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Red Hat Enterprise Linux Release 9.2 Manual Pages on 'eventfd2.2' command

\$ man eventfd2.2

EVENTFD(2) Linux Programmer's Manual EVENTFD(2)

NAME

eventfd - create a file descriptor for event notification

SYNOPSIS

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

```
int eventfd(unsigned int initval, int flags);
```

DESCRIPTION

eventfd() creates an "eventfd object" that can be used as an event wait/notify mechanism by user-space applications, and by the kernel to notify user-space applications of events. The object contains an unsigned 64-bit integer (uint64_t) counter that is maintained by the kernel. This counter is initialized with the value specified in the argument initval.

As its return value, eventfd() returns a new file descriptor that can be used to refer to the eventfd object.

The following values may be bitwise ORed in flags to change the behavior of eventfd():

EFD_CLOEXEC (since Linux 2.6.27)

Set the close-on-exec (FD_CLOEXEC) flag on the new file descriptor. See the description of the O_CLOEXEC flag in open(2) for reasons why this may be useful.

EFD_NONBLOCK (since Linux 2.6.27)

Set the O_NONBLOCK file status flag on the open file description

(see `open(2)`) referred to by the new file descriptor. Using this flag saves extra calls to `fcntl(2)` to achieve the same result.

`EFD_SEMAPHORE` (since Linux 2.6.30)

Provide semaphore-like semantics for reads from the new file descriptor. See below.

In Linux up to version 2.6.26, the `flags` argument is unused, and must be specified as zero.

The following operations can be performed on the file descriptor returned by `eventfd()`:

`read(2)`

Each successful `read(2)` returns an 8-byte integer. A `read(2)` fails with the error `EINVAL` if the size of the supplied buffer is less than 8 bytes.

The value returned by `read(2)` is in host byte order—that is, the native byte order for integers on the host machine.

The semantics of `read(2)` depend on whether the `eventfd` counter currently has a nonzero value and whether the `EFD_SEMAPHORE` flag was specified when creating the `eventfd` file descriptor:

- * If `EFD_SEMAPHORE` was not specified and the `eventfd` counter has a nonzero value, then a `read(2)` returns 8 bytes containing that value, and the counter's value is reset to zero.
- * If `EFD_SEMAPHORE` was specified and the `eventfd` counter has a nonzero value, then a `read(2)` returns 8 bytes containing the value 1, and the counter's value is decremented by 1.
- * If the `eventfd` counter is zero at the time of the call to `read(2)`, then the call either blocks until the counter becomes nonzero (at which time, the `read(2)` proceeds as described above) or fails with the error `EAGAIN` if the file descriptor has been made nonblocking.

`write(2)`

A `write(2)` call adds the 8-byte integer value supplied in its buffer to the counter. The maximum value that may be stored in

the counter is the largest unsigned 64-bit value minus 1 (i.e., 0xffffffffffe). If the addition would cause the counter's value to exceed the maximum, then the write(2) either blocks until a read(2) is performed on the file descriptor, or fails with the error EAGAIN if the file descriptor has been made nonblocking.

A write(2) fails with the error EINVAL if the size of the supplied buffer is less than 8 bytes, or if an attempt is made to write the value 0xffffffff.

poll(2), select(2) (and similar)

The returned file descriptor supports poll(2) (and analogously epoll(7)) and select(2), as follows:

- * The file descriptor is readable (the select(2) readfds argument; the poll(2) POLLIN flag) if the counter has a value greater than 0.
- * The file descriptor is writable (the select(2) writefds argument; the poll(2) POLLOUT flag) if it is possible to write a value of at least "1" without blocking.
- * If an overflow of the counter value was detected, then select(2) indicates the file descriptor as being both readable and writable, and poll(2) returns a POLLERR event. As noted above, write(2) can never overflow the counter. However an overflow can occur if 2⁶⁴ eventfd "signal posts" were performed by the KAIO subsystem (theoretically possible, but practically unlikely). If an overflow has occurred, then read(2) will return that maximum uint64_t value (i.e., 0xffffffff).

The eventfd file descriptor also supports the other file-descriptor multiplexing APIs: pselect(2) and ppoll(2).

close(2)

When the file descriptor is no longer required it should be closed. When all file descriptors associated with the same eventfd object have been closed, the resources for object are

freed by the kernel.

A copy of the file descriptor created by eventfd() is inherited by the child produced by fork(2). The duplicate file descriptor is associated with the same eventfd object. File descriptors created by eventfd() are preserved across execve(2), unless the close-on-exec flag has been set.

RETURN VALUE

On success, eventfd() returns a new eventfd file descriptor. On error, -1 is returned and errno is set to indicate the error.

ERRORS

EINVAL An unsupported value was specified in flags.

EMFILE The per-process limit on the number of open file descriptors has been reached.

ENFILE The system-wide limit on the total number of open files has been reached.

ENODEV Could not mount (internal) anonymous inode device.

ENOMEM There was insufficient memory to create a new eventfd file descriptor.

VERSIONS

eventfd() is available on Linux since kernel 2.6.22. Working support is provided in glibc since version 2.8. The eventfd2() system call (see NOTES) is available on Linux since kernel 2.6.27. Since version 2.9, the glibc eventfd() wrapper will employ the eventfd2() system call, if it is supported by the kernel.

ATTRIBUTES

For an explanation of the terms used in this section, see attributes(7).

??

?Interface ? Attribute ? Value ?

??

?eventfd() ? Thread safety ? MT-Safe ?

??

CONFORMING TO

eventfd() and eventfd2() are Linux-specific.

NOTES

Applications can use an eventfd file descriptor instead of a pipe (see pipe(2)) in all cases where a pipe is used simply to signal events.

The kernel overhead of an eventfd file descriptor is much lower than that of a pipe, and only one file descriptor is required (versus the two required for a pipe).

When used in the kernel, an eventfd file descriptor can provide a bridge from kernel to user space, allowing, for example, functionalities like KAIO (kernel AIO) to signal to a file descriptor that some operation is complete.

A key point about an eventfd file descriptor is that it can be monitored just like any other file descriptor using select(2), poll(2), or epoll(7). This means that an application can simultaneously monitor the readiness of "traditional" files and the readiness of other kernel mechanisms that support the eventfd interface. (Without the eventfd() interface, these mechanisms could not be multiplexed via select(2), poll(2), or epoll(7).)

The current value of an eventfd counter can be viewed via the entry for the corresponding file descriptor in the process's /proc/[pid]/fdinfo directory. See proc(5) for further details.

C library/kernel differences

There are two underlying Linux system calls: eventfd() and the more recent eventfd2(). The former system call does not implement a flags argument. The latter system call implements the flags values described above. The glibc wrapper function will use eventfd2