          /* 00:00:00 GMT, Jan. 1, 1970 */
```

- st_mode** The mode of the file as described in `mknod(2)`.
- st_ino** This field uniquely identifies the file in a given file system. The pair `st_ino` and `st_dev` uniquely identifies regular files.
- st_dev** This field uniquely identifies the file system that contains the file. Its value may be used as input to the `ustat` system call to determine more information about this file system. No other meaning is associated with this value.
- st_rdev** This field should be used only by administrative commands. It is valid only for block special files or character special files or XENIX special named files. The `st_rdev` field for block special and character special files only has meaning on the system where the file was configured.
If the file is a XENIX special named file, it contains the type code [see `stat(4)` for the XENIX semaphore and shared data type code values `S_INSEM` and `S_INSHD`].
- st_nlink** This field should be used only by administrative commands.
- st_uid** The user ID of the file's owner.
- st_gid** The group ID of the file's group.
- st_size** For regular files, this is the address of the end of the file. For pipes or FIFOs, this is the count of the data currently in the file. For block special character special, or XENIX special named files. this is not defined.
- st_atime** Time when file data was last accessed. Changed by the following system calls: `creat`, `mknod`, `pipe`, `utime`, `read`, `creatsem`, `opensem`, `sigsem`, `waitsem`, `sdget` and `sdfree`.
- st_mtime** Time when data was last modified. Changed by the following system calls: `creat`, `mknod`, `pipe`, `utime`, `write`.
- st_ctime** Time when file status was last changed. Changed by the following system calls: `chmod`, `chown`, `creat`, `link`, `mknod`, `pipe`, `unlink`, `utime`, `write`, `creatsem`, `sdget` and `sdfree`.

`stat` and `lstat` fail if one or more of the following are true:

- EACCES** Search permission is denied for a component of the path prefix.
- EBADF** *fd* is not a valid open file descriptor.
- EFAULT** *buf* or *path* points to an invalid address.
- EINTR** A signal was caught during the `stat` system call.
- ELOOP** Too many symbolic links were encountered in translating *path*.
- EMULTIHOP** Components of *path* require hopping to multiple remote machines.
- ENAMETOOLONG** The length of the *path* argument exceeds `{PATH_MAX}`, or the length of a *path* component exceeds `{NAME_MAX}` while `{_POSIX_NO_TRUNC}` is in effect.

| | |
|---|--|
| ENOENT | The named file does not exist or is the null pathname. |
| ENOTDIR | A component of the path prefix is not a directory. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| E_OVERFLOW | A component is too large to store in the structure pointed to by <i>buf</i> . |
| fstat fails if one or more of the following are true: | |
| ENOLINK | <i>fildev</i> points to a remote machine and the link to that machine is no longer active. |
| E_OVERFLOW | A component is too large to store in the structure pointed to by <i>buf</i> . |

SEE ALSO

chmod(2), chown(2), creat(2), link(2), mknod(2), pipe(2), read(2), time(2), unlink(2), utime(2), write(2), stat(5)

DIAGNOSTICS

Upon successful completion a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

statvfs(2)

statvfs(2)

NAME

statvfs, fstatvfs - get file system information

SYNOPSIS

```
#include <sys/types.h>
#include <sys/statvfs.h>

int statvfs (const char *path, struct statvfs *buf);
int fstatvfs (int fildes, struct statvfs *buf);
```

DESCRIPTION

`statvfs` returns a “generic superblock” describing a file system; it can be used to acquire information about mounted file systems. `buf` is a pointer to a structure (described below) that is filled by the system call.

`path` should name a file that resides on that file system. The file system type is known to the operating system. Read, write, or execute permission for the named file is not required, but all directories listed in the `path` name leading to the file must be searchable.

The `statvfs` structure pointed to by `buf` includes the following members:

```
    ulong  f_bsize;           /* preferred file system block size */
    ulong  f_frsize;         /* fundamental filesystem block size
                             (if supported) */
    ulong  f_blocks;         /* total # of blocks on file system
                             in units of f_frsize */
    ulong  f_bfree;          /* total # of free blocks */
    ulong  f_bavail;         /* # of free blocks avail to
                             non-superuser */
    ulong  f_files;          /* total # of file nodes (inodes) */
    ulong  f_ffree;          /* total # of free file nodes */
    ulong  f_favail;         /* # of inodes avail to
                             non-superuser */
    fsid_t f_fsid;           /* file system id (dev for now) */
    char   f_basetype[FSTYPSZ]; /* target fs type name,
                             null-terminated */
    ulong  f_flag;           /* bit mask of flags */
    ulong  f_namemax;        /* maximum file name length */
    char   f_fstr[32];       /* file system specific string */
    ulong  f_filler[16];     /* reserved for future expansion */
```

`f_basetype` contains a null-terminated FS type name of the mounted target (for example, `s5` mounted over `rfs` will contain `s5`).

The following flags can be returned in the `f_flag` field:

```
ST_RDONLY    0x01    /* read-only file system */
ST_NOSUID    0x02    /* does not support setuid/setgid
                     semantics */
ST_NOTRUNC   0x04    /* does not truncate file names
                     longer than {NAME_MAX}*/
```

statvfs(2)

statvfs(2)

fstatvfs is similar to statvfs, except that the file named by *path* in statvfs is instead identified by an open file descriptor *fildev* obtained from a successful open, creat, dup, fcntl, or pipe system call.

statvfs fails if one or more of the following are true:

| | |
|--------------|--|
| EACCES | Search permission is denied on a component of the path prefix. |
| EFAULT | <i>path</i> or <i>buf</i> points outside the process's allocated address space. |
| EINTR | A signal was caught during statvfs execution. |
| EIO | An I/O error occurred while reading the file system. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and file system type does not allow it. |
| ENAMETOOLONG | The length of a <i>path</i> component exceeds {NAME_MAX} characters, or the length of <i>path</i> exceeds {PATH_MAX} characters. |
| ENOENT | Either a component of the path prefix or the file referred to by <i>path</i> does not exist. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| ENOTDIR | A component of the path prefix of <i>path</i> is not a directory. |

fstatvfs fails if one or more of the following are true:

| | |
|--------|--|
| EFAULT | <i>buf</i> points to an invalid address. |
| EBADF | <i>fildev</i> is not an open file descriptor. |
| EINTR | A signal was caught during fstatvfs execution. |
| EIO | An I/O error occurred while reading the file system. |

DIAGNOSTICS

Upon successful completion a value of 0 is returned. Otherwise, a value of -1 is returned and errno is set to indicate the error.

SEE ALSO

chmod(2), chown(2), creat(2), link(2), mknod(2), pipe(2), read(2), time(2), unlink(2), utime(2), write(2).

NAME

stdarg - handle variable argument list

SYNOPSIS

```
#include <stdarg.h>

va_list pvar;

void va_start(va_list pvar, parmN);

type va_arg(va_list pvar, type);

void va_end(va_list pvar);
```

DESCRIPTION

This set of macros allows portable procedures that accept variable numbers of arguments of variable types to be written. Routines that have variable argument lists [such as `printf`] but do not use *stdarg* are inherently non-portable, as different machines use different argument-passing conventions.

`va_list` is a type defined for the variable used to traverse the list.

The `va_start()` macro is invoked before any access to the unnamed arguments and initializes `pvar` for subsequent use by `va_arg()` and `va_end()`. The parameter *parmN* is the identifier of the rightmost parameter in the variable parameter list in the function definition (the one just before the `, ...`). If this parameter is declared with the `register` storage class or with a function or array type, or with a type that is not compatible with the type that results after application of the default argument promotions, the behavior is undefined.

The parameter *parmN* is required under strict ANSI C compilation. In other compilation modes, *parmN* need not be supplied and the second parameter to the `va_start()` macro can be left empty [for example, `va_start(pvar,);`]. This allows for routines that contain no parameters before the `...` in the variable parameter list.

The `va_arg()` macro expands to an expression that has the type and value of the next argument in the call. The parameter `pvar` should have been previously initialized by `va_start()`. Each invocation of `va_arg()` modifies `pvar` so that the values of successive arguments are returned in turn. The parameter *type* is the type name of the next argument to be returned. The type name must be specified in such a way so that the type of a pointer to an object that has the specified type can be obtained simply by postfixing a `*` to *type*. If there is no actual next argument, or if *type* is not compatible with the type of the actual next argument (as promoted according to the default argument promotions), the behavior is undefined.

The `va_end()` macro is used to clean up.

Multiple traversals, each bracketed by `va_start` and `va_end`, are possible.

EXAMPLE

This example gathers into an array a list of arguments that are pointers to strings (but not more than `MAXARGS` arguments) with function `f1`, then passes the array as a single argument to function `f2`. The number of pointers is specified by the first argument to `f1`.

stdarg (5)**stdarg (5)**

```

#include <stdarg.h>
#define MAXARGS 31

void f1(int n_ptrs, ...)
{
    va_list ap;
    char *array[MAXARGS];
    int ptr_no = 0;

    if (n_ptrs > MAXARGS)
        n_ptrs = MAXARGS;
    va_start(ap, n_ptrs);
    while (ptr_no < n_ptrs)
        array[ptr_no++] = va_arg(ap, char*);
    va_end(ap);
    f2(n_ptrs, array);
}

```

Each call to `f1` shall have visible the definition of the function or a declaration such as

```
void f1(int, ...)
```

SEE ALSO

`vprintf(3S)`

NOTES

It is up to the calling routine to specify in some manner how many arguments there are, since it is not always possible to determine the number of arguments from the stack frame. For example, `execl` is passed a zero pointer to signal the end of the list. `printf` can tell how many arguments there are by the format. It is non-portable to specify a second argument of `char`, `short`, or `float` to `va_arg`, because arguments seen by the called function are not `char`, `short`, or `float`. C converts `char` and `short` arguments to `int` and converts `float` arguments to `double` before passing them to a function.

NAME

stdio - standard buffered input/output package

SYNOPSIS

```
#include <stdio.h>

FILE *stdin, *stdout, *stderr;
```

DESCRIPTION

The functions described in the entries of sub-class 3S of this manual constitute an efficient, user-level I/O buffering scheme. The in-line macros `getc` and `putc` handle characters quickly. The macros `getchar` and `putchar`, and the higher-level routines `fgetc`, `fgets`, `fprintf`, `fputc`, `fputs`, `fread`, `fscanf`, `fwrite`, `gets`, `getw`, `printf`, `puts`, `putw`, and `scanf` all use or act as if they use `getc` and `putc`; they can be freely intermixed.

A file with associated buffering is called a *stream* [see `intro(3)`] and is declared to be a pointer to a defined type `FILE`. `fopen` creates certain descriptive data for a stream and returns a pointer to designate the stream in all further transactions. Normally, there are three open streams with constant pointers declared in the `<stdio.h>` header file and associated with the standard open files:

```
stdin      standard input file
stdout     standard output file
stderr     standard error file
```

The following symbolic values in `<unistd.h>` define the file descriptors that will be associated with the C-language *stdin*, *stdout* and *stderr* when the application is started:

```
STDIN_FILENO   Standard input value, stdin. It has the value of 0.
STDOUT_FILENO  Standard output value, stdout. It has the value of 1.
STDERR_FILENO  Standard error value, stderr. It has the value of 2.
```

A constant `null` designates a null pointer.

An integer-constant `EOF` (-1) is returned upon end-of-file or error by most integer functions that deal with streams (see the individual descriptions for details).

An integer constant `BUFSIZ` specifies the size of the buffers used by the particular implementation.

An integer constant `FILENAME_MAX` specifies the size needed for an array of `char` large enough to hold the longest file name string that the implementation guarantees can be opened.

An integer constant `FOPEN_MAX` specifies the minimum number of files that the implementation guarantees can be open simultaneously. Note that no more than 255 files may be opened via `fopen`, and only file descriptors 0 through 255 are valid.

Any program that uses this package must include the header file of pertinent macro definitions, as follows:

```
#include <stdio.h>
```

The functions and constants mentioned in the entries of sub-class 3S of this manual are declared in that header file and need no further declaration. The constants and the following "functions" are implemented as macros (redeclaration of these names is perilous): `getc`, `getchar`, `putc`, `putchar`, `ferror`, `feof`, `clearerr`, and `fileno`.

There are also function versions of `getc`, `getchar`, `putc`, `putchar`, `ferror`, `feof`, `clearerr`, and `fileno`.

Output streams, with the exception of the standard error stream `stderr`, are by default buffered if the output refers to a file and line-buffered if the output refers to a terminal. The standard error output stream `stderr` is by default unbuffered, but use of `freopen` [see `fopen(3S)`] will cause it to become buffered or line-buffered. When an output stream is unbuffered, information is queued for writing on the destination file or terminal as soon as written; when it is buffered, many characters are saved up and written as a block. When it is line-buffered, each line of output is queued for writing on the destination terminal as soon as the line is completed (that is, as soon as a new-line character is written or terminal input is requested). `setbuf` or `setvbuf` [both described in `setbuf(3S)`] may be used to change the stream's buffering strategy.

SEE ALSO

`open(2)`, `close(2)`, `lseek(2)`, `pipe(2)`, `read(2)`, `write(2)`, `ctermid(3S)`, `cuserid(3S)`, `fclose(3S)`, `ferror(3S)`, `fopen(3S)`, `fread(3S)`, `fseek(3S)`, `getc(3S)`, `gets(3S)`, `popen(3S)`, `printf(3S)`, `putc(3S)`, `puts(3S)`, `scanf(3S)`, `setbuf(3S)`, `system(3S)`, `tmpfile(3S)`, `tmpnam(3S)`, `ungetc(3S)`

DIAGNOSTICS

Invalid *stream* pointers usually cause grave disorder, possibly including program termination. Individual function descriptions describe the possible error conditions.

NAME

stdipc: ftok - standard interprocess communication package

SYNOPSIS

```
#include <sys/types.h>
#include <sys/ipc.h>

key_t ftok(const char *path, int id);
```

DESCRIPTION

All interprocess communication facilities require the user to supply a key to be used by the `msgget(2)`, `semget(2)`, and `shmget(2)` system calls to obtain interprocess communication identifiers. One suggested method for forming a key is to use the `ftok` subroutine described below. Another way to compose keys is to include the project ID in the most significant byte and to use the remaining portion as a sequence number. There are many other ways to form keys, but it is necessary for each system to define standards for forming them. If some standard is not adhered to, it will be possible for unrelated processes to unintentionally interfere with each other's operation. It is still possible to interface intentionally. Therefore, it is strongly suggested that the most significant byte of a key in some sense refer to a project so that keys do not conflict across a given system.

`ftok` returns a key based on *path* and *id* that is usable in subsequent `msgget`, `semget`, and `shmget` system calls. *path* must be the path name of an existing file that is accessible to the process. *id* is a character that uniquely identifies a project. Note that `ftok` will return the same key for linked files when called with the same *id* and that it will return different keys when called with the same file name but different *ids*.

SEE ALSO

`intro(2)`, `msgget(2)`, `semget(2)`, `shmget(2)`

DIAGNOSTICS

`ftok` returns (key_t) -1 if *path* does not exist or if it is not accessible to the process.

NOTES

If the file whose *path* is passed to `ftok` is removed when keys still refer to the file, future calls to `ftok` with the same *path* and *id* will return an error. If the same file is recreated, then `ftok` is likely to return a different key than it did the original time it was called.

stime (2)

stime (2)

NAME

stime - set time

SYNOPSIS

```
#include <unistd.h>
int stime(const time_t *tp);
```

DESCRIPTION

stime sets the system's idea of the time and date. *tp* points to the value of time as measured in seconds from 00:00:00 UTC January 1, 1970.

stime will fail if:

EPERM the effective user ID of the calling process is not super-user.

SEE ALSO

time(2)

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

stkprotect(2)

stkprotect(2)

NAME

stkprotect - set permissions of stack

SYNOPSIS

```
#include <sys/types.h>
#include <sys/mman.h>

int stkprotect(unsigned perm);
```

DESCRIPTION

This function sets the permissions of the stack. *Perm* must be either `PROT_READ|PROT_WRITE` or `PROT_READ|PROT_WRITE|PROT_EXEC`.

Upon successful completion of an `exec(2)` function, a process's stack shall have `PROT_READ|PROT_WRITE` permissions. A new process created via `fork(2)` shall inherit the stack permissions of its parent process.

Under the following conditions, `stkprotect` fails and sets `errno` to:

`EINVAL` *perm* is invalid.

DIAGNOSTICS

Upon successful completion a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

SEE ALSO

`csync(2)`, `exec(2)`, `fork(2)`, `mmap(2)`

NAME

str: strfind, strrspn, strtrns - string manipulations

SYNOPSIS

```
cc [flag...]file... -lgen [library...]
#include <libgen.h>
int strfind (const char *as1, const char *as2);
char *strrspn (const char *string, const char *tc);
char * strtrns (const char *str, const char *old, const char *new,
               char *result);
```

DESCRIPTION

strfind returns the offset of the second string, *as2*, if it is a substring of string *as1*.

strrspn returns a pointer to the first character in the string to be trimmed (all characters from the first character to the end of *string* are in *tc*).

strtrns transforms *str* and copies it into *result*. Any character that appears in *old* is replaced with the character in the same position in *new*. The *new* result is returned.

EXAMPLES

```
/* find pointer to substring "hello" in as1 */
i = strfind(as1, "hello");

/* trim junk from end of string */
s2 = strrspn(s1, ".*#$%");
*s2 = '\0';

/* transform lower case to upper case */
a1[] = "abcdefghijklmnopqrstuvwxyz";
a2[] = "ABCDEFGHIJKLMNOPQRSTUVWXYZ";
s2 = strtrns(s1, a1, a2, s2);
```

SEE ALSO

string(3C)

DIAGNOSTICS

If the second string is not a substring of the first string strfind returns -1.

strccpy(3G)

strccpy(3G)

NAME

strccpy: streadd, strcadd, strecpy - copy strings, compressing or expanding escape codes

SYNOPSIS

```
cc [flag ...] file ... -lgen [library ...]  
#include <libgen.h>  
char *strccpy (char *output, const char *input);  
char *strcadd (char *output, const char *input);  
char *strecpy (char *output, const char *input, const char  
*exceptions);  
char *streadd (char *output, const char *input, const char  
*exceptions);
```

DESCRIPTION

strccpy copies the *input* string, up to a null byte, to the *output* string, compressing the C-language escape sequences (for example, \n, \001) to the equivalent character. A null byte is appended to the output. The *output* argument must point to a space big enough to accommodate the result. If it is as big as the space pointed to by *input* it is guaranteed to be big enough. strccpy returns the *output* argument.

strcadd is identical to strccpy, except that it returns the pointer to the null byte that terminates the output.

strecpy copies the *input* string, up to a null byte, to the *output* string, expanding non-graphic characters to their equivalent C-language escape sequences (for example, \n, \001). The *output* argument must point to a space big enough to accommodate the result; four times the space pointed to by *input* is guaranteed to be big enough (each character could become \ and 3 digits). Characters in the *exceptions* string are not expanded. The *exceptions* argument may be zero, meaning all non-graphic characters are expanded. strecpy returns the *output* argument.

streadd is identical to strecpy, except that it returns the pointer to the null byte that terminates the output.

EXAMPLES

```
/* expand all but newline and tab */  
strecpy( output, input, "\n\t" );  
  
/* concatenate and compress several strings */  
cp = strcadd( output, input1 );  
cp = strcadd( cp, input2 );  
cp = strcadd( cp, input3 );
```

SEE ALSO

string(3C), str(3G)

NAME

strcoll - string collation

SYNOPSIS

```
#include <string.h>
int strcoll (const char *s1, const char *s2);
```

DESCRIPTION

strcoll returns an integer greater than, equal to, or less than zero in direct correlation to whether string *s1* is greater than, equal to, or less than the string *s2*. The comparison is based on strings interpreted as appropriate to the program's locale for category LC_COLLATE [see setlocale(3C)].

Both strcoll and strxfrm provide for locale-specific string sorting. strcoll is intended for applications in which the number of comparisons per string is small. When strings are to be compared a number of times, strxfrm is a more appropriate utility because the transformation process occurs only once.

FILES

/usr/lib/locale/*locale*/LC_COLLATE LC_COLLATE database for *locale*.

SEE ALSO

colltbl(1M), setlocale(3C), string(3C), strxfrm(3C), environ(5).

NAME

strerror - get error message string

SYNOPSIS

```
#include <string.h>
char *strerror (int errnum);
```

DESCRIPTION

strerror maps the error number in *errnum* to an error message string, and returns a pointer to that string. *strerror* uses the same set of error messages as *perror*. The returned string should not be overwritten.

SEE ALSO

perror(3C)

NAME

strptime, cftime, ascftime - convert date and time to string

SYNOPSIS

```
#include <time.h>

size_t *strptime (char *s, size_t maxsize, const char *format,
                  const struct tm *timeptr);

int cftime (char *s, char *format, const time_t *clock);

int ascftime (char *s, const char *format, const struct tm
              *timeptr);
```

DESCRIPTION

strptime, ascftime, and cftime place characters into the array pointed to by *s* as controlled by the string pointed to by *format*. The *format* string consists of zero or more directives and ordinary characters. All ordinary characters (including the terminating null character) are copied unchanged into the array. For strptime, no more than *maxsize* characters are placed into the array.

If *format* is (char *)0, then the locale's default format is used. For strptime the default format is the same as "%c", for cftime and ascftime the default format is the same as "%C". cftime and ascftime first try to use the value of the environment variable CFTIME, and if that is undefined or empty, the default format is used.

Each directive is replaced by appropriate characters as described in the following list. The appropriate characters are determined by the LC_TIME category of the program's locale and by the values contained in the structure pointed to by *timeptr* for strptime and ascftime, and by the time represented by *clock* for cftime.

| | |
|----|--|
| % | same as % |
| %a | locale's abbreviated weekday name |
| %A | locale's full weekday name |
| %b | locale's abbreviated month name |
| %B | locale's full month name |
| %c | locale's appropriate date and time representation |
| %C | locale's date and time representation as produced by date(1) |
| %d | day of month (01 - 31) |
| %D | date as %m/%d/%y |
| %e | day of month (1-31; single digits are preceded by a blank) |
| %h | locale's abbreviated month name. |
| %H | hour (00 - 23) |
| %I | hour (01 - 12) |
| %j | day number of year (001 - 366) |
| %m | month number (01 - 12) |
| %M | minute (00 - 59) |
| %n | same as \n |
| %p | locale's equivalent of either AM or PM |
| %r | time as %I:%M:%S [AM\|PM] |
| %R | time as %H:%M |
| %S | seconds (00 - 61), allows for leap seconds |

| | |
|----|--|
| %t | insert a tab |
| %T | time as %H:%M:%S |
| %U | week number of year (00 - 53), Sunday is the first day of week 1 |
| %w | weekday number (0 - 6), Sunday = 0 |
| %W | week number of year (00 - 53), Monday is the first day of week 1 |
| %x | locale's appropriate date representation |
| %X | locale's appropriate time representation |
| %y | year within century (00 - 99) |
| %Y | year as ccpy (for example, 1986) |
| %Z | time zone name or no characters if no time zone exists |

The difference between %U and %W lies in which day is counted as the first of the week. Week number 01 is the first week in January starting with a Sunday for %U or a Monday for %W. Week number 00 contains those days before the first Sunday or Monday in January for %U and %W, respectively.

If the total number of resulting characters including the terminating null character is not more than *maxsize*, `strptime`, `cftime` and `ascftime` return the number of characters placed into the array pointed to by *s* not including the terminating null character. Otherwise, zero is returned and the contents of the array are indeterminate. `cftime` and `ascftime` return the number of characters placed into the array pointed to by *s* not including the terminating null character.

Selecting the Output's Language

By default, the output of `strptime`, `cftime`, and `ascftime` appear in US English. The user can request that the output of `strptime`, `cftime` or `ascftime` be in a specific language by setting the *locale* for category `LC_TIME` in `setlocale`.

Timezone

The timezone is taken from the environment variable `TZ` [see `ctime(3C)` for a description of `TZ`].

EXAMPLES

The example illustrates the use of `strptime`. It shows what the string in `str` would look like if the structure pointed to by `tmpr` contains the values corresponding to Thursday, August 28, 1986 at 12:44:36 in New Jersey.

```
strptime (str, strsize, "%A %b %d %j", tmpr)
```

This results in `str` containing "Thursday Aug 28 240".

FILES

`/usr/lib/locale/locale/LC_TIME` - file containing locale specific date and time information

SEE ALSO

`ctime(3C)`, `getenv(3C)`, `setlocale(3C)`, `strptime(4)`, `timezone(4)`, `environ(5)`

NOTE

`cftime` and `ascftime` are obsolete. `strptime` should be used instead.

NAME

string: strcat, strdup, strncat, strcmp, strncmp, strcpy, strncpy, strlen, strchr, strrchr, strpbrk, strspn, strcspn, strtok, strstr - string operations

SYNOPSIS

```
#include <string.h>

char *strcat (char *s1, const char *s2);
char *strdup (const char *s1);
char *strncat (char *s1, const char *s2, size_t n);
int strcmp (const char *s1, const char *s2);
int strncmp (const char *s1, const char *s2, size_t n);
char *strcpy (char *s1, const char *s2);
char *strncpy (char *s1, const char *s2, size_t n);
size_t strlen (const char *s);
char *strchr (const char *s, int c);
char *strrchr (const char *s, int c);
char *strpbrk (const char *s1, const char *s2);
size_t strspn (const char *s1, const char *s2);
size_t strcspn (const char *s1, const char *s2);
char *strtok (char *s1, const char *s2);
char *strstr (const char *s1, const char *s2);
```

DESCRIPTION

The arguments *s*, *s1*, and *s2* point to strings (arrays of characters terminated by a null character). The functions `strcat`, `strncat`, `strcpy`, `strncpy`, and `strtok` all alter *s1*. These functions do not check for overflow of the array pointed to by *s1*.

`strcat` appends a copy of string *s2*, including the terminating null character, to the end of string *s1*. `strncat` appends at most *n* characters. Each returns a pointer to the null-terminated result. The initial character of *s2* overrides the null character at the end of *s1*.

`strcmp` compares its arguments and returns an integer less than, equal to, or greater than 0, based upon whether *s1* is lexicographically less than, equal to, or greater than *s2*. `strncmp` makes the same comparison but looks at at most *n* characters. Characters following a null character are not compared.

`strcpy` copies string *s2* to *s1* including the terminating null character, stopping after the null character has been copied. `strncpy` copies exactly *n* characters, truncating *s2* or adding null characters to *s1* if necessary. The result will not be null-terminated if the length of *s2* is *n* or more. Each function returns *s1*.

`strdup` returns a pointer to a new string which is a duplicate of the string pointed to by *s1*. The space for the new string is obtained using `malloc(3C)`. If the new string can not be created, a NULL pointer is returned.

`strlen` returns the number of characters in *s*, not including the terminating null character.

`strchr` (or `strrchr`) returns a pointer to the first (last) occurrence of *c* (converted to a `char`) in string *s*, or a NULL pointer if *c* does not occur in the string. The null character terminating a string is considered to be part of the string.

`strpbrk` returns a pointer to the first occurrence in string *s1* of any character from string *s2*, or a NULL pointer if no character from *s2* exists in *s1*.

`strspn` (or `strcspn`) returns the length of the initial segment of string *s1* which consists entirely of characters from (not from) string *s2*.

`strtok` considers the string *s1* to consist of a sequence of zero or more text tokens separated by spans of one or more characters from the separator string *s2*. The first call (with pointer *s1* specified) returns a pointer to the first character of the first token, and will have written a null character into *s1* immediately following the returned token. The function keeps track of its position in the string between separate calls, so that subsequent calls (which must be made with the first argument a NULL pointer) will work through the string *s1* immediately following that token. In this way subsequent calls will work through the string *s1* until no tokens remain. The separator string *s2* may be different from call to call. When no token remains in *s1*, a NULL pointer is returned.

`strstr` locates the first occurrence in string *s1* of the sequence of characters (excluding the terminating null character) in string *s2*. `strstr` returns 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 (that is, the string ""), the function returns *s1*.

SEE ALSO

`malloc(3C)`, `setlocale(3C)`, `strxfrm(3C)`

NOTES

All of these functions assume the default locale "C." For some locales, `strxfrm` should be applied to the strings before they are passed to the functions.

NAME

string: strcasecmp, strncasecmp - string operations

SYNOPSIS

```
/usr/ucb/cc [flag...] file...  
int strcasecmp(s1, s2)  
char *s1, *s2;  
int strncasecmp(s1, s2, n)  
char *s1, *s2;  
int n;
```

DESCRIPTION

The `strcasecmp` and `strncasecmp` routines compare the strings and ignore differences in case. These routines assume the ASCII character set when equating lower and upper case characters.

These functions operate on null-terminated strings. They do not check for overflow of any receiving string.

SEE ALSO

`bstring(3)`, `malloc(3C)`, `string(3C)`.

NOTES

`strcasecmp` and `strncasecmp` use native character comparison as above and assume the ASCII character set.

NAME

strtod, atof, - convert string to double-precision number

SYNOPSIS

```
#include <stdlib.h>

double strtod (const char *nptr, char **endptr);
double atof (const char *nptr);
```

DESCRIPTION

strtod returns as a double-precision floating-point number the value represented by the character string pointed to by *nptr*. The string is scanned up to the first unrecognized character.

strtod recognizes an optional string of “white-space” characters [as defined by isspace in ctype(3C)], then an optional sign, then a string of digits optionally containing a decimal point character, then an optional exponent part including an e or E followed by an optional sign, followed by an integer.

If the value of *endptr* is not (char **)NULL, a pointer to the character terminating the scan is returned in the location pointed to by *endptr*. If no number can be formed, **endptr* is set to *nptr*, and zero is returned.

atof(*nptr*) is equivalent to:
strtod(*nptr*, (char **)NULL).

SEE ALSO

ctype(3C), scanf(3S), strtol(3C)

DIAGNOSTICS

If the correct value would cause overflow, ±HUGE is returned (according to the sign of the value), and *errno* is set to ERANGE.

If the correct value would cause underflow, zero is returned and *errno* is set to ERANGE.

When the -Xc or -Xa compilation options are used, HUGE_VAL is returned instead of HUGE.

NAME

strtol, strtoul, atol, atoi - convert string to integer

SYNOPSIS

```
#include <stdlib.h>
long strtol (const char *str, char **ptr, int base);
unsigned long strtoul (const char *str, char **ptr, int base);
long atol (const char *str);
int atoi (const char *str);
```

DESCRIPTION

strtol returns as a long integer the value represented by the character string pointed to by *str*. The string is scanned up to the first character inconsistent with the base. Leading "white-space" characters [as defined by `isspace` in `ctype(3C)`] are ignored.

If the value of *ptr* is not `(char **)NULL`, a pointer to the character terminating the scan is returned in the location pointed to by *ptr*. If no integer can be formed, that location is set to *str*, and zero is returned.

If *base* is positive (and not greater than 36), it is used as the base for conversion. After an optional leading sign, leading zeros are ignored, and "0x" or "0X" is ignored if *base* is 16.

If *base* is zero, the string itself determines the base as follows: After an optional leading sign a leading zero indicates octal conversion, and a leading "0x" or "0X" hexadecimal conversion. Otherwise, decimal conversion is used.

Truncation from long to int can, of course, take place upon assignment or by an explicit cast.

If the value represented by *str* would cause overflow, `LONG_MAX` or `LONG_MIN` is returned (according to the sign of the value), and `errno` is set to the value, `ERANGE`.

strtoul is similar to strtol except that strtoul returns as an unsigned long integer the value represented by *str*. If the value represented by *str* would cause overflow, `ULONG_MAX` is returned, and `errno` is set to the value, `ERANGE`.

Except for behavior on error, `atol(str)` is equivalent to: `strtol(str, (char **)NULL, 10)`.

Except for behavior on error, `atoi(str)` is equivalent to: `(int) strtol(str, (char **)NULL, 10)`.

DIAGNOSTICS

If strtol is given a *base* greater than 36, it returns 0 and sets `errno` to `EINVAL`.

SEE ALSO

`ctype(3C)`, `scanf(3S)`, `strtod(3C)`

NOTES

strtol no longer accepts values greater than `LONG_MAX` as valid input. Use strtoul instead.

NAME

strxfrm - string transformation

SYNOPSIS

```
#include <string.h>

size_t strxfrm (char *s1, const char *s2, size_t n);
```

DESCRIPTION

strxfrm transforms the string *s2* and places the resulting string into the array *s1*. The transformation is such that if strcmp is applied to two transformed strings, it returns a value greater than, equal to, or less than zero, corresponding to the result of the strcoll function applied to the same two original strings. The transformation is based on the program's locale for category LC_COLLATE [see setlocale(3C)].

No more than *n* characters will be placed into the resulting array pointed to by *s1*, including the terminating null character. If *n* is 0, then *s1* is permitted to be a null pointer. If copying takes place between objects that overlap, the behavior is undefined.

strxfrm returns the length of the transformed string (not including the terminating null character). If the value returned is *n* or more, the contents of the array *s1* are indeterminate.

EXAMPLE

The value of the following expression is the size of the array needed to hold the transformation of the string pointed to by *s*.

