NAME

clearerr, feof, ferror, fileno – check and reset stream status

SYNOPSIS

#include <stdio.h>

void clearerr(FILE ****stream*);**
int feof(FILE ****stream*);**
int ferror(FILE ****stream*);**
int fileno(FILE ****stream*);**

DESCRIPTION

The function **clearerr**() clears the end-of-file and error indicators for the stream pointed to by *stream*.

The function **feof**() tests the end-of-file indicator for the stream pointed to by *stream*, returning non-zero if it is set. The end-of-file indicator can only be cleared by the function **clearerr**().

The function **ferror**() tests the error indicator for the stream pointed to by *stream*, returning non-zero if it is set. The error indicator can only be reset by the **clearerr**() function.

The function **fileno**() examines the argument *stream* and returns its integer descriptor.

For non-locking counterparts, see **unlocked_stdio**(3).

ERRORS

These functions should not fail and do not set the external variable *errno*. (However, in case **fileno**() detects that its argument is not a valid stream, it must return −1 and set *errno* to **EBADF**.)

CONFORMING TO

The functions **clearerr**(), **feof**(), and **ferror**() conform to C89 and C99.

SEE ALSO

open(2), **fdopen**(3), **stdio**(3), **unlocked_stdio**(3)

NAME

fflush – flush a stream

SYNOPSIS

#include <stdio.h>

int fflush(FILE ****stream*);**

DESCRIPTION

For output streams, **fflush**() forces a write of all user-space buffered data for the given output or update *stream* via the stream's underlying write function.

For input streams associated with seekable files (e.g., disk files, but not pipes or terminals), **fflush**() discards any buffered data that has been fetched from the underlying file, but has not been consumed by the application.

The open status of the stream is unaffected.

If the *stream* argument is NULL, **fflush**() flushes *all* open output streams.

For a nonlocking counterpart, see **unlocked_stdio**(3).

RETURN VALUE

Upon successful completion 0 is returned. Otherwise, **EOF** is returned and *errno* is set to indicate the error.

ERRORS

EBADF
stream is not an open stream, or is not open for writing.

The function **fflush**() may also fail and set *errno* for any of the errors specified for **write**(2).

SEE ALSO

fsync(2), **sync**(2), **write**(2), **fclose**(3), **fileno**(3), **fopen**(3), **setbuf**(3), **unlocked_stdio**(3)

NAME

fnmatch – match filename or pathname

SYNOPSIS

#include <fnmatch.h>

int fnmatch(const char ***_pattern_, const char ***_string_**, int** _flags_**);**

DESCRIPTION

The **fnmatch**() function checks whether the _string_ argument matches the _pattern_ argument, which is a shell wildcard pattern.

The _flags_ argument modifies the behavior; it is the bitwise OR of zero or more of the following flags:

FNM_NOESCAPE
If this flag is set, treat backslash as an ordinary character, instead of an escape character.

FNM_PATHNAME
If this flag is set, match a slash in _string_ only with a slash in _pattern_ and not by an asterisk (*) or a question mark (?) metacharacter, nor by a bracket expression ([]) containing a slash.

FNM_PERIOD
If this flag is set, a leading period in _string_ has to be matched exactly by a period in _pattern_. A period is considered to be leading if it is the first character in _string_, or if both **FNM_PATHNAME** is set and the period immediately follows a slash.

FNM_FILE_NAME
This is a GNU synonym for **FNM_PATHNAME**.

FNM_LEADING_DIR
If this flag (a GNU extension) is set, the pattern is considered to be matched if it matches an initial segment of _string_ which is followed by a slash. This flag is mainly for the internal use of glibc and is only implemented in certain cases.

FNM_CASEFOLD
If this flag (a GNU extension) is set, the pattern is matched case-insensitively.

RETURN VALUE

Zero if _string_ matches _pattern_, **FNM_NOMATCH** if there is no match or another nonzero value if there is an error.

CONFORMING TO

POSIX.2. The **FNM_FILE_NAME**, **FNM_LEADING_DIR**, and **FNM_CASEFOLD** flags are GNU extensions.

NAME

fopen, fdopen, fileno – stream open functions

SYNOPSIS

#include <stdio.h>

FILE *fopen(const char ***_path_, const char ***_mode_**);**
FILE *fdopen(int _fildes_**, const char ***_mode_**);**
int fileno(FILE ***_stream_);**
int fclose(FILE ***_stream_);**

DESCRIPTION

The **fopen** function opens the file whose name is the string pointed to by _path_ and associates a stream with it.

