NAME

exec, execl, execv, execle, execve, execlp, execvp – execute a file

SYNOPSIS

#include <unistd.h>

int execl(const char * *path*, **const char *** *arg0*, **…, const char *** *argn*, **char * /*NULL*/);**

int execv(const char * *path*, **char *const** *argv[ ]*);

int execle(const char * *path*,**char *const** *arg0[ ]*, **…, const char *** *argn*,
char * /*NULL*/, char *const *envp[ ]*);

int execve (const char * *path*, **char *const** *argv[ ]* **char *const** *envp[ ]*);

int execlp (const char * *file*, **const char *** *arg0*, **…, const char *** *argn*, **char * /*NULL*/);**

int execvp (const char * *file*, **char *const** *argv[ ]*);

DESCRIPTION

Each of the functions in the **exec** family 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 call to one of these functions because the calling process image is overlaid by the new process image.

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.

The arguments *arg0*, …, *argn* point to null-terminated character strings. These strings constitute the argument list available to the new process image. Conventionally at least *arg0* should be present. The *arg0* argument 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.

The *argv* argument 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). The *argv* argument is terminated by a null pointer.

The *path* argument points to a path name that identifies the new process file.

The *file* argument 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)).

File descriptors open in the calling process remain open in the new process.

Signals that are being caught by the calling process are set to the default disposition in the new process image (see **signal**(3C)). Otherwise, the new process image inherits the signal dispositions of the calling process.

RETURN VALUES

If a function in the **exec** family returns to the calling process, an error has occurred; the return value is **–1** and **errno** is set to indicate the error.

NAME

fork – create a child process

SYNOPSIS

#include <unistd.h>

pid_t fork(void);

DESCRIPTION

fork() creates a new process by duplicating the calling process. The new process, referred to as the *child*, is an exact duplicate of the calling process, referred to as the *parent*, except for the following points:

* The child has its own unique process ID, and this PID does not match the ID of any existing process group (**setpgid**(2)).
* The child's parent process ID is the same as the parent's process ID.
* The child's set of pending signals is initially empty (**sigpending**(2)).

The process attributes in the preceding list are all specified in POSIX.1-2001. The parent and child also differ with respect to the following Linux-specific process attributes:

* Memory mappings that have been marked with the **madvise**(2) **MADV_DONTFORK** flag are not inherited across a **fork**().
* The termination signal of the child is always **SIGCHLD** (see **clone**(2)).

Note the following further points:

* The child inherits copies of the parent's set of open file descriptors. Each file descriptor in the child refers to the same open file description (see **open**(2)) as the corresponding file descriptor in the parent. This means that the two descriptors share open file status flags, current file offset, and signal-driven I/O attributes (see the description of **F_SETOWN** and **F_SETSIG** in **fcntl**(2)).
* The child inherits copies of the parent's set of open directory streams (see **opendir**(3)). POSIX.1-2001 says that the corresponding directory streams in the parent and child *may* share the directory stream positioning; on Linux/glibc they do not.

RETURN VALUE

On success, the PID of the child process is returned in the parent, and 0 is returned in the child. On failure, –1 is returned in the parent, no child process is created, and *errno* is set appropriately.

ERRORS

EAGAIN
fork() cannot allocate sufficient memory to copy the parent's page tables and allocate a task structure for the child.

EAGAIN
It was not possible to create a new process because the caller's **RLIMIT_NPROC** resource limit was encountered. To exceed this limit, the process must have either the **CAP_SYS_ADMIN** or the **CAP_SYS_RESOURCE** capability.

ENOMEM
fork() failed to allocate the necessary kernel structures because memory is tight.

CONFORMING TO

SVr4, 4.3BSD, POSIX.1-2001.

SEE ALSO

clone(2), **execve**(2), **setrlimit**(2), **unshare**(2), **vfork**(2), **wait**(2), **daemon**(3), **capabilities**(7), **credentials**(7)

NAME

fgetc, fgets, getc, getchar, fputc, fputs, putc, putchar – input and output of characters and strings

SYNOPSIS

```
#include <stdio.h>

int fgetc(FILE *stream);
char *fgets(char *s, int size, FILE *stream);
int getc(FILE *stream);
int getchar(void);
int fputc(int c, FILE *stream);
int fputs(const char *s, FILE *stream);
int putc(int c, FILE *stream);
int putchar(int c);
```

DESCRIPTION

fgetc() reads the next character from *stream* and returns it as an *unsigned char* cast to an *int*, or **EOF** on end of file or error.

getc() is equivalent to **fgetc**() except that it may be implemented as a macro which evaluates *stream* more than once.

getchar() is equivalent to **getc**(*stdin*).

fgets() reads in at most one less than *size* characters from *stream* and stores them into the buffer pointed to by *s*. Reading stops after an **EOF** or a newline. If a newline is read, it is stored into the buffer. A **'\0'** is stored after the last character in the buffer.

fputc() writes the character *c*, cast to an *unsigned char*, to *stream*.

fputs() writes the string *s* to *stream*, without its terminating null byte ('\0').

putc() is equivalent to **fputc**() except that it may be implemented as a macro which evaluates *stream* more than once.

putchar(*c*); is equivalent to **putc**(*c*, *stdout*).

Calls to the functions described here can be mixed with each other and with calls to other output functions from the *stdio* library for the same output stream.

RETURN VALUE

fgetc(), **getc**() and **getchar**() return the character read as an *unsigned char* cast to an *int* or **EOF** on end of file or error.

fgets() returns *s* on success, and NULL on error or when end of file occurs while no characters have been read. **fputc**(), **putc**() and **putchar**() return the character written as an *unsigned char* cast to an *int* or **EOF** on error.

fputs() returns a nonnegative number on success, or **EOF** on error.

SEE ALSO

read(2), **write**(2), **ferror**(3), **fgetwc**(3), **fgetws**(3), **fopen**(3), **fread**(3), **fseek**(3), **getline**(3), **getwchar**(3), **scanf**(3), **ungetwc**(3), **write**(2), **ferror**(3), **fopen**(3), **fputwc**(3), **fputws**(3), **fseek**(3), **fwrite**(3), **gets**(3), **putwchar**(3), **scanf**(3), **unlocked_stdio**(3)

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 **<sys/wait.h>**:

WCONTINUED The status of any continued child process specified by *pid*, whose status has not been reported since it continued, is also 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 *pid*.

WNOWAIT Keep the process whose status is returned in *stat_loc* in a waitable state. The process may be waited for again with identical results.

If *wstatus* is not NULL, **waitpid**() store status information in the *int* to which it points. This integer can be inspected with the following macros:

WIFEXITED(*wstatus*), **WEXITSTATUS**(*wstatus*), **WIFSIGNALED**(*wstatus*), **WTERMSIG**(*wstatus*)

RETURN VALUES

If **waitpid**() returns because the status of a child process is available, this function returns 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, **−1** is returned and **errno** is 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*, **0** is returned. Otherwise, **−1** is returned, and **errno** is set to indicate the error.

ERRORS

waitpid() will fail if one or more of the following is true:

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*.

EINTR **waitpid**() was interrupted due to the receipt of a signal sent by the calling process.

EINVAL An invalid value was specified for *options*.