```
1 + strxfrm(NULL, s, 0);
```

FILES

/usr/lib/locale/locale/LC_COLLATE LC_COLLATE database for locale.

SEE ALSO

colltbl(1M), setlocale(3C), strcoll(3C), string(3C), environ(5).

DIAGNOSTICS

On failure, strxfrm returns (size_t) -1.

NAME

swab - swap bytes

SYNOPSIS

```
#include <stdlib.h>

void swab (const char *from, char *to, int nbytes);
```

DESCRIPTION

swab copies *nbytes* bytes pointed to by *from* to the array pointed to by *to*, exchanging adjacent even and odd bytes. *nbytes* should be even and non-negative. If *nbytes* is odd and positive, swab uses *nbytes-1* instead. If *nbytes* is negative, swab does nothing.

NAME

swapctl - manage swap space

SYNOPSIS

```
#include <sys/stat.h>
#include <sys/swap.h>

int swapctl(int cmd, void *arg);
```

DESCRIPTION

swapctl adds, deletes, or returns information about swap resources. *cmd* specifies one of the following options contained in *sys/swap.h*:

```
SC_ADD           /* add a resource for swapping */
SC_LIST         /* list the resources for swapping */
SC_REMOVE       /* remove a resource for swapping */
SC_GETNSWP      /* return number of swap resources */
```

When *SC_ADD* or *SC_REMOVE* is specified, *arg* is a pointer to a *swapres* structure containing the following members:

```
char   *sr_name;    /* pathname of resource */
off_t  sr_start;    /* offset to start of swap area */
off_t  sr_length;   /* length of swap area */
```

sr_start and *sr_length* are specified in 512-byte blocks. When *SC_LIST* is specified, *arg* is a pointer to a *swaptable* structure containing the following members:

```
int     swt_n;      /* number of swapents following */
struct swapent swt_ent[]; /* array of swt_n swapents */
```

A *swapent* structure contains the following members:

```
char   *ste_path;   /* name of the swap file */
off_t  ste_start;   /* starting block for swapping */
off_t  ste_length;  /* length of swap area */
long   ste_pages;   /* number of pages for swapping */
long   ste_free;    /* number of ste_pages free */
long   ste_flags;   /* ST_INDEL bit set if swap file */
                          /* is now being deleted */
```

SC_LIST causes *swapctl* to return at most *swt_n* entries. The return value of *swapctl* is the number actually returned. The *ST_INDEL* bit is turned on in *ste_flags* if the swap file is in the process of being deleted. When *SC_GETNSWP* is specified, *swapctl* returns as its value the number of swap resources in use. *arg* is ignored for this operation. The *SC_ADD* and *SC_REMOVE* functions will fail if calling process does not have appropriate privileges.

RETURN VALUE

Upon successful completion, the function *swapctl* returns a value of 0 for *SC_ADD* or *SC_REMOVE*, the number of *struct swapent* entries actually returned for *SC_LIST*, or the number of swap resources in use for *SC_GETNSWP*. Upon failure, the function *swapctl* returns a value of -1 and sets *errno* to indicate an error.

ERRORS

Under the following conditions, the function `swapctl` fails and sets `errno` to:

| | |
|--------------|---|
| EEXIST | Part of the range specified by <code>sr_start</code> and <code>sr_length</code> is already being used for swapping on the specified resource (<code>SC_ADD</code>). |
| EFAULT | <code>arg</code> , <code>sr_name</code> , or <code>ste_path</code> points outside the allocated address space. |
| EINVAL | The specified function value is not valid, the path specified is not a swap resource (<code>SC_REMOVE</code>), part of the range specified by <code>sr_start</code> and <code>sr_length</code> lies outside the resource specified (<code>SC_ADD</code>), or the specified swap area is less than one page (<code>SC_ADD</code>). |
| EISDIR | The path specified for <code>SC_ADD</code> is a directory. |
| ELOOP | Too many symbolic links were encountered in translating the pathname provided to <code>SC_ADD</code> or <code>SC_REMOVE</code> . |
| ENAMETOOLONG | The length of a component of the path specified for <code>SC_ADD</code> or <code>SC_REMOVE</code> exceeds <code>{NAME_MAX}</code> characters or the length of the path exceeds <code>{PATH_MAX}</code> characters and <code>{_POSIX_NO_TRUNC}</code> is in effect. |
| ENOENT | The pathname specified for <code>SC_ADD</code> or <code>SC_REMOVE</code> does not exist. |
| ENOMEM | An insufficient number of <code>struct swapent</code> structures were provided to <code>SC_LIST</code> , or there were insufficient system storage resources available during an <code>SC_ADD</code> or <code>SC_REMOVE</code> , or the system would not have enough swap space after an <code>SC_REMOVE</code> . |
| ENOSYS | The pathname specified for <code>SC_ADD</code> or <code>SC_REMOVE</code> is not a file or block special device. |
| ENOTDIR | Pathname provided to <code>SC_ADD</code> or <code>SC_REMOVE</code> contained a component in the path prefix that was not a directory. |
| EPERM | The process does not have appropriate privileges. |
| EROFS | The pathname specified for <code>SC_ADD</code> is a read-only file system. |

symlink(2)

symlink(2)

NAME

symlink - make a symbolic link to a file

SYNOPSIS

```
#include <unistd.h>
int symlink(const char *name1, const char *name2);
```

DESCRIPTION

symlink creates a symbolic link *name2* to the file *name1*. Either name may be an arbitrary pathname, the files need not be on the same file system, and *name1* may be nonexistent.

The file to which the symbolic link points is used when an `open(2)` operation is performed on the link. A `stat(2)` on a symbolic link returns the linked-to file, while an `lstat` returns information about the link itself. This can lead to surprising results when a symbolic link is made to a directory. To avoid confusion in programs, the `readlink(2)` call can be used to read the contents of a symbolic link.

If the file named by *name2* does not exist, it is created. The permission mode of *name2* is 777 [see `creat(2)`].

The symbolic link is made unless one or more of the following are true:

| | |
|--------------|---|
| EACCES | Search permission is denied for a component of the path prefix of <i>name2</i> . |
| EDQUOT | The user's quota of inodes on the file system on which the file is being created has been exhausted. |
| EEXIST | The file referred to by <i>name2</i> already exists. |
| EFAULT | <i>name1</i> or <i>name2</i> points outside the allocated address space for the process. |
| EIO | An I/O error occurs while reading from or writing to the file system. |
| ELOOP | Too many symbolic links are encountered in translating <i>name2</i> . |
| ENAMETOOLONG | The length of the <i>name1</i> or <i>name2</i> argument exceeds { <code>PATH_MAX</code> }, or the length of a <i>name1</i> or <i>name2</i> component exceeds { <code>NAME_MAX</code> } while (<code>_POSIX_NO_TRUNC</code>) is in effect. |
| ENOENT | A component of the path prefix of <i>name2</i> does not exist. |
| ENOSPC | The directory in which the entry for the new symbolic link is being placed cannot be extended because no space is left on the file system containing the directory. |
| ENOSPC | The new symbolic link cannot be created because no space is left on the file system which will contain the link. |
| ENOSPC | There are no free inodes on the file system on which the file is being created. |
| ENOSYS | The file system does not support symbolic links |

symlink(2)

symlink(2)

ENOTDIR A component of the path prefix of *name2* is not a directory.
EROFS The file *name2* would reside on a read-only file system.

DIAGNOSTICS

Upon successful completion `symlink` returns a value of 0; otherwise, it returns -1 and places an error code in `errno`.

SEE ALSO

`cp(1)`, `link(2)`, `readlink(2)`, `unlink(2)`.

sync(2)

sync(2)

NAME

sync - update super block

SYNOPSIS

```
#include <unistd.h>
void sync(void);
```

DESCRIPTION

sync causes all information in memory that should be on disk to be written out. This includes modified super blocks, modified i-nodes, and delayed block I/O.

It should be used by programs that examine a file system, such as fsck(1M), df(1M), and so on. It is mandatory before a re-boot.

The writing, although scheduled, is not necessarily completed before sync returns. The fsync system call completes the writing before it returns.

SEE ALSO

fsync(2)

NAME

syscall - indirect system call

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...  
#include <sys/syscall.h>  
int syscall(number, arg, ...)
```

DESCRIPTION

syscall performs the system call whose assembly language interface has the specified *number*, and arguments *arg* Symbolic constants for system calls can be found in the header file /usr/include/sys/syscall.h.

RETURN VALUE

When the C-bit is set, syscall returns -1 and sets the external variable errno [see intro(2)].

SEE ALSO

intro(2), pipe(2).

NAME

sysconf - retrieves configurable system variables

SYNOPSIS

```
#include <unistd.h>

long sysconf(int name);
```

DESCRIPTION

Multiprocessing supports the following new name values:

`_SC_NPROC_CONF` Number of currently configured processors.
`_SC_NPROC_ONLN` Number of processors currently online.

The `sysconf` function provides a method for the application to determine the current value of a configurable system limit or option (variable).

The name argument represents the system variable to be queried. The following table lists the minimal set of system variables from `limits.h` and `unistd.h` that can be returned by `sysconf`, and the symbolic constants, defined in `unistd.h` that are the corresponding values used for *name*.

| NAME | RETURN VALUE |
|--------------------------------|---------------------------------|
| <code>_SC_ARG_MAX</code> | <code>ARG_MAX</code> |
| <code>_SC_CHILD_MAX</code> | <code>CHILD_MAX</code> |
| <code>_SC_CLK_TCK</code> | <code>CLK_TCK</code> |
| <code>_SC_NGROUPS_MAX</code> | <code>NGROUPS_MAX</code> |
| <code>_SC_OPEN_MAX</code> | <code>OPEN_MAX</code> |
| <code>_SC_PASS_MAX</code> | <code>PASS_MAX</code> |
| <code>_SC_PAGESIZE</code> | <code>PAGESIZE</code> |
| <code>_SC_JOB_CONTROL</code> | <code>_POSIX_JOB_CONTROL</code> |
| <code>_SC_SAVED_IDS</code> | <code>_POSIX_SAVED_IDS</code> |
| <code>_SC_VERSION</code> | <code>_POSIX_VERSION</code> |
| <code>_SC_XOPEN_VERSION</code> | <code>_XOPEN_VERSION</code> |
| <code>_SC_LOGNAME_MAX</code> | <code>LOGNAME_MAX</code> |
| <code>_SC_NPROC_CONF</code> | # configured processors |
| <code>_SC_NPROC_ONLN</code> | # processors online |

The value of `CLK_TCK` may be variable and it should not be assumed that `CLK_TCK` is a compile-time constant. The value of `CLK_TCK` is the same as the value of `sysconf(_SC_CLK_TCK)`.

The unique system identifier returned by `sysconf(_SC_BCS_SYS_ID)` is equal to the lower four bytes of the unique Ethernet address of the Ethernet board with the lowest board number. If two or more Ethernet boards have the same lowest board number, the address of the board with the lowest board number in the lowest slot will be returned.

For example, given this configuration:

| Board | Slot | Address |
|-------|------|------------|
| 376 | 13 | 0x10000000 |
| 374 | 15 | 0x20000000 |

`sysconf(_SC_BCS_SYS_ID)` returns: 0x20000000

This algorithm can be overridden by `uadmin(1M)` as follows: `uadmin A_SET_SYS_ID address` This will set the unique system identifier to `address` if an Ethernet board with an Ethernet address equal to `address` exists in the system.

For example, given this configuration:

| Board | Slot | Address |
|-------|------|------------|
| 376 | 13 | 0x10000000 |
| 374 | 15 | 0x20000000 |
| 374 | 14 | 0x30000000 |

`sysconf(_SC_BCS_SYS_ID)` returns: 0x30000000

But after entering `uadmin A_SET_SYS_ID 0x20000000`
`sysconf(_SC_BCS_SYS_ID)` returns: 0x20000000

DIAGNOSTICS

`sysconf` returns the appropriate value on success, or a negative value on failure.

Failure may result from:

`EINVAL` The name argument is invalid.

If `name` is an invalid value, `sysconf` will return -1 and set `errno` to indicate the error. If `sysconf` fails due to a value of `name` that is not defined on the system, the function will return a value of -1 without changing the value of `errno`.

NOTES

A call to `setrlimit` may cause the value of `OPEN_MAX` to change.

SEE ALSO

`pathconf(3C)`

NAME

sysfs - get file system type information

SYNOPSIS

```
#include <sys/fstyp.h>
#include <sys/fsid.h>

int sysfs(int opcode, const char *fsname);
int sysfs(int opcode, int fs_index, char *buf);
int sysfs(int opcode);
```

DESCRIPTION

sysfs returns information about the file system types configured in the system. The number of arguments accepted by sysfs varies and depends on the *opcode*. The currently recognized *opcodes* and their functions are:

| | |
|------------|---|
| GETFSIND | Translate <i>fsname</i> , a null-terminated file-system type identifier, into a file-system type index. |
| GETFSTYP | Translate <i>fs_index</i> , a file-system type index, into a null-terminated file-system type identifier and write it into the buffer pointed to by <i>buf</i> ; this buffer must be at least of size <code>FSTYPSZ</code> as defined in <code>sys/fstyp.h</code> . |
| GETNFSSTYP | Return the total number of file system types configured in the system. |

sysfs fails if one or more of the following are true:

| | |
|--------|---|
| EINVAL | <i>fsname</i> points to an invalid file-system identifier; <i>fs_index</i> is zero, or invalid; <i>opcode</i> is invalid. |
| EFAULT | <i>buf</i> or <i>fsname</i> points to an invalid user address. |

DIAGNOSTICS

Upon successful completion, sysfs returns the file-system type index if the *opcode* is GETFSIND, a value of 0 if the *opcode* is GETFSTYP, or the number of file system types configured if the *opcode* is GETNFSSTYP. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

sysinfo - get and set system information strings

SYNOPSIS

```
#include <sys/systeminfo.h>

long sysinfo (int command, char *buf, long count);
```

DESCRIPTION

sysinfo copies information relating to the UNIX system on which the process is executing into the buffer pointed to by *buf*; sysinfo can also set certain information where appropriate commands are available. *count* is the size of the buffer.

The POSIX P1003.1 interface `sysconf` [see `sysconf(2)`] provides a similar class of configuration information, but returns an integer rather than a string.

The commands available are:

`SI_SYSNAME` Copy into the array pointed to by *buf* the string that would be returned by `uname` [see `uname(2)`] in the *sysname* field. This is the name of the implementation of the operating system, for example, *System V* or *UTS*.

`SI_HOSTNAME` Copy into the array pointed to by *buf* a string that names the present host machine. This is the string that would be returned by `uname` [see `uname(2)`] in the *nodename* field. This hostname or nodename is often the name the machine is known by locally.

The *hostname* is the name of this machine as a node in some network; different networks may have different names for the node, but presenting the nodename to the appropriate network Directory or name-to-address mapping service should produce a transport end point address. The name may not be fully qualified.

Internet host names may be up to 256 bytes in length (plus the terminating null).

`SI_SET_HOSTNAME` Copy the null-terminated contents of the array pointed to by *buf* into the string maintained by the kernel whose value will be returned by succeeding calls to `sysinfo` with the command `SI_HOSTNAME`. This command requires that the effective-user-id be super-user.

`SI_RELEASE` Copy into the array pointed to by *buf* the string that would be returned by `uname` [see `uname(2)`] in the *release* field. Typical values might be *4.0* or *3.2*.

`SI_VERSION` Copy into the array pointed to by *buf* the string that would be returned by `uname` [see `uname(2)`] in the *version* field. The syntax and semantics of this string are defined by the system provider.

`SI_MACHINE` Copy into the array pointed to by *buf* the string that would be returned by `uname` [see `uname(2)`] in the *machine* field, for example, *3b2* or *580*.

sysinfo(2)

sysinfo(2)

| | |
|--------------------|--|
| SI_ARCHITECTURE | Copy into the array pointed to by <i>buf</i> a string describing the instruction set architecture of the current system, for example, <i>mc68030</i> , <i>m32100</i> , or <i>i80486</i> . These names may not match predefined names in the C language compilation system. |
| SI_HW_PROVIDER | Copies the name of the hardware manufacturer into the array pointed to by <i>buf</i> . |
| SI_HW_SERIAL | Copy into the array pointed to by <i>buf</i> a string which is the ASCII representation of the hardware-specific serial number of the physical machine on which the system call is executed. Note that this may be implemented in Read-Only Memory, via software constants set when building the operating system, or by other means, and may contain non-numeric characters. It is anticipated that manufacturers will not issue the same "serial number" to more than one physical machine. The pair of strings returned by <i>SI_HW_PROVIDER</i> and <i>SI_HW_SERIAL</i> is likely to be unique across all vendor's System V implementations. |
| SI_SRPC_DOMAIN | Copies the Secure Remote Procedure Call domain name into the array pointed to by <i>buf</i> . |
| SI_SET_SRPC_DOMAIN | Set the string to be returned by <i>sysinfo</i> with the <i>SI_SRPC_DOMAIN</i> command to the value contained in the array pointed to by <i>buf</i> . This command requires that the effective-user-id be super-user. |

sysinfo will fail if one or both of the following are true:

| | |
|--------|---|
| EPERM | The process does not have appropriate privilege for a SET commands. |
| EINVAL | <i>buf</i> does not point to a valid address, or the data for a SET command exceeds the limits established by the implementation. |

DIAGNOSTICS

Upon successful completion, the value returned indicates the buffer size in bytes required to hold the complete value and the terminating null character. If this value is no greater than the value passed in *count*, the entire string was copied; if this value is greater than *count*, the string copied into *buf* has been truncated to *count-1* bytes plus a terminating null character.

Otherwise, a value of *-1* is returned and *errno* is set to indicate the error.

USAGE

There is in many cases no corresponding programmatic interface to set these values; such strings are typically settable only by the system administrator modifying entries in the *master.d* directory or the code provided by the particular OEM reading a serial number or code out of read-only memory, or hard-coded in the version of the operating system.

A good starting guess for *count* is 257, which is likely to cover all strings returned by this interface in typical installations.

sysinfo(2)

sysinfo(2)

SEE ALSO

uname(2), sysconf(3C)

BSD compatibility package interfaces gethostname(3), gethostid(3)

NAME

syslog, openlog, closelog, setlogmask - control system log

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
#include <syslog.h>

openlog(ident, logopt, facility)
char *ident;

syslog(priority, message, parameters ... )
char *message;

closelog()

setlogmask(maskpri)
```

DESCRIPTION

syslog passes *message* to syslogd(1M), which logs it in an appropriate system log, writes it to the system console, forwards it to a list of users, or forwards it to the syslogd on another host over the network. The message is tagged with a priority of *priority*. The message looks like a printf(3S) string except that %m is replaced by the current error message (collected from errno). A trailing NEWLINE is added if needed.

Priorities are encoded as a *facility* and a *level*. The facility describes the part of the system generating the message. The level is selected from an ordered list:

| | |
|-------------|--|
| LOG_EMERG | A panic condition. This is normally broadcast to all users. |
| LOG_ALERT | A condition that should be corrected immediately, such as a corrupted system database. |
| LOG_CRIT | Critical conditions, such as hard device errors. |
| LOG_ERR | Errors. |
| LOG_WARNING | Warning messages. |
| LOG_NOTICE | Conditions that are not error conditions, but that may require special handling. |
| LOG_INFO | Informational messages. |
| LOG_DEBUG | Messages that contain information normally of use only when debugging a program. |

If special processing is needed, openlog can be called to initialize the log file. The parameter *ident* is a string that is prepended to every message. *logopt* is a bit field indicating logging options. Current values for *logopt* are:

| | |
|----------|--|
| LOG_PID | Log the process ID with each message. This is useful for identifying specific daemon processes (for daemons that fork). |
| LOG_CONS | Write messages to the system console if they cannot be sent to syslogd. This option is safe to use in daemon processes that have no controlling terminal, since syslog forks before opening the console. |

| | |
|------------|--|
| LOG_NDELAY | Open the connection to <code>syslogd</code> immediately. Normally the open is delayed until the first message is logged. This is useful for programs that need to manage the order in which file descriptors are allocated. |
| LOG_NOWAIT | Do not wait for child processes that have been forked to log messages onto the console. This option should be used by processes that enable notification of child termination using <code>SIGCHLD</code> , since <code>syslog</code> may otherwise block waiting for a child whose exit status has already been collected. |

The *facility* parameter encodes a default facility to be assigned to all messages that do not have an explicit facility already encoded:

| | |
|--------------|--|
| LOG_KERN | Messages generated by the kernel. These cannot be generated by any user processes. |
| LOG_USER | Messages generated by random user processes. This is the default facility identifier if none is specified. |
| LOG_MAIL | The mail system. |
| LOG_DAEMON | System daemons, such as <code>ftpd(1M)</code> , <code>routed(1M)</code> , etc. |
| LOG_AUTH | The authorization system: <code>login(1)</code> , <code>su(1)</code> , <code>getty(1M)</code> , etc. |
| LOG_LPR | The line printer spooling system: <code>lpr(1)</code> , <code>lpc(1M)</code> , etc. |
| LOG_NEWS | Reserved for the USENET network news system. |
| LOG_UUCP | Reserved for the UUCP system; it does not currently use <code>syslog</code> . |
| LOG_CRON | The <code>cron/at</code> facility; <code>crontab(1)</code> , <code>at(1)</code> , <code>cron(1M)</code> , etc. |
| LOG_LOCAL0-7 | Reserved for local use. |

`closelog` can be used to close the log file.

`setlogmask` sets the log priority mask to *maskpri* and returns the previous mask. Calls to `syslog` with a priority not set in *maskpri* are rejected. The mask for an individual priority *pri* is calculated by the macro `LOG_MASK(pri)`; the mask for all priorities up to and including *toppri* is given by the macro `LOG_UPTO(toppri)`. The default allows all priorities to be logged.

EXAMPLE

This call logs a message at priority `LOG_ALERT`:

```
syslog(LOG_ALERT, "who: internal error 23");
```

The FTP daemon, `ftpd`, would make this call to `openlog` to indicate that all messages it logs should have an identifying string of `ftpd`, should be treated by `syslogd` as other messages from system daemons are, and should include the process ID of the process logging the message:

```
openlog("ftpd", LOG_PID, LOG_DAEMON);
```

Then it would make the following call to `setlogmask` to indicate that messages at priorities from `LOG_EMERG` through `LOG_ERR` should be logged, but that no messages at any other priority should be logged:

```
setlogmask(LOG_UPTO(LOG_ERR));
```

Then, to log a message at priority `LOG_INFO`, it would make the following call to `syslog`:

```
syslog(LOG_INFO, "Connection from host %d", CallingHost);
```

A locally-written utility could use the following call to `syslog` to log a message at priority `LOG_INFO`, to be treated by `syslogd` as other messages to the facility `LOG_LOCAL2` are treated:

```
syslog(LOG_INFO|LOG_LOCAL2, "error: %m");
```

SEE ALSO

`at(1)`, `cron(1M)`, `crontab(1)`, `ftpd(1M)`, `getty(1M)`, `logger(1)`, `login(1)`, `lpc(1M)`, `lpr(1)`, `routed(1M)`, `su(1)`, `syslogd(1M)`, `printf(3S)`.

NAME

sysm68k - machine-specific functions

SYNOPSIS

```
#include <sys/types.h>
#include <sys/sysm68k.h>

int sysm68k(int cmd, . . .);
```

DESCRIPTION

sysm68k implements machine-specific functions. The *cmd* argument determines the function performed. The type and number of arguments expected depends on the function.

Command RTODC

When *cmd* is RTODC, an argument of type `time_t *` is expected.

This function reads the hardware time-of-day clock and returns the number of seconds since midnight, January 1, 1970, in the `time_t` structure referred to by the argument. This command is available only to the super-user.

Command SM68KSYM

When *cmd* is SM68KSYM, the symbol table created when a new bootable operating system is configured may be accessed. The symbols available via this command are defined in one of two places: the driver routines loaded or the variable specifications in the files in the `/etc/master.d` directory. Two arguments are expected: the first must be a pointer to a buffer into which the symbol table is copied, and the second must be an integer containing the total size of the buffer. The format of the symbol table is:

```
int size;          /* symbol size in bytes */
int count;        /* total number of symbols */

/* Each symbol is stored as: */
/* char name[]; (padded */
/* with '\0' to next */
/* sizeof(long) boundary */
/* long value; the symbol's value */
```

The SM68KSVAL macro in `sys/sysm68k.h` takes a pointer to a symbol name in the table and returns its value. The SM68KNXTSYM macro takes a pointer to a symbol name in the table and returns a pointer to the next entry.

Typically, the symbol table would be retrieved with two calls to `sysm68k`. First, the size of the symbol table is obtained by calling `sysm68k` with a buffer of one integer. This integer is then used to obtain a buffer large enough to contain the entire symbol table. The second invocation of `sysm68k` with this newly obtained buffer retrieves the entire symbol table.

```
#include <sys/sysm68k.h>

int          size;          /* size of buffer needed */
struct sm68ksym *buffer;   /* buffer pointer */

sysm68k( SM68KSYM, (struct sm68ksym *) &size, sizeof(size) );
buffer = (struct sm68ksym *) malloc( size );
sysm68k( SM68KSYM, buffer, size );
```

Command SMCONF

When *cmd* is SMCONF, the configuration table created during the configuration of a new bootable operating system may be accessed. This table contains the names and locations of the devices supported by the currently running UNIX system, the names of all software modules included in the system, and the names of all devices in the EDT that were ignored. Two arguments are expected: the first must be a pointer to a buffer into which the configuration table is copied, and the second must be an integer containing the total size of the buffer. The format of the configuration table is:

```

int    count;          /* total number of entries */
                        /* for each entry ... */
time_t timestamp;    /* f_timdat from file header */
char   name[DIRSIZ]; /* name of device/module */
unsigned char flag;  /* configuration information */
                        /* 0x80: device ignored */
                        /* 0x40: name[] is a driver */
                        /* 0x20: name[] is a software module */
unsigned char mmajor; /* external major device number*/

```

Typically, the configuration table would be retrieved with two calls to `sysm68k`. First, the number of entries is obtained by calling `sysm68k` with a buffer of one integer. This integer is then used to calculate and obtain a buffer large enough to contain the entire configuration table. The second invocation of `sysm68k` with this newly obtained buffer retrieves the configuration table.

```

#include <sys/sysm68k.h>

int    count;          /* total number of devices */
int    size;           /* size of buffer needed */
struct smconf *buffer; /* buffer pointer */

sysm68k( SMCONF, (struct smconf *)&count, sizeof(count));
size = sizeof(int);
size += count * sizeof(struct smc);
buffer = (struct smconf *)malloc(size);
sysm68k(SMCONF, buffer, size);

```

Command XGETEDT

When *cmd* is XGETEDT, the extended EDT table (XEDT) for a specified device controller is returned. This table contains the names and locations of the devices attached to the argument controller. Three arguments are expected: the first must be a `dev_t` that specifies the controller to be accessed, the second is a pointer to a buffer into which the extended EDT table is copied, and the third must be an integer containing the total size of the buffer. The format of the extended EDT table is:

```

int    count;          /* total number of entries */
                        /* for each entry ... */
char   x_name[X_XNAMLEN]; /*device name/information */
int    x_unit;         /*unit number on controller */
u_int  x_ksize;       /*size in kbytes */

```

Typically, the extended EDT table would be retrieved with two calls to `sysm68k`. First, the number of extended EDT entries for the controller specified by the device argument is obtained by calling `sysm68k` with a buffer of one integer. This integer is then used to calculate how large a buffer is needed to contain the entire extended EDT table for the controller, and that buffer is then obtained. The second invocation of `sysm68k` with this newly obtained buffer retrieves the extended EDT table.

```
#include <sys/sysm68k.h>
#include <sys/edt.h>

int    count;           /* total number of devices */
int    size;           /* size of buffer needed */
struct kxedt *buffer;  /* buffer pointer */

sysm68k( XGETEDT, dev, &count, sizeof(count) );
size = sizeof(int);
size += count * sizeof(struct kxedt);
buffer = (struct kxedt *)malloc(size);
sysm68k( XGETEDT, dev, buffer, size);
```

Command GET_MR_TBL

When `cmd` is `XGET_MR_TBL`, the memory region table for the kernel is returned. This table contains the names, location, ID, and attribute IDs for each memory region configured into the kernel. Two arguments are expected: the first is a pointer to a buffer into which the memory region table is copied, and the second must be an integer containing the total size of the buffer.

Typically, the memory region table would be retrieved with two calls to `sysm68k`. First, the number of memory regions is obtained by calling `sysm68k` with a buffer of one integer. This integer is then used to calculate how large a buffer is needed to contain the entire memory region table, and that buffer is then obtained. The second invocation of `sysm68k` with this newly obtained buffer retrieves the memory region table.

```
#include <sys/mrt.h>
#include <sys/sysm68k.h>

int    count;           /* total number of entries */
int    size;           /* size of buffer needed */
struct mrt_x*buffer;   /* buffer pointer */

sysm68k( GET_MR_TBL, &count, sizeof(count) );
size = sizeof(int);
size += count * sizeof(struct mrt);
buffer = (struct mrt_x *)malloc(size);
sysm68k( GET_MR_TBL, buffer, size);
```

Command GET_MA_TBL

When `cmd` is `XGET_MA_TBL`, the memory attribute table for the kernel is returned. This table contains the attributes associated with the memory regions configured into the kernel. Two arguments are expected: the first is a pointer to a buffer into which the memory attribute table is copied, and the second must be an integer containing the total size of the buffer.

Typically, the memory attribute table would be retrieved with two calls to `sysm68k`. First, the number of attributes is obtained by calling `sysm68k` with a buffer of one integer. This integer is then used to calculate how large a buffer is needed to contain the entire memory attribute table, and that buffer is then obtained. The second invocation of `sysm68k` with this newly obtained buffer retrieves the memory attribute table.

```
#include <sys/mrt.h>
#include <sys/sysm68k.h>

int    count;           /* total number of entries */
int    size;           /* size of buffer needed */
struct matr_x*buffer;  /* buffer pointer */

sysm68k( GET_MA_TBL, &count, sizeof(count) );
size = sizeof(int);
size += count * sizeof(struct mrt);
buffer = (struct matr_x *)malloc(size);
sysm68k( GET_MA_TBL, buffer, size);
```

Command MDRVRINFO

When *cmd* is MDRVRINFO, a command may be issued directly to a device driver.

Three arguments are expected: the first must be a `dev_t` that specifies the device the command is for, second is the command to send to the device driver, and the third is command specific.

Command SM68KBOOT

When *cmd* is SM68KBOOT, the timestamp and path name of the program last used to bootstrap the machine may be accessed. The path name of the `a.out` format file which was booted, and the timestamp from the file header [see `a.out(4)`] are saved. One argument is expected: a pointer to a buffer into which the information is copied. The format of this information is:

```
time_t timestamp;     /* f_timdat from file header */
char   path[100];     /* path name */
```

This information would be retrieved with a single call to `sysm68k`.

```
#include <sys/sysm68k.h>

struct sm68kboot buffer; /* buffer */

sysm68k(SM68KBOOT, &buffer);
```

Command SM68KAUTO

When *cmd* is SM68KAUTO, no arguments are expected. This function returns a boolean value in answer to the question, "Was the operating system reconfigured during the last boot, or was an existing bootable operating system booted?" The value returned is zero if an existing bootable (such as `/stand/stand/unix` or `/stand/unix`) was booted. The integer value 1 is returned if the bootable operating system was configured during the preceding boot process. This command is available only to the super-user.

Command SM68KSWPI

NOTE: This *cmd* is compatible with UNIX System V Release 2.1 and Release 3 software. Its function is subsumed by the *swap* command; see *swap(1M)*.

When *cmd* is SM68KSWPI, individual swapping areas may be added, deleted or the current areas determined. The address of an appropriately primed swap buffer is passed as the only argument. (Refer to the *sys/swap.h* header file for details of loading the buffer.)

The format of the swap buffer is:

```
struct swapint {
    char    si_cmd;      /*command: list, add, delete*/
    char    *si_buf;    /*swap file path pointer*/
    int     si_swpl0;   /*start block*/
    int     si_nblks;   /*swap size*/
}
```

Note that the add and delete options of the command may be exercised only by the super-user.

Typically, a swap area is added by a single call to *sysm68k*. First, the swap buffer is primed with appropriate entries for the structure members. Then *sysm68k* is invoked.

```
#include <sys/sysm68k.h>
#include <sys/swap.h>

struct swapint swapbuf;      /*swap into buffer ptr*/
sysm68k(SM68KSWPI, &swapbuf);
```

If this command succeeds, it returns 0 to the calling process. It fails and returns -1 if one or more of the following is true:

| | |
|---------|---|
| EFAULT | <i>swapbuf</i> points to an invalid address. |
| EFAULT | <i>swapbuf</i> . <i>si_buf</i> points to an invalid address. |
| ENOTBLK | The swap area specified is not a block special device. |
| EEXIST | The swap area specified has already been added. |
| ENOSPC | Too many swap areas are in use (if adding). |
| ENOMEM | The swap area specified is the last remaining swap area. |
| ENOMEM | There is no place to put swapped pages when deleting a swap area. |
| EINVAL | An argument is invalid. |

Command STIME

When *cmd* is STIME, an argument of type *long* is expected. This function sets the system time and date. The argument contains the time as measured in seconds from 00:00:00 UTC January 1, 1970. This command is available only to the super-user.

Command SM68KTRAPLOCORE

Prior to release 4.0, user processes could read low memory (for example, read accesses using NULL pointers were permitted from user programs). When *cmd* is SM68KTRAPLOCORE, user level access permission on low core memory can be changed and user accesses of low core memory can be trapped. Only read access is

affected; user level write access to low core is not allowed under any circumstances. A single argument of type `int` is expected. This argument may have one of the following five values, defined in `<sys/sysm68k.h>`:

`SM68KTLC_DISABLE`

Disable low core trapping. Read accesses to low core are allowed from user processes.

`SM68KTLC_SIGNAL`

Trap low core accesses. Any user process which attempts to read low core will be sent a `SIGSEGV` signal with `si_code` set to `SEGV_MAPERR`.

`SM68KTLC_PRINT`

Trap low core accesses. Any user process which attempts to read low core will be sent a `SIGSEGV` signal with `si_code` set to `SEGV_MAPERR`. In addition, a message will be printed on the system console each time a process attempts to read low core.

`SM68KTLC_WARN`

Trap low core accesses and print a message on the system console identifying the process and the address accessed. Do not send signals to the process.

`SM68KTLC_STATUS`

Return current state of low core trapping. The state of low core trapping is unchanged.

If this command succeeds, it returns one of `SM68KTLC_DISABLE`, `SM68KTLC_SIGNAL`, `SM68KTLC_PRINT`, to indicate the setting of low core protection prior to the call. NOTE: this command changes behavior for all processes, not just for the current process. The command fails and returns `-1` if one or more of the following is true:

`EPERM` The caller is not super-user (not required for `SM68KTLC_STATUS`).

`EINVAL` An argument is invalid.

Command `CRASHDUMP`

When *cmd* is `CRASHDUMP`, two arguments are expected - *pathname* and *flag*. This function enables crash dumps to the special device defined by the *pathname* and sets the mode of crash dumps per the value of the *flag*. If *pathname* is `NULL`, then crash dumps are disabled.

The *flag* must be 0 or joined by an "or" with any of the following values (defined in `crash.h`):

`CRASH_DUMPS_ASK` - the crash dump system prompts the user for preparing the dump device and to resolve errors

The default action unless modified by one of the above is that the crash dump system does not prompt the user to prepare the dump device and fails if an error occurs.

The special device used for crash dumps must have sufficient room to hold an image of physical memory or not all of the crash image will be saved. If the device is a disk-drive slice, it must be tagged with `V_SWAP`. If the device is currently used for swapping, it must have sufficient room to allow the system to be rebooted and the crash dump to be retrieved before it is corrupted. The crash dump is stored at

the rear of a slice if possible to facilitate some swapping.

Command SETNAME

When *cmd* is SETNAME, an argument of type `char *` is expected. This function sets the new node name and can consist of alphanumeric and the special characters dash, underbar, and dollar sign. The node name argument is restricted to SYS_NMLN characters. SYS_NMLN is an implementation specific value defined in `<sys/utsname.h>`. This command is available only to the superuser.

Command SETSYSNAME

When *cmd* is SETSYSNAME, an argument of type `char *` is expected. This function sets the new system name and can consist of alphanumeric and the special characters dash, underbar, and dollar sign. The system name argument is restricted to SYS_NMLN characters. SYS_NMLN is an implementation specific value defined in `<sys/utsname.h>`. This command is available only to the superuser.

DIAGNOSTICS

On success, `sysm68k` returns a value that depends on *cmd* as follows:

| | |
|-----------------|--|
| SM68KSYM | A value of zero. |
| SM68KCONF | A value of zero. |
| SM68KBOOT | A value of zero. |
| CRASHDUMP | A value of zero. |
| SM68KAUTO | A value of zero if an existing bootable operating system (such as <code>/stand/stand/unix</code> or <code>/stand/unix</code>) was last booted. A value of one if a new bootable operating system was configured during the last boot process. |
| SM68KTRAPLOCORE | Returns the setting of low core protection prior to the call. |

Otherwise, a value of `-1` is returned and `errno` is set to indicate the error. When *cmd* is invalid, `errno` is set to `EINVAL` on return.

SEE ALSO

`cunix(1M)`, `swap(1M)`, `sync(2)`, `a.out(4)`.

NAME

sysm88k - machine-specific functions

SYNOPSIS

```
#include <sys/types.h>
#include <sys/sysm88k.h>

int sysm88k(int cmd, . . .);
```

DESCRIPTION

sysm88k implements machine-specific functions. The *cmd* argument determines the function performed. The type and number of arguments expected depends on the function.

Command RTODC

When *cmd* is RTODC, an argument of type `time_t *` is expected.

```
struct todc {
    short htenths;  short hsecs;  short hmins;
    short hhours;  short hdays;  short hweekday;
    short hmonth;   short hyear;
};
```

This function reads the hardware time-of-day clock and returns the number of seconds since midnight, January 1, 1970, in the `time_t` structure referred to by the argument. This command is available only to the super-user.

Command SM88KSYM

When *cmd* is SM88KSYM, the symbol table created when a new bootable operating system is configured may be accessed. The symbols available via this command are defined in one of two places: the driver routines loaded or the variable specifications in the files in the `/etc/master.d` directory. Two arguments are expected: the first must be a pointer to a buffer into which the symbol table is copied, and the second must be an integer containing the total size of the buffer. The format of the symbol table is:

```
int size;          /* symbol size in bytes */
int count;        /* total number of symbols */

/* Each symbol is stored as: */
/* char name[]; (padded */
/* with '\0' to next */
/* sizeof(long) boundary */
/* long value; the symbol's value */
```

The SM88KSVAL macro in `sys/sysm88k.h` takes a pointer to a symbol name in the table and returns its value. The SM88KNXTSYM macro takes a pointer to a symbol name in the table and returns a pointer to the next entry.

Typically, the symbol table would be retrieved with two calls to `sysm88k`. First, the size of the symbol table is obtained by calling `sysm88k` with a buffer of one integer. This integer is then used to obtain a buffer large enough to contain the entire symbol table. The second invocation of `sysm88k` with this newly obtained buffer retrieves the entire symbol table.

```

#include sys/sysm88k.h

int      size;          /* size of buffer needed */
struct sm88ksym *buffer; /* buffer pointer */

sysm88k( SM88KSYM, (struct sm88ksym *) &size, sizeof(size) );
buffer = (struct sm88ksym *) malloc( size );
sysm88k( SM88KSYM, buffer, size );

```

Command SMCONF

When *cmd* is SMCONF, the configuration table created during the configuration of a new bootable operating system may be accessed. This table contains the names and locations of the devices supported by the currently running UNIX system, the names of all software modules included in the system, and the names of all devices in the EDT that were ignored. Two arguments are expected: the first must be a pointer to a buffer into which the configuration table is copied, and the second must be an integer containing the total size of the buffer. The format of the configuration table is:

```

int      count;          /* total number of entries */
                        /* for each entry ... */
time_t timestamp;      /* f_timdat from file header */
char     name[DIRSIZ]; /* name of device/module */
unsigned char flag;    /* configuration information */
                        /* 0x80: device ignored */
                        /* 0x40: name[] is a driver */
                        /* 0x20: name[] is a software module */
unsigned char nmajor; /* external major device number */

```

Typically, the configuration table would be retrieved with two calls to `sysm88k`. First, the number of entries is obtained by calling `sysm88k` with a buffer of one integer. This integer is then used to calculate and obtain a buffer large enough to contain the entire configuration table. The second invocation of `sysm88k` with this newly obtained buffer retrieves the configuration table.

```

#include sys/sysm88k.h

int      count;          /* total number of devices */
int      size;          /* size of buffer needed */
struct sm88kconf *buffer; /* buffer pointer */

sysm88k(SMCONF, (struct sm88kconf *)&count, sizeof(count));
size = sizeof(int);
size += count * sizeof(struct sm88kc);
buffer = (struct sm88kconf *)malloc(size);
sysm88k(SMCONF, buffer, size);

```

Command XGETEDT

When *cmd* is XGETEDT, the extended EDT table (XEDT) for a specified device controller is returned. This table contains the names and locations of the devices attached to the argument controller. Three arguments are expected: the first must be a `dev_t` that specifies the controller to be accessed, the second is a pointer to a buffer into which the extended EDT table is copied, and the third must be an

integer containing the total size of the buffer. The format of the extended EDT table is:

```
int    count;          /* total number of entries */
                        /* for each entry ... */
char   x_name[X_XNAMLEN]; /*device name/information */
int    x_unit;        /*unit number on controller */
u_int  x_ksize;       /*size in kbytes */
```

Typically, the extended EDT table would be retrieved with two calls to `sysm88k`. First, the number of extended EDT entries for the controller specified by the device argument is obtained by calling `sysm88k` with a buffer of one integer. This integer is then used to calculate how large a buffer is needed to contain the entire extended EDT table for the controller, and that buffer is then obtained. The second invocation of `sysm88k` with this newly obtained buffer retrieves the extended EDT table.

```
#include <sys/sysm88k.h>
#include <sys/edt.h>

int    count;          /* total number of devices */
int    size;          /* size of buffer needed */
struct kxedt *buffer; /* buffer pointer */

sysm88k( XGETEDT, dev, &count, sizeof(count) );
size = sizeof(int);
size += count * sizeof(struct xedt);
buffer = (struct kxedt *)malloc(size);
sysm88k( XGETEDT, dev, buffer, size);
```

Command GET_MR_TBL

When `cmd` is `XGET_MR_TBL`, the memory region table for the kernel is returned. This table contains the names, location, ID, and attribute IDs for each memory region configured into the kernel. Two arguments are expected: the first is a pointer to a buffer into which the memory region table is copied, and the second must be an integer containing the total size of the buffer.

Typically, the memory region table would be retrieved with two calls to `sysm88k`. First, the number of memory regions is obtained by calling `sysm88k` with a buffer of one integer. This integer is then used to calculate how large a buffer is needed to contain the entire memory region table, and that buffer is then obtained. The second invocation of `sysm88k` with this newly obtained buffer retrieves the memory region table.

```
#include <sys/mrt.h>
#include <sys/sysm88k.h>

int    count;          /* total number of entries */
int    size;          /* size of buffer needed */
struct mrt_x*buffer; /* buffer pointer */

sysm88k( GET_MR_TBL, &count, sizeof(count) );
size = sizeof(int);
size += count * sizeof(struct mrt);
buffer = (struct mrt_x *)malloc(size);
sysm88k( GET_MR_TBL, buffer, size);
```

Command GET_MA_TBL

When *cmd* is XGET_MA_TBL, the memory attribute table for the kernel is returned. This table contains the attributes associated with the memory regions configured into the kernel. Two arguments are expected: the first is a pointer to a buffer into which the memory attribute table is copied, and the second must be an integer containing the total size of the buffer.

Typically, the memory attribute table would be retrieved with two calls to *sysm88k*. First, the number of attributes is obtained by calling *sysm88k* with a buffer of one integer. This integer is then used to calculate how large a buffer is needed to contain the entire memory attribute table, and that buffer is then obtained. The second invocation of *sysm88k* with this newly obtained buffer retrieves the memory attribute table.

```
#include <sys/mrt.h>
#include <sys/sysm88k.h>

int    count;           /* total number of entries */
int    size;           /* size of buffer needed */
struct matr_x*buffer;  /* buffer pointer */

sysm88k( GET_MA_TBL, &count, sizeof(count) );
size = sizeof(int);
size += count * sizeof(struct mrt);
buffer = (struct matr_x *)malloc(size);
sysm88k( GET_MA_TBL, buffer, size);
```

Command MDRVRINFO

When *cmd* is MDRVRINFO, a command may be issued directly to a device driver.

Three arguments are expected: the first must be a *dev_t* that specifies the device the command is for, second is the command to send to the device driver, and the third is command specific.

Command SM88KBOOT

When *cmd* is SM88KBOOT, the timestamp and path name of the program last used to bootstrap the machine may be accessed. The path name of the *a.out* format file which was booted, and the timestamp from the file header [see *a.out(4)*] are saved. One argument is expected: a pointer to a buffer into which the information is copied. The format of this information is:

```
time_t timestamp;     /* f_timdat from file header */
char   path[100];     /* path name */
```

This information would be retrieved with a single call to *sysm88k*.

```
#include sys/sysm88k.h

struct sm88kboot buffer; /* buffer */

sysm88k(SM88KBOOT, &buffer);
```

Command SM88KAUTO

When *cmd* is SM88KAUTO, no arguments are expected. This function returns a boolean value in answer to the question, "Was the operating system reconfigured during the last boot, or was an existing bootable operating system booted?" The value returned is zero if an existing bootable (such as */stand/stand/unix* or */stand/unix*) was booted. The integer value 1 is returned if the bootable

operating system was configured during the preceding boot process. The value is undefined if the system was booted in "magic mode." This command is available only to the super-user.

Command SM88KTODEBUG

When *cmd* is SM88KTODEBUG, no arguments are expected. This function allows entry into the kernel debugger from any port. This differs from the current use of @@P to enter the kernel debugger from the console. If no debugger exists, this function sets *errno* to EINVAL. This command is available only to the super-user.

Command SM88KSWPI

NOTE: This *cmd* is available only with UNIX System V Release 2.1 and Release 3 software. Its function is subsumed by the *swap* command; see *swap(1M)*.

When *cmd* is SM88KSWPI, individual swapping areas may be added, deleted or the current areas determined. The address of an appropriately primed swap buffer is passed as the only argument. (Refer to the *sys/swap.h* header file for details of loading the buffer.)

The format of the swap buffer is:

```

struct swapint {
    char    si_cmd;    /*command: list, add, delete*/
    char    *si_buf;   /*swap file path pointer*/
    int     si_swpl0;  /*start block*/
    int     si_nblks;  /*swap size*/
}

```

Note that the add and delete options of the command may be exercised only by the super-user.

Typically, a swap area is added by a single call to *sysm88k*. First, the swap buffer is primed with appropriate entries for the structure members. Then *sysm88k* is invoked.

```

#include sys/sysm88k.h
#include sys/swap.h
struct swapint swapbuf;    /*swap into buffer ptr*/
sysm88k(SM88KSWPI, &swapbuf);

```

If this command succeeds, it returns 0 to the calling process. It fails and returns -1 if one or more of the following is true:

| | |
|---------|---|
| EFAULT | <i>swapbuf</i> points to an invalid address. |
| EFAULT | <i>swapbuf</i> . <i>si_buf</i> points to an invalid address. |
| ENOTBLK | The swap area specified is not a block special device. |
| EEXIST | The swap area specified has already been added. |
| ENOSPC | Too many swap areas are in use (if adding). |
| ENOMEM | The swap area specified is the last remaining swap area. |
| ENOMEM | There is no place to put swapped pages when deleting a swap area. |

EINVAL An argument is invalid.

Command STIME

When *cmd* is STIME, an argument of type `long` is expected. This function sets the system time and date. The argument contains the time as measured in seconds from 00:00:00 UTC January 1, 1970. This command is available only to the super-user.

Command SM88KTRAPLOCORE

Prior to Release 4.0, user processes could read low memory (for example, read accesses using NULL pointers were permitted from user programs). When *cmd* is SM88KTRAPLOCORE, user level access permission on low core memory can be changed and user accesses of low core memory can be trapped. Only read access is affected; user level write access to low core is not allowed under any circumstances.

A single argument of type `int` is expected. This argument may have one of the following four values, defined in `sys/sysm88k.h`:

SM88KTLC_DISABLE

Disable low core trapping. Read accesses to low core are allowed from user processes.

SM88KTLC_SIGNAL

Trap low core accesses. Any user process which attempts to read low core will be sent a SIGSEGV signal with `si_code` set to SEGV_MAPERR.

SM88KTLC_PRINT

Trap low core accesses. Any user process which attempts to read low core will be sent a SIGSEGV signal with `si_code` set to SEGV_MAPERR. In addition, a message will be printed on the system console each time a process attempts to read low core.

SM88KTLC_STATUS

Return current state of low core trapping. The state of low core trapping is unchanged.

If this command succeeds, it returns one of SM88KTLC_DISABLE, SM88KTLC_SIGNAL, SM88KTLC_PRINT, to indicate the setting of low core protection prior to the call. NOTE: This command changes behavior for all processes, not just for the current process. The command fails and returns -1 if one or more of the following is true:

EPERM The caller is not super-user (not required for SM88KTLC_STATUS).

EINVAL An argument is invalid.

Command CRASHDUMP

When *cmd* is CRASHDUMP, two arguments are expected - *pathname* and *flag*. This function enables crash dumps to the special device defined by the *pathname* and sets the mode of crash dumps per the value of the *flag*. If *pathname* is NULL, then crash dumps are disabled.

The *flag* must be 0 or joined by an "or" with any of the following values (defined in `crash.h`):

CRASH_DUMPS_ASK - the crash dump system prompts the user for preparing the dump device and to resolve errors

The default action unless modified by one of the above is that the crash dump system does not prompt the user to prepare the dump device and fails if an error occurs.

The special device used for crash dumps must have sufficient room to hold an image of physical memory or not all of the crash dump will be saved. If the device is a disk-drive partition, it must be tagged with `V_SWAP`. If the device is currently used for swapping, it must have sufficient room to allow the system to be rebooted and the crash dump to be retrieved before it is corrupted. The crash dump is stored at the rear of a partition if possible to facilitate some swapping.

Command SETNAME

When *cmd* is `SETNAME`, an argument of type `char *` is expected. This function sets the new node name and can consist of alphanumeric and the special characters dash, underbar, and dollar sign. The node name argument is restricted to `SYS_NMLN` characters. `SYS_NMLN` is an implementation specific value defined in `<sys/utsname.h>`. This command is available only to the superuser.

Command SETSYSNAME

When *cmd* is `SETSYSNAME`, an argument of type `char *` is expected. This function sets the new system name and can consist of alphanumeric and the special characters dash, underbar, and dollar sign. The system name argument is restricted to `SYS_NMLN` characters. `SYS_NMLN` is an implementation specific value defined in `<sys/utsname.h>`. This command is available only to the superuser.

DIAGNOSTICS

On success, `sysm88k` returns a value that depends on *cmd* as follows:

| | |
|------------------------------|--|
| <code>SM88KSYM</code> | A value of zero. |
| <code>SM88KCONF</code> | A value of zero. |
| <code>SM88KBOOT</code> | A value of zero. |
| <code>CRASHDUMP</code> | A value of zero. |
| <code>SM88KAUTO</code> | A value of zero if an existing bootable operating system (such as <code>/stand/stand/unix</code> or <code>/stand/unix</code>) was last booted. A value of one if a new bootable operating system was configured during the last boot process. |
| <code>SM88KTRAPLOCORE</code> | Returns the setting of low core protection prior to the call. |

Otherwise, a value of `-1` is returned and `errno` is set to indicate the error. When *cmd* is invalid, `errno` is set to `EINVAL` on return.

SEE ALSO

`cunix(1M)`, `swap(1M)`, `sync(2)`, `a.out(4)`

NAME

system - issue a shell command

SYNOPSIS

```
#include <stdlib.h>

int system (const char *string);
```

DESCRIPTION

`system` causes the *string* to be given to the shell [see `sh(1)`] as input, as if the string had been typed as a command at a terminal. The current process waits until the shell has completed, then returns the exit status of the shell in the format specified by `waitpid(2)`.

If *string* is a `NULL` pointer, `system` checks if `/sbin/sh` exists and is executable. If `/sbin/sh` is available, `system` returns non-zero; otherwise it returns zero.

`system` fails if one or more of the following are true:

- | | |
|--------|---|
| EAGAIN | The system-imposed limit on the total number of processes under execution by a single user would be exceeded. |
| EINTR | <code>system</code> was interrupted by a signal. |
| ENOMEM | The new process requires more memory than is allowed by the system-imposed maximum <code>MAXMEM</code> . |

SEE ALSO

`sh(1)`, `exec(2)`, `waitpid(2)`.

DIAGNOSTICS

`system` forks to create a child process that in turn `execs` `/sbin/sh` in order to execute *string*. If the fork or `exec` fails, `system` returns -1 and sets `errno`.

NAME

t_accept - accept a connect request

SYNOPSIS

```
#include <tiuser.h>

int t_accept( int fd, int resfd, struct t_call *call);
```

DESCRIPTION

This function is issued by a transport user to accept a connect request. `fd` identifies the local transport endpoint where the connect indication arrived, `resfd` specifies the local transport endpoint where the connection is to be established, and `call` contains information required by the transport provider to complete the connection. `call` points to a `t_call` structure that contains the following members:

```
    struct netbuf addr;
    struct netbuf opt;
    struct netbuf udata;
    int sequence;
```

`netbuf` is described in `intro(3N)`. In `call`, `addr` is the address of the caller, `opt` indicates any protocol-specific parameters associated with the connection, `udata` points to any user data to be returned to the caller, and `sequence` is the value returned by `t_listen` that uniquely associates the response with a previously received connect indication.

A transport user may accept a connection on either the same, or on a different, local transport endpoint from the one on which the connect indication arrived. If the same endpoint is specified (that is, `resfd=fd`), the connection can be accepted unless the following condition is true: The user has received other indications on that endpoint but has not responded to them (with `t_accept` or `t_snddis`). For this condition, `t_accept` will fail and set `t_errno` to `TBADF`.

If a different transport endpoint is specified (`resfd!=fd`), the endpoint must be bound to a protocol address and must be in the `T_IDLE` state [see `t_getstate(3N)`] before the `t_accept` is issued.

For both types of endpoints, `t_accept` will fail and set `t_errno` to `TLOOK` if there are indications (for example, a connect or disconnect) waiting to be received on that endpoint.

The values of parameters specified by `opt` and the syntax of those values are protocol specific. The `udata` argument enables the called transport user to send user data to the caller and the amount of user data must not exceed the limits supported by the transport provider as returned in the `connect` field of the `info` argument of `t_open` or `t_getinfo`. If the `len` [see `netbuf` in `intro(3N)`] field of `udata` is zero, no data will be sent to the caller.

On failure, `t_errno` may be set to one of the following:

| | |
|--------------------|---|
| <code>TBADF</code> | The specified file descriptor does not refer to a transport endpoint, or the user is invalidly accepting a connection on the same transport endpoint on which the connect indication arrived. |
|--------------------|---|

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| | |
|-------------|--|
| TOUTSTATE | The function was issued in the wrong sequence on the transport endpoint referenced by <code>fd</code> , or the transport endpoint referred to by <code>resfd</code> is not in the <code>T_IDLE</code> state. |
| TACCES | The user does not have permission to accept a connection on the responding transport endpoint or use the specified options. |
| TBADOPT | The specified options were in an incorrect format or contained invalid information. |
| TBADDATA | The amount of user data specified was not within the bounds supported by the transport provider as returned in the <code>connect</code> field of the <code>info</code> argument of <code>t_open</code> or <code>t_getinfo</code> . |
| TBADSEQ | An invalid sequence number was specified. |
| TLOOK | An asynchronous event has occurred on the transport endpoint referenced by <code>fd</code> and requires immediate attention. |
| TNOTSUPPORT | This function is not supported by the underlying transport provider. |
| TSYSERR | A system error has occurred during execution of this function. |

SEE ALSO

`intro(3N)`, `t_connect(3N)`, `t_getstate(3N)`, `t_listen(3N)`, `t_open(3N)`, `t_rcvconnect(3N)`.

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `t_errno` is set to indicate the error.

NAME

t_alloc - allocate a library structure

SYNOPSIS

```
#include <tiuser.h>

char *t_alloc(fd, struct_type, fields)
int fd;
int struct_type;
int fields;
```

DESCRIPTION

The t_alloc function dynamically allocates memory for the various transport function argument structures as specified below. This function will allocate memory for the specified structure, and will also allocate memory for buffers referenced by the structure.

The structure to allocate is specified by struct_type, and can be one of the following:

| | |
|------------|-------------------|
| T_BIND | struct t_bind |
| T_CALL | struct t_call |
| T_OPTMGMT | struct t_optmgmt |
| T_DIS | struct t_discon |
| T_UNITDATA | struct t_unitdata |
| T_UDERROR | struct t_uderr |
| T_INFO | struct t_info |

where each of these structures may subsequently be used as an argument to one or more transport functions.

Each of the above structures, except T_INFO, contains at least one field of type struct netbuf. netbuf is described in intro(3N). For each field of this type, the user may specify that the buffer for that field should be allocated as well. The fields argument specifies this option, where the argument is the bitwise-OR of any of the following:

| | |
|---------|--|
| T_ADDR | The addr field of the t_bind, t_call, t_unitdata, or t_uderr structures. |
| T_OPT | The opt field of the t_optmgmt, t_call, t_unitdata, or t_uderr structures. |
| T_UDATA | The udata field of the t_call, t_discon, or t_unitdata structures. |
| T_ALL | All relevant fields of the given structure. |

For each field specified in fields, t_alloc will allocate memory for the buffer associated with the field, and initialize the buf pointer and maxlen [see netbuf in intro(3N) for description of buf and maxlen] field accordingly. The length of the buffer allocated will be based on the same size information that is returned to the user on t_open and t_getinfo. Thus, fd must refer to the transport endpoint through which the newly allocated structure will be passed, so that the appropriate size information can be accessed. If the size value associated with any specified field is -1, t_alloc will allocate the buffer with the size of 1024 bytes. If the size

value is -2, `t_alloc` will set the buffer pointer to `NULL` and the buffer maximum size to 0 and will return with success. For any field not specified in `fields`, `buf` will be set to `NULL` and `maxlen` will be set to zero.

Use of `t_alloc` to allocate structures will help ensure the compatibility of user programs with future releases of the transport interface.

On failure, `t_errno` may be set to one of the following:

`TBADF` The specified file descriptor does not refer to a transport endpoint.

`TSYSERR` A system error has occurred during execution of this function.

SEE ALSO

`intro(3N)`, `t_free(3N)`, `t_getinfo(3N)`, `t_open(3N)`.

DIAGNOSTICS

On successful completion, `t_alloc` returns a pointer to the newly allocated structure. On failure, `NULL` is returned.

NAME

t_bind - bind an address to a transport endpoint

SYNOPSIS

```
#include <tiuser.h>

int t_bind (fd, req, ret)
int fd;
struct t_bind *req;
struct t_bind *ret;
```

DESCRIPTION

This function associates a protocol address with the transport endpoint specified by `fd` and activates that transport endpoint. In connection mode, the transport provider may begin accepting or requesting connections on the transport endpoint. In connectionless mode, the transport user may send or receive data units through the transport endpoint.

The `req` and `ret` arguments point to a `t_bind` structure containing the following members:

```
    struct netbuf addr;
    unsigned qlen;
```

`netbuf` is described in `intro(3N)`. The `addr` field of the `t_bind` structure specifies a protocol address and the `qlen` field is used to indicate the maximum number of outstanding connect indications.

`req` is used to request that an address, represented by the `netbuf` structure, be bound to the given transport endpoint. `len` [see `netbuf` in `intro(3N)`]; also for `buf` and `maxlen`] specifies the number of bytes in the address and `buf` points to the address buffer. `maxlen` has no meaning for the `req` argument. On return, `ret` contains the address that the transport provider actually bound to the transport endpoint; this may be different from the address specified by the user in `req`. In `ret`, the user specifies `maxlen`, which is the maximum size of the address buffer, and `buf`, which points to the buffer where the address is to be placed. On return, `len` specifies the number of bytes in the bound address and `buf` points to the bound address. If `maxlen` is not large enough to hold the returned address, an error will result.

If the requested address is not available, or if no address is specified in `req` (the `len` field of `addr` in `req` is zero) the transport provider may assign an appropriate address to be bound, and will return that address in the `addr` field of `ret`. The user can compare the addresses in `req` and `ret` to determine whether the transport provider bound the transport endpoint to a different address than that requested.

`req` may be `NULL` if the user does not wish to specify an address to be bound. Here, the value of `qlen` is assumed to be zero, and the transport provider must assign an address to the transport endpoint. Similarly, `ret` may be `NULL` if the user does not care what address was bound by the provider and is not interested in the negotiated value of `qlen`. It is valid to set `req` and `ret` to `NULL` for the same call, in which case the provider chooses the address to bind to the transport endpoint and does not return that information to the user.

The `qlen` field has meaning only when initializing a connection-mode service. It specifies the number of outstanding connect indications the transport provider should support for the given transport endpoint. An outstanding connect indication is one that has been passed to the transport user by the transport provider. A value of `qlen` greater than zero is only meaningful when issued by a passive transport user that expects other users to call it. The value of `qlen` will be negotiated by the transport provider and may be changed if the transport provider cannot support the specified number of outstanding connect indications. On return, the `qlen` field in `ret` will contain the negotiated value.

This function allows more than one transport endpoint to be bound to the same protocol address (however, the transport provider must support this capability also), but it is not allowable to bind more than one protocol address to the same transport endpoint. If a user binds more than one transport endpoint to the same protocol address, only one endpoint can be used to listen for connect indications associated with that protocol address. In other words, only one `t_bind` for a given protocol address may specify a value of `qlen` greater than zero. In this way, the transport provider can identify which transport endpoint should be notified of an incoming connect indication. If a user attempts to bind a protocol address to a second transport endpoint with a value of `qlen` greater than zero, the transport provider will assign another address to be bound to that endpoint. If a user accepts a connection on the transport endpoint that is being used as the listening endpoint, the bound protocol address will be found to be busy for the duration of that connection. No other transport endpoints may be bound for listening while that initial listening endpoint is in the data transfer phase. This will prevent more than one transport endpoint bound to the same protocol address from accepting connect indications.

On failure, `t_errno` may be set to one of the following:

| | |
|-------------|--|
| [TBADF] | The specified file descriptor does not refer to a transport endpoint. |
| [TOUTSTATE] | The function was issued in the wrong sequence. |
| [TBADADDR] | The specified protocol address was in an incorrect format or contained illegal information. |
| [TNOADDR] | The transport provider could not allocate an address. |
| [TACCES] | The user does not have permission to use the specified address. |
| [TBUFOVFLW] | The number of bytes allowed for an incoming argument is not sufficient to store the value of that argument. The provider's state will change to [T_IDLE] and the information to be returned in <code>ret</code> will be discarded. |
| TSYSERR | A system error has occurred during execution of this function. |

SEE ALSO

`t_open(3N)`, `t_optmgmt(3N)`, `t_unbind(3N)`.

DIAGNOSTICS

`t_bind` returns 0 on success and -1 on failure and `t_errno` is set to indicate the error.

NAME

t_close - close a transport endpoint

SYNOPSIS

```
#include <tiuser.h>
int t_close(fd)
int fd;
```

DESCRIPTION

The `t_close` function informs the transport provider that the user is finished with the transport endpoint specified by `fd`, and frees any local library resources associated with the endpoint. In addition, `t_close` closes the file associated with the transport endpoint.

`t_close` should be called from the `T_UNBND` state [see `t_getstate(3N)`]. However, this function does not check state information, so it may be called from any state to close a transport endpoint. If this occurs, the local library resources associated with the endpoint will be freed automatically. In addition, `close(2)` will be issued for that file descriptor; the close will be abortive if no other process has that file open, and will break any transport connection that may be associated with that endpoint.

On failure, `t_errno` may be set to the following:

`TBADF` The specified file descriptor does not refer to a transport endpoint.

SEE ALSO

`t_getstate(3N)`, `t_open(3N)`, `t_unbind(3N)`.

DIAGNOSTICS

`t_close` returns 0 on success and -1 on failure and `t_errno` is set to indicate the error.

NAME

t_connect - establish a connection with another transport user

SYNOPSIS

```
#include <tiuser.h>

int t_connect(fd, sndcall, rcvcall)
int fd;
struct t_call *sndcall;
struct t_call *rcvcall;
```

DESCRIPTION

This function enables a transport user to request a connection to the specified destination transport user. `fd` identifies the local transport endpoint where communication will be established, while `sndcall` and `rcvcall` point to a `t_call` structure that contains the following members:

```
struct netbuf addr;
struct netbuf opt;
struct netbuf udata;
int sequence;
```

`sndcall` specifies information needed by the transport provider to establish a connection and `rcvcall` specifies information that is associated with the newly established connection.

`netbuf` is described in [intro\(3N\)](#). In `sndcall`, `addr` specifies the protocol address of the destination transport user, `opt` presents any protocol-specific information that might be needed by the transport provider, `udata` points to optional user data that may be passed to the destination transport user during connection establishment, and `sequence` has no meaning for this function.

On return in `rcvcall`, `addr` returns the protocol address associated with the responding transport endpoint, `opt` presents any protocol-specific information associated with the connection, `udata` points to optional user data that may be returned by the destination transport user during connection establishment, and `sequence` has no meaning for this function.

The `opt` argument implies no structure on the options that may be passed to the transport provider. The transport provider is free to specify the structure of any options passed to it. These options are specific to the underlying protocol of the transport provider. The user may choose not to negotiate protocol options by setting the `len` field of `opt` to zero. In this case, the provider may use default options.

The `udata` argument enables the caller to pass user data to the destination transport user and receive user data from the destination user during connection establishment. However, the amount of user data must not exceed the limits supported by the transport provider as returned in the `connect` field of the `info` argument of `t_open` or `t_getinfo`. If the `len` [see `netbuf` in [intro\(3N\)](#)] field of `udata` is zero in `sndcall`, no data will be sent to the destination transport user.

On return, the `addr`, `opt`, and `udata` fields of `rcvcall` will be updated to reflect values associated with the connection. Thus, the `maxlen` [see `netbuf` in [intro\(3N\)](#)] field of each argument must be set before issuing this function to indicate the maximum size of the buffer for each. However, `rcvcall` may be NULL, in which case no information is given to the user on return from `t_connect`.

By default, `t_connect` executes in synchronous mode, and will wait for the destination user's response before returning control to the local user. A successful return (that is, return value of zero) indicates that the requested connection has been established. However, if `O_NDELAY` or `O_NONBLOCK` is set (via `t_open` or `fcntl`), `t_connect` executes in asynchronous mode. In this case, the call will not wait for the remote user's response, but will return control immediately to the local user and return -1 with `t_errno` set to `TNODATA` to indicate that the connection has not yet been established. In this way, the function simply initiates the connection establishment procedure by sending a connect request to the destination transport user.

On failure, `t_errno` may be set to one of the following:

| | |
|--------------------------|--|
| <code>TBADF</code> | The specified file descriptor does not refer to a transport endpoint. |
| <code>TOUTSTATE</code> | The function was issued in the wrong sequence. |
| <code>TNODATA</code> | <code>O_NDELAY</code> or <code>O_NONBLOCK</code> was set, so the function successfully initiated the connection establishment procedure, but did not wait for a response from the remote user. |
| <code>TBADADDR</code> | The specified protocol address was in an incorrect format or contained invalid information. |
| <code>TBADOPT</code> | The specified protocol options were in an incorrect format or contained invalid information. |
| <code>TBADDATA</code> | The amount of user data specified was not within the bounds supported by the transport provider as returned in the <code>connect</code> field of the <code>info</code> argument of <code>t_open</code> or <code>t_getinfo</code> . |
| <code>TACCES</code> | The user does not have permission to use the specified address or options. |
| <code>TBUFOVFLW</code> | The number of bytes allocated for an incoming argument is not sufficient to store the value of that argument. If executed in synchronous mode, the provider's state, as seen by the user, changes to <code>T_DATAXFER</code> , and the connect indication information to be returned in <code>rcvcall</code> is discarded. |
| <code>TLOOK</code> | An asynchronous event has occurred on this transport endpoint and requires immediate attention. |
| <code>TNOTSUPPORT</code> | This function is not supported by the underlying transport provider. |
| <code>TSYSERR</code> | A system error has occurred during execution of this function. |

SEE ALSO

`intro(3N)`, `t_accept(3N)`, `t_getinfo(3N)`, `t_listen(3N)`, `t_open(3N)`, `t_optmgmt(3N)`, `t_rcvconnect(3N)`.

DIAGNOSTICS

`t_connect` returns 0 on success and -1 on failure and `t_errno` is set to indicate the error.

NAME

t_error - produce error message

SYNOPSIS

```
#include <tiuser.h>

void t_error(errmsg)
char *errmsg;
extern int t_errno;
extern char *t_errlist[];
extern int t_nerr;
```

DESCRIPTION

t_error produces a message on the standard error output which describes the last error encountered during a call to a transport function. The argument string errmsg is a user-supplied error message that gives context to the error.

t_error prints the user-supplied error message followed by a colon and the standard transport function error message for the current value contained in t_errno. If t_errno is TSYSEERR, t_error will also print the standard error message for the current value contained in errno [see intro(2)].

t_errlist is the array of message strings, to allow user message formatting. t_errno can be used as an index into this array to retrieve the error message string (without a terminating newline). t_nerr is the maximum index value for the t_errlist array.

t_errno is set when an error occurs and is not cleared on subsequent successful calls.

EXAMPLE

If a t_connect function fails on transport endpoint fd2 because a bad address was given, the following call might follow the failure:

```
t_error("t_connect failed on fd2");
```

The diagnostic message would print as:

```
t_connect failed on fd2: Incorrect transport address format
```

where "t_connect failed on fd2" tells the user which function failed on which transport endpoint, and "Incorrect transport address format" identifies the specific error that occurred.

NAME

t_free - free a library structure

SYNOPSIS

```
#include <tiuser.h>

int t_free(ptr, struct_type)
char *ptr;
int struct_type;
```

DESCRIPTION

The `t_free` function frees memory previously allocated by `t_alloc`. This function will free memory for the specified structure, and will also free memory for buffers referenced by the structure.

`ptr` points to one of the six structure types described for `t_alloc`, and `struct_type` identifies the type of that structure, which can be one of the following:

| | |
|------------|-------------------|
| T_BIND | struct t_bind |
| T_CALL | struct t_call |
| T_OPTMGMT | struct t_optmgmt |
| T_DIS | struct t_discon |
| T_UNITDATA | struct t_unitdata |
| T_UDERROR | struct t_uderr |
| T_INFO | struct t_info |

where each of these structures is used as an argument to one or more transport functions.

`t_free` will check the `addr`, `opt`, and `udata` fields of the given structure (as appropriate), and free the buffers pointed to by the `buf` field of the `netbuf` [see `intro(3N)`] structure. If `buf` is `NULL`, `t_free` will not attempt to free memory. After all buffers are freed, `t_free` will free the memory associated with the structure pointed to by `ptr`.

Undefined results will occur if `ptr` or any of the `buf` pointers points to a block of memory that was not previously allocated by `t_alloc`.

On failure, `t_errno` may be set to the following:

| | |
|---------|--|
| TSYSERR | A system error has occurred during execution of this function. |
|---------|--|

SEE ALSO

`intro(3N)`, `t_alloc(3N)`.

DIAGNOSTICS

`t_free` returns 0 on success and -1 on failure and `t_errno` is set to indicate the error.

NAME

t_getinfo - get protocol-specific service information

SYNOPSIS

```
#include <tiuser.h>

int t_getinfo(fd, info)
int fd;
struct t_info *info;
```

DESCRIPTION

This function returns the current characteristics of the underlying transport protocol associated with file descriptor `fd`. The `info` structure is used to return the same information returned by `t_open`. This function enables a transport user to access this information during any phase of communication.

This argument points to a `t_info` structure, which contains the following members:

```
long addr;          /* max size of the transport protocol address */
long options;      /* max number of bytes of protocol-specific options */
long tsdu;         /* max size of a transport service data unit (TSDU) */
long etsdu;        /* max size of an expedited transport service data unit (ETSDU) */
long connect;      /* max amount of data allowed on connection establishment functions */
long discon;       /* max amount of data allowed on t_snddis and t_rcvdis functions */
long servtype;     /* service type supported by the transport provider */
```

The values of the fields have the following meanings:

| | |
|---------|--|
| addr | A value greater than or equal to zero indicates the maximum size of a transport protocol address; a value of -1 specifies that the size of the field will be set to the default of 1024 bytes by <code>t_alloc</code> ; and a value of -2 specifies that the transport provider does not provide user access to transport protocol addresses. |
| options | A value greater than or equal to zero indicates the maximum number of bytes of protocol-specific options supported by the provider; a value of -1 specifies that the size of the field will be set to the default of 1024 bytes by <code>t_alloc</code> ; and a value of -2 specifies that the transport provider does not support user-settable options. |
| tsdu | A value greater than zero specifies the maximum size of a transport service data unit (TSDU); a value of zero specifies that the transport provider does not support the concept of TSDU, although it does support the sending of a data stream with no logical boundaries preserved across a connection; a value of -1 specifies that the size of the field will be set to the default of 1024 bytes by <code>t_alloc</code> ; and a value of -2 specifies that the transfer of normal data is not supported by the transport provider. |
| etsdu | A value greater than zero specifies the maximum size of an expedited transport service data unit (ETSDU); a value of zero specifies that the transport provider does not support the concept of ETSDU, although it does support the sending of an expedited data stream with no logical boundaries preserved across a connection; a value of -1 specifies that the size of the field will be set to the |

default of 1024 bytes by `t_alloc`; and a value of -2 specifies that the transfer of expedited data is not supported by the transport provider.

| | |
|-----------------------|---|
| <code>connect</code> | A value greater than or equal to zero specifies the maximum amount of data that may be associated with connection establishment functions; a value of -1 specifies that the size of the field will be set to the default of 1024 bytes by <code>t_alloc</code> ; and a value of -2 specifies that the transport provider does not allow data to be sent with connection establishment functions. |
| <code>discon</code> | A value greater than or equal to zero specifies the maximum amount of data that may be associated with the <code>t_snddis</code> and <code>t_rcvdis</code> functions; a value of -1 specifies that the size of the field will be set to the default of 1024 bytes by <code>t_alloc</code> ; and a value of -2 specifies that the transport provider does not allow data to be sent with the abortive release functions. |
| <code>servtype</code> | This field specifies the service type supported by the transport provider, as described below. |

If a transport user is concerned with protocol independence, the above sizes may be accessed to determine how large the buffers must be to hold each piece of information. Alternatively, the `t_alloc` function may be used to allocate these buffers. An error will result if a transport user exceeds the allowed data size on any function. The value of each field may change as a result of option negotiation, and `t_getinfo` enables a user to retrieve the current characteristics.

The `servtype` field of `info` may specify one of the following values on return:

| | |
|-------------------------|--|
| <code>T_COTS</code> | The transport provider supports a connection-mode service but does not support the optional orderly release facility. |
| <code>T_COTS_ORD</code> | The transport provider supports a connection-mode service with the optional orderly release facility. |
| <code>T_CLTS</code> | The transport provider supports a connectionless-mode service. For this service type, <code>t_open</code> will return -2 for <code>etsdu</code> , <code>connect</code> , and <code>discon</code> . |

On failure, `t_errno` may be set to one of the following:

| | |
|----------------------|---|
| <code>TBADF</code> | The specified file descriptor does not refer to a transport endpoint. |
| <code>TSYSERR</code> | A system error has occurred during execution of this function. |

SEE ALSO

`t_open(3N)`.

DIAGNOSTICS

`t_getinfo` returns 0 on success and -1 on failure and `t_errno` is set to indicate the error.

NAME

t_getstate - get the current state

SYNOPSIS

```
#include <tiuser.h>
int t_getstate(fd)
int fd;
```

DESCRIPTION

The t_getstate function returns the current state of the provider associated with the transport endpoint specified by fd.

On failure, t_errno may be set to one of the following:

| | |
|------------|---|
| TBADF | The specified file descriptor does not refer to a transport endpoint. |
| TSTATECHNG | The transport provider is undergoing a state change. |
| TSYSERR | A system error has occurred during execution of this function. |

SEE ALSO

t_open(3N).

DIAGNOSTICS

t_getstate returns the current state on successful completion and -1 on failure and t_errno is set to indicate the error. The current state may be one of the following:

| | |
|------------|--|
| T_UNBND | unbound |
| T_IDLE | idle |
| T_OUTCON | outgoing connection pending |
| T_INCON | incoming connection pending |
| T_DATAXFER | data transfer |
| T_OUTREL | outgoing orderly release (waiting for an orderly release indication) |
| T_INREL | incoming orderly release (waiting for an orderly release request) |

If the provider is undergoing a state transition when t_getstate is called, the function will fail.

NAME

t_listen - listen for a connect request

SYNOPSIS

```
#include <tiuser.h>

int t_listen(fd, call)
int fd;
struct t_call *call;
```

DESCRIPTION

This function listens for a connect request from a calling transport user. fd identifies the local transport endpoint where connect indications arrive, and on return, call contains information describing the connect indication. call points to a t_call structure, which contains the following members:

```
struct netbuf addr;
struct netbuf opt;
struct netbuf udata;
int sequence;
```

netbuf is described in intro(3N). In call, addr returns the protocol address of the calling transport user, opt returns protocol-specific parameters associated with the connect request, udata returns any user data sent by the caller on the connect request, and sequence is a number that uniquely identifies the returned connect indication. The value of sequence enables the user to listen for multiple connect indications before responding to any of them.

Since this function returns values for the addr, opt, and udata fields of call, the maxlen [see netbuf in intro(3N)] field of each must be set before issuing t_listen to indicate the maximum size of the buffer for each.

By default, t_listen executes in synchronous mode and waits for a connect indication to arrive before returning to the user. However, if O_NDELAY or O_NONBLOCK is set (via t_open or fcntl), t_listen executes asynchronously, reducing to a poll for existing connect indications. If none are available, it returns -1 and sets t_errno to TNO_DATA.

On failure, t_errno may be set to one of the following:

| | |
|-----------|--|
| TBADF | The specified file descriptor does not refer to a transport endpoint. |
| TBUFOVFLW | The number of bytes allocated for an incoming argument is not sufficient to store the value of that argument. The provider's state, as seen by the user, changes to T_INCON, and the connect indication information to be returned in call is discarded. |
| TNO_DATA | O_NDELAY or O_NONBLOCK was set, but no connect indications had been queued. |
| TLOOK | An asynchronous event has occurred on this transport endpoint and requires immediate attention. |

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TNOTSUPPORT

This function is not supported by the underlying transport provider.

TSYSERR

A system error has occurred during execution of this function.

NOTES

If a user issues `t_listen` in synchronous mode on a transport endpoint that was not bound for listening (that is, `qlen` was zero on `t_bind`), the call will wait forever because no connect indications will arrive on that endpoint.

SEE ALSO

`intro(3N)`, `t_accept(3N)`, `t_bind(3N)`, `t_connect(3N)`, `t_open(3N)`,
`t_rcvconnect(3N)`.

DIAGNOSTICS

`t_listen` returns 0 on success and -1 on failure and `t_errno` is set to indicate the error.

NAME

t_look - look at the current event on a transport endpoint

SYNOPSIS

```
#include <tiuser.h>
int t_look(fd)
int fd;
```

DESCRIPTION

This function returns the current event on the transport endpoint specified by `fd`. This function enables a transport provider to notify a transport user of an asynchronous event when the user is issuing functions in synchronous mode. Certain events require immediate notification of the user and are indicated by a specific error, `TLOOK`, on the current or next function to be executed.

This function also enables a transport user to poll a transport endpoint periodically for asynchronous events.

On failure, `t_errno` may be set to one of the following:

| | |
|----------------------|---|
| <code>TBADF</code> | The specified file descriptor does not refer to a transport endpoint. |
| <code>TSYSERR</code> | A system error has occurred during execution of this function. |

SEE ALSO

`t_open(3N)`.

DIAGNOSTICS

Upon success, `t_look` returns a value that indicates which of the allowable events has occurred, or returns zero if no event exists. One of the following events is returned:

| | |
|---------------------------|--------------------------------|
| <code>T_LISTEN</code> | connection indication received |
| <code>T_CONNECT</code> | connect confirmation received |
| <code>T_DATA</code> | normal data received |
| <code>T_EXDATA</code> | expedited data received |
| <code>T_DISCONNECT</code> | disconnect received |
| <code>T_UDERR</code> | datagram error indication |
| <code>T_ORDREL</code> | orderly release indication |

On failure, `-1` is returned and `t_errno` is set to indicate the error.

NAME

t_open - establish a transport endpoint

SYNOPSIS

```
#include <tiuser.h>
#include <fcntl.h>

int t_open (char path, int oflag, struct t_info *info);
```

DESCRIPTION

t_open must be called as the first step in the initialization of a transport endpoint. This function establishes a transport endpoint by opening a UNIX file that identifies a particular transport provider (that is, transport protocol) and returning a file descriptor that identifies that endpoint. For example, opening the file /dev/iso_cots identifies an OSI connection-oriented transport layer protocol as the transport provider.

path points to the path name of the file to open, and oflag identifies any open flags [as in open(2)]. oflag may be constructed from O_NDELAY or O_NONBLOCK OR-ed with O_RDWR. These flags are defined in the header file <fcntl.h>. t_open returns a file descriptor that will be used by all subsequent functions to identify the particular local transport endpoint.

t_open also returns various default characteristics of the underlying transport protocol by setting fields in the t_info structure. The t_info argument points to a t_info structure that contains the following members:

```
long addr;          /* maximum size of the transport protocol address */
long options;      /* maximum number of bytes of protocol-specific options */
long tsdu;         /* maximum size of a transport service data unit (TSDU) */
long etsdu;       /* maximum size of an expedited transport service data unit (ETSDU) */
long connect;     /* maximum amount of data allowed on connection establishment
                  functions */
long discon;      /* maximum amount of data allowed on t_snddis and t_rcvdis
                  functions */
long servtype;    /* service type supported by the transport provider */
```

The values of the fields have the following meanings:

| | |
|---------|--|
| addr | A value greater than or equal to zero indicates the maximum size of a transport protocol address; a value of -1 specifies that the size of the field will be set to the default of 1024 bytes by t_alloc(); and a value of -2 specifies that the transport provider does not provide user access to transport protocol addresses. |
| options | A value greater than or equal to zero indicates the maximum number of bytes of protocol-specific options supported by the provider; a value of -1 specifies that the size of the field will be set to the default of 1024 bytes by t_alloc(); and a value of -2 specifies that the transport provider does not support user-settable options. |
| tsdu | A value greater than zero specifies the maximum size of a transport service data unit (TSDU); a value of zero specifies that the transport provider does not support the concept of TSDU, although it does support the sending of a data stream with no logical boundaries preserved across a connection; a value of -1 specifies that the size of |

the field will be set to the default of 1024 bytes by `t_alloc()`; and a value of -2 specifies that the transfer of normal data is not supported by the transport provider.

| | |
|----------|---|
| etsdu | A value greater than zero specifies the maximum size of an expedited transport service data unit (ETSDU); a value of zero specifies that the transport provider does not support the concept of ETSDU, although it does support the sending of an expedited data stream with no logical boundaries preserved across a connection; a value of -1 specifies that the size of the field will be set to the default of 1024 bytes by <code>t_alloc()</code> ; and a value of -2 specifies that the transfer of expedited data is not supported by the transport provider. |
| connect | A value greater than or equal to zero specifies the maximum amount of data that may be associated with connection establishment functions; a value of -1 specifies that the size of the field will be set to the default of 1024 bytes by <code>t_alloc()</code> ; and a value of -2 specifies that the transport provider does not allow data to be sent with connection establishment functions. |
| discon | A value greater than or equal to zero specifies the maximum amount of data that may be associated with the <code>t_snddis</code> and <code>t_rcvdis</code> functions; a value of -1 specifies that the size of the field will be set to the default of 1024 bytes by <code>t_alloc()</code> ; and a value of -2 specifies that the transport provider does not allow data to be sent with the abortive release functions. |
| servtype | This field specifies the service type supported by the transport provider, as described below. |

If a transport user is concerned with protocol independence, the above sizes may be accessed to determine how large the buffers must be to hold each piece of information. Alternatively, the `t_alloc` function may be used to allocate these buffers. An error will result if a transport user exceeds the allowed data size on any function.

The `servtype` field of `info` may specify one of the following values on return:

| | |
|------------|--|
| T_COTS | The transport provider supports a connection-mode service but does not support the optional orderly release facility. |
| T_COTS_ORD | The transport provider supports a connection-mode service with the optional orderly release facility. |
| T_CLTS | The transport provider supports a connectionless-mode service. For this service type, <code>t_open</code> will return -2 for <code>etsdu</code> , <code>connect</code> , and <code>discon</code> . |

A single transport endpoint may support only one of the above services at one time.

If `info` is set to `NULL` by the transport user, no protocol information is returned by `t_open`.

On failure, `t_errno` may be set to the following:

| | |
|-----------------------|--|
| <code>TSYSERR</code> | A system error has occurred during execution of this function. |
| <code>TBADFLAG</code> | An invalid flag is specified. |

DIAGNOSTICS

`t_open` returns a valid file descriptor on success and -1 on failure and `t_errno` is set to indicate the error.

NOTES

If `t_open` is used on a non-TLI-conforming STREAMS device, unpredictable events may occur.

SEE ALSO

`open(2)`.

NAME

t_optmgmt - manage options for a transport endpoint

SYNOPSIS

```
#include <tiuser.h>

int t_optmgmt (int fd, struct t_optmgmt *req, struct t_optmgmt *ret);
```

DESCRIPTION

The t_optmgmt function enables a transport user to retrieve, verify, or negotiate protocol options with the transport provider. fd identifies a bound transport endpoint.

The req and ret arguments point to a t_optmgmt structure containing the following members:

```
    struct netbuf opt;
    long flags;
```

The opt field identifies protocol options and the flags field is used to specify the action to take with those options.

The options are represented by a netbuf [see intro(3N)]; also for len, buf, and maxlen] structure in a manner similar to the address in t_bind. req is used to request a specific action of the provider and to send options to the provider. len specifies the number of bytes in the options, buf points to the options buffer, and maxlen has no meaning for the req argument. The transport provider may return options and flag values to the user through ret. For ret, maxlen specifies the maximum size of the options buffer and buf points to the buffer where the options are to be placed. On return, len specifies the number of bytes of options returned. maxlen has no meaning for the req argument, but must be set in the ret argument to specify the maximum number of bytes the options buffer can hold. The actual structure and content of the options is imposed by the transport provider.

The flags field of req can specify one of the following actions:

- | | |
|-------------|--|
| T_NEGOTIATE | This action enables the user to negotiate the values of the options specified in req with the transport provider. The provider will evaluate the requested options and negotiate the values, returning the negotiated values through ret. |
| T_CHECK | This action enables the user to verify whether the options specified in req are supported by the transport provider. On return, the flags field of ret will have either T_SUCCESS or T_FAILURE set to indicate to the user whether the options are supported. These flags are only meaningful for the T_CHECK request. |
| T_DEFAULT | This action enables a user to retrieve the default options supported by the transport provider into the opt field of ret. In req, the len field of opt must be zero and the buf field may be NULL. |

If issued as part of the connectionless-mode service, t_optmgmt may block due to flow control constraints. The function will not complete until the transport provider has processed all previously sent data units.

On failure, `t_errno` may be set to one of the following:

| | |
|-----------|---|
| TBADF | The specified file descriptor does not refer to a transport endpoint. |
| TOUTSTATE | The function was issued in the wrong sequence. |
| TACCES | The user does not have permission to negotiate the specified options. |
| TBADOPT | The specified protocol options were in an incorrect format or contained illegal information. |
| TBADFLAG | An invalid flag was specified. |
| TBUFOVFLW | The number of bytes allowed for an incoming argument is not sufficient to store the value of that argument. The information to be returned in <code>ret</code> will be discarded. |
| TSYSERR | A system error has occurred during execution of this function. |

SEE ALSO

`intro(3N)`, `t_getinfo(3N)`, `t_open(3N)`.

DIAGNOSTICS

`t_optmgmt` returns 0 on success and -1 on failure and `t_errno` is set to indicate the error.

NAME

t_rcv - receive data or expedited data sent over a connection

SYNOPSIS

```
int t_rcv (int fd, char *buf, unsigned nbytes, int *flags);
```

DESCRIPTION

This function receives either normal or expedited data. `fd` identifies the local transport endpoint through which data will arrive, `buf` points to a receive buffer where user data will be placed, and `nbytes` specifies the size of the receive buffer. `flags` may be set on return from `t_rcv` and specifies optional flags as described below.

By default, `t_rcv` operates in synchronous mode and will wait for data to arrive if none is currently available. However, if `O_NDELAY` or `O_NONBLOCK` is set (via `t_open` or `fcntl`), `t_rcv` will execute in asynchronous mode and will fail if no data is available. (See `TNODATA` below.)

On return from the call, if `T_MORE` is set in `flags`, this indicates that there is more data and the current transport service data unit (TSDU) or expedited transport service data unit (ETSDU) must be received in multiple `t_rcv` calls. Each `t_rcv` with the `T_MORE` flag set indicates that another `t_rcv` must follow to get more data for the current TSDU. The end of the TSDU is identified by the return of a `t_rcv` call with the `T_MORE` flag not set. If the transport provider does not support the concept of a TSDU as indicated in the `info` argument on return from `t_open` or `t_getinfo`, the `T_MORE` flag is not meaningful and should be ignored.

On return, the data returned is expedited data if `T_EXPEDITED` is set in `flags`. If the number of bytes of expedited data exceeds `nbytes`, `t_rcv` will set `T_EXPEDITED` and `T_MORE` on return from the initial call. Subsequent calls to retrieve the remaining ETSDU will have `T_EXPEDITED` set on return. The end of the ETSDU is identified by the return of a `t_rcv` call with the `T_MORE` flag not set.

If expedited data arrives after part of a TSDU has been retrieved, receipt of the remainder of the TSDU will be suspended until the ETSDU has been processed. Only after the full ETSDU has been retrieved (`T_MORE` not set) will the remainder of the TSDU be available to the user.

On failure, `t_errno` may be set to one of the following:

| | |
|-------------|---|
| TBADF | The specified file descriptor does not refer to a transport endpoint. |
| TNODATA | <code>O_NDELAY</code> or <code>O_NONBLOCK</code> was set, but no data is currently available from the transport provider. |
| TLOOK | An asynchronous event has occurred on this transport endpoint and requires immediate attention. |
| TNOTSUPPORT | This function is not supported by the underlying transport provider. |
| TSYSERR | A system error has occurred during execution of this function. |

SEE ALSO

`t_open(3N)`, `t_snd(3N)`.

t_rcv(3N)

(Networking Support Utilities)

t_rcv(3N)

DIAGNOSTICS

On successful completion, `t_rcv` returns the number of bytes received, and it returns -1 on failure and `t_errno` is set to indicate the error.

NAME

t_rcvconnect - receive the confirmation from a connect request

SYNOPSIS

```
#include <tiuser.h>

int t_rcvconnect (int fd, struct t_call *call);
```

DESCRIPTION

This function enables a calling transport user to determine the status of a previously sent connect request and is used in conjunction with t_connect to establish a connection in asynchronous mode. The connection will be established on successful completion of this function.

fd identifies the local transport endpoint where communication will be established, and call contains information associated with the newly established connection. call points to a t_call structure which contains the following members:

```
    struct netbuf addr;
    struct netbuf opt;
    struct netbuf udata;
    int sequence;
```

netbuf is described in intro(3N). In call, addr returns the protocol address associated with the responding transport endpoint, opt presents any protocol-specific information associated with the connection, udata points to optional user data that may be returned by the destination transport user during connection establishment, and sequence has no meaning for this function.

The maxlen [see netbuf in intro(3N)] field of each argument must be set before issuing this function to indicate the maximum size of the buffer for each. However, call may be NULL, in which case no information is given to the user on return from t_rcvconnect. By default, t_rcvconnect executes in synchronous mode and waits for the connection to be established before returning. On return, the addr, opt, and udata fields reflect values associated with the connection.

If O_NDELAY or O_NONBLOCK is set (via t_open or fcntl), t_rcvconnect executes in asynchronous mode, and reduces to a poll for existing connect confirmations. If none are available, t_rcvconnect fails and returns immediately without waiting for the connection to be established. (See TNODATA below.) t_rcvconnect must be re-issued at a later time to complete the connection establishment phase and retrieve the information returned in call.

On failure, t_errno may be set to one of the following:

| | |
|-----------|--|
| TBADF | The specified file descriptor does not refer to a transport endpoint. |
| TBUFOVFLW | The number of bytes allocated for an incoming argument is not sufficient to store the value of that argument and the connect information to be returned in call will be discarded. The provider's state, as seen by the user, will be changed to DATAXFER. |

t_rcvconnect(3N)**(Networking Support Utilities)****t_rcvconnect(3N)**

| | |
|-------------|---|
| TNODATA | O_NDELAY or O_NONBLOCK was set, but a connect confirmation has not yet arrived. |
| TLOOK | An asynchronous event has occurred on this transport connection and requires immediate attention. |
| TNOTSUPPORT | This function is not supported by the underlying transport provider. |
| TSYSERR | A system error has occurred during execution of this function. |

SEE ALSO

intro(3N), t_accept(3N), t_bind(3N), t_connect(3N), t_listen(3N), t_open(3N).

DIAGNOSTICS

t_rcvconnect returns 0 on success and -1 on failure and t_errno is set to indicate the error.

NAME

t_rcvdis - retrieve information from disconnect

SYNOPSIS

```
#include <tiuser.h>

t_rcvdis (int fd, struct t_discon *discon);
```

DESCRIPTION

This function is used to identify the cause of a disconnect, and to retrieve any user data sent with the disconnect. `fd` identifies the local transport endpoint where the connection existed, and `discon` points to a `t_discon` structure containing the following members:

```
    struct netbuf udata;
    int reason;
    int sequence;
```

`netbuf` is described in `intro(3N)`. `reason` specifies the reason for the disconnect through a protocol-dependent reason code, `udata` identifies any user data that was sent with the disconnect, and `sequence` may identify an outstanding connect indication with which the disconnect is associated. `sequence` is only meaningful when `t_rcvdis` is issued by a passive transport user who has executed one or more `t_listen` functions and is processing the resulting connect indications. If a disconnect indication occurs, `sequence` can be used to identify which of the outstanding connect indications is associated with the disconnect.

If a user does not care if there is incoming data and does not need to know the value of `reason` or `sequence`, `discon` may be `NULL` and any user data associated with the disconnect will be discarded. However, if a user has retrieved more than one outstanding connect indication (via `t_listen`) and `discon` is `NULL`, the user will be unable to identify which connect indication the disconnect is associated with.

On failure, `t_errno` may be set to one of the following:

| | |
|-------------|---|
| TBADF | The specified file descriptor does not refer to a transport endpoint. |
| TNODIS | No disconnect indication currently exists on the specified transport endpoint. |
| TBUFOVFLW | The number of bytes allocated for incoming data is not sufficient to store the data. The provider's state, as seen by the user, will change to <code>T_IDLE</code> , and the disconnect indication information to be returned in <code>discon</code> will be discarded. |
| TNOTSUPPORT | This function is not supported by the underlying transport provider. |
| TSYSERR | A system error has occurred during execution of this function. |

t_rcvdis(3N)

(Networking Support Utilities)

t_rcvdis(3N)

SEE ALSO

intro(3N), t_connect(3N), t_listen(3N), t_open(3N), t_snddis(3N).

DIAGNOSTICS

t_rcvdis returns 0 on success and -1 on failure and t_errno is set to indicate the error.

NAME

t_rcvrel - acknowledge receipt of an orderly release indication

SYNOPSIS

```
#include <tiuser.h>
t_rcvrel (int fd);
```

DESCRIPTION

This function is used to acknowledge receipt of an orderly release indication. fd identifies the local transport endpoint where the connection exists. After receipt of this indication, the user should not attempt to receive more data because such an attempt will block forever. However, the user may continue to send data over the connection if t_sndrel has not been issued by the user.

This function is an optional service of the transport provider, and is only supported if the transport provider returned service type T_COTS_ORD on t_open or t_getinfo.

On failure, t_errno may be set to one of the following:

| | |
|-------------|---|
| TBADF | The specified file descriptor does not refer to a transport endpoint. |
| TNOREL | No orderly release indication currently exists on the specified transport endpoint. |
| TLOOK | An asynchronous event has occurred on this transport endpoint and requires immediate attention. |
| TNOTSUPPORT | This function is not supported by the underlying transport provider. |
| TSYSERR | A system error has occurred during execution of this function. |

SEE ALSO

t_open(3N), t_sndrel(3N).

DIAGNOSTICS

t_rcvrel returns 0 on success and -1 on failure t_errno is set to indicate the error.

NAME

t_rcvudata - receive a data unit

SYNOPSIS

```
#include <tiuser.h>
int t_rcvudata (int fd, struct t_unitdata *unitdata, int *flags);
```

DESCRIPTION

This function is used in connectionless mode to receive a data unit from another transport user. `fd` identifies the local transport endpoint through which data will be received, `unitdata` holds information associated with the received data unit, and `flags` is set on return to indicate that the complete data unit was not received. `unitdata` points to a `t_unitdata` structure containing the following members:

```
struct netbuf addr;
struct netbuf opt;
struct netbuf udata;
```

The `maxlen` [see `netbuf` in `intro(3N)`] field of `addr`, `opt`, and `udata` must be set before issuing this function to indicate the maximum size of the buffer for each.

On return from this call, `addr` specifies the protocol address of the sending user, `opt` identifies protocol-specific options that were associated with this data unit, and `udata` specifies the user data that was received.

By default, `t_rcvudata` operates in synchronous mode and will wait for a data unit to arrive if none is currently available. However, if `O_NDELAY` or `O_NONBLOCK` is set (via `t_open` or `fcntl`), `t_rcvudata` will execute in asynchronous mode and will fail if no data units are available.

If the buffer defined in the `udata` field of `unitdata` is not large enough to hold the current data unit, the buffer will be filled and `T_MORE` will be set in `flags` on return to indicate that another `t_rcvudata` should be issued to retrieve the rest of the data unit. Subsequent `t_rcvudata` call(s) will return zero for the length of the address and options until the full data unit has been received.

On failure, `t_errno` may be set to one of the following:

| | |
|-------------|---|
| TBADF | The specified file descriptor does not refer to a transport endpoint. |
| TNODATA | <code>O_NDELAY</code> or <code>O_NONBLOCK</code> was set, but no data units are currently available from the transport provider. |
| TBUFOVFLW | The number of bytes allocated for the incoming protocol address or options is not sufficient to store the information. The unit data information to be returned in <code>unitdata</code> will be discarded. |
| TLOOK | An asynchronous event has occurred on this transport endpoint and requires immediate attention. |
| TNOTSUPPORT | This function is not supported by the underlying transport provider. |

t_rcvudata (3N)

(Networking Support Utilities)

t_rcvudata (3N)

TSYSERR

A system error has occurred during execution of this function.

SEE ALSO

intro(3N), t_rcvuderr(3N), t_sndudata(3N).

DIAGNOSTICS

t_rcvudata returns 0 on successful completion and -1 on failure and t_errno is set to indicate the error.

NAME

t_rcvuderr - receive a unit data error indication

SYNOPSIS

```
#include <tiuser.h>

int t_rcvuderr (int fd, struct t_uderr *uderr);
```

DESCRIPTION

This function is used in connectionless mode to receive information concerning an error on a previously sent data unit, and should be issued only after a unit data error indication. It informs the transport user that a data unit with a specific destination address and protocol options produced an error. `fd` identifies the local transport endpoint through which the error report will be received, and `uderr` points to a `t_uderr` structure containing the following members:

```
struct netbuf addr;
struct netbuf opt;
long error;
```

`netbuf` is described in [intro\(3N\)](#). The `maxlen` [see `netbuf` in [intro\(3N\)](#)] field of `addr` and `opt` must be set before issuing this function to indicate the maximum size of the buffer for each.

On return from this call, the `addr` structure specifies the destination protocol address of the erroneous data unit, the `opt` structure identifies protocol-specific options that were associated with the data unit, and `error` specifies a protocol-dependent error code.

If the user does not care to identify the data unit that produced an error, `uderr` may be set to `NULL` and `t_rcvuderr` will simply clear the error indication without reporting any information to the user.

On failure, `t_errno` may be set to one of the following:

| | |
|-------------|--|
| TBADF | The specified file descriptor does not refer to a transport endpoint. |
| TNOUDERR | No unit data error indication currently exists on the specified transport endpoint. |
| TBUFOVFLW | The number of bytes allocated for the incoming protocol address or options is not sufficient to store the information. The unit data error information to be returned in <code>uderr</code> will be discarded. |
| TNOTSUPPORT | This function is not supported by the underlying transport provider. |
| TSYSERR | A system error has occurred during execution of this function. |

SEE ALSO

[intro\(3N\)](#), [t_rcvudata\(3N\)](#), [t_sndudata\(3N\)](#).

DIAGNOSTICS

`t_rcvuderr` returns 0 on successful completion and -1 on failure and `t_errno` is set to indicate the error.

NAME

t_snd - send data or expedited data over a connection

SYNOPSIS

```
#include <tiuser.h>

int t_snd(int fd, char *buf, unsigned nbytes, int flags);
```

DESCRIPTION

This function is used to send either normal or expedited data. `fd` identifies the local transport endpoint over which data should be sent, `buf` points to the user data, `nbytes` specifies the number of bytes of user data to be sent, and `flags` specifies any optional flags described below.

By default, `t_snd` operates in synchronous mode and may wait if flow control restrictions prevent the data from being accepted by the local transport provider at the time the call is made. However, if `O_NDELAY` or `O_NONBLOCK` is set (via `t_open` or `fcntl`), `t_snd` will execute in asynchronous mode, and will fail immediately if there are flow control restrictions.

Even when there are no flow control restrictions, `t_snd` will wait if STREAMS internal resources are not available, regardless of the state of `O_NDELAY` or `O_NONBLOCK`.

On successful completion, `t_snd` returns the number of bytes accepted by the transport provider. Normally this will equal the number of bytes specified in `nbytes`. However, if `O_NDELAY` or `O_NONBLOCK` is set, it is possible that only part of the data will be accepted by the transport provider. In this case, `t_snd` will set `T_MORE` for the data that was sent (see below) and will return a value less than `nbytes`. If `nbytes` is zero and sending of zero bytes is not supported by the underlying transport provider, `t_snd()` will return -1 with `t_errno` set to `TBADDATA`. A return value of zero indicates that the request to send a zero-length data message was sent to the provider.

If `T_EXPEDITED` is set in `flags`, the data will be sent as expedited data, and will be subject to the interpretations of the transport provider.

If `T_MORE` is set in `flags`, or is set as described above, an indication is sent to the transport provider that the transport service data unit (TSDU) or expedited transport service data unit (ETSDU) is being sent through multiple `t_snd` calls. Each `t_snd` with the `T_MORE` flag set indicates that another `t_snd` will follow with more data for the current TSDU. The end of the TSDU (or ETSDU) is identified by a `t_snd` call with the `T_MORE` flag not set. Use of `T_MORE` enables a user to break up large logical data units without losing the boundaries of those units at the other end of the connection. The flag implies nothing about how the data is packaged for transfer below the transport interface. If the transport provider does not support the concept of a TSDU as indicated in the `info` argument on return from `t_open` or `t_getinfo`, the `T_MORE` flag is not meaningful and should be ignored.

The size of each TSDU or ETSDU must not exceed the limits of the transport provider as returned by `t_open` or `t_getinfo`. If the size is exceeded, a `TSYSERR` with system error `EPROTO` will occur. However, the `t_snd` may not fail because `EPROTO` errors may not be reported immediately. In this case, a subsequent call that accesses the transport endpoint will fail with the associated `TSYSERR`.

If `t_snd` is issued from the `T_IDLE` state, the provider may silently discard the data. If `t_snd` is issued from any state other than `T_DATAXFER`, `T_INREL` or `T_IDLE`, the provider will generate a `TSYSERR` with system error `EPROTO` (which may be reported in the manner described above).

On failure, `t_errno` may be set to one of the following:

| | |
|--------------------------|---|
| <code>TBADF</code> | The specified file descriptor does not refer to a transport endpoint. |
| <code>TFLOW</code> | <code>O_NDELAY</code> or <code>O_NONBLOCK</code> was set, but the flow control mechanism prevented the transport provider from accepting data at this time. |
| <code>TNOTSUPPORT</code> | This function is not supported by the underlying transport provider. |
| <code>TSYSERR</code> | A system error [see <code>intro(2)</code>] has been detected during execution of this function. |
| <code>TBADDATA</code> | <code>nbytes</code> is zero and sending zero bytes is not supported by the transport provider. |

NOTES

The `t_snd` routine does not look for a disconnect indication (showing that the connection was broken) before passing data to the provider.

SEE ALSO

`t_open(3N)`, `t_rcv(3N)`.

DIAGNOSTICS

On successful completion, `t_snd` returns the number of bytes accepted by the transport provider, and it returns -1 on failure and `t_errno` is set to indicate the error.

NAME

t_snddis - send user-initiated disconnect request

SYNOPSIS

```
#include <tiuser.h>

int t_snddis (int fd, struct t_call *call);
```

DESCRIPTION

This function is used to initiate an abortive release on an already established connection or to reject a connect request. `fd` identifies the local transport endpoint of the connection, and `call` specifies information associated with the abortive release. `call` points to a `t_call` structure that contains the following members:

```
struct netbuf addr;
struct netbuf opt;
struct netbuf udata;
int sequence;
```

`netbuf` is described in `intro(3N)`. The values in `call` have different semantics, depending on the context of the call to `t_snddis`. When rejecting a connect request, `call` must be non-NULL and contain a valid value of `sequence` to identify uniquely the rejected connect indication to the transport provider. The `addr` and `opt` fields of `call` are ignored. In all other cases, `call` need only be used when data is being sent with the disconnect request. The `addr`, `opt`, and `sequence` fields of the `t_call` structure are ignored. If the user does not want to send data to the remote user, the value of `call` may be NULL.

`udata` specifies the user data to be sent to the remote user. The amount of user data must not exceed the limits supported by the transport provider as returned in the `discon` field of the `info` argument of `t_open` or `t_getinfo`. If the `len` field of `udata` is zero, no data will be sent to the remote user.

On failure, `t_errno` may be set to one of the following:

| | |
|-----------|---|
| TBADF | The specified file descriptor does not refer to a transport endpoint. |
| TOUTSTATE | The function was issued in the wrong sequence. The transport provider's outgoing queue may be flushed, so data may be lost. |
| TBADDATA | The amount of user data specified was not within the bounds supported by the transport provider as returned in the <code>discon</code> field of the <code>info</code> argument of <code>t_open</code> or <code>t_getinfo</code> . The transport provider's outgoing queue will be flushed, so data may be lost. |
| TBADSEQ | An invalid sequence number was specified, or a NULL <code>call</code> structure was specified when rejecting a connect request. The transport provider's outgoing queue will be flushed, so data may be lost. |
| TLOOK | An asynchronous event has occurred on this transport endpoint and requires immediate attention. |

t_snddis (3N)

(Networking Support Utilities)

t_snddis (3N)

TNOTSUPPORT

This function is not supported by the underlying transport provider.

TSYSERR

A system error has occurred during execution of this function.

SEE ALSO

intro(3N), t_connect(3N), t_getinfo(3N), t_listen(3N), t_open(3N).

DIAGNOSTICS

t_snddis returns 0 on success and -1 on failure and t_errno is set to indicate the error.

NAME

t_sndrel - initiate an orderly release

SYNOPSIS

```
#include <tiuser.h>
int t_sndrel (int fd);
```

DESCRIPTION

This function is used to initiate an orderly release of a transport connection and indicates to the transport provider that the transport user has no more data to send. fd identifies the local transport endpoint where the connection exists. After issuing t_sndrel, the user may not send any more data over the connection. However, a user may continue to receive data if an orderly release indication has not been received.

This function is an optional service of the transport provider, and is only supported if the transport provider returned service type T_COTS_ORD on t_open or t_getinfo.

If t_sndrel is issued from an invalid state, the provider will generate an EPROTO protocol error; however, this error may not occur until a subsequent reference to the transport endpoint.

On failure, t_errno may be set to one of the following:

| | |
|-------------|---|
| TBADF | The specified file descriptor does not refer to a transport endpoint. |
| TFLOW | O_NDELAY or O_NONBLOCK was set, but the flow control mechanism prevented the transport provider from accepting the function at this time. |
| TNOTSUPPORT | This function is not supported by the underlying transport provider. |
| TSYSERR | A system error has occurred during execution of this function. |

SEE ALSO

t_open(3N), t_rcvrel(3N).

DIAGNOSTICS

t_sndrel returns 0 on success and -1 on failure and t_errno is set to indicate the error.

NAME

t_sndudata - send a data unit

SYNOPSIS

```
#include <tiuser.h>

int t_sndudata (int fd, struct t_unitdata *unitdata);
```

DESCRIPTION

This function is used in connectionless mode to send a data unit to another transport user. `fd` identifies the local transport endpoint through which data will be sent, and `unitdata` points to a `t_unitdata` structure containing the following members:

```
    struct netbuf addr;
    struct netbuf opt;
    struct netbuf udata;
```

`netbuf` is described in `intro(3N)`. In `unitdata`, `addr` specifies the protocol address of the destination user, `opt` identifies protocol-specific options that the user wants associated with this request, and `udata` specifies the user data to be sent. The user may choose not to specify what protocol options are associated with the transfer by setting the `len` field of `opt` to zero. In this case, the provider may use default options.

If the `len` field of `udata` is zero, and the sending of zero bytes is not supported by the underlying transport provider, `t_sndudata` will return `-1` with `t_errno` set to `TBADDATA`.

By default, `t_sndudata` operates in synchronous mode and may wait if flow control restrictions prevent the data from being accepted by the local transport provider at the time the call is made. However, if `O_NDELAY` or `O_NONBLOCK` is set (via `t_open` or `fcntl`), `t_sndudata` will execute in asynchronous mode and will fail under such conditions.

If `t_sndudata` is issued from an invalid state, or if the amount of data specified in `udata` exceeds the TSDU size as returned in the `tsdu` field of the `info` argument of `t_open` or `t_getinfo`, the provider will generate an `EPROTO` protocol error. (See `TSYSERR` below.) If the state is invalid, this error may not occur until a subsequent reference is made to the transport endpoint.

On failure, `t_errno` may be set to one of the following:

| | |
|--------------------------|---|
| <code>TBADF</code> | The specified file descriptor does not refer to a transport endpoint. |
| <code>TFLOW</code> | <code>O_NDELAY</code> or <code>O_NONBLOCK</code> was set, but the flow control mechanism prevented the transport provider from accepting data at this time. |
| <code>TNOTSUPPORT</code> | This function is not supported by the underlying transport provider. |
| <code>TSYSERR</code> | A system error has occurred during execution of this function. |
| <code>TBADDATA</code> | <code>nbytes</code> is zero and sending zero bytes is not supported by the transport provider. |

t_sndudata (3N)

(Networking Support Utilities)

t_sndudata (3N)

SEE ALSO

intro(3N), t_rcvudata(3N), t_rcvuderr(3N).

DIAGNOSTICS

t_sndudata returns 0 on successful completion and -1 on failure t_errno is set to indicate the error.

NAME

t_sync - synchronize transport library

SYNOPSIS

```
#include <tiuser.h>
int t_sync (int fd);
```

DESCRIPTION

For the transport endpoint specified by `fd`, `t_sync` synchronizes the data structures managed by the transport library with information from the underlying transport provider. In doing so, it can convert a raw file descriptor [obtained via `open(2)`, `dup(2)`, or as a result of a `fork(2)` and `exec(2)`] to an initialized transport endpoint, assuming that file descriptor referenced a transport provider. This function also allows two cooperating processes to synchronize their interaction with a transport provider.

For example, if a process `forks` a new process and issues an `exec`, the new process must issue a `t_sync` to build the private library data structure associated with a transport endpoint and to synchronize the data structure with the relevant provider information.

It is important to remember that the transport provider treats all users of a transport endpoint as a single user. If multiple processes are using the same endpoint, they should coordinate their activities so as not to violate the state of the provider. `t_sync` returns the current state of the provider to the user, thereby enabling the user to verify the state before taking further action. This coordination is only valid among cooperating processes; it is possible that a process or an incoming event could change the provider's state *after* a `t_sync` is issued.

If the provider is undergoing a state transition when `t_sync` is called, the function will fail.

On failure, `t_errno` may be set to one of the following:

| | |
|------------|---|
| TBADF | The specified file descriptor does not refer to a transport endpoint. |
| TSTATECHNG | The transport provider is undergoing a state change. |
| TSYSERR | A system error has occurred during execution of this function. |

SEE ALSO

`dup(2)`, `exec(2)`, `fork(2)`, `open(2)`.

DIAGNOSTICS

`t_sync` returns the state of the transport provider on successful completion and -1 on failure and `t_errno` is set to indicate the error. The state returned may be one of the following:

t_sync(3N)

(Networking Support Utilities)

t_sync(3N)

| | |
|------------|--|
| T_UNBND | unbound |
| T_IDLE | idle |
| T_OUTCON | outgoing connection pending |
| T_INCON | incoming connection pending |
| T_DATAXFER | data transfer |
| T_OUTREL | outgoing orderly release (waiting for an orderly release indication) |
| T_INREL | incoming orderly release (waiting for an orderly release request) |

NAME

t_unbind - disable a transport endpoint

SYNOPSIS

```
#include <tiuser.h>
int t_unbind (int fd);
```

DESCRIPTION

The t_unbind function disables the transport endpoint specified by fd which was previously bound by t_bind(3N). On completion of this call, no further data or events destined for this transport endpoint will be accepted by the transport provider.

On failure, t_errno may be set to one of the following:

| | |
|-----------|---|
| TBADF | The specified file descriptor does not refer to a transport endpoint. |
| TOUTSTATE | The function was issued in the wrong sequence. |
| TLOOK | An asynchronous event has occurred on this transport endpoint. |
| TSYSERR | A system error has occurred during execution of this function. |

SEE ALSO

t_bind(3N).

DIAGNOSTICS

t_unbind returns 0 on success and -1 on failure and t_errno is set to indicate the error.

NAME

tam - TAM transition libraries

SYNOPSIS

```
#include <tam.h>
cc -I /usr/include/tam [flags] files -ltam -lcurses [libraries]
```

DESCRIPTION

These routines are used to port UNIX PC character-based TAM programs so that they will run using any terminal supported by curses(3X), the low-level ETI library. Once a TAM program has been changed to remove machine-specific code, it can be recompiled with the standard TAM header file <tam.h> and linked with the TAM transition and curses(3X) libraries.

Note that TAM will probably not be supported in future releases.

FUNCTIONS

The following is a list of TAM routines supplied in the transition library. Those routines marked with a dagger (†) are macros and do not return a value.

```
addch (c)†                               See curses(3X).
char c;

addstr (s)†
char *s;

int adf_gttok (ptr, tbl)                   See paste(3X).
char *ptr;
struct s_kwtbl *tbl;

char *adf_gtwrđ (sptr, dptr)
char *sptr, *dptr;

char *adf_gtxcd (sptr, dptr)
char *sptr, *dptr;

int attroff (attrs)                        See curses(3X).
long attrs;

int attron(attrs)
long attrs;

int baudrate()

int beep()

int cbreak()

int clear()

clearok (dummy, dummy)†
int dummy;

int clrrobot()

int clrtoeol()

int delch()
```

tam(3X)**tam(3X)**

```

int deleteln()
int echo()
int endwin()
erase()†
int exhelp (hfile, htitle).           See message(3T).
char *hfile, *htitle;
int fixterm()                         See curses(3X).
flash()†
int flushing()
int form (form, op)                   See form(3X).
form_t *form;
int op;
int getch()                           See curses(3X).
getyx(win, r, c)†
int win, r, c;
int initscr()
int insch(ch)
char ch;
int insertln()
int iswind()                           See tam(3X); always returns 0.
char *kcodemap (code).                See curses(3X).
unsigned char code;
int keypad (dummy, flag)
int dummy, flag;
leaveok (dummy, dummy)†
int dummy;
int menu (menu, op)                   See menu(3X).
menu_t *menu;
int op;
int message (mtype, hfile, htitle, format [, arg ...])
                                         See message(3X).
int mtype;
char *hfile, *htitle, *format;
move(r, c)†                            See curses(3X).
int r, c;
mvaddch (r, c, ch)†
int r, c;
char ch;

```

```

mvaddstr (r, c, s)†
int r, c;
char *s;
unsigned long mvinch(r, c)
int r, c;
nl()†
int nocbreak()
int nodelay (dummy, bool)
int dummy, bool;
int noecho()
nonl()†
int pb_check (stream)
FILE *stream;
int pb_empty (stream)
FILE *stream;
int pb_gbuf (ptr, n, fn, stream)
char *ptr;
int n;
int (*fn) ();
FILE *stream;
char *pb_gets (ptr, n, stream)
char *ptr;
int n;
FILE *stream;
char *pb_name()
FILE *pb_open()
int pb_puts (ptr, stream)
char *ptr;
FILE *stream;
int pb_seek (stream)
FILE *stream;
int pb_weof (stream)
FILE *stream;
int printw (fmt[, arg1 ... argn])
char *fmt;
refresh()†
int resetterm()
int resetty()
int savetty()

```

Not supported

NOT SUPPORTED

See paste(3X).

See curses(3X).

tam(3X)**tam(3X)**

```

int track (w, trk, op, butptr, whyptr)
int w, op, *butptr, *whyptr;
track_t *trk;
int wcmd (wn, cp)
short wn;
char *cp;
int wcreate (row, col, height, width, flags)
short row, col, height, width;
unsigned short flags;
int wdelete (wn)
short wn;
void wexit(ret)
int ret;
int wgetc (wn)
short wn;
int wgetmouse (wn, ms)
short wn;
struct umdata *ms;
int wgetpos (wn, rowp, colp)
short wn;
int *rowp, *colp;
int wgetsel()
int wgetstat (wn, wstatp)
short wn;
WSTAT *wstatp;
int wgoto (wn, row, col)
short wn, row, col;
void wicoff (wn, row, col, icp)
short wn, row, col;
struct icon *icp;
void wicon (wn, row, col, icp)
short wn, row, col;
struct icon *icp;
int wind (type, height, width, flags, pfont)
int type, height, width;
short flags;
char *pfont[];
void winit()

```

See *wgetc()*.

See *tam(3X)*. Outputs a null-terminated string to the entry/echo line.

Creates a window.

Deletes the specified window.

See *tam(3X)*.

no-op; returns 0.

Gets the current position (row, column) of the cursor in the specified window (*wn*).

Returns the currently selected window.

Returns the information in WSTAT for a window.

Moves the window's cursor to a specified row, column.

no-op. returns 0.

no-op. returns 0.

See *wind(3X)*.

Sets up the process for window access. See *tam(3X)*.

| | |
|---|---|
| <pre>int wlabel (wn, cp) short wn; char *cp; int wndelay (wn, bool) int wn, bool; void wnl (wn, flag) short wn; int flag; int wpostwait() int wprexec()</pre> | <p>Outputs a null-terminated string to the window label area.</p> <p>Reverses the effects of <i>wprexec()</i>.</p> <p>Performs the appropriate actions for passing a window to a child process.</p> |
| <pre>int wprintf (wn, fmt[, arg1 ... argn]) short wn; char *fmt; int wprompt (wn, cp) short wn; char *cp; int wputc (wn, c) short wn; char c; int wputs (wn, cp) short wn; char *cp;</pre> | <p>Outputs a null-terminated string to the prompt line.</p> <p>Outputs a character to a window (<i>wn</i>).</p> <p>Outputs a character string to a window.</p> |
| <pre>int wrastop (w, srcbase, srcwidth, dstbase dstwidth, srcx, srcy, dstx, dsty, width, height, srcop, dstop, pattern) int w; unsigned short *srcbase, *dstbase, *pattern; unsigned short srcwidth, dswidth, width, height; unsigned short srcx, srcy, dstx, dsty; char srcop, dstop;</pre> | <p>NOT SUPPORTED.</p> |
| <pre>int wreadmouse (wn, xp, yp, bp, rp) short wn; int *xp, *yp, *bp, *rp; int wrefresh (wn) short wn; int wselect (wn) short wn; int wsetmouse (wn, ms)</pre> | <p>no-op; returns 0.</p> <p>Flushes all output to the window.</p> <p>Selects the specified window as the current or active one.</p> <p>no-op; returns 0.</p> |

tam(3X)**tam(3X)**

```

short wn;
struct umdata *ms;
int wsetstat (wn, wstatp)
short wn;
WSTAT *wstatp;
int wslk (wn, 0, slong1, slong2, sshort)

short wn;
char *slong1, *slong2, *sshort;
int wslk (wn, kn, llabel, slabel)
short wn, kn;
char *llabel, *slabel;

int wuser (wn, cp)
short wn;
char *cp;

```

Sets the status for a window.

Writes a null-terminated string to a set of screen-labeled keys.

Writes a null-terminated string to a screen-labeled key. The alternate form writes all the screen-labeled keys at once more efficiently.

Not supported

SEE ALSO

curses(3X)

NAME

tcsetpgrp - set terminal foreground process group id

SYNOPSIS

```
#include <unistd.h>

int tcsetpgrp (int fildes, pid_t pgid)
```

DESCRIPTION

tcsetpgrp sets the foreground process group ID of the terminal specified by *fildes* to *pgid*. The file associated with *fildes* must be the controlling terminal of the calling process and the controlling terminal must be currently associated with the session of the calling process. The value of *pgid* must match a process group ID of a process in the same session as the calling process.

tcsetpgrp fails if one or more of the following is true:

| | |
|--------|---|
| EBADF | The <i>fildes</i> argument is not a valid file descriptor. |
| EINVAL | The <i>fildes</i> argument is a terminal that does not support tcsetpgrp, or <i>pgid</i> is not a valid process group ID. |
| ENOTTY | The calling process does not have a controlling terminal, or the file is not the controlling terminal, or the controlling terminal is no longer associated with the session of the calling process. |
| EPERM | <i>pgid</i> does not match the process group ID of an existing process in the same session as the calling process. |

SEE ALSO

tcsetpgrp(3C), tcsetsid(3C), termio(7).

DIAGNOSTICS

Upon successful completion, tcsetpgrp returns a value of 0. Otherwise, a value of -1 is returned and errno is set to indicate the error.

NAME

termios: tcgetattr, tcsetattr, tcsendbreak, tcdrain, tcflush, tcflow, cfgetospeed, cfgetispeed, cfsetispeed, cfsetospeed, tcgetpgrp, tcsetpgrp, tcgetsid - **general terminal interface**

SYNOPSIS

```
#include <termios.h>

int tcgetattr(int fildes, struct termios *termios_p);
int tcsetattr(int fildes, int optional_actions,
              const struct termios *termios_p);
int tcsendbreak(int fildes, int duration);
int tcdrain(int fildes);
int tcflush(int fildes, int queue_selector);
int tcflow(int fildes, int action);
speed_t cfgetospeed(const struct termios *termios_p);
int cfsetospeed(struct termios *termios_p, speed_t speed);
speed_t cfgetispeed(const struct termios *termios_p);
int cfsetispeed(struct termios *termios_p, speed_t speed);
#include <sys/types.h>
#include <termios.h>
pid_t tcgetpgrp(int fildes);
int tcsetpgrp(int fildes, pid_t pgrp);
pid_t tcgetsid(int fildes);
```

DESCRIPTION

These functions describe a general terminal interface for controlling asynchronous communications ports. A more detailed overview of the terminal interface can be found in [termio\(7\)](#), which also describes an [ioctl\(2\)](#) interface that provides the same functionality. However, the function interface described here is the preferred user interface.

Many of the functions described here have a *termios_p* argument that is a pointer to a *termios* structure. This structure 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 */
```

These structure members are described in detail in [termio\(7\)](#).

Get and Set Terminal Attributes

The `tcgetattr` function gets the parameters associated with the object referred by *fildes* and stores them in the *termios* structure referenced by *termios_p*. This

function may be invoked from a background process; however, the terminal attributes may be subsequently changed by a foreground process.

The `tcsetattr` function sets the parameters associated with the terminal (unless support is required from the underlying hardware that is not available) from the `termios` structure referenced by `termios_p` as follows:

If `optional_actions` is `TCSANOW`, the change occurs immediately.

If `optional_actions` is `TCSADRAIN`, the change occurs after all output written to `fildev` has been transmitted. This function should be used when changing parameters that affect output.

If `optional_actions` is `TCSAFLUSH`, the change occurs after all output written to the object referred by `fildev` has been transmitted, and all input that has been received but not read is discarded before the change is made.

The symbolic constants for the values of `optional_actions` are defined in `termios.h`.

Line Control

If the terminal is using asynchronous serial data transmission, the `tcsendbreak` function causes transmission of a continuous stream of zero-valued bits for a specific duration. If `duration` is zero, it causes transmission of zero-valued bits for at least 0.25 seconds, and not more than 0.5 seconds. If `duration` is not zero, it behaves in a way similar to `tcdrain`.

If the terminal is not using asynchronous serial data transmission, the `tcsendbreak` function sends data to generate a break condition or returns without taking any action.

The `tcdrain` function waits until all output written to the object referred to by `fildev` has been transmitted.

The `tcflush` function discards data written to the object referred to by `fildev` but not transmitted, or data received but not read, depending on the value of `queue_selector`:

If `queue_selector` is `TCIFLUSH`, it flushes data received but not read.

If `queue_selector` is `TCOFLUSH`, it flushes data written but not transmitted.

If `queue_selector` is `TCIOFLUSH`, it flushes both data received but not read, and data written but not transmitted.

The `tcflow` function suspends transmission or reception of data on the object referred to by `fildev`, depending on the value of `action`:

If `action` is `TCOOFF`, it suspends output.

If `action` is `TCOON`, it restarts suspended output.

If `action` is `TCIOFF`, the system transmits a STOP character, which causes the terminal device to stop transmitting data to the system.

If `action` is `TCION`, the system transmits a START character, which causes the terminal device to start transmitting data to the system.

Get and Set Baud Rate

The baud rate functions `get` and `set` the values of the input and output baud rates in the `termios` structure. The effects on the terminal device described below do not become effective until the `tcsetattr` function is successfully called.

The input and output baud rates are stored in the `termios` structure. The values shown in the table are supported. The names in this table are defined in `termios.h`.

| Name | Description | Name | Description |
|------|-------------|--------|-------------|
| B0 | Hang up | B600 | 600 baud |
| B50 | 50 baud | B1200 | 1200 baud |
| B75 | 75 baud | B1800 | 1800 baud |
| B110 | 110 baud | B2400 | 2400 baud |
| B134 | 134.5 baud | B4800 | 4800 baud |
| B150 | 150 baud | B9600 | 9600 baud |
| B200 | 200 baud | B19200 | 19200 baud |
| B300 | 300 baud | B38400 | 38400 baud |

`cfgetospeed` gets the output baud rate stored in the `termios` structure pointed to by `termios_p`.

`cfsetospeed` sets the output baud rate stored in the `termios` structure pointed to by `termios_p` to `speed`. The zero baud rate, B0, is used to terminate the connection. If B0 is specified, the modem control lines are no longer asserted. Normally, this disconnects the line.

`cfgetispeed` gets the input baud rate and stores it in the `termios` structure pointed to by `termios_p`.

`cfsetispeed` sets the input baud rate stored in the `termios` structure pointed to by `termios_p` to `speed`. If the input baud rate is set to zero, the input baud rate is specified by the value of the output baud rate. Both `cfsetispeed` and `cfsetospeed` return a value of zero if successful and -1 to indicate an error. Attempts to set unsupported baud rates are ignored. This refers both to changes to baud rates not supported by the hardware, and to changes setting the input and output baud rates to different values if the hardware does not support this.

Get and Set Terminal Foreground Process Group ID

`tcsetpgrp` sets the foreground process group ID of the terminal specified by `fildev` to `pgid`. The file associated with `fildev` must be the controlling terminal of the calling process and the controlling terminal must be currently associated with the session of the calling process. `f2pgid` must match a process group ID of a process in the same session as the calling process.

`tcgetpgrp` returns the foreground process group ID of the terminal specified by `fildev`. `tcgetpgrp` is allowed from a process that is a member of a background process group; however, the information may be subsequently changed by a process that is a member of a foreground process group.

Get Terminal Session ID

`tcgetsid` returns the session ID of the terminal specified by `fildev`.

DIAGNOSTICS

On success, `tcgetpgrp` returns the process group ID of the foreground process group associated with the specified terminal. Otherwise, it returns -1 and sets `errno` to indicate the error.

On success, `tcgetsid` returns the session ID associated with the specified terminal. Otherwise, it returns `-1` and sets `errno` to indicate the error.

On success, `cfgetispeed` returns the input baud rate from the `termios` structure.

On success, `cfgetospeed` returns the output baud rate from the `termios` structure.

On success, all other functions return a value of `0`. Otherwise, they return `-1` and set `errno` to indicate the error.

All of the functions fail if one or more of the following is true:

`EBADF` The *fildev* argument is not a valid file descriptor.

`ENOTTY` The file associated with *fildev* is not a terminal.

`tcsetattr` also fails if the following is true:

`EINVAL` The *optional_actions* argument is not a proper value, or an attempt was made to change an attribute represented in the `termios` structure to an unsupported value.

`tcsendbreak` also fails if the following is true:

`EINVAL` The device does not support the `tcsendbreak` function.

`tcdrain` also fails if one or more of the following is true:

`EINTR` A signal interrupted the `tcdrain` function.

`EINVAL` The device does not support the `tcdrain` function.

`tcflush` also fails if the following is true:

`EINVAL` The device does not support the `tcflush` function or the *queue_selector* argument is not a proper value.

`tcflow` also fails if the following is true:

`EINVAL` The device does not support the `tcflow` function or the *action* argument is not a proper value.

`tcgetpgrp` also fails if the following is true:

`ENOTTY` the calling process does not have a controlling terminal, or *fildev* does not refer to the controlling terminal.

`tcsetpgrp` also fails if the following is true:

`EINVAL` *pgid* is not a valid process group ID.

`ENOTTY` the calling process does not have a controlling terminal, or *fildev* does not refer to the controlling terminal, or the controlling terminal is no longer associated with the session of the calling process.

`EPERM` *pgid* does not match the process group of an existing process in the same session as the calling process.

`tcgetsid` also fails if the following is true:

`EACCES` *fildev* is a terminal that is not allocated to a session.

termios(2)

termios(2)

SEE ALSO

setpgid(2), setsid(2), termio(7).

time (2)

time (2)

NAME

time - get time

SYNOPSIS

```
#include <sys/types.h>
#include <time.h>

time_t time(time_t *tloc);
```

DESCRIPTION

time returns the value of time in seconds since 00:00:00 UTC, January 1, 1970.

If *tloc* is non-zero, the return value is also stored in the location to which *tloc* points.

SEE ALSO

stime(2), ctime(3C)

NOTES

time fails and its actions are undefined if *tloc* points to an illegal address.

DIAGNOSTICS

Upon successful completion, time returns the value of time. Otherwise, a value of (time_t)-1 is returned and *errno* is set to indicate the error.

times(2)

times(2)

NAME

times - get process and child process times

SYNOPSIS

```
#include <sys/types.h>
#include <sys/times.h>

clock_t times(struct tms *buffer);
```

DESCRIPTION

times fills the tms structure pointed to by *buffer* with time-accounting information. The tms structure is defined in `sys/times.h` as follows:

```
struct tms {
    clock_t    tms_utime;
    clock_t    tms_stime;
    clock_t    tms_cutime;
    clock_t    tms_cstime;
};
```

This information comes from the calling process and each of its terminated child processes for which it has executed a wait routine. All times are reported in clock ticks per second. Clock ticks are a system-dependent parameter. The specific value for an implementation is defined by the variable `CLK_TCK`, found in the include file `limits.h`.

`tms_utime` is the CPU time used while executing instructions in the user space of the calling process.

`tms_stime` is the CPU time used by the system on behalf of the calling process.

`tms_cutime` is the sum of the `tms_utime` and the `tms_cutime` of the child processes.

`tms_cstime` is the sum of the `tms_stime` and the `tms_cstime` of the child processes.

times fails if:

EFAULT *buffer* points to an illegal address.

SEE ALSO

`time(1)`, `timex(1)`, `exec(2)`, `fork(2)`, `time(2)`, `wait(2)`, `waitid(2)`, `waitpid(3C)`.

DIAGNOSTICS

Upon successful completion, times returns the elapsed real time, in clock ticks per second, from an arbitrary point in the past (for example, system start-up time). This point does not change from one invocation of times to another. If times fails, a -1 is returned and `errno` is set to indicate the error.

NAME

times - get process times

SYNOPSIS

```
/usr/ucb/cc [flag...] file...  
#include <sys/types.h>  
#include <sys/times.h>  
  
times(buffer)  
struct tms *buffer;
```

DESCRIPTION

times returns time-accounting information for the current process and for the terminated child processes of the current process. All times are in 1/HZ seconds, where HZ is 60.

This is the structure returned by times:

```
struct tms {  
    time_t tms_utime;    /* user time */  
    time_t tms_stime;    /* system time */  
    time_t tms_cutime;   /* user time, children */  
    time_t tms_cstime;   /* system time, children */  
};
```

The children's times are the sum of the children's process times and their children's times.

SEE ALSO

time(1), wait(2), getrusage(3), time(3), wait(3).

NOTES

times has been superseded by getrusage.

NAME

timezone - get time zone name given offset from GMT

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
```

```
char *timezone(zone, dst)
```

```
int zone
```

```
int dst
```

DESCRIPTION

timezone attempts to return the name of the time zone associated with its first argument, which is measured in minutes westward from Greenwich. If the second argument is 0, the standard name is used, otherwise the Daylight Savings Time version. If the required name does not appear in a table built into the routine, the difference from GMT is produced; for instance, in Afghanistan `timezone(-(60*4+30), 0)` is appropriate because it is 4:30 ahead of GMT and the string `GMT+4:30` is produced.

SEE ALSO

`ctime(3)`.

NOTES

The offset westward from Greenwich and an indication of whether Daylight Savings Time is in effect may not be sufficient to determine the name of the time zone, as the name may differ between different locations in the same time zone. Instead of using `timezone` to determine the name of the time zone for a given time, that time should be converted to a `struct tm` using `localtime` [see `ctime(3)`] and the `tm_zone` field of that structure should be used. `timezone` is retained for compatibility with existing programs.

NAME

tmpfile - create a temporary file

SYNOPSIS

```
#include <stdio.h>
FILE *tmpfile (void);
```

DESCRIPTION

tmpfile creates a temporary file using a name generated by the tmpnam routine and returns a corresponding FILE pointer. If the file cannot be opened, a NULL pointer is returned. The file is automatically deleted when the process using it terminates or when the file is closed. The file is opened for update ("w+").

SEE ALSO

creat(2), open(2), unlink(2), fopen(3S), mktemp(3C), perror(3C), stdio(3S), tmpnam(3S)

NAME

tmpnam, tmpnam - create a name for a temporary file

SYNOPSIS

```
#include <stdio.h>
char *tmpnam (char *s);
char *tmpnam (const char *dir, const char *pfx);
```

DESCRIPTION

These functions generate file names that can safely be used for a temporary file.

tmpnam always generates a file name using the path-prefix defined as `P_tmpdir` in the `<stdio.h>` header file. If `s` is `NULL`, tmpnam leaves its result in an internal static area and returns a pointer to that area. The next call to tmpnam will destroy the contents of the area. If `s` is not `NULL`, it is assumed to be the address of an array of at least `L_tmpnam` bytes, where `L_tmpnam` is a constant defined in `<stdio.h>`; tmpnam places its result in that array and returns `s`.

tmpnam allows the user to control the choice of a directory. The argument `dir` points to the name of the directory in which the file is to be created. If `dir` is `NULL` or points to a string that is not a name for an appropriate directory, the path-prefix defined as `P_tmpdir` in the `<stdio.h>` header file is used. If that directory is not accessible, `/tmp` will be used as a last resort. This entire sequence can be up-staged by providing an environment variable `TMPDIR` in the user's environment, whose value is the name of the desired temporary-file directory.

Many applications prefer their temporary files to have certain favorite initial letter sequences in their names. Use the `pfx` argument for this. This argument may be `NULL` or point to a string of up to five characters to be used as the first few characters of the temporary-file name.

tmpnam uses `malloc` to get space for the constructed file name, and returns a pointer to this area. Thus, any pointer value returned from tmpnam may serve as an argument to `free` [see `malloc(3C)`]. If tmpnam cannot return the expected result for any reason— for example, `malloc` failed—or none of the above mentioned attempts to find an appropriate directory was successful, a `NULL` pointer will be returned.

tmpnam fails if there is not enough space.

FILES

`p_tmpdir /var/tmp`

SEE ALSO

`creat(2)`, `unlink(2)`, `fopen(3S)`, `malloc(3C)`, `mktemp(3C)`, `tmpfile(3S)`

NOTES

These functions generate a different file name each time they are called.

Files created using these functions and either `fopen` or `creat` are temporary only in the sense that they reside in a directory intended for temporary use, and their names are unique. It is the user's responsibility to remove the file when its use is ended.

If called more than `TMP_MAX` (defined in `stdio.h`) times in a single process, these functions start recycling previously used names.

Between the time a file name is created and the file is opened, it is possible for some other process to create a file with the same name. This can never happen if that other process is using these functions or `mktemp` and the file names are chosen to render duplication by other means unlikely.

NAME

trig: sin, sinf, cos, cosf, tan, tanf, asin, asinf, acos, acosf, atan, atanf, atan2, atan2f - trigonometric functions

SYNOPSIS

```
cc [flag ...] file... -lm [library ...]
cc -O -Ksd [flag ...] file... -J sfm [library ...]
#include <math.h>
double sin (double x);
float sinf (float x);
double cos (double x);
float cosf (float x);
double tan (double x);
float tanf (float x);
double asin (double x);
float asinf (float x);
double acos (double x);
float acosf (float x);
double atan (double x);
float atanf (float x);
double atan2 (double y, double x);
float atan2f (float y, float x);
```

DESCRIPTION

sin, cos, and tan and the single-precision versions sinf, cosf, and tanf return, respectively, the sine, cosine, and tangent of their argument, x , measured in radians.

asin and asinf return the arcsine of x , in the range $[-\pi/2, +\pi/2]$.

acos and acosf return the arccosine of x , in the range $[0, +\pi]$.

atan and atanf return the arctangent of x , in the range $(-\pi/2, +\pi/2)$.

atan2 and atan2f return the arctangent of y/x , in the range $(-\pi, +\pi]$, using the signs of both arguments to determine the quadrant of the return value.

SEE ALSO

matherr(3M)

DIAGNOSTICS

If the magnitude of the argument of asin, asinf, acos, or acosf is greater than 1, or if both arguments of atan2 or atan2f are 0, 0 is returned and errno is set to EDOM. In addition, a message indicating DOMAIN error is printed on the standard error output.

trig (3M)

(Math Libraries)

trig (3M)

Except when the `-Xc` compilation option is used, these error-handling procedures may be changed with the function `matherr`. When the `-Xa` or `-Xc` compilation options are used, no error messages are printed.

NAME

truncate, ftruncate - set a file to a specified length

SYNOPSIS

```
#include <unistd.h>

int truncate (const char *path, off_t length);
int ftruncate (int fildes, off_t length);
```

DESCRIPTION

The file whose name is given by *path* or referenced by the descriptor *fildes* has its size set to *length* bytes.

If the file was previously longer than *length*, bytes past *length* will no longer be accessible. If it was shorter, bytes from the EOF before the call to the EOF after the call will be read in as zeros. The effective user ID of the process must have write permission for the file, and for *ftruncate* the file must be open for writing.

truncate fails if one or more of the following are true:

| | |
|--------------|--|
| EACCES | Search permission is denied on a component of the path prefix. |
| EACCES | Write permission is denied for the file referred to by <i>path</i> . |
| EFAULT | <i>path</i> points outside the process's allocated address space. |
| EINTR | A signal was caught during execution of the <i>truncate</i> routine. |
| EINVAL | <i>path</i> is not an ordinary file. |
| EIO | An I/O error occurred while reading from or writing to the file system. |
| EISDIR | The file referred to by <i>path</i> is a directory. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMFILE | The maximum number of file descriptors available to the process has been reached. |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and file system type does not allow it. |
| ENAMETOOLONG | The length of a <i>path</i> component exceeds {NAME_MAX} characters, or the length of <i>path</i> exceeds {PATH_MAX} characters. |
| ENFILE | Could not allocate any more space for the system file table. |
| ENOENT | Either a component of the path prefix or the file referred to by <i>path</i> does not exist. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| ENOTDIR | A component of the path prefix of <i>path</i> is not a directory. |
| EROFS | The file referred to by <i>path</i> resides on a read-only file system. |
| ETXTBSY | The file referred to by <i>path</i> is a pure procedure (shared text) file that is being executed. |

`ftruncate` fails if one or more of the following are true:

| | |
|---------|---|
| EAGAIN | The file exists, mandatory file/record locking is set, and there are outstanding record locks on the file [see <code>chmod(2)</code>]. |
| EBADF | <i>fildev</i> is not a file descriptor open for writing. |
| EINTR | A signal was caught during execution of the <code>ftruncate</code> routine. |
| EIO | An I/O error occurred while reading from or writing to the file system. |
| ENOLINK | <i>fildev</i> points to a remote machine and the link to that machine is no longer active. |
| EINVAL | <i>fildev</i> does not correspond to an ordinary file. |

SEE ALSO

`fcntl(2)`, `open(2)`

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

tsearch, tfind, tdelete, twalk - manage binary search trees

SYNOPSIS

```
#include <search.h>

void *tsearch (const void *key, void **rootp, int (*compar)
              (const void *, const void *));

void *tfind (const void *key, void * const *rootp, int (*compar)
            (const void *, const void *));

void *tdelete (const void *key, void **rootp, int (*compar)
              (const void *, const void *));

void twalk (void *root, void(*action) (void *, VISIT, int));
```

DESCRIPTION

tsearch, tfind, tdelete, and twalk are routines for manipulating binary search trees. They are generalized from Knuth (6.2.2) Algorithms T and D. All comparisons are done with a user-supplied routine. This routine is called with two arguments, the pointers to the elements being compared. It returns an integer less than, equal to, or greater than 0, according to whether the first argument is to be considered less than, equal to or greater than the second argument. The comparison function need not compare every byte, so arbitrary data may be contained in the elements in addition to the values being compared.

tsearch is used to build and access the tree. *key* is a pointer to a datum to be accessed or stored. If there is a datum in the tree equal to *key (the value pointed to by *key*), a pointer to this found datum is returned. Otherwise, *key is inserted, and a pointer to it returned. Only pointers are copied, so the calling routine must store the data. *rootp* points to a variable that points to the root of the tree. A NULL value for the variable pointed to by *rootp* denotes an empty tree; in this case, the variable will be set to point to the datum which will be at the root of the new tree.

Like tsearch, tfind will search for a datum in the tree, returning a pointer to it if found. However, if it is not found, tfind will return a NULL pointer. The arguments for tfind are the same as for tsearch.

tdelete deletes a node from a binary search tree. The arguments are the same as for tsearch. The variable pointed to by *rootp* will be changed if the deleted node was the root of the tree. tdelete returns a pointer to the parent of the deleted node, or a NULL pointer if the node is not found.

twalk traverses a binary search tree. *root* is the root of the tree to be traversed. (Any node in a tree may be used as the root for a walk below that node.) *action* is the name of a routine to be invoked at each node. This routine is, in turn, called with three arguments. The first argument is the address of the node being visited. The second argument is a value from an enumeration data type `typedef enum { preorder, postorder, endorder, leaf } VISIT;` (defined in the search.h header file), depending on whether this is the first, second or third time that the node has been visited (during a depth-first, left-to-right traversal of the tree), or whether the node is a leaf. The third argument is the level of the node in the tree, with the root being level zero.

The pointers to the key and the root of the tree should be of type pointer-to-element, and cast to type pointer-to-character. Similarly, although declared as type pointer-to-character, the value returned should be cast into type pointer-to-element.

EXAMPLE

The following code reads in strings and stores structures containing a pointer to each string and a count of its length. It then walks the tree, printing out the stored strings and their lengths in alphabetical order.

```
#include <string.h>
#include <stdio.h>
#include <search.h>

struct node {
    char *string;
    int length;
};
char string_space[10000];
struct node nodes[500];
void *root = NULL;

int node_compare(const void *node1, const void *node2) {
    return strcmp(((const struct node *) node1)->string,
                 ((const struct node *) node2)->string);
}

void print_node(void **node, VISIT order, int level) {
    if (order == preorder || order == leaf) {
        printf("length=%d, string=%20s\n",
              (*(struct node **)node)->length,
              (*(struct node **)node)->string);
    }
}

main() {
    char *strpstr = string_space;
    struct node *nodeptr = nodes;
    int i = 0;

    while (gets(strpstr) != NULL && i++ < 500) {
        nodeptr->string = strpstr;
        nodeptr->length = strlen(strpstr);
        (void) tsearch((void *)nodeptr,
                      &root, node_compare);
        strpstr += nodeptr->length + 1;
        nodeptr++;
    }
    twalk(root, print_node);
}
```

SEE ALSO

bsearch(3C), hsearch(3C), lsearch(3C)

DIAGNOSTICS

A `NULL` pointer is returned by `tsearch` if there is not enough space available to create a new node.

A `NULL` pointer is returned by `tfind` and `tdelete` if `rootp` is `NULL` on entry.

If the datum is found, both `tsearch` and `tfind` return a pointer to it. If not, `tfind` returns `NULL`, and `tsearch` returns a pointer to the inserted item.

NOTES

The `root` argument to `twalk` is one level of indirection less than the `rootp` arguments to `tsearch` and `tdelete`.

There are two nomenclatures used to refer to the order in which tree nodes are visited. `tsearch` uses `preorder`, `postorder` and `endorder` to refer respectively to visiting a node before any of its children, after its left child and before its right, and after both its children. The alternate nomenclature uses `preorder`, `inorder` and `postorder` to refer to the same visits, which could result in some confusion over the meaning of `postorder`.

If the calling function alters the pointer to the root, results are unpredictable.

NAME

ttyname, isatty - find name of a terminal

SYNOPSIS

```
#include <stdlib.h>
char *ttyname (int fildes);
int isatty (int fildes);
```

DESCRIPTION

ttyname returns a pointer to a string containing the null-terminated path name of the terminal device associated with file descriptor *fildes*.

isatty returns 1 if *fildes* is associated with a terminal device, 0 otherwise.

FILES

/dev/*

DIAGNOSTICS

ttyname returns a NULL pointer if *fildes* does not describe a terminal device in directory /dev.

SEE ALSO

ttysrch(4)

NOTES

The return value points to static data whose content is overwritten by each call.

NAME

ttyslot - find the slot in the utmp file of the current user

SYNOPSIS

```
#include <stdlib.h>

int ttyslot (void);
```

DESCRIPTION

ttyslot returns the index of the current user's entry in the `/var/adm/utmp` file. The returned index is accomplished by scanning files in `/dev` for the name of the terminal associated with the standard input, the standard output, or the standard error output (0, 1, or 2).

FILES

`/var/adm/utmp`

SEE ALSO

`getut(3C)`, `ttyname(3C)`

DIAGNOSTICS

A value of -1 is returned if an error was encountered while searching for the terminal name or if none of the above file descriptors are associated with a terminal device.

NAME

types - primitive system data types

SYNOPSIS

```
#include <sys/types.h>
```

DESCRIPTION

The data types defined in `types.h` are used in UNIX System code. Some data of these types are accessible to user code:

```
typedef struct { int r[1]; } *physadr;
typedef long      clock_t;
typedef long      daddr_t;
typedef char *    caddr_t;
typedef unsigned char  unchar;
typedef unsigned short ushort;
typedef unsigned int   uint;
typedef unsigned long  ulong;
typedef unsigned long  ino_t;
typedef long          uid_t;
typedef long          gid_t;
typedef ulong         nlink_t;
typedef ulong         mode_t;
typedef short         cnt_t;
typedef long          time_t;
typedef int           label_t[24];
typedef ulong         dev_t;
typedef long          off_t;
typedef long          pid_t;
typedef unsigned long paddr_t;
typedef int           key_t;
typedef unsigned char use_t;
typedef short         sysid_t;
typedef short         index_t;
typedef short         lock_t;
typedef unsigned int  size_t;
```

The form `daddr_t` is used for disk addresses except in an i-node on disk, see `fs(4)`. Times are encoded in seconds since 00:00:00 UTC, January 1, 1970. The major and minor parts of a device code specify kind and unit number of a device and are installation-dependent. Offsets are measured in bytes from the beginning of a file. The `label_t` variables are used to save the processor state while another process is running.

NAME

uadmin - administrative control

SYNOPSIS

```
#include <sys/uadmin.h>

int uadmin(int cmd, int fcn, int mdep);
```

DESCRIPTION

uadmin provides control for basic administrative functions. This system call is tightly coupled to the system administrative procedures and is not intended for general use. The argument *mdep* is provided for machine-dependent use and is not defined here.

As specified by *cmd*, the following commands are available:

| | |
|------------|---|
| A_SHUTDOWN | The system is shut down. All user processes are killed, the buffer cache is flushed, and the root file system is unmounted. The action to be taken after the system has been shut down is specified by <i>fcn</i> . The functions are generic; the hardware capabilities vary on specific machines. |
| AD_HALT | Halt the processor and turn off the power. |
| AD_BOOT | Reboot the system, using <code>/stand/unix</code> . |
| AD_IBOOT | Interactive reboot; user is prompted for bootable program name. |
| A_REBOOT | The system stops immediately without any further processing. The action to be taken next is specified by <i>fcn</i> as above. |
| A_REMOUNT | The root file system is mounted again after having been fixed. This should be used only during the startup process. |

uadmin fails if any of the following are true:

| | |
|-------|--|
| EPERM | The effective user ID is not super-user. |
|-------|--|

DIAGNOSTICS

Upon successful completion, the value returned depends on *cmd* as follows:

| | |
|------------|----------------|
| A_SHUTDOWN | Never returns. |
| A_REBOOT | Never returns. |
| A_REMOUNT | 0 |

Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

ualarm - schedule signal after interval in microseconds

SYNOPSIS

```
/usr/ucb/cc [flag...] file...
```

```
unsigned ualarm(value, interval)
```

```
unsigned value;
```

```
unsigned interval;
```

DESCRIPTION

ualarm sends signal SIGALRM [see signal(3)], to the invoking process in a number of microseconds given by the *value* argument. Unless caught or ignored, the signal terminates the process.

If the *interval* argument is non-zero, the SIGALRM signal will be sent to the process every *interval* microseconds after the timer expires (for instance, after *value* microseconds have passed).

Because of scheduling delays, resumption of execution of when the signal is caught may be delayed an arbitrary amount. The longest specifiable delay time is 2147483647 microseconds.

The return value is the amount of time previously remaining in the alarm clock.

NOTES

ualarm is a simplified interface to setitimer; see getitimer(2).

SEE ALSO

alarm(2), getitimer(3), signal(3), sigpause(3), sigvec(3), sleep(3), usleep(3).

NAME

ucontext - user context

SYNOPSIS

```
#include <ucontext.h>
```

DESCRIPTION

The `ucontext` structure defines the context of a thread of control within an executing process.

This structure includes at least the following members:

```
ucontext_t  *uc_link
sigset_t    uc_sigmask
stack_t     uc_stack
mcontext_t  uc_mcontext
```

`uc_link` is a pointer to the context that to be resumed when this context returns. If `uc_link` is equal to 0, then this context is the main context, and the process exits when this context returns.

`uc_sigmask` defines the set of signals that are blocked when this context is active [see `sigprocmask(2)`].

`uc_stack` defines the stack used by this context [see `sigaltstack(2)`].

`uc_mcontext` contains the saved set of machine registers and any implementation specific context data. Portable applications should not modify or access `uc_mcontext`.

SEE ALSO

`getcontext(2)`, `sigaction(2)`, `sigprocmask(2)`, `sigaltstack(2)`,
`makecontext(3C)`

ulimit(2)

ulimit(2)

NAME

ulimit - get and set user limits

SYNOPSIS

```
#include <ulimit.h>
long ulimit(int cmd, ... /* newlimit */ );
```

DESCRIPTION

This function provides for control over process limits. The *cmd* values available are:

- UL_GETFSIZE Get the regular file size limit of the process. The limit is in units of 512-byte blocks and is inherited by child processes. Files of any size can be read.
- UL_SETFSIZE Set the regular file size limit of the process to the value of *newlimit*, taken as a long. Any process may decrease this limit, but only a process with an effective user ID of super-user may increase the limit.
- UL_GMEMLIM Get the maximum possible break value [see [brk\(2\)](#)].
- UL_GDESLIM Get the current value of the maximum number of open files per process configured in the system.

The `getrlimit` system call provides a more general interface for controlling process limits.

ulimit fails if the following is true:

- EINVAL The *cmd* argument is not valid.
- EPERM A process with an effective user ID other than super user attempts to increase its file size limit.

SEE ALSO

[brk\(2\)](#), [getrlimit\(2\)](#), [write\(2\)](#)

NOTES

ulimit is effective in limiting the growth of regular files. Pipes are currently limited to {PIPE_MAX}.

DIAGNOSTICS

Upon successful completion, a non-negative value is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

umask(2)

umask(2)

NAME

umask - set and get file creation mask

SYNOPSIS

```
#include <sys/types.h>
#include <sys/stat.h>

mode_t umask(mode_t cmask);
```

DESCRIPTION

umask sets the process's file mode creation mask to *cmask* and returns the previous value of the mask. Only the access permission bits of *cmask* and the file mode creation mask are used.

SEE ALSO

mkdir(1), sh(1), chmod(2), creat(2), mknod(2), open(2), stat(5).

DIAGNOSTICS

The previous value of the file mode creation mask is returned.

NAME

umount - unmount a file system

SYNOPSIS

```
#include <sys/mount.h>
int umount(const char *file);
```

DESCRIPTION

umount requests that a previously mounted file system contained on the block special device or directory identified by *file* be unmounted. *file* is a pointer to a path name. After unmounting the file system, the directory upon which the file system was mounted reverts to its ordinary interpretation.

umount may be invoked only by the super-user.

umount will fail if one or more of the following are true:

| | |
|--------------|--|
| EPERM | The process's effective user ID is not super-user. |
| ENOENT | <i>file</i> does not exist. |
| ELOOP | Too many symbolic links were encountered in translating the path pointed to by <i>file</i> . |
| ENAMETOOLONG | The length of the <i>file</i> argument exceeds {PATH_MAX}, or the length of a <i>file</i> component exceeds {NAME_MAX} while _POSIX_NO_TRUNC is in effect. |
| ENOTBLK | <i>file</i> is not a block special device. |
| EINVAL | <i>file</i> is not mounted. |
| EBUSY | A file on <i>file</i> is busy. |
| EFAULT | <i>file</i> points to an illegal address. |
| EREMOTE | <i>file</i> is remote. |
| ENOLINK | <i>file</i> is on a remote machine, and the link to that machine is no longer active. |
| EMULTIHOP | Components of the path pointed to by <i>file</i> require hopping to multiple remote machines. |

SEE ALSO

mount(2).

DIAGNOSTICS

Upon successful completion a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

uname(2)

uname(2)

NAME

uname - get name of current UNIX system

SYNOPSIS

```
#include <sys/utsname.h>

int uname(struct utsname *name);
```

DESCRIPTION

uname stores information identifying the current UNIX system in the structure pointed to by *name*.

uname uses the structure `utsname` defined in `sys/utsname.h` whose members are:

```
char sysname[SYS_NMLN];
char nodename[SYS_NMLN];
char release[SYS_NMLN];
char version[SYS_NMLN];
char machine[SYS_NMLN];
```

uname returns a null-terminated character string naming the current UNIX system in the character array *sysname*. Similarly, *nodename* contains the name that the system is known by on a communications network. *release* and *version* further identify the operating system. *machine* contains a standard name that identifies the hardware that the UNIX system is running on.

EFAULT *uname* fails if *name* points to an invalid address.

SEE ALSO

uname(1).

DIAGNOSTICS

Upon successful completion, a non-negative value is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

ungetc - push character back onto input stream

SYNOPSIS

```
#include <stdio.h>
int ungetc (int c, FILE *stream);
```

DESCRIPTION

ungetc inserts the character specified by *c* (converted to an unsigned char) into the buffer associated with an input *stream* [see intro(3)]. That character, *c*, will be returned by the next getc(3S) call on that *stream*. ungetc returns *c*, and leaves the file corresponding to *stream* unchanged. A successful call to ungetc clears the EOF indicator for stream.

Four bytes of pushback are guaranteed.

The value of the file position indicator for *stream* after reading or discarding all pushed-back characters will be the same as it was before the characters were pushed back.

If *c* equals EOF, ungetc does nothing to the buffer and returns EOF.

fseek, rewind [both described on fseek(3S)], and fsetpos erase the memory of inserted characters for the stream on which they are applied.

SEE ALSO

fseek(3S), fsetpos(3C), getc(3S), setbuf(3S), stdio(3S)

DIAGNOSTICS

ungetc returns EOF if it cannot insert the character.

ungetwc(3W)

ungetwc(3W)

NAME

ungetwc - push wchar_t character back into input stream

SYNOPSIS

```
#include <stdio.h>
#include <wchar.h>

int ungetwc(wchar_t c, FILE *stream);
```

DESCRIPTION (International Functions)

ungetwc() inserts the wchar_t character *c* into the buffer associated with the input stream. That character, *c*, will be returned by the next *getwc* call on that stream. ungetwc() returns *c*.

One character of pushback is guaranteed, provided something has already been read from the stream and the stream is actually buffered.

If *c* equals (wchar_t) EOF, ungetwc() does nothing to the buffer and returns EOF.

fseek() erases all memory of inserted characters.

DIAGNOSTICS

ungetwc() returns EOF if it cannot insert a wchar_t character.

SEE ALSO

fseek(3S), getwc(3W), setbuf(3S), stdio(3S), widec(3W).

unlink(2)

unlink(2)

NAME

unlink - remove directory entry

SYNOPSIS

```
#include <unistd.h>

int unlink(const char *path);
```

DESCRIPTION

unlink removes the directory entry named by the path name pointed to by *path*. and decrements the link count of the file referenced by the directory entry. When all links to a file have been removed and no process has the file open, the space occupied by the file is freed and the file ceases to exist. If one or more processes have the file open when the last link is removed, space occupied by the file is not released until all references to the file have been closed. If *path* is a symbolic link, the symbolic link is removed. *path* should not name a directory unless the process has appropriate privileges. Applications should use `rmdir` to remove directories.

Upon successful completion unlink marks for update the `st_ctime` and `st_mtime` fields of the parent directory. Also, if the file's link count is not zero, the `st_ctime` field of the file is marked for update.

The named file is unlinked unless one or more of the following are true:

| | |
|--------------|---|
| EACCES | Search permission is denied for a component of the <i>path</i> prefix. |
| EACCES | Write permission is denied on the directory containing the link to be removed. |
| EACCES | The parent directory has the sticky bit set and the file is not writable by the user; the user does not own the parent directory and the user does not own the file; |
| EBUSY | The entry to be unlinked is the mount point for a mounted file system. |
| EFAULT | <i>path</i> points outside the process's allocated address space. |
| EINTR | A signal was caught during the unlink system call. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and the file system does not allow it. |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds { <code>PATH_MAX</code> }, or the length of a <i>path</i> component exceeds { <code>NAME_MAX</code> } while <code>_POSIX_NO_TRUNC</code> is in effect. |
| ENOENT | The named file does not exist or is a null pathname. The user is not a super-user. |
| ENOTDIR | A component of the <i>path</i> prefix is not a directory. |
| EPERM | The named file is a directory and the effective user ID of the process is not super-user. |

unlink(2)

unlink(2)

| | |
|---------|--|
| ETXTBSY | The entry to be unlinked is the last link to a pure procedure (shared text) file that is being executed. |
| EROFS | The directory entry to be unlinked is part of a read-only file system. |
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |

SEE ALSO

rm(1), close(2), link(2), open(2), rmdir(2).

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

unlockpt - unlock a pseudo-terminal master/slave pair

SYNOPSIS

```
int unlockpt(int fildes);
```

DESCRIPTION

The function `unlockpt()` clears a lock flag associated with the slave pseudo-terminal device associated with its master pseudo-terminal counterpart so that the slave pseudo-terminal device can be opened. *fildes* is a file descriptor returned from a successful open of a master pseudo-terminal device.

RETURN VALUE

Upon successful completion, the function `unlockpt()` returns 0; otherwise it returns -1. A failure may occur if *fildes* is not an open file descriptor or is not associated with a master pseudo-terminal device.

SEE ALSO

`open(2)`, `grantpt(3C)`, `ptsname(3C)`.

NAME

usleep - suspend execution for interval in microseconds

SYNOPSIS

```
/usr/ucb/cc [flag...] file ...
```

```
usleep(useconds)
```

```
unsigned useconds;
```

DESCRIPTION

Suspend the current process for the number of microseconds specified by the argument. The actual suspension time may be an arbitrary amount longer because of other activity in the system, or because of the time spent in processing the call.

The routine is implemented by setting an interval timer and pausing until it occurs. The previous state of this timer is saved and restored. If the sleep time exceeds the time to the expiration of the previous timer, the process sleeps only until the signal would have occurred, and the signal is sent a short time later.

This routine is implemented using `setitimer` [see `getitimer(2)`]; it requires eight system calls each time it is invoked.

SEE ALSO

`alarm(2)`, `getitimer(3)`, `sigpause(3)`, `sleep(3)`, `ualarm(3)`.

NAME

ustat - get file system statistics

SYNOPSIS

```
#include <sys/types.h>
#include <ustat.h>

int ustat(dev_t dev, struct ustat *buf);
```

DESCRIPTION

ustat returns information about a mounted file system. *dev* is a device number identifying a device containing a mounted file system [see `makedev(3C)`]. *buf* is a pointer to a `ustat` structure that includes the following elements:

```
daddr_t  f_tfree;      /* Total free blocks */
ino_t    f_tinode;    /* Number of free inodes */
char     f_fname[6];  /* Filsys name */
char     f_fpack[6];  /* Filsys pack name */
```

ustat fails if one or more of the following are true:

| | |
|---------|---|
| EINVAL | <i>dev</i> is not the device number of a device containing a mounted file system. |
| EFAULT | <i>buf</i> points outside the process's allocated address space. |
| EINTR | A signal was caught during a <code>ustat</code> system call. |
| ENOLINK | <i>dev</i> is on a remote machine and the link to that machine is no longer active. |
| ECOMM | <i>dev</i> is on a remote machine and the link to that machine is no longer active. |

SEE ALSO

`stat(2)`, `statvfs(2)`, `makedev(3C)`, `fs(4)`

NOTES

ustat will be phased out in favor of the `statvfs` function.

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

utime(2)

utime(2)

NAME

utime - set file access and modification times

SYNOPSIS

```
#include <sys/types.h>
#include <utime.h>

int utime(const char *path, const struct utimbuf *times);
```

DESCRIPTION

path points to a path name naming a file. *utime* sets the access and modification times of the named file.

If *times* is `NULL`, the access and modification times of the file are set to the current time. A process must be the owner of the file or have write permission to use *utime* in this manner.

If *times* is not `NULL`, *times* is interpreted as a pointer to a `utimbuf` structure (defined in `utime.h`) and the access and modification times are set to the values contained in the designated structure. Only the owner of the file or the super-user may use *utime* this way.

The times in the following structure are measured in seconds since 00:00:00 UTC, Jan. 1, 1970.

```
struct utimbuf{
    time_t actime;    /* access time */
    time_t modtime;  /* modification time */
};
```

utime also causes the time of the last file status change (`st_ctime`) to be updated.

utime will fail if one or more of the following are true:

| | |
|--------------|--|
| EACCES | Search permission is denied by a component of the <i>path</i> prefix. |
| EACCES | The effective user ID is not super-user and not the owner of the file and <i>times</i> is <code>NULL</code> and write access is denied. |
| EFAULT | <i>times</i> is not <code>NULL</code> and points outside the process's allocated address space. |
| EFAULT | <i>path</i> points outside the process's allocated address space. |
| EINTR | A signal was caught during the <i>utime</i> system call. |
| ELOOP | Too many symbolic links were encountered in translating <i>path</i> . |
| EMULTIHOP | Components of <i>path</i> require hopping to multiple remote machines and the file system does not allow it. |
| ENAMETOOLONG | The length of the <i>path</i> argument exceeds <code>{PATH_MAX}</code> , or the length of a <i>path</i> component exceeds <code>{NAME_MAX}</code> while <code>_POSIX_NO_TRUNC</code> is in effect. |
| ENOENT | The named file does not exist or is a null pathname. |

utime(2)

utime(2)

| | |
|---------|---|
| ENOLINK | <i>path</i> points to a remote machine and the link to that machine is no longer active. |
| ENOTDIR | A component of the <i>path</i> prefix is not a directory. |
| EPERM | The effective user ID is not super-user and not the owner of the file and <i>times</i> is not NULL. |
| EROFS | The file system containing the file is mounted read-only. |

SEE ALSO

stat(2)

DIAGNOSTICS

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

utimes - set file times

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
#include <sys/types.h>
int utimes(file, tvp)
char *file;
struct timeval *tvp;
```

DESCRIPTION

utimes sets the access and modification times of the file named by *file*.

If *tvp* is NULL, the access and modification times are set to the current time. A process must be the owner of the file or have write permission for the file to use utimes in this manner.

If *tvp* is not NULL, it is assumed to point to an array of two timeval structures. The access time is set to the value of the first member, and the modification time is set to the value of the second member. Only the owner of the file or the privileged user may use utimes in this manner.

In either case, the *inode-changed* time of the file is set to the current time.

RETURN VALUE

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and *errno* is set to indicate the error.

ERRORS

utimes will fail if one or more of the following are true:

| | |
|--------------|---|
| ENOTDIR | A component of the path prefix of <i>file</i> is not a directory. |
| ENAMETOOLONG | The length of a component of <i>file</i> exceeds 255 characters, or the length of <i>file</i> exceeds 1023 characters. |
| ENOENT | The file referred to by <i>file</i> does not exist. |
| EACCES | Search permission is denied for a component of the path prefix of <i>file</i> . |
| ELOOP | Too many symbolic links were encountered in translating <i>file</i> . |
| EPERM | The effective user ID of the process is not privileged user and not the owner of the file, and <i>tvp</i> is not NULL. |
| EACCES | The effective user ID of the process is not privileged user and not the owner of the file, write permission is denied for the file, and <i>tvp</i> is NULL. |
| EIO | An I/O error occurred while reading from or writing to the file system. |
| EROFS | The file system containing the file is mounted read-only. |
| EFAULT | <i>file</i> or <i>tvp</i> points outside the process's allocated address space. |

utimes(3)

(BSD Compatibility Package)

utimes(3)

SEE ALSO

stat(2), utime(2).

NOTES

utimes is a library routine that calls the utime system call.

NAME

values - machine-dependent values

SYNOPSIS

```
#include <values.h>
```

DESCRIPTION

This file contains a set of manifest constants, conditionally defined for particular processor architectures.

The model assumed for integers is binary representation (one's or two's complement), where the sign is represented by the value of the high-order bit.

BITS (*type*) The number of bits in a specified type (for example, `int`).

HIBITS The value of a short integer with only the high-order bit set.

HIBITL The value of a long integer with only the high-order bit set.

HIBITI The value of a regular integer with only the high-order bit set.

MAXSHORT The maximum value of a signed short integer.

MAXLONG The maximum value of a signed long integer.

MAXINT The maximum value of a signed regular integer.

MAXFLOAT, LN_MAXFLOAT

The maximum value of a single-precision floating-point number, and its natural logarithm.

MAXDOUBLE, LN_MAXDOUBLE

The maximum value of a double-precision floating-point number, and its natural logarithm.

MINFLOAT, LN_MINFLOAT

The minimum positive value of a single-precision floating-point number, and its natural logarithm.

MINDOUBLE, LN_MINDOUBLE

The minimum positive value of a double-precision floating-point number, and its natural logarithm.

FSIGNIF The number of significant bits in the mantissa of a single-precision floating-point number.

DSIGNIF The number of significant bits in the mantissa of a double-precision floating-point number.

SEE ALSO

intro(3), math(5)

NAME

varargs - handle variable argument list

SYNOPSIS

```
#include <varargs.h>
va_alist
va_dcl
va_list pvar;
void va_start(va_list pvar);
type va_arg(va_list pvar, type);
void va_end(va_list pvar);
```

DESCRIPTION

This set of macros allows portable procedures that accept variable argument lists to be written. Routines that have variable argument lists [such as printf(3S)] but do not use varargs are inherently non-portable, as different machines use different argument-passing conventions.

va_alist is used as the parameter list in a function header.

va_dcl is a declaration for va_alist. No semicolon should follow va_dcl.

va_list is a type defined for the variable used to traverse the list.

va_start is called to initialize pvar to the beginning of the list.

va_arg will return the next argument in the list pointed to by pvar. *type* is the type the argument is expected to be. Different types can be mixed, but it is up to the routine to know what type of argument is expected, as it cannot be determined at runtime.

va_end is used to clean up.

Multiple traversals, each bracketed by va_start and va_end, are possible.

EXAMPLE

This example is a possible implementation of execl [see exec(2)].

```
#include <unistd.h>
#include <varargs.h>
#define MAXARGS 100

/*  execl is called by
    execl(file, arg1, arg2, . . ., (char *)0);
*/
execl(va_alist)
va_dcl
{
    va_list ap;
    char *file;
    char *args[MAXARGS];      /* assumed big enough*/
    int argno = 0;

    va_start(ap);
```

varargs (5)

varargs (5)

```
    file = va_arg(ap, char *);
    while ((args[argno++] = va_arg(ap, char *)) != 0)
        ;
    va_end(ap);
    return execv(file, args);
}
```

SEE ALSO

exec(2), printf(3S), vprintf(3S), stdarg(5)

NOTES

It is up to the calling routine to specify in some manner how many arguments there are, since it is not always possible to determine the number of arguments from the stack frame. For example, `execl` is passed a zero pointer to signal the end of the list. `printf` can tell how many arguments are there by the format.

It is non-portable to specify a second argument of `char`, `short`, or `float` to `va_arg`, since arguments seen by the called function are not `char`, `short`, or `float`. C converts `char` and `short` arguments to `int` and converts `float` arguments to `double` before passing them to a function.

`stdarg` is the preferred interface.

NAME

vfork - spawn new process in a virtual memory efficient way

SYNOPSIS

```
#include <unistd.h>
pid_t vfork (void);
```

DESCRIPTION

vfork can be used to create new processes without fully copying the address space of the old process. It is useful when the purpose of fork would have been to create a new system context for an execve. vfork differs from fork in that the child borrows the parent's memory and thread of control until a call to execve or an exit (either by a call to exit or abnormally.) The parent process is suspended while the child is using its resources.

vfork returns 0 in the child's context and (later) the process ID (PID of the child in the parent's context.

vfork can normally be used just like fork. It does not work, however, to return while running in the child's context from the procedure which called vfork since the eventual return from vfork would then return to a no longer existent stack frame. Be careful, also, to call _exit rather than exit if you cannot execve, since exit will flush and close standard I/O channels, and thereby mess up the parent processes standard I/O data structures. Even with fork it is wrong to call exit since buffered data would then be flushed twice.

DIAGNOSTICS

Upon successful completion, vfork returns a value of 0 to the child process and returns the process ID of the child process to the parent process. Otherwise, a value of -1 is returned to the parent process, no child process is created, and the global variable errno is set to indicate the error.

vfork will fail and no child process will be created if one or more of the following are true:

| | |
|--------|--|
| EAGAIN | The system-imposed limit on the total number of processes under execution would be exceeded. This limit is determined when the system is generated. |
| EAGAIN | The system-imposed limit on the total number of processes under execution by a single user would be exceeded. This limit is determined when the system is generated. |
| ENOMEM | There is insufficient swap space for the new process. |

SEE ALSO

exec(2), exit(2), fork(2), ioctl(2), wait(2)

NOTES

This system call will be eliminated in a future release. System implementation changes are making the efficiency gain of vfork over fork smaller. The memory sharing semantics of vfork can be obtained through other mechanisms.

To avoid a possible deadlock situation, processes that are children in the middle of a vfork are never sent SIGTTOU or SIGTTIN signals; rather, output or ioctls are allowed and input attempts result in an EOF indication.

vfork(2)

vfork(2)

On some systems, the implementation of `vfork` causes the parent to inherit register values from the child. This can create problems for certain optimizing compilers if `unistd.h` is not included in the source calling `vfork`.

NAME

vlfmt - display error message in standard format and pass to logging and monitoring services

SYNOPSIS

```
#include <stdarg.h>
#include <pfmt.h>
```

```
int vlfmt(FILE *stream, long flags, char *format, va_list ap);
```

DESCRIPTION

vlfmt() is the same as lfmt() except that instead of being called with a variable number of arguments, it is called with an argument list as defined by the <stdarg.h> header file.

The <stdarg.h> header file defines the type va_list and a set of macros for advancing through a list of arguments whose number and types may vary. The argument *ap* to vlfmt() is of type va_list. This argument is used with the <stdarg.h> header file macros va_start(), va_arg() and va_end() [see va_start(), va_arg(), and va_end() in stdarg(5)]. The EXAMPLE section below shows their use with vlfmt().

The macro va_alist is used as the parameter list in a function definition as in the function called errlog() in the example below. The macro va_start(*ap*,), where *ap* is of type va_list, must be called before any attempt to traverse and access unnamed arguments. Calls to va_arg(*ap*, *atype*) traverse the argument list. Each execution of va_arg() expands to an expression with the value and type of the next argument in the list *ap*, which is the same object initialized by va_start. The argument *atype* is the type that the returned argument is expected to be. The va_end(*ap*) macro must be invoked when all desired arguments have been accessed. (The argument list in *ap* can be traversed again if va_start() is called again after va_end().) In the example below, va_arg() is executed first to retrieve the format string passed to errlog(). The remaining errlog() arguments, *arg1*, *arg2*, ..., are given to vlfmt() in the argument *ap*.

RETURN VALUE

Upon success, lfmt() returns the number of bytes transmitted. Upon failure, it returns a negative value:

- 1 write error to *stream*.
- 2 cannot log and/or display at console.

EXAMPLE

The following demonstrates how vlfmt() could be used to write an errlog() routine:

```
#include <pfmt.h>
#include <stdarg.h>
/*
 * errlog should be called like
 * errlog(log_info, format, arg1, ...);
 */
void errlog(long log_info, ...)
{
```

```
    va_list ap;
    char *format;

    va_start(ap, );
    format = va_arg(ap, char *);
    (void) vlfmt(stderr, log_info|MM_ERROR, format, ap);
    va_end(ap);
    (void) abort();
}
```

SEE ALSO

lfmt(3C), stdarg(5).

NAME

vpfmt - display error message in standard format and pass to logging and monitoring services

SYNOPSIS

```
#include <stdarg.h>
#include <vpfmt.h>
```

```
int vpfmt(FILE *stream, long flags, char *format, va_list ap);
```

DESCRIPTION

vpfmt() is the same as lfmt() except that instead of being called with a variable number of arguments, it is called with an argument list as defined by the <stdarg.h> header file.

The <stdarg.h> header file defines the type va_list and a set of macros for advancing through a list of arguments whose number and types may vary. The argument ap to vpfmt() is of type va_list. This argument is used with the <stdarg.h> header file macros va_start(), va_arg() and va_end() [see va_start(), va_arg(), and va_end() in stdarg(5)]. The EXAMPLE section below shows their use with vpfmt().

The macro va_alist is used as the parameter list in a function definition as in the function called error() in the example below. The macro va_start(ap,), where ap is of type va_list, must be called before any attempt to traverse and access unnamed arguments. Calls to va_arg(ap, atype) traverse the argument list. Each execution of va_arg() expands to an expression with the value and type of the next argument in the list ap, which is the same object initialized by va_start. The argument atype is the type that the returned argument is expected to be. The va_end(ap) macro must be invoked when all desired arguments have been accessed. (The argument list in ap can be traversed again if va_start() is called again after va_end().) In the example below, va_arg() is executed first to retrieve the format string passed to error(). The remaining error() arguments, arg1, arg2, ..., are given to vpfmt() in the argument ap.

RETURN VALUE

Upon success, lfmt() returns the number of bytes transmitted. Upon failure, it returns a negative value:

```
-1      write error to stream.
```

EXAMPLE

The following demonstrates how vpfmt() could be used to write an error() routine:

```
#include <vpfmt.h>
#include <stdarg.h>
/*
 * error should be called like
 *     error(format, arg1, ...);
 */
void error(...)
{
    va_list ap;
```

```
char *format;
va_start(ap, );
format = va_arg(ap, char *);
(void) vpfmt(stderr, MM_ERROR, format, ap);
va_end(ap);
(void) abort();
}
```

SEE ALSO

pfmt(3C), stdarg(5).

NAME

vprintf, vfprintf, vsprintf - print formatted output of a variable argument list

SYNOPSIS

```
#include <stdio.h>
#include <stdarg.h>

int vprintf(const char *format, va_list ap);
int vfprintf(FILE *stream, const char *format, va_list ap);
int vsprintf(char *s, const char *format, va_list ap);
```

DESCRIPTION

vprintf, vfprintf and vsprintf are the same as printf, fprintf, and sprintf respectively, except that instead of being called with a variable number of arguments, they are called with an argument list as defined by the `stdarg.h` header file.

The `stdarg.h` header file defines the type `va_list` and a set of macros for advancing through a list of arguments whose number and types may vary. The argument *ap* to the vprint family of routines is of type `va_list`. This argument is used with the `stdarg.h` header file macros `va_start`, `va_arg` and `va_end` [see `va_start`, `va_arg`, and `va_end` in `stdarg(5)`]. The EXAMPLE section below shows their use with `vprintf`.

EXAMPLE

The following demonstrates how `vfprintf` could be used to write an error routine:

```
#include <stdio.h>
#include <stdarg.h>
/*
 * error should be called like
 * error(function_name, format, arg1, ...);
 */
void error(char *function_name, char *format, ...)
{
    va_list ap;

    va_start(ap, format);
    /* print out name of function causing error */
    (void) fprintf(stderr, "ERR in %s: ", function_name);
    /* print out remainder of message */
    (void) vfprintf(stderr, format, ap);
    va_end(ap);
    (void) abort;
}
```

SEE ALSO

`printf(3S)`, `stdarg(5)`.

DIAGNOSTICS

`vprintf` and `vfprintf` return the number of characters transmitted, or return -1 if an error was encountered.

NAME

vprintf, vfprintf, vsprintf - print formatted output of a variable argument list

SYNOPSIS

```
#include <stdio.h>
#include <stdarg.h>
#include <wchar.h>

int vprintf (const char *format, va_list ap);
int vfprintf (FILE *stream, const char *format, va_list ap);
int vsprintf (char *s, const char *format, va_list ap);
```

DESCRIPTION (International Functions)

vprintf(), vfprintf(), and vsprintf() are the same as printf(), fprintf(), and sprintf() respectively, except that instead of being called with a variable number of arguments, they are called with an argument list as defined by the <stdarg.h> header file.

wc and *ws* are the new conversion specifications for `wchar_t` character control. Both *wc* and *ws* may be used in all three functions.

- wc* The `wchar_t` character *arg* is transformed into EUC, and then printed. If a field width is specified and the transformed EUC has fewer bytes than the field width, it will be padded to the given width. A precision specification is ignored, if specified.
- ws* The *arg* is taken to be a `wchar_t` string and the `wchar_t` characters from the string are transformed into EUC, and printed until a `wchar_t` null character is encountered or the number of bytes indicated by the precision specification is printed. If the precision specification is missing, it is taken to be infinite, and all `wchar_t` characters up to the first `wchar_t` null character are transformed into EUC and printed. If a field width is specified and the transformed EUC have fewer bytes than the field width, they are padded to the given width.

The ASCII space character (0x20) is used as a padding characters.

SEE ALSO

printf(3W), scanf(3W), stdio(3S), vprintf(3S), wchar(3W), stdarg(5).

wait (2)

wait (2)

NAME

wait - wait for child process to stop or terminate

SYNOPSIS

```
#include <sys/types.h>
#include <sys/wait.h>

pid_t wait(int *stat_loc);
```

DESCRIPTION

wait suspends the calling process until one of its immediate children terminates or until a child that is being traced stops because it has received a signal. The wait system call will return prematurely if a signal is received. If all child processes stopped or terminated prior to the call on wait, return is immediate.

If wait returns because the status of a child process is available, it returns the process ID of the child process. If the calling process had specified a non-zero value for *stat_loc*, the status of the child process will be stored in the location pointed to by *stat_loc*. It may be evaluated with the macros described on `wstat(5)`. In the following, *status* is the object pointed to by *stat_loc*:

If the child process stopped, the high order 8 bits of *status* will contain the number of the signal that caused the process to stop and the low order 8 bits will be set equal to `WSTOPFLG`.

If the child process terminated due to an `exit` call, the low order 8 bits of *status* will be 0 and the high order 8 bits will contain the low order 8 bits of the argument that the child process passed to `exit`; see `exit(2)`.

If the child process terminated due to a signal, the high order 8 bits of *status* will be 0 and the low order 8 bits will contain the number of the signal that caused the termination. In addition, if `WCOREFLG` is set, a "core image" will have been produced; see `signal(2)`.

If wait returns because the status of a child process is available, then that status may be evaluated with the macros defined by `wstat(5)`.

If a parent process terminates without waiting for its child processes to terminate, the parent process ID of each child process is set to 1. This means the initialization process inherits the child processes; see `intro(2)`.

wait will fail if one or both of the following is true:

- | | |
|---------------------|---|
| <code>ECHILD</code> | The calling process has no existing unwaited-for child processes. |
| <code>EINTR</code> | The function was interrupted by a signal. |

SEE ALSO

`exec(2)`, `exit(2)`, `fork(2)`, `intro(2)`, `pause(2)`, `ptrace(2)`, `signal(2)`, `signal(5)`, `wstat(5)`

NOTES

See NOTES in `signal(2)`

If `SIGCLD` is held, then wait does not recognize death of children.

DIAGNOSTICS

If wait returns due to a stopped or terminated child process, the process ID of the child is returned to the calling process. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

NAME

wait, wait3, WIFSTOPPED, WIFSIGNALED, WIFEXITED - wait for process to terminate or stop

SYNOPSIS

```
/usr/ucb/cc [flag...]file...
#include <sys/wait.h>
int wait(statusp)
union wait *statusp;
#include <sys/time.h>
#include <sys/resource.h>
int wait3(statusp, options, rusage)
union wait *statusp;
int options;
struct rusage *rusage;
WIFSTOPPED(status)
union wait status;
WIFSIGNALED(status)
union wait status;
WIFEXITED(status)
union wait status;
```

DESCRIPTION

wait delays its caller until a signal is received or one of its child processes terminates or stops due to tracing. If any child has died or stopped due to tracing and this has not been reported using wait, return is immediate, returning the process ID and exit status of one of those children. If that child had died, it is discarded. If there are no children, return is immediate with the value -1 returned. If there are only running or stopped but reported children, the calling process is blocked.

If *status* is not a NULL pointer, then on return from a successful wait call the status of the child process whose process ID is the return value of wait is stored in the wait union pointed to by *status*. The *w_status* member of that union is an int; it indicates the cause of termination and other information about the terminated process in the following manner:

If the low-order 8 bits of *w_status* are equal to 0177, the child process has stopped; the 8 bits higher up from the low-order 8 bits of *w_status* contain the number of the signal that caused the process to stop. See ptrace(2) and sigvec(3).

If the low-order 8 bits of *w_status* are non-zero and are not equal to 0177, the child process terminated due to a signal; the low-order 7 bits of *w_status* contain the number of the signal that terminated the process. In addition, if the low-order seventh bit of *w_status* (that is, bit 0200) is set, a "core image" of the process was produced; see sigvec(3).

Otherwise, the child process terminated due to an exit call; the 8 bits higher up from the low-order 8 bits of *w_status* contain the low-order 8 bits of the argument that the child process passed to exit; see exit(2).

Other members of the `wait` union can be used to extract this information more conveniently:

If the `w_stopval` member has the value `WSTOPPED`, the child process has stopped; the value of the `w_stopsig` member is the signal that stopped the process.

If the `w_termsig` member is non-zero, the child process terminated due to a signal; the value of the `w_termsig` member is the number of the signal that terminated the process. If the `w_coredump` member is non-zero, a core dump was produced.

Otherwise, the child process terminated due to an `exit` call; the value of the `w_retcode` member is the low-order 8 bits of the argument that the child process passed to `exit`.

The other members of the `wait` union merely provide an alternate way of analyzing the status. The value stored in the `w_status` field is compatible with the values stored by other versions of the UNIX system, and an argument of type `int *` may be provided instead of an argument of type `union wait *` for compatibility with those versions.

`wait3` is an alternate interface that allows both non-blocking status collection and the collection of the status of children stopped by any means. The `status` parameter is defined as above. The `options` parameter is used to indicate the call should not block if there are no processes that have status to report (`WNOHANG`), and/or that children of the current process that are stopped due to a `SIGTTIN`, `SIGTTOU`, `SIGTSTP`, or `SIGSTOP` signal are eligible to have their status reported as well (`WUNTRACED`). A terminated child is discarded after it reports status, and a stopped process will not report its status more than once. If `rusage` is not a `NULL` pointer, a summary of the resources used by the terminated process and all its children is returned. Only the user time used and the system time used are currently available. They are returned in `rusage.ru_utime` and `rusage.ru_stime`, respectively.

When the `WNOHANG` option is specified and no processes have status to report, `wait3` returns 0. The `WNOHANG` and `WUNTRACED` options may be combined by ORing the two values.

`WIFSTOPPED`, `WIFSIGNALED`, `WIFEXITED`, are macros that take an argument `status`, of type 'union wait', as returned by `wait`, or `wait3`. `WIFSTOPPED` evaluates to true (1) when the process for which the `wait` call was made is stopped, or to false (0) otherwise. `WIFSIGNALED` evaluates to true when the process was terminated with a signal. `WIFEXITED` evaluates to true when the process exited by using an `exit(2)` call.

RETURN VALUE

If `wait` returns due to a stopped or terminated child process, the process ID of the child is returned to the calling process. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

`wait3` returns 0 if `WNOHANG` is specified and there are no stopped or exited children, and returns the process ID of the child process if it returns due to a stopped or terminated child process. Otherwise, `wait3` returns a value of -1 and sets `errno` to indicate the error.

ERRORS

wait, or wait3 will fail and return immediately if one or more of the following are true:

ECHILD The calling process has no existing unwaited-for child processes.

EFAULT The *status* or *rusage* arguments point to an illegal address.

wait, and wait3 will terminate prematurely, return -1, and set *errno* to EINTR upon the arrival of a signal whose SV_INTERRUPT bit in its flags field is set [see sigvec(3) and siginterrupt(3)]. signal(3), in the System V compatibility library, sets this bit for any signal it catches.

SEE ALSO

exit(2), ptrace(2), signal(2), wait(2), waitpid(2), getrusage(3), siginterrupt(3), signal(3), sigvec(3).

NOTES

If a parent process terminates without waiting on its children, the initialization process (process ID = 1) inherits the children.

wait, and wait3 are automatically restarted when a process receives a signal while awaiting termination of a child process, unless the SV_INTERRUPT bit is set in the flags for that signal.

Calls to wait with an argument of 0 should be cast to type 'union wait *', as in:

```
wait((union wait *)0)
```

Otherwise lint will complain.

waitid(2)

waitid(2)

NAME

waitid - wait for child process to change state

SYNOPSIS

```
#include <sys/types.h>
#include <wait.h>

int waitid(idtype_t idtype, id_t id, siginfo_t *infop, int
options);
```

DESCRIPTION

waitid suspends the calling process until one of its children changes state. It records the current state of a child in the structure pointed to by *infop*. If a child process changed state prior to the call to waitid, waitid returns immediately.

The *idtype* and *id* arguments specify which children waitid is to wait for.

If *idtype* is P_PID, waitid waits for the child with a process ID equal to (pid_t) *id*.

If *idtype* is P_PGID, waitid waits for any child with a process group ID equal to (pid_t) *id*.

If *idtype* is P_ALL, waitid waits for any children and *id* is ignored.

The *options* argument is used to specify which state changes *waitid* is to wait for. It is formed by an OR of any of the following flags:

| | |
|------------|--|
| WEXITED | Wait for process(es) to exit. |
| WTRAPPED | Wait for traced process(es) to become trapped or reach a breakpoint [see ptrace(2)]. |
| WSTOPPED | Wait for and return the process status of any child that has stopped upon receipt of a signal. |
| WCONTINUED | Return the status for any child that was stopped and has been continued. |
| WNOHANG | Return immediately. |
| WNOWAIT | Keep the process in a waitable state. |

infop must point to a siginfo_t structure, as defined in siginfo(5). siginfo_t is filled in by the system with the status of the process being waited for.

waitid fails if one or more of the following is true.

| | |
|--------|--|
| EFAULT | <i>infop</i> points to an invalid address. |
| EINTR | waitid was interrupted due to the receipt of a signal by the calling process. |
| EINVAL | An invalid value was specified for <i>options</i> . |
| EINVAL | <i>idtype</i> and <i>id</i> specify an invalid set of processes. |
| ECHILD | The set of processes specified by <i>idtype</i> and <i>id</i> does not contain any unwaited-for processes. |

waitid(2)

waitid(2)

DIAGNOSTICS

If `waitid` returns due to a change of state of one of its children, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

SEE ALSO

`intro(2)`, `exec(2)`, `exit(2)`, `fork(2)`, `pause(2)`, `ptrace(2)`, `signal(2)`,
`sigaction(2)`, `wait(2)`, `siginfo(5)`

NAME

waitpid - wait for child process to change state

SYNOPSIS

```
#include <sys/types.h>
#include <sys/wait.h>

pid_t waitpid (pid_t pid, int *stat_loc, int options);
```

DESCRIPTION

waitpid suspends the calling process until one of its children changes state; if a child process changed state prior to the call to waitpid, return is immediate. *pid* specifies a set of child processes for which status is requested.

If *pid* is equal to (pid_t)-1, status is requested for any child process.

If *pid* is greater than (pid_t)0, it specifies the process ID of the child process for which status is requested.

If *pid* is equal to (pid_t)0 status is requested for any child process whose process group ID is equal to that of the calling process.

If *pid* is less than (pid_t)-1, status is requested for any child process whose process group ID is equal to the absolute value of *pid*.

If waitpid returns because the status of a child process is available, then that status may be evaluated with the macros defined by wstat(5). If the calling process had specified a non-zero value of *stat_loc*, the status of the child process will be stored in the location pointed to by *stat_loc*.

The *options* argument is constructed from the bitwise inclusive OR of zero or more of the following flags, defined in the header file sys/wait.h:

| | |
|------------|---|
| WCONTINUED | the status of any continued child process specified by <i>pid</i> , whose status has not been reported since it continued, shall also be reported to the calling process. |
| WNOHANG | waitpid will not suspend execution of the calling process if status is not immediately available for one of the child processes specified by <i>pid</i> . |
| WNOWAIT | keep the process whose status is returned in <i>stat_loc</i> in a waitable state. The process may be waited for again with identical results. |
| WUNTRACED | the status of any child processes specified by <i>pid</i> that are stopped, and whose status has not yet been reported since they stopped, shall also be reported to the calling process. |

waitpid with *options* equal to WUNTRACED and *pid* equal to (pid_t)-1 is identical to a call to wait(2).

waitpid will fail if one or more of the following is true:

| | |
|--------|---|
| EINTR | waitpid was interrupted due to the receipt of a signal sent by the calling process. |
| EINVAL | An invalid value was specified for <i>options</i> . |

waitpid(2)

waitpid(2)

ECHILD

The process or process group specified by *pid* does not exist or is not a child of the calling process or can never be in the states specified by *options*.

SEE ALSO

exec(2), exit(2), fork(2), intro(2), pause(2), ptrace(2), signal(2), sigaction(2), siginfo(5), wstat(5)

DIAGNOSTICS

If `waitpid` returns because the status of a child process is available, this function shall return a value equal to the process ID of the child process for which status is reported. If `waitpid` returns due to the delivery of a signal to the calling process, a value of -1 shall be returned and `errno` shall be set to `EINTR`. If this function was invoked with `WNOHANG` set in *options*, it has at least one child process specified by *pid* for which status is not available, and status is not available for any process specified by *pid*, a value of 0 shall be returned. Otherwise, a value of -1 shall be returned, and `errno` shall be set to indicate the error.

NAME

waitsem, nbwaitsem - await and check access to a resource governed by a semaphore

SYNOPSIS

```
cc [flag...]file...-lx
waitsem(int sem_num);
nbwaitsem(int sem_num);
```

DESCRIPTION

waitsem gives the calling process access to the resource governed by the semaphore *sem_num*. If the resource is in use by another process, waitsem will put the process to sleep until the resource becomes available; nbwaitsem will return the error ENAVAIL. waitsem and nbwaitsem are used in conjunction with sigsem to allow synchronization of processes waiting to access a resource. One or more processes may waitsem on the given semaphore and will be put to sleep until the process which currently has access to the resource issues sigsem. sigsem causes the process which is next in line on the semaphore's queue to be rescheduled for execution. The semaphore's queue is organized in First In, First Out (FIFO) order.

DIAGNOSTICS

waitsem returns the value (*int*) -1 if an error occurs. If *sem_num* has not been previously opened by a call to *opensem* or *creatsem*, *errno* is set to EBADF. If *sem_num* does not refer to a semaphore type file, *errno* is set to ENOTNAM. All processes waiting (or attempting to wait) on the semaphore return with *errno* set to ENAVAIL when the process controlling the semaphore exits without relinquishing control (thereby leaving the resource in an undeterminate state). If a process does two waitsems in a row without doing an intervening sigsem, *errno* is set to EINVAL.

SEE ALSO

opensem(2), *creatsem*(2)

NAME

wconv: towupper, tolower - translate characters

SYNOPSIS

```
#include <ctype.h>
#include <wdec.h>
#include <wctype.h>

wchar_t towupper(wchar_t c);
wchar_t tolower(wchar_t c);
```

DESCRIPTION

If the argument to `towupper()` represents a lower-case letter of the ASCII or supplementary code sets, the result is the corresponding upper-case letter. If the argument to `tolower()` represents an upper-case letter of the ASCII or supplementary code sets, the result is the corresponding lower-case letter.

In the case of all other arguments, the return value is unchanged. The table which is used for translation is generated by `wchrtbl(1M)`.

SEE ALSO

`wchrtbl(1M)`, `ctype(3C)`, `wctype(3W)`.

NAME

wctype: iswalpha, iswupper, iswlower, iswdigit, iswxdigit, iswalnum, iswspace, iswpunct, iswprint, iswgraph, iswcntrl, iswascii, isphonogram, isideogram, isenglish, isnumber, isspecial - classify ASCII and supplementary code set characters

SYNOPSIS

```
#include <ctype.h>
#include <wdec.h>
#include <wctype.h>

int iswalpha(wchar_t c);

...
```

DESCRIPTION

These functions classify character-coded `wchar_t` values by table lookup. Each is a predicate returning nonzero for true, zero for false. The lookup table is generated by `wchrtbl(1M)`. Each of these functions operates on both ASCII and supplementary code sets unless otherwise indicated.

| | |
|-----------------------------|--|
| <code>iswalpha(c)</code> | <code>c</code> is an English letter. |
| <code>iswupper(c)</code> | <code>c</code> is an English upper-case letter. |
| <code>iswlower(c)</code> | <code>c</code> is an English lower-case letter. |
| <code>iswdigit(c)</code> | <code>c</code> is a digit [0-9]. |
| <code>iswxdigit(c)</code> | <code>c</code> is a hexadecimal digit [0-9], [A-F] or [a-f]. |
| <code>iswalnum(c)</code> | <code>c</code> is an alphanumeric (letter or digit). |
| <code>iswspace(c)</code> | <code>c</code> is a space character or a tab, carriage return, new line, vertical tab or form-feed. |
| <code>iswpunct(c)</code> | <code>c</code> is a punctuation character (neither control nor alphanumeric). |
| <code>iswprint(c)</code> | <code>c</code> is a printing character including space. |
| <code>iswgraph(c)</code> | <code>c</code> is a printing character, like <code>iswprint()</code> except false for space. |
| <code>iswcntrl(c)</code> | <code>c</code> is a delete character (0177), an ordinary control character (less than 040) or other control character of a supplementary code set. |
| <code>iswascii(c)</code> | <code>c</code> is an ASCII character code less than 0200. |
| <code>isphonogram(c)</code> | <code>c</code> is a phonogram in a supplementary code set. |
| <code>isideogram(c)</code> | <code>c</code> is an ideogram in a supplementary code set. |
| <code>isenglish(c)</code> | <code>c</code> is an English letters in a supplementary code set. |
| <code>isnumber(c)</code> | <code>c</code> is a digit of a supplementary code set. |
| <code>isspecial(c)</code> | <code>c</code> is a special character in a supplementary code set. |

SEE ALSO

`wchrtbl(1M)`, `ctype(3C)`.

NAME

widerc - multibyte character I/O routines

SYNOPSIS

```
#include <stdio.h>
#include <widerc.h>
```

DESCRIPTION (International Functions)

The functions that the multibyte character library provides for `wchar_t` string operations correspond to those provided by the `stdio(3S)` as shown in the figure below:

| | <i>character based function</i> | <i>byte based function</i> | <i>character and byte based</i> |
|----------------------|-------------------------------------|----------------------------|-------------------------------------|
| <i>character I/O</i> | <code>getwc</code> | <code>getc</code> | |
| | <code>getwchar</code> | <code>getchar</code> | |
| | <code>fgetwc</code> | <code>fgetc</code> | |
| | <code>ungetwc</code> | <code>ungetc</code> | |
| | <code>putwc</code> | <code>putc</code> | |
| | <code>putwchar</code> | <code>putchar</code> | |
| | <code>fputwc</code> | <code>fputc</code> | |
| <i>string I/O</i> | <code>getws</code> | <code>gets</code> | |
| | <code>fgetws</code> | <code>fgets</code> | |
| | <code>putws</code> | <code>puts</code> | |
| | <code>fputws</code> | <code>fputs</code> | |
| <i>formatted I/O</i> | | | <code>printf</code> |
| | | | <code>fprintf</code> |
| | | | <code>sprintf</code> |
| | | | <code>vprintf</code> |
| | | | <code>vfprintf</code> |
| | | | <code>vsprintf</code> |
| | | | <code>scanf</code> |
| | | | <code>fscanf</code> |
| | | | <code>sscanf</code> |

The character based input and output routines provides the ability to work in units of a characters instead of bytes. C programs using these routines can handle any character, from any of the four EUC code sets as the same size by using the `wchar_t` representation.

`getwc()` returns a value of type `wchar_t`, which corresponds to the EUC representation of a character read from the input stream. `getwc()` uses the `cswidth` parameter in the *character class table* to determine the width of the character in its EUC form.

`putwc()` transforms a `wchar_t` character into the EUC, and writes it to the named output stream. `putwc()` also uses the `cswidth` parameter for determining the widths of characters in EUC.

The macros `getwchar()` and `putwchar()`; the functions `fgetwc()`, `fputwc()`, `getws()`, `fgetws()`, `putws()` and `fputws()`; and the format specifications `%wc` and `%ws` of the functions `printf()`, `fprintf()`, `sprintf()`, `vprintf()`, `vfprintf()`, `vsprintf()`, `scanf()`, `fscanf()`, and `sscanf()`; act as if they had made successive calls to either `getwc()` or `putwc()`.

The character based routines use the existing byte based routines internally, so the buffering scheme is the same.

Any program that uses these routines must include the following header files:

```
#include <stdio.h>
#include <widec.h>
```

SEE ALSO

`open(2)`, `close(2)`, `lseek(2)`, `pipe(2)`, `read(2)`, `write(2)`, `ctermid(3S)`, `cuserid(3S)`, `fclose(3S)`, `ferror(3S)`, `fopen(3S)`, `fread(3S)`, `fseek(3S)`, `getwc(3W)`, `getws(3W)`, `mbchar(3C)`, `mbstring(3C)`, `popen(3S)`, `printf(3S)`, `printf(3W)`, `putwc(3W)`, `putws(3W)`, `scanf(3S)`, `scanf(3W)`, `setbuf(3S)`, `stdio(3S)`, `system(3S)`, `tmpfile(3S)`, `tmpnam(3S)`, `ungetwc(3W)`, `vprintf(3W)`, `wstring(3W)`.

write(2)

write(2)

NAME

write, writev - write on a file

SYNOPSIS

```
#include <unistd.h>
int write(int fildes, const void *buf, unsigned nbyte);

#include <sys/types.h>
#include <sys/uio.h>

int writev(int fildes, const struct iovec *iov, int iovcnt);
```

DESCRIPTION

`write` attempts to write *nbyte* bytes from the buffer pointed to by *buf* to the file associated with *fildes*. If *nbyte* is zero and the file is a regular file, `write` returns zero and has no other results. *fildes* is a file descriptor obtained from a `creat`, `open`, `dup`, `fcntl`, `pipe`, or `ioctl` system call.

`writev` performs the same action as `write`, but gathers the output data from the *iovcnt* buffers specified by the members of the *iov* array: *iov*[0], *iov*[1], ..., *iov*[*iovcnt*-1]. The *iovcnt* is valid if greater than 0 and less than or equal to {IOV_MAX}.

For `writev`, the `iovec` structure contains the following members:

```
    caddr_t   iov_base;
    int       iov_len;
```

Each `iovec` entry specifies the base address and length of an area in memory from which data should be written. `writev` always writes a complete area before proceeding to the next.

On devices capable of seeking, the actual writing of data proceeds from the position in the file indicated by the file pointer. On return from `write`, the file pointer is incremented by the number of bytes actually written. On a regular file, if the incremented file pointer is greater than the length of the file, the length of the file is set to the new file pointer.

On devices incapable of seeking, writing always takes place starting at the current position. The value of a file pointer associated with such a device is undefined.

If the `O_APPEND` flag of the file status flags is set, the file pointer is set to the end of the file prior to each `write`.

For regular files, if the `O_SYNC` flag of the file status flags is set, `write` does not return until both the file data and file status have been physically updated. This function is for special applications that require extra reliability at the cost of performance. For block special files, if `O_SYNC` is set, `write` does not return until the data has been physically updated.

A `write` to a regular file is blocked if mandatory file/record locking is set [see `chmod(2)`], and there is a record lock owned by another process on the segment of the file to be written:

```
    If O_NDELAY or O_NONBLOCK is set, write returns -1 and sets errno to EAGAIN.
```

If `O_NDELAY` and `O_NONBLOCK` are clear, `write` sleeps until all blocking locks are removed or the `write` is terminated by a signal.

If a `write` requests that more bytes be written than there is room for—for example, if the `write` would exceed the process file size limit [see `getrlimit(2)` and `ulimit(2)`], the system file size limit, or the free space on the device—only as many bytes as there is room for will be written. For example, suppose there is space for 20 bytes more in a file before reaching a limit. A `write` of 512 bytes returns 20. The next `write` of a non-zero number of bytes gives a failure return (except as noted for pipes and FIFO below).

Write requests to a pipe or FIFO are handled the same as a regular file with the following exceptions:

There is no file offset associated with a pipe, hence each `write` request appends to the end of the pipe.

Write requests of `{PIPE_BUF}` bytes or less are guaranteed not to be interleaved with data from other processes doing writes on the same pipe. Writes of greater than `{PIPE_BUF}` bytes may have data interleaved, on arbitrary boundaries, with writes by other processes, whether or not the `O_NONBLOCK` or `O_NDELAY` flags are set.

If `O_NONBLOCK` and `O_NDELAY` are clear, a `write` request may cause the process to block, but on normal completion it returns *nbyte*.

If `O_NONBLOCK` is set, `write` requests are handled in the following way: the `write` does not block the process; `write` requests for `{PIPE_BUF}` or fewer bytes either succeed completely and return *nbyte*, or return `-1` and set `errno` to `EAGAIN`. A `write` request for greater than `{PIPE_BUF}` bytes either transfers what it can and returns the number of bytes written, or transfers no data and returns `-1` with `errno` set to `EAGAIN`. Also, if a request is greater than `{PIPE_BUF}` bytes and all data previously written to the pipe has been read, `write` transfers at least `{PIPE_BUF}` bytes.

If `O_NDELAY` is set, `write` requests are handled in the following way: the `write` does not block the process; `write` requests for `{PIPE_BUF}` or fewer bytes either succeed completely and return *nbyte*, or return `0`. A `write` request for greater than `{PIPE_BUF}` bytes either transfers what it can and returns the number of bytes written, or transfers no data and returns `0`. Also, if a request is greater than `{PIPE_BUF}` bytes and all data previously written to the pipe has been read, `write` transfers at least `{PIPE_BUF}` bytes.

When attempting to write to a file descriptor (other than a pipe or FIFO) that supports nonblocking writes and cannot accept the data immediately:

If `O_NONBLOCK` and `O_NDELAY` are clear, `write` blocks until the data can be accepted.

If `O_NONBLOCK` or `O_NDELAY` is set, `write` does not block the process. If some data can be written without blocking the process, `write` writes what it can and returns the number of bytes written. Otherwise, if `O_NONBLOCK` is set, it returns `-1` and sets `errno` to `EAGAIN` or if `O_NDELAY` is set, it returns `0`.

write(2)

write(2)

For STREAMS files [see `intro(2)`], the operation of `write` is determined by the values of the minimum and maximum *nbyte* range (“packet size”) accepted by the stream. These values are contained in the topmost stream module. Unless the user pushes the topmost module [see `I_PUSH` in `streamio(7)`], these values can not be set or tested from user level. If *nbyte* falls within the packet size range, *nbyte* bytes are written. If *nbyte* does not fall within the range and the minimum packet size value is zero, `write` breaks the buffer into maximum packet size segments prior to sending the data downstream (the last segment may be smaller than the maximum packet size). If *nbyte* does not fall within the range and the minimum value is non-zero, `write` fails and sets `errno` to `ERANGE`. Writing a zero-length buffer (*nbyte* is zero) to a STREAMS device sends a zero length message with zero returned. However, writing a zero-length buffer to a pipe or FIFO sends no message and zero is returned. The user program may issue the `I_SWROPT` `ioctl(2)` to enable zero-length messages to be sent across the pipe or FIFO [see `streamio(7)`].

When writing to a stream, data messages are created with a priority band of zero. When writing to a stream that is not a pipe or FIFO:

If `O_NDELAY` and `O_NONBLOCK` are not set, and the stream cannot accept data (the stream write queue is full due to internal flow control conditions), `write` blocks until data can be accepted.

If `O_NDELAY` or `O_NONBLOCK` is set and the stream cannot accept data, `write` returns `-1` and sets `errno` to `EAGAIN`.

If `O_NDELAY` or `O_NONBLOCK` is set and part of the buffer has already been written when a condition occurs in which the stream cannot accept additional data, `write` terminates and returns the number of bytes written.

`write` and `writew` fail and the file pointer remains unchanged if one or more of the following are true:

| | |
|---------|---|
| EAGAIN | Mandatory file/record locking is set, <code>O_NDELAY</code> or <code>O_NONBLOCK</code> is set, and there is a blocking record lock. |
| EAGAIN | Total amount of system memory available when writing via raw I/O is temporarily insufficient. |
| EAGAIN | An attempt is made to write to a stream that can not accept data with the <code>O_NDELAY</code> or <code>O_NONBLOCK</code> flag set. |
| EAGAIN | If a <code>write</code> to a pipe or FIFO of <code>{PIPE_BUF}</code> bytes or less is requested and less than <i>nbytes</i> of free space is available. |
| EBADF | <i>fdes</i> is not a valid file descriptor open for writing. |
| EDEADLK | The <code>write</code> was going to go to sleep and cause a deadlock situation to occur. |
| EFAULT | <i>buf</i> points outside the process’s allocated address space. |
| EFBIG | An attempt is made to write a file that exceeds the process’s file size limit or the maximum file size [see <code>getrlimit(2)</code> and <code>ulimit(2)</code>]. |
| EINTR | A signal was caught during the <code>write</code> system call. |

write(2)

write(2)

| | |
|--------------------------|---|
| EINVAL | An attempt is made to write to a stream linked below a multiplexor. |
| EIO | The process is in the background and is attempting to write to its controlling terminal whose TOSTOP flag is set; the process is neither ignoring nor blocking SIGTTOU signals, and the process group of the process is orphaned. |
| ENOLCK | The system record lock table was full, so the write could not go to sleep until the blocking record lock was removed. |
| ENOLINK | <i>fildes</i> is on a remote machine and the link to that machine is no longer active. |
| ENOSR | An attempt is made to write to a stream with insufficient STREAMS memory resources available in the system. |
| ENOSPC | During a write to an ordinary file, there is no free space left on the device. |
| ENXIO | A hangup occurred on the stream being written to. |
| EPIPE and SIGPIPE signal | An attempt is made to write to a pipe that is not open for reading by any process. |
| EPIPE | An attempt is made to write to a FIFO that is not open for reading by any process. |
| EPIPE | An attempt is made to write to a pipe that has only one end open. |
| ERANGE | An attempt is made to write to a stream with <i>nbyte</i> outside specified minimum and maximum write range, and the minimum value is non-zero. |
| ENOLCK | Enforced record locking was enabled and {LOCK_MAX} regions are already locked in the system. |

In addition, `writew` may return one of the following errors:

| | |
|--------|---|
| EINVAL | <i>iovcnt</i> was less than or equal to 0, or greater than 16. |
| EINVAL | One of the <i>iov_len</i> values in the <i>iov</i> array was negative. |
| EINVAL | The sum of the <i>iov_len</i> values in the <i>iov</i> array overflowed a 32-bit integer. |

A write to a STREAMS file can fail if an error message has been received at the stream head. In this case, `errno` is set to the value included in the error message.

Upon successful completion `write` and `writew` mark for update the `st_ctime` and `st_mtime` fields of the file.

SEE ALSO

`intro(2)`, `creat(2)`, `dup(2)`, `fcntl(2)`, `getrlimit(2)`, `lseek(2)`, `open(2)`, `pipe(2)`, `ulimit(2)`

DIAGNOSTICS

On success, `write` returns the number of bytes actually written. Otherwise, it returns -1 and sets `errno` to indicate the error.

wstat(5)

wstat(5)

NAME

wstat - wait status

SYNOPSIS

```
#include <sys/wait.h>
```

DESCRIPTION

When a process waits for status from its children via either the `wait` or `waitpid` function, the status returned may be evaluated with the following macros, defined in `sys/wait.h`. These macros evaluate to integral expressions. The *stat* argument to these macros is the integer value returned from `wait` or `waitpid`.

| | |
|--|---|
| <code>WIFEXITED(<i>stat</i>)</code> | Evaluates to a non-zero value if status was returned for a child process that terminated normally. |
| <code>WEXITSTATUS(<i>stat</i>)</code> | If the value of <code>WIFEXITED(<i>stat</i>)</code> is non-zero, this macro evaluates to the exit code that the child process passed to <code>_exit</code> or <code>exit</code> , or the value that the child process returned from <code>main</code> . |
| <code>WIFSIGNALED(<i>stat</i>)</code> | Evaluates to a non-zero value if status was returned for a child process that terminated due to the receipt of a signal. |
| <code>WTERMSIG(<i>stat</i>)</code> | If the value of <code>WIFSIGNALED(<i>stat</i>)</code> is non-zero, this macro evaluates to the number of the signal that caused the termination of the child process. |
| <code>WIFSTOPPED(<i>stat</i>)</code> | Evaluates to a non-zero value if status was returned for a child process that is currently stopped. |
| <code>WSTOPSIG(<i>stat</i>)</code> | If the value of <code>WIFSTOPPED(<i>stat</i>)</code> is non-zero, this macro evaluates to the number of the signal that caused the child process to stop. |
| <code>WIFCONTINUED(<i>stat</i>)</code> | Evaluates to a non-zero value if status was returned for a child process that has continued. |
| <code>WCOREDUMP(<i>stat</i>)</code> | If the value of <code>WIFSIGNALED(<i>stat</i>)</code> is non-zero, this macro evaluates to a non-zero value if a core image of the terminated child was created. |

SEE ALSO

`exit(2)`, `wait(2)`, `waitpid(3C)`

NAME

wstring: wscat, wsnocat, wscmp, wsncmp, wscopy, wsncpy, wslen, wschr, wschr, wspbkr, wsspn, wscspn, wstok, wstostr, strtows - wchar_t string operations and type transformation

SYNOPSIS

```
#include <wchar.h>

wchar_t *wscat(wchar_t *s1, wchar_t *s2);
wchar_t *wsnocat(wchar_t *s1, wchar_t *s2, int n);
int wscmp(wchar_t *s1, wchar_t *s2);
int wsncmp(wchar_t *s1, wchar_t *s2, int n);
wchar_t *wscopy(wchar_t *s1, wchar_t *s2);
wchar_t *wsncpy(wchar_t *s1, wchar_t *s2, int n);
int wslen(wchar_t *s);
wchar_t *wschr(wchar_t *s, int c);
wchar_t *wsrchr(wchar_t *s, int c);
wchar_t *wspbkr(wchar_t *s1, wchar_t *s2);
int wsspn(wchar_t *s1, wchar_t *s2);
int wscspn(wchar_t *s1, wchar_t *s2);
wchar_t *wstok(wchar_t *s1, wchar_t *s2);
char *wstostr(char *s1, wchar_t *s2);
wchar_t *strtows(wchar_t *s1, char *s2);
```

DESCRIPTION (International Functions)

The arguments *s1*, *s2* and *s* point to wchar_t strings (that is, arrays of wchar_t characters terminated by a wchar_t null character). The functions wscat(), wsnocat(), wscopy() and wsncpy() all modify *s1*. These functions do not check for an overflow condition of the array pointed to by *s1*.

wscat() appends a copy of the wchar_t string *s2* to the end of the wchar_t string *s1*. wsnocat() appends at most *n* wchar_t characters. Each function returns *s1*.

wscmp() compares its arguments and returns an integer less than, equal to, or greater than 0, depending on whether *s1* is less than, equal to, or greater than *s2*. wsncmp() makes the same comparison but looks at most *n* wchar_t characters.

wscopy() copies wchar_t string *s2* to *s1*, stopping after the wchar_t null character has been copied. wsncpy() copies exactly *n* wchar_t characters, truncating *s2* or adding wchar_t null characters to *s1*, if necessary. The result will not be wchar_t null-terminated if the length of *s2* is *n* or more. Each function returns *s1*.

wslen() returns the number of wchar_t characters in *s*, not including the terminating wchar_t null character.

`wchr()` [`wrchr()`] returns a pointer to the first [last] occurrence of `wchar_t` character `c` in `wchar_t` string `s`, or a null pointer, if `c` does not occur in the string. The `wchar_t` null character terminating a string is considered to be part of the string.

`wspbrk()` returns a pointer to the first occurrence in `wchar_t` string `s1` of any `wchar_t` character from `wchar_t` string `s2`, or a null pointer if there is no `wchar_t` character from `s2` in `s1`.

`wsspn()` [`wscspn()`] returns the length of the initial segment of `wchar_t` string `s1`, which consists [does not consist] entirely of `wchar_t` characters from `wchar_t` string `s2`.

`wstok()` considers the `wchar_t` string `s1` to consist of a sequence of zero or more text tokens, separated by spans of one or more `wchar_t` characters from the separator `wchar_t` string `s2`. The first call (with the pointer `s1` specified) returns a pointer to the first `wchar_t` character of the first token, and writes a `wchar_t` null character into `s1` immediately following the returned token. The function keeps track of its position in the `wchar_t` string between separate calls, so that subsequent calls (which must be made with the first argument a null pointer) will progress through the `wchar_t` string `s1` immediately following that token. Similarly, subsequent calls will progress through the `wchar_t` string `s1` until no tokens remain. The `wchar_t` separator string `s2` may be different from call to call. A null pointer is returned when no token remains in `s1`.

`wstostr()` transforms `wchar_t` characters in `wchar_t` string `s2` into EUC, and transfers them to character string `s1`, stopping after the `wchar_t` null character has been processed.

`strtows()` transforms EUC in character string `s2` into the `wchar_t` characters, and transfers those to `wchar_t` string `s1`, stopping after the null character has been processed.

DIAGNOSTICS

On success, `wstostr()` and `strtows()` return `s1`. If an illegal byte sequence is detected, a null pointer is returned and `EILSEQ` is set to `errno`.

SEE ALSO

`malloc(3C)`, `malloc(3X)`, `widex(3W)`.

NAME

xdr - library routines for external data representation

DESCRIPTION

XDR routines allow C programmers to describe arbitrary data structures in a machine-independent fashion. Data for remote procedure calls (RPC) are transmitted using these routines.

Index to Routines

The following table lists XDR routines and the manual reference pages on which they are described:

| <i>XDR Routine</i> | <i>Manual Reference Page</i> |
|--------------------|------------------------------|
| xdr_array | xdr_complex(3N) |
| xdr_bool | xdr_simple(3N) |
| xdr_bytes | xdr_complex(3N) |
| xdr_char | xdr_simple(3N) |
| xdr_destroy | xdr_create(3N) |
| xdr_double | xdr_simple(3N) |
| xdr_enum | xdr_simple(3N) |
| xdr_float | xdr_simple(3N) |
| xdr_free | xdr_simple(3N) |
| xdr_getpos | xdr_admin(3N) |
| xdr_inline | xdr_admin(3N) |
| xdr_int | xdr_simple(3N) |
| xdr_long | xdr_simple(3N) |
| xdr_opaque | xdr_complex(3N) |
| xdr_pointer | xdr_complex(3N) |
| xdr_reference | xdr_complex(3N) |
| xdr_setpos | xdr_admin(3N) |
| xdr_short | xdr_simple(3N) |
| xdr_string | xdr_complex(3N) |
| xdr_u_char | xdr_simple(3N) |
| xdr_u_long | xdr_simple(3N) |
| xdr_u_short | xdr_simple(3N) |
| xdr_union | xdr_complex(3N) |
| xdr_vector | xdr_complex(3N) |
| xdr_void | xdr_simple(3N) |
| xdr_wrapstring | xdr_complex(3N) |
| xdrmem_create | xdr_create(3N) |
| xdrrec_create | xdr_create(3N) |
| xdrrec_eof | xdr_admin(3N) |
| xdrstdio_create | xdr_create(3N) |

SEE ALSO

xdr_admin(3N), xdr_complex(3N), xdr_create(3N), xdr_simple(3N), rpc(3N)

NAME

xdr_admin: xdr_getpos, xdr_inline, xdrrec_eof, xdr_setpos - library routines for external data representation

DESCRIPTION

XDR library routines allow C programmers to describe arbitrary data structures in a machine-independent fashion. Protocols such as remote procedure calls (RPC) use these routines to describe the format of the data.

These routines deal specifically with the management of the XDR stream.

Routines

See `rpc(3N)` for the definition of the XDR data structure.

```
#include <rpc/xdr.h>
```

```
u_int
```

```
xdr_getpos(const XDR *xdrs);
```

A macro that invokes the get-position routine associated with the XDR stream, *xdrs*. The routine returns an unsigned integer, which indicates the position of the XDR byte stream. A desirable feature of XDR streams is that simple arithmetic works with this number, although the XDR stream instances need not guarantee this. Therefore, applications written for portability should not depend on this feature.

```
long *
```

```
xdr_inline(XDR *xdrs; const int len);
```

A macro that invokes the in-line routine associated with the XDR stream, *xdrs*. The routine returns a pointer to a contiguous piece of the stream's buffer; *len* is the byte length of the desired buffer. Note: pointer is cast to long *.

Note: `xdr_inline` may return NULL (0) if it cannot allocate a contiguous piece of a buffer. Therefore the behavior may vary among stream instances; it exists for the sake of efficiency, and applications written for portability should not depend on this feature.

```
bool_t
```

```
xdrrec_eof(XDR *xdrs);
```

This routine can be invoked only on streams created by `xdrrec_create`. After consuming the rest of the current record in the stream, this routine returns 1 if the stream has no more input, 0 otherwise.

```
bool_t
```

```
xdr_setpos(XDR *xdrs, const u_int pos);
```

A macro that invokes the set position routine associated with the XDR stream *xdrs*. The parameter *pos* is a position value obtained from `xdr_getpos`. This routine returns 1 if the XDR stream was repositioned, and 0 otherwise.

Note: it is difficult to reposition some types of XDR streams, so this routine may fail with one type of stream and succeed with another. Therefore, applications written for portability should not depend on this feature.

xdr_admin(3N)

xdr_admin(3N)

SEE ALSO

rpc(3N), xdr_complex(3N), xdr_create(3N), xdr_simple(3N)

NAME

xdr_complex: xdr_array, xdr_bytes, xdr_opaque, xdr_pointer, xdr_reference, xdr_string, xdr_union, xdr_vector, xdr_wrapstring - library routines for external data representation

DESCRIPTION

XDR library routines allow C programmers to describe complex data structures in a machine-independent fashion. Protocols such as remote procedure calls (RPC) use these routines to describe the format of the data. These routines are the XDR library routines for complex data structures. They require the creation of XDR stream [see xdr_create(3N)].

Routines

See `rpc(3N)` for the definition of the XDR data structure.

```
#include <rpc/xdr.h>
```

```
bool_t
```

```
xdr_array(XDR *xdrs, caddr_t *arrp, u_int *sizep,
          const u_int maxsize, const u_int elsize,
          const xdrproc_t elproc);
```

`xdr_array` translates between variable-length arrays and their corresponding external representations. The parameter `arrp` is the address of the pointer to the array, while `sizep` is the address of the element count of the array; this element count cannot exceed `maxsize`. The parameter `elsize` is the `sizeof` each of the array's elements, and `elproc` is an XDR routine that translates between the array elements' C form and their external representation. This routine returns 1 if it succeeds, 0 otherwise.

```
bool_t
```

```
xdr_bytes(XDR *xdrs, char **sp, u_int *sizep,
          const u_int maxsize);
```

`xdr_bytes` translates between counted byte strings and their external representations. The parameter `sp` is the address of the string pointer. The length of the string is located at address `sizep`; strings cannot be longer than `maxsize`. This routine returns 1 if it succeeds, 0 otherwise.

```
bool_t
```

```
xdr_opaque(XDR *xdrs, caddr_t cp, const u_int cnt);
```

`xdr_opaque` translates between fixed size opaque data and its external representation. The parameter `cp` is the address of the opaque object, and `cnt` is its size in bytes. This routine returns 1 if it succeeds, 0 otherwise.

```
bool_t
```

```
xdr_pointer(XDR *xdrs, char **objpp, u_int objsize,
            const xdrproc_t xdrobj);
```

Like `xdr_reference` except that it serializes `NULL` pointers, whereas `xdr_reference` does not. Thus, `xdr_pointer` can represent recursive data structures, such as binary trees or linked lists.

```
bool_t
xdr_reference(XDR *xdrs, caddr_t *pp, u_int size,
              const xdrproc_t proc);
```

`xdr_reference` provides pointer chasing within structures. The parameter *pp* is the address of the pointer; *size* is the `sizeof` of the structure that **pp* points to; and *proc* is an XDR procedure that translates the structure between its C form and its external representation. This routine returns 1 if it succeeds, 0 otherwise.

Note: this routine does not understand `NULL` pointers. Use `xdr_pointer` instead.

```
bool_t
xdr_string(XDR *xdrs, char **sp, const u_int maxsize);
```

`xdr_string` translates between C strings and their corresponding external representations. Strings cannot be longer than *maxsize*. Note: *sp* is the address of the string's pointer. This routine returns 1 if it succeeds, 0 otherwise.

```
bool_t
xdr_union(XDR *xdrs, enum_t *dscmp, char *unp,
           const struct xdr_discrim *choices,
           const bool_t (*defaultarm)(const XDR *, const char *,
                                     const int));
```

`xdr_union` translates between a discriminated C union and its corresponding external representation. It first translates the discriminant of the union located at *dscmp*. This discriminant is always an `enum_t`. Next the union located at *unp* is translated. The parameter *choices* is a pointer to an array of `xdr_discrim` structures. Each structure contains an ordered pair of [*value*, *proc*]. If the union's discriminant is equal to the associated *value*, then the *proc* is called to translate the union. The end of the `xdr_discrim` structure array is denoted by a routine of value `NULL`. If the discriminant is not found in the *choices* array, then the *defaultarm* procedure is called (if it is not `NULL`). Returns 1 if it succeeds, 0 otherwise.

```
bool_t
xdr_vector(XDR *xdrs, char *arrp, const u_int size,
           const u_int elsize, const xdrproc_t elproc);
```

`xdr_vector` translates between fixed-length arrays and their corresponding external representations. The parameter *arrp* is the address of the pointer to the array, while *size* is the element count of the array. The parameter *elsize* is the `sizeof` each of the array's elements, and *elproc* is an XDR routine that translates between the array elements' C form and their external representation. This routine returns 1 if it succeeds, 0 otherwise.

xdr_complex(3N)

xdr_complex(3N)

```
bool_t  
xdr_wrapstring(XDR *xdrs, char **sp);
```

A routine that calls `xdr_string(xdrs, sp, maxuint)`; where *maxuint* is the maximum value of an unsigned integer.

Many routines, such as `xdr_array`, `xdr_pointer` and `xdr_vector` take a function pointer of type `xdrproc_t`, which takes two arguments. `xdr_string`, one of the most frequently used routines, requires three arguments, while `xdr_wrapstring` only requires two. For these routines, `xdr_wrapstring` is desirable. This routine returns 1 if it succeeds, 0 otherwise.

SEE ALSO

`rpc(3N)`, `xdr_admin(3N)`, `xdr_create(3N)`, `xdr_simple(3N)`

NAME

xdr_create: xdr_destroy, xdrmem_create, xdrrec_create, xdrstdio_create - library routines for external data representation stream creation

DESCRIPTION

XDR library routines allow C programmers to describe arbitrary data structures in a machine-independent fashion. Protocols such as remote procedure calls (RPC) use these routines to describe the format of the data.

These routines deal with the creation of XDR streams. XDR streams have to be created before any data can be translated into XDR format.

Routines

See `rpc(3N)` for the definition of the XDR, CLIENT, and SVCXPRT data structures.

```
#include <rpc/xdr.h>
```

```
void
```

```
xdr_destroy(XDR *xdrs);
```

A macro that invokes the destroy routine associated with the XDR stream, *xdrs*. Destruction usually involves freeing private data structures associated with the stream. Using *xdrs* after invoking `xdr_destroy` is undefined.

```
void
```

```
xdrmem_create(XDR *xdrs, const caddr_t addr,
              const u_int size, const enum xdr_op op);
```

This routine initializes the XDR stream object pointed to by *xdrs*. The stream's data is written to, or read from, a chunk of memory at location *addr* whose length is no more than *size* bytes long. The *op* determines the direction of the XDR stream (either XDR_ENCODE, XDR_DECODE, or XDR_FREE).

```
void
```

```
xdrrec_create(XDR *xdrs, const u_int sendsz,
              const u_int recvsz, const caddr_t handle,
              const int (*readit)(const void *, char *, const int),
              const int (*writeit)(const void *, const char *, const int));
```

This routine initializes the XDR stream object pointed to by *xdrs*. The stream's data is written to a buffer of size *sendsz*; a value of 0 indicates the system should use a suitable default. The stream's data is read from a buffer of size *recvsz*; it too can be set to a suitable default by passing a 0 value. When a stream's output buffer is full, *writeit* is called. Similarly, when a stream's input buffer is empty, *readit* is called. The behavior of these two routines is similar to the system calls `read` and `write` [see `read(2)` and `write(2)`, respectively], except that *handle* (CLIENT, or SVCXPRT) is passed to the former routines as the first parameter instead of a file descriptor. Note: the XDR stream's *op* field must be set by the caller.

Note: this XDR stream implements an intermediate record stream. Therefore there are additional bytes in the stream to provide record boundary information.

xdr_create(3N)

xdr_create(3N)

```
void  
xdrstdio_create(XDR *xdrs, FILE *file, const enum xdr_op op);
```

This routine initializes the XDR stream object pointed to by *xdrs*. The XDR stream data is written to, or read from, the standard I/O stream *file*. The parameter *op* determines the direction of the XDR stream (either XDR_ENCODE, XDR_DECODE, or XDR_FREE).

Note: the destroy routine associated with such XDR streams calls `fflush` on the *file* stream, but never `fclose` [see `fclose(3S)`].

SEE ALSO

`fclose(3S)`, `read(2)`, `rpc(3N)`, `write(2)`, `xdr_admin(3N)`, `xdr_complex(3N)`,
`xdr_simple(3N)`

NAME

xdr_simple: xdr_bool, xdr_char, xdr_double, xdr_enum, xdr_float, xdr_free, xdr_int, xdr_long, xdr_short, xdr_u_char, xdr_u_long, xdr_u_short, xdr_void - library routines for external data representation

DESCRIPTION

XDR library routines allow C programmers to describe simple data structures in a machine-independent fashion. Protocols such as remote procedure calls (RPC) use these routines to describe the format of the data.

These routines require the creation of XDR streams [see xdr_create(3N)].

Routines

See rpc(3N) for the definition of the XDR data structure.

```
#include <rpc/xdr.h>
```

```
bool_t
```

```
xdr_bool(XDR *xdrs, bool_t *bp);
```

xdr_bool translates between booleans (C integers) and their external representations. When encoding data, this filter produces values of either 1 or 0. This routine returns 1 if it succeeds, 0 otherwise.

```
bool_t
```

```
xdr_char(XDR *xdrs, char *cp);
```

xdr_char translates between C characters and their external representations. This routine returns 1 if it succeeds, 0 otherwise. Note: encoded characters are not packed, and occupy 4 bytes each. For arrays of characters, it is worthwhile to consider xdr_bytes, xdr_opaque or xdr_string [see xdr_bytes, xdr_opaque and xdr_string in xdr_complex(3N)].

```
bool_t
```

```
xdr_double(XDR *xdrs, double *dp);
```

xdr_double translates between C double precision numbers and their external representations. This routine returns 1 if it succeeds, 0 otherwise.

```
bool_t
```

```
xdr_enum(XDR *xdrs, enum_t *ep);
```

xdr_enum translates between C enums (actually integers) and their external representations. This routine returns 1 if it succeeds, 0 otherwise.

```
bool_t
```

```
xdr_float(XDR *xdrs, float *fp);
```

xdr_float translates between C floats and their external representations. This routine returns 1 if it succeeds, 0 otherwise.

```
void
```

```
xdr_free(xdrproc_t proc, char *objp);
```

Generic freeing routine. The first argument is the XDR routine for the object being freed. The second argument is a pointer to the object itself. Note: the pointer passed to this routine is not freed, but what it points to is freed (recursively).

xdr_simple(3N)

xdr_simple(3N)

```
bool_t  
xdr_int(XDR *xdrs, int *ip);
```

xdr_int translates between C integers and their external representations. This routine returns 1 if it succeeds, 0 otherwise.

```
bool_t  
xdr_long(XDR *xdrs, long *lp);
```

xdr_long translates between C long integers and their external representations. This routine returns 1 if it succeeds, 0 otherwise.

```
bool_t  
xdr_short(XDR *xdrs, short *sp);
```

xdr_short translates between C short integers and their external representations. This routine returns 1 if it succeeds, 0 otherwise.

```
bool_t  
xdr_u_char(XDR *xdrs, char *ucp);
```

xdr_u_char translates between unsigned C characters and their external representations. This routine returns 1 if it succeeds, 0 otherwise.

```
bool_t  
xdr_u_long(XDR *xdrs, unsigned long *ulp);
```

xdr_u_long translates between C unsigned long integers and their external representations. This routine returns 1 if it succeeds, 0 otherwise.

```
bool_t  
xdr_u_short(XDR *xdrs, unsigned short *usp);
```

xdr_u_short translates between C unsigned short integers and their external representations. This routine returns 1 if it succeeds, 0 otherwise.

```
bool_t  
xdr_void(void);
```

This routine always returns 1. It may be passed to RPC routines that require a function parameter, where nothing is to be done.

SEE ALSO

rpc(3N), xdr_admin(3N), xdr_complex(3N), xdr_create(3N)

NAME

ypclnt, yp_get_default_domain, yp_bind, yp_unbind, yp_match, yp_first, yp_next, yp_all, yp_order, yp_master, yperr_string, ypprot_err - NIS client interface

SYNOPSIS

```
#include <rpcsvc/ypclnt.h>
#include <rpcsvc/yp_prot.h>
```

DESCRIPTION

This package of functions provides an interface to the NIS network lookup service. The package can be loaded from the standard library, `/usr/lib/libnsl.{so,a}`. Refer to `ypfiles(4)` and `ypserv(1M)` for an overview of the NIS name services, including the definitions of *map* and *domain*, and a description of the various servers, databases, and commands that comprise the NIS name service.

All input parameter names begin with *in*. Output parameters begin with *out*. Output parameters of type `char **` should be addresses of uninitialized character pointers. Memory is allocated by the NIS client package using `malloc(3)`, and may be freed if the user code has no continuing need for it. For each *outkey* and *outval*, two extra bytes of memory are allocated at the end that contain newline and `NULL`, respectively, but these two bytes are not reflected in *outkeylen* or *outvallen*. *indomain* and *inmap* strings must be non-`NULL` and `NULL`-terminated. String parameters which are accompanied by a count parameter may not be `NULL`, but may point to `NULL` strings, with the count parameter indicating this. Counted strings need not be `NULL`-terminated.

All functions in this package of type *int* return 0 if they succeed, and a failure code (`YPERR_xxxx`) otherwise. Functions requiring a full YP map name cannot use nicknames. For example, `hosts.byname` must be used instead of the nickname `hosts`. Failure codes are described under **DIAGNOSTICS** below.

Routines

```
int yp_bind (char *indomain);
```

To use the NIS name services, the client process must be bound to a NIS server that serves the appropriate domain using `yp_bind`. Binding need not be done explicitly by user code; this is done automatically whenever a NIS lookup function is called. `yp_bind` can be called directly for processes that make use of a backup strategy (for example, a local file) in cases when NIS services are not available.

```
void yp_unbind (char *indomain);
```

Each binding allocates (uses up) one client process socket descriptor; each bound domain costs one socket descriptor. However, multiple requests to the same domain use that same descriptor. `yp_unbind` is available at the client interface for processes that explicitly manage their socket descriptors while accessing multiple domains. The call to `yp_unbind` make the domain *unbound*, and free all per-process and per-node resources used to bind it.

If an RPC failure results upon use of a binding, that domain will be unbound automatically. At that point, the `ypclnt` layer will retry forever or until the operation succeeds, provided that `ypbind` is running, and either the client process cannot bind a server for the proper domain or RPC requests to the server fail.

If an error is not RPC-related, or if `ypbind` is not running, or if a bound `ypserv` process returns any answer (success or failure), the `ypclnt` layer will return control to the user code, either with an error code, or a success code and any results.

```
int yp_get_default_domain (char **outdomain);
```

The NIS lookup calls require a map name and a domain name, at minimum. It is assumed that the client process knows the name of the map of interest. Client processes should fetch the node's default domain by calling `yp_get_default_domain`, and use the returned *outdomain* as the *indomain* parameter to successive NIS name service calls.

```
int yp_match(char *indomain, char *inmap, char *inkey,
             int inkeylen, char **outval, int *outvallen);
```

`yp_match` returns the value associated with a passed key. This key must be exact; no pattern matching is available.

```
int yp_first(char *indomain, char *inmap, char **outkey,
             int *outkeylen, char **outval, int *outvallen);
```

`yp_first` returns the first key-value pair from the named map in the named domain.

```
int yp_next(char *indomain, char *inmap, char *inkey,
            int inkeylen, char **outkey, int *outkeylen,
            char **outval, int *outvallen);
```

`yp_next` returns the next key-value pair in a named map. The *inkey* parameter should be the *outkey* returned from an initial call to `yp_first` (to get the second key-value pair) or the one returned from the *n*th call to `yp_next` (to get the *n*th + second key-value pair).

The concept of first (and, for that matter, of next) is particular to the structure of the NIS map being processing; there is no relation in retrieval order to either the lexical order within any original (non-NIS name service) data base, or to any obvious numerical sorting order on the keys, values, or key-value pairs. The only ordering guarantee made is that if the `yp_first` function is called on a particular map, and then the `yp_next` function is repeatedly called on the same map at the same server until the call fails with a reason of `YPERR_NOMORE`, every entry in the data base will be seen exactly once. Further, if the same sequence of operations is performed on the same map at the same server, the entries will be seen in the same order.

Under conditions of heavy server load or server failure, it is possible for the domain to become unbound, then bound once again (perhaps to a different server) while a client is running. This can cause a break in one of the enumeration rules; specific entries may be seen twice by the client, or not at all. This approach protects the client from error messages that would otherwise be returned in the midst of the enumeration. The next paragraph describes a better solution to enumerating all entries in a map.

```
int yp_all(char *indomain, char *inmap,
           struct ypall_callback *incallback);
```

`yp_all` provides a way to transfer an entire map from server to client in a single request using TCP (rather than UDP as with other functions in this package). The entire transaction take place as a single RPC request and response. `yp_all` can be used just like any other NIS name service procedure, identify the map in the normal manner, and supply the name of a function which will be called to process each key-value pair within the map. The call to `yp_all` returns only when the transaction is completed (successfully or unsuccessfully), or the `foreach` function decides that it does not want to see any more key-value pairs.

The third parameter to `yp_all` is

```
struct ypcallback *incallback {
    int (*foreach)();
    char *data;
};
```

The function `foreach` is called

```
int foreach(int instatus, char *inkey, int inkeylen,
           char *inval, int invallen, char *indata);
```

The *instatus* parameter will hold one of the return status values defined in `rpcsvc/yp_prot.h`—either `YP_TRUE` or an error code. (See `ypprot_err`, below, for a function which converts a NIS name service protocol error code to a `ypclnt` layer error code.)

The key and value parameters are somewhat different than defined in the **SYNOPSIS** section above. First, the memory pointed to by the *inkey* and *inval* parameters is private to the `yp_all` function, and is overwritten with the arrival of each new key-value pair. It is the responsibility of the `foreach` function to do something useful with the contents of that memory, but it does not own the memory itself. Key and value objects presented to the `foreach` function look exactly as they do in the server's map—if they were not newline-terminated or NULL-terminated in the map, they will not be here either.

The *indata* parameter is the contents of the `incallback->data` element passed to `yp_all`. The `data` element of the callback structure may be used to share state information between the `foreach` function and the mainline code. Its use is optional, and no part of the NIS client package inspects its contents—cast it to something useful, or ignore it.

The `foreach` function is a Boolean. It should return zero to indicate that it wants to be called again for further received key-value pairs, or non-zero to stop the flow of key-value pairs. If `foreach` returns a non-zero value, it is not called again; the functional value of `yp_all` is then 0.

```
int yp_order(char *indomain, char *inmap, int *outorder);
```

`yp_order` returns the order number for a map.

ypclnt(3N)

ypclnt(3N)

```
int yp_master(char *indomain, char *inmap, char **outname);
    yp_master returns the machine name of the master NIS server for a map.
char *yperr_string(int incode);
    yperr_string returns a pointer to an error message string that is NULL-
    terminated but contains no period or newline.
int ypprot_err (unsigned int incode);
    ypprot_err takes a NIS name service protocol error code as input, and
    returns a ypclnt layer error code, which may be used in turn as an input to
    yperr_string.
```

FILES

/usr/lib/libyp.a

SEE ALSO

ypserv(1M), malloc(3), ypupdate(3N), ypfiles(4)

DIAGNOSTICS

All integer functions return 0 if the requested operation is successful, or one of the following errors if the operation fails.

| | | |
|----|---------------|---------------------------------------|
| 1 | YPERR_BADARGS | args to function are bad |
| 2 | YPERR_RPC | RPC failure - domain has been unbound |
| 3 | YPERR_DOMAIN | can't bind to server on this domain |
| 4 | YPERR_MAP | no such map in server's domain |
| 5 | YPERR_KEY | no such key in map |
| 6 | YPERR_YPERR | internal NIS server or client error |
| 7 | YPERR_RESRC | resource allocation failure |
| 8 | YPERR_NOMORE | no more records in map database |
| 9 | YPERR_PMAP | can't communicate with RPC binder |
| 10 | YPERR_YPBIND | can't communicate with ypbind |
| 11 | YPERR_YPSERV | can't communicate with ypserv |
| 12 | YPERR_NODOM | local domain name not set |
| 13 | YPERR_BADDDB | NIS database is bad |
| 14 | YPERR_VERS | NIS version mismatch |
| 15 | YPERR_ACCESS | access violation |
| 16 | YPERR_BUSY | database busy |

ypupdate (3N)

ypupdate (3N)

NAME

yp_update - change NIS information

SYNOPSIS

```
#include <rpcsvc/ypclnt.h>

yp_update(char *domain, char *map, unsigned ypop, char *key,
           int keylen, char *data, int datalen);
```

DESCRIPTION

yp_update is used to make changes to the NIS database. The syntax is the same as that of yp_match except for the extra parameter *ypop*, which may take on one of four values. If it is YPOP_CHANGE then the data associated with the key will be changed to the new value. If the key is not found in the database, then yp_update will return YPERR_KEY. If *ypop* has the value YPOP_INSERT then the key-value pair will be inserted into the database. The error YPERR_KEY is returned if the key already exists in the database. To store an item into the database without concern for whether it exists already or not, pass *ypop* as YPOP_STORE and no error will be returned if the key already or does not exist. To delete an entry, the value of *ypop* should be YPOP_DELETE.

This routine depends upon secure RPC, and will not work unless the network is running secure RPC.

SEE ALSO

secure_rpc(3N)

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abort generate an termination signal value
abs, labs return integer floor, ceiling, remainder, t_accept
accept accept a connection on a socket
accept accept a connection on a
access and modification times
access determine accessibility of a
access
access
access library
access list IDs /setgroups
access list initgroups
access long integer data in a
access
access to a resource governed by a/
access to a shared data segment
access to the slave pseudo-terminal
access utmp file entry /pututline,
access utmpx file entry /getutmp,
accessibility of a file
acct enable or disable process accounting
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The reference manual set for UNIX System V Release 4 for Motorola Processors is the definitive source for complete and detailed specifications for all System V interfaces. Retitled and reorganized, this edition makes finding the manual page you need fast and easy. The following table reflects these changes.

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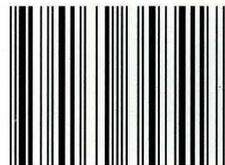
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