The argument _mode_ points to a string beginning with one of the following sequences (Additional characters may follow these sequences.):

r Open text file for reading. The stream is positioned at the beginning of the file.

r+ Open for reading and writing. The stream is positioned at the beginning of the file.

w Truncate file to zero length or create text file for writing. The stream is positioned at the beginning of the file.

w+ Open for reading and writing. The file is created if it does not exist, otherwise it is truncated. The stream is positioned at the beginning of the file.

a Open for appending (writing at end of file). The file is created if it does not exist. The stream is positioned at the end of the file.

a+ Open for reading and appending (writing at end of file). The file is created if it does not exist. The stream is positioned at the end of the file.

The **fdopen** function associates a stream with the existing file descriptor, _fildes_. The _mode_ of the stream (one of the values "r", "r+", "w", "w+", "a", "a+") must be compatible with the mode of the file descriptor. The file position indicator of the new stream is set to that belonging to _fildes_, and the error and end-of-file indicators are cleared. Modes "w" or "w+" do not cause truncation of the file. The file descriptor is not dup'ed, and will be closed when the stream created by **fdopen** is closed. The result of applying **fdopen** to a shared memory object is undefined.

The function **fileno**() examines the argument _stream_ and returns its integer descriptor.

The **fclose**() function flushes the stream pointed to by _stream_ (writing any buffered output data using **fflush**(3)) and closes the underlying file descriptor.

RETURN VALUE

Upon successful completion **fopen**, **fdopen** and **freopen** return a **FILE** pointer. Otherwise, **NULL** is returned and the global variable _errno_ is set to indicate the error. Upon successful completion of **fclose**, 0 is returned. Otherwise, **EOF** is returned and _errno_ is set to indicate the error.

ERRORS

EINVAL
The _mode_ provided to **fopen**, **fdopen**, or **freopen** was invalid.

EBADF
The file descriptor underlying _stream_ passed to **fclose** is not valid.

The **fopen**, **fdopen** and **freopen** functions may also fail and set _errno_ for any of the errors specified for the routine **malloc**(3).

The **fopen** function may also fail and set _errno_ for any of the errors specified for the routine **open**(2).

The **fdopen** function may also fail and set _errno_ for any of the errors specified for the routine **fcntl**(2).

NAME

calloc, malloc, free, realloc − Allocate and free dynamic memory

SYNOPSIS

#include <stdlib.h>

void *calloc(size_t *nmemb***, size_t** *size***);**
void *malloc(size_t *size***);**
void free(void **ptr***);**
void *realloc(void **ptr***, size_t** *size***);**

DESCRIPTION

calloc() allocates memory for an array of *nmemb* elements of *size* bytes each and returns a pointer to the allocated memory. The memory is set to zero.

malloc() allocates *size* bytes and returns a pointer to the allocated memory. The memory is not cleared.

free() frees the memory space pointed to by *ptr*, which must have been returned by a previous call to **malloc**(), **calloc**() or **realloc**(). Otherwise, or if **free**(*ptr*) has already been called before, undefined behaviour occurs. If *ptr* is **NULL**, no operation is performed.

realloc() changes the size of the memory block pointed to by *ptr* to *size* bytes. The contents will be unchanged to the minimum of the old and new sizes; newly allocated memory will be uninitialized. If *ptr* is **NULL**, the call is equivalent to **malloc(size)**; if size is equal to zero, the call is equivalent to **free**(*ptr*). Unless *ptr* is **NULL**, it must have been returned by an earlier call to **malloc()**, **calloc()** or **realloc()**.

RETURN VALUE

For **calloc()** and **malloc()**, the value returned is a pointer to the allocated memory, which is suitably aligned for any kind of variable, or **NULL** if the request fails.

free() returns no value.

realloc() returns a pointer to the newly allocated memory, which is suitably aligned for any kind of variable and may be different from *ptr*, or **NULL** if the request fails. If *size* was equal to 0, either NULL or a pointer suitable to be passed to *free*() is returned. If **realloc()** fails the original block is left untouched - it is not freed or moved.

CONFORMING TO

ANSI-C

SEE ALSO

brk(2), **posix_memalign**(3)

NAME

printf, fprintf, sprintf, snprintf, vprintf, vfprintf, vsprintf, vsnprintf − formatted output conversion

SYNOPSIS

#include <stdio.h>

int printf(const char * *format***, ...);**
int fprintf(FILE ****stream*, const char *** *format***, ...);**
int sprintf(char ****str*, const char *** *format***, ...);**
int snprintf(char ****str*, size_t** *size***, const char *** *format***, ...);**
...

DESCRIPTION

The functions in the **printf**() family produce output according to a *format* as described below. The function **printf**() writes output to *stdout*, the standard output stream; **fprintf**() writes output to the given output *stream*; **sprintf**() and **snprintf**(), write to the character string *str*.

The function **snprintf**() writes at most *size* bytes (including the trailing null byte ('\0')) to *str*.

These functions write the output under the control of a *format* string that specifies how subsequent arguments (or arguments accessed via the variable-length argument facilities of **stdarg**(3)) are converted for output.

Return value

Upon successful return, these functions return the number of characters printed (not including the trailing '\0' used to end output to strings).

The functions **snprintf**() and **vsnprintf**() do not write more than *size* bytes (including the trailing '\0'). If the output was truncated due to this limit then the return value is the number of characters (not including the trailing '\0') which would have been written to the final string if enough space had been available. Thus, a return value of *size* or more means that the output was truncated.

If an output error is encountered, a negative value is returned.

Format of the format string

The format string is a character string, beginning and ending in its initial shift state, if any. The format string is composed of zero or more directives: ordinary characters (not **%**), which are copied unchanged to the output stream; and conversion specifications, each of which results in fetching zero or more subsequent arguments. Each conversion specification is introduced by the character **%**, and ends with a *conversion specifier*. In between there may be (in this order) zero or more *flags*, an optional minimum *field width*, an optional *precision* and an optional *length modifier*.

The conversion specifier

A character that specifies the type of conversion to be applied. An example for a conversion specifier is:

o, **u**, **x**, **X**
The *unsigned int* argument is converted to unsigned octal (**o**), unsigned decimal (**u**), or unsigned hexadecimal (**x** and **X**) notation.

s
The *const char ** argument is expected to be a pointer to an array of character type (pointer to a string). Characters from the array are written up to (but not including) a terminating null byte ('\0'); if a precision is specified, no more than the number specified are written. If a precision is given, no null byte need be present; if the precision is not specified, or is greater than the size of the array, the array must contain a terminating null byte.

SEE ALSO

printf(1), **asprintf**(3), **dprintf**(3), **scanf**(3), **setlocale**(3), **wcrtomb**(3), **wprintf**(3), **locale**(5)

NAME

pthread_create – create a new thread / pthread_exit – terminate the calling thread

SYNOPSIS

#include <pthread.h>

int pthread_create(pthread_t * *thread***, pthread_attr_t *** *attr***, void * (***start_routine***)(void *), void *** *arg***);**

void pthread_exit(void ***retval*);**

DESCRIPTION

pthread_create creates a new thread of control that executes concurrently with the calling thread. The new thread applies the function *start_routine* passing it *arg* as first argument. The new thread terminates either explicitly, by calling **pthread_exit**(3), or implicitly, by returning from the *start_routine* function. The latter case is equivalent to calling **pthread_exit**(3) with the result returned by *start_routine* as exit code.

The *attr* argument specifies thread attributes to be applied to the new thread. See **pthread_attr_init**(3) for a complete list of thread attributes. The *attr* argument can also be **NULL**, in which case default attributes are used: the created thread is joinable (not detached) and has default (non real-time) scheduling policy.

pthread_exit terminates the execution of the calling thread. All cleanup handlers that have been set for the calling thread with **pthread_cleanup_push**(3) are executed in reverse order (the most recently pushed handler is executed first). Finalization functions for thread-specific data are then called for all keys that have non- **NULL** values associated with them in the calling thread (see **pthread_key_create**(3)). Finally, execution of the calling thread is stopped.

The *retval* argument is the return value of the thread. It can be consulted from another thread using **pthread_join**(3).

RETURN VALUE

On success, the identifier of the newly created thread is stored in the location pointed by the *thread* argument, and a 0 is returned. On error, a non-zero error code is returned.

The **pthread_exit** function never returns.

ERRORS

EAGAIN
: not enough system resources to create a process for the new thread.

EAGAIN
: more than **PTHREAD_THREADS_MAX** threads are already active.

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SEE ALSO

pthread_join(3), **pthread_detach**(3), **pthread_attr_init**(3).

NAME

pthread_join – join with a terminated thread

SYNOPSIS

#include <pthread.h>

int pthread_join(pthread_t *thread***, void ****retval***);**

Compile and link with *−pthread*.

DESCRIPTION

The **pthread_join**() function waits for the thread specified by *thread* to terminate. If that thread has already terminated, then **pthread_join**() returns immediately. The thread specified by *thread* must be joinable.

If *retval* is not NULL, then **pthread_join**() copies the exit status of the target thread (i.e., the value that the target thread supplied to **pthread_exit**(3)) into the location pointed to by *retval*. If the target thread was canceled, then **PTHREAD_CANCELED** is placed in the location pointed to by *retval*.

If multiple threads simultaneously try to join with the same thread, the results are undefined. If the thread calling **pthread_join**() is canceled, then the target thread will remain joinable (i.e., it will not be detached).

RETURN VALUE

On success, **pthread_join**() returns 0; on error, it returns an error number.

ERRORS

EDEADLK
: A deadlock was detected (e.g., two threads tried to join with each other); or *thread* specifies the calling thread.

EINVAL
: *thread* is not a joinable thread.

EINVAL
: Another thread is already waiting to join with this thread.

ESRCH
: No thread with the ID *thread* could be found.

NOTES

After a successful call to **pthread_join**(), the caller is guaranteed that the target thread has terminated. The caller may then choose to do any clean-up that is required after termination of the thread (e.g., freeing memory or other resources that were allocated to the target thread).

Joining with a thread that has previously been joined results in undefined behavior.

Failure to join with a thread that is joinable (i.e., one that is not detached), produces a "zombie thread". Avoid doing this, since each zombie thread consumes some system resources, and when enough zombie threads have accumulated, it will no longer be possible to create new threads (or processes).

There is no pthreads analog of *waitpid(-1, &status, 0)*, that is, "join with any terminated thread". If you believe you need this functionality, you probably need to rethink your application design.

All of the threads in a process are peers: any thread can join with any other thread in the process.

EXAMPLE

See **pthread_create**(3).

SEE ALSO

pthread_cancel(3), **pthread_create**(3), **pthread_detach**(3), **pthread_exit**(3), **pthreads**(7)

NAME

qsort − sorts an array

SYNOPSIS

```
#include <stdlib.h>

void qsort(void *base, size_t nmemb, size_t size,
        int(*compar)(const void *, const void *));
```

DESCRIPTION

The **qsort**() function sorts an array with *nmemb* elements of size *size*. The *base* argument points to the start of the array.

The contents of the array are sorted in ascending order according to a comparison function pointed to by *compar*, which is called with two arguments that point to the objects being compared.

The comparison function must return an integer less than, equal to, or greater than zero if the first argument is considered to be respectively less than, equal to, or greater than the second. If two members compare as equal, their order in the sorted array is undefined.

RETURN VALUE

The **qsort**() function returns no value.

SEE ALSO

sort(1), **alphasort**(3), **strcmp**(3), **versionsort**(3)

ATTRIBUTES

Multithreading (see pthreads(7))

The **qsort**() function is thread-safe if the comparison function *compar* does not access any global variables.

NAME

stat, fstat, lstat − get file status

SYNOPSIS

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

int stat(const char *path, struct stat *buf);
int fstat(int fd, struct stat *buf);
int lstat(const char *path, struct stat *buf);
```

Feature Test Macro Requirements for glibc (see **feature_test_macros**(7)):

lstat(): _BSD_SOURCE || _XOPEN_SOURCE >= 500

DESCRIPTION

These functions return information about a file. No permissions are required on the file itself, but — in the case of **stat**() and **lstat**() — execute (search) permission is required on all of the directories in *path* that lead to the file.

stat() stats the file pointed to by *path* and fills in *buf*.

lstat() is identical to **stat**(), except that if *path* is a symbolic link, then the link itself is stat-ed, not the file that it refers to.

fstat() is identical to **stat**(), except that the file to be stat-ed is specified by the file descriptor *fd*.

All of these system calls return a *stat* structure, which contains the following fields:

```
struct stat {
    dev_t      st_dev;      /* ID of device containing file  */
    ino_t      st_ino;      /* inode number                  */
    mode_t     st_mode;     /* protection                    */
    nlink_t    st_nlink;    /* number of hard links          */
    uid_t      st_uid;      /* user ID of owner              */
    gid_t      st_gid;      /* group ID of owner             */
    dev_t      st_rdev;     /* device ID (if special file)   */
    off_t      st_size;     /* total size, in bytes          */
    blksize_t  st_blksize;  /* blocksize for file system I/O */
    blkcnt_t   st_blocks;   /* number of blocks allocated    */
    time_t     st_atime;    /* time of last access           */
    time_t     st_mtime;    /* time of last modification     */
    time_t     st_ctime;    /* time of last status change    */
};
```

The *st_dev* field describes the device on which this file resides.

The *st_rdev* field describes the device that this file (inode) represents.

The *st_size* field gives the size of the file (if it is a regular file or a symbolic link) in bytes. The size of a symlink is the length of the pathname it contains, without a trailing null byte.

The *st_blocks* field indicates the number of blocks allocated to the file, 512-byte units. (This may be smaller than *st_size*/512 when the file has holes.)

The *st_blksize* field gives the "preferred" blocksize for efficient file system I/O. (Writing to a file in smaller chunks may cause an inefficient read-modify-rewrite.)

Not all of the Linux file systems implement all of the time fields. Some file system types allow mounting in such a way that file accesses do not cause an update of the *st_atime* field. (See "noatime" in **mount**(8).)

The field *st_atime* is changed by file accesses, for example, by **execve**(2), **mknod**(2), **pipe**(2), **utime**(2) and **read**(2) (of more than zero bytes). Other routines, like **mmap**(2), may or may not update *st_atime*.

The field *st_mtime* is changed by file modifications, for example, by **mknod**(2), **truncate**(2), **utime**(2) and **write**(2) (of more than zero bytes). Moreover, *st_mtime* of a directory is changed by the creation or deletion of files in that directory. The *st_mtime* field is *not* changed for changes in owner, group, hard link count, or mode.

The field *st_ctime* is changed by writing or by setting inode information (i.e., owner, group, link count, mode, etc.).

The following POSIX macros are defined to check the file type using the *st_mode* field:

S_ISREG(m)	is it a regular file?
S_ISDIR(m)	directory?
S_ISCHR(m)	character device?
S_ISBLK(m)	block device?
S_ISFIFO(m)	FIFO (named pipe)?
S_ISLNK(m)	symbolic link? (Not in POSIX.1-1996.)
S_ISSOCK(m)	socket? (Not in POSIX.1-1996.)

RETURN VALUE

On success, zero is returned. On error, −1 is returned, and *errno* is set appropriately.

ERRORS

EACCES
Search permission is denied for one of the directories in the path prefix of *path*. (See also **path_resolution**(7).)

EBADF
fd is bad.

EFAULT
Bad address.

ELOOP
Too many symbolic links encountered while traversing the path.

ENAMETOOLONG
File name too long.

ENOENT
A component of the path *path* does not exist, or the path is an empty string.

ENOMEM
Out of memory (i.e., kernel memory).

ENOTDIR
A component of the path is not a directory.

SEE ALSO

access(2), **chmod**(2), **chown**(2), **fstatat**(2), **readlink**(2), **utime**(2), **capabilities**(7), **symlink**(7)

NAME

strcat, strchr, strcmp, strcpy, strdup, strlen, strncat, strncmp, strncpy, strstr, strtok − string operations

SYNOPSIS

#include <string.h>

char *strcat(char ****dest*, const char ****src***);**
Append the string *src* to the string *dest*, returning a pointer *dest*.

char *strchr(const char ****s*, int** *c***);**
Return a pointer to the first occurrence of the character *c* in the string *s*.

int strcmp(const char ****s1*, const char ****s2***);**
Compare the strings *s1* with *s2*. It returns an integer less than, equal to, or greater than zero if *s1* is found, respectively, to be less than, to match, or be greater than *s2*.

char *strcpy(char ****dest*, const char ****src***);**
Copy the string *src* to *dest*, returning a pointer to the start of *dest*.

char *strdup(const char ****s*);**
Return a duplicate of the string *s* in memory allocated using **malloc**(3).

size_t strlen(const char ****s*);**
Return the length of the string *s*.

char *strncat(char ****dest*, const char ****src***, size_t** *n***);**
Append at most *n* characters from the string *src* to the string *dest*, returning a pointer to *dest*.

int strncmp(const char ****s1*, const char ****s2***, size_t** *n***);**
Compare at most *n* bytes of the strings *s1* and *s2*. It returns an integer less than, equal to, or greater than zero if *s1* is found, respectively, to be less than, to match, or be greater than *s2*.

char *strncpy(char ****dest*, const char ****src***, size_t** *n***);**
Copy at most *n* bytes from string *src* to *dest*, returning a pointer to the start of *dest*.

char *strstr(const char ****haystack*, const char ****needle***);**
Find the first occurrence of the substring *needle* in the string *haystack*, returning a pointer to the found substring.

char *strtok(char ****s*, const char ****delim***);**
Extract tokens from the string *s* that are delimited by one of the bytes in *delim*.

DESCRIPTION

The string functions perform operations on null-terminated strings.