

**NAME**

dup, dup2, dup3 – duplicate a file descriptor

**SYNOPSIS**

```
#include <unistd.h>

int dup(int oldfd);
int dup2(int oldfd, int newfd);

#define _GNU_SOURCE          /* See feature_test_macros(7) */
#include <fcntl.h>          /* Obtain O_* constant definitions */
#include <unistd.h>

int dup3(int oldfd, int newfd, int flags);
```

**DESCRIPTION**

The **dup()** system call creates a copy of the file descriptor *oldfd*, using the lowest-numbered unused file descriptor for the new descriptor.

After a successful return, the old and new file descriptors may be used interchangeably. They refer to the same open file description (see **open(2)**) and thus share file offset and file status flags; for example, if the file offset is modified by using **lseek(2)** on one of the file descriptors, the offset is also changed for the other.

The two file descriptors do not share file descriptor flags (the close-on-exec flag). The close-on-exec flag (**FD\_CLOEXEC**; see **fcntl(2)**) for the duplicate descriptor is off.

**dup2()**

The **dup2()** system call performs the same task as **dup()**, but instead of using the lowest-numbered unused file descriptor, it uses the file descriptor number specified in *newfd*. If the file descriptor *newfd* was previously open, it is silently closed before being reused.

The steps of closing and reusing the file descriptor *newfd* are performed *atomically*. This is important, because trying to implement equivalent functionality using **close(2)** and **dup()** would be subject to race conditions, whereby *newfd* might be reused between the two steps. Such reuse could happen because the main program is interrupted by a signal handler that allocates a file descriptor, or because a parallel thread allocates a file descriptor.

Note the following points:

- \* If *oldfd* is not a valid file descriptor, then the call fails, and *newfd* is not closed.
- \* If *oldfd* is a valid file descriptor, and *newfd* has the same value as *oldfd*, then **dup2()** does nothing, and returns *newfd*.

**dup3()**

**dup3()** is the same as **dup2()**, except that:

- \* The caller can force the close-on-exec flag to be set for the new file descriptor by specifying **O\_CLOEXEC** in *flags*. See the description of the same flag in **open(2)** for reasons why this may be useful.
- \* If *oldfd* equals *newfd*, then **dup3()** fails with the error **EINVAL**.

**RETURN VALUE**

On success, these system calls return the new file descriptor. On error,  $-1$  is returned, and *errno* is set appropriately.

**ERRORS****EBADF**

*oldfd* isn't an open file descriptor.

**EBADF**

*newfd* is out of the allowed range for file descriptors (see the discussion of **RLIMIT\_NOFILE** in **getrlimit(2)**).

**EBUSY**

(Linux only) This may be returned by **dup2()** or **dup3()** during a race condition with **open(2)** and **dup()**.

**EINTR**

The **dup2()** or **dup3()** call was interrupted by a signal; see **signal(7)**.

**EINVAL**

(**dup3()**) *flags* contain an invalid value.

**EINVAL**

(**dup3()**) *oldfd* was equal to *newfd*.

**EMFILE**

The per-process limit on the number of open file descriptors has been reached (see the discussion of **RLIMIT\_NOFILE** in **getrlimit(2)**).

**VERSIONS**

**dup3()** was added to Linux in version 2.6.27; glibc support is available starting with version 2.9.

**CONFORMING TO**

**dup()**, **dup2()**: POSIX.1-2001, POSIX.1-2008, SVr4, 4.3BSD.

**dup3()** is Linux-specific.

**NOTES**

The error returned by **dup2()** is different from that returned by **fcntl(..., F\_DUPFD, ...)** when *newfd* is out of range. On some systems, **dup2()** also sometimes returns **EINVAL** like **F\_DUPFD**.

If *newfd* was open, any errors that would have been reported at **close(2)** time are lost. If this is of concern, then—unless the program is single-threaded and does not allocate file descriptors in signal handlers—the correct approach is *not* to close *newfd* before calling **dup2()**, because of the race condition described above. Instead, code something like the following could be used:

```
/* Obtain a duplicate of 'newfd' that can subsequently
   be used to check for close() errors; an EBADF error
   means that 'newfd' was not open. */

tmpfd = dup(newfd);
if (tmpfd == -1 && errno != EBADF) {
    /* Handle unexpected dup() error */
}

/* Atomically duplicate 'oldfd' on 'newfd' */

if (dup2(oldfd, newfd) == -1) {
    /* Handle dup2() error */
}

/* Now check for close() errors on the file originally
   referred to by 'newfd' */

if (tmpfd != -1) {
    if (close(tmpfd) == -1) {
        /* Handle errors from close */
    }
}
```

**SEE ALSO**

**close(2)**, **fcntl(2)**, **open(2)**

**COLOPHON**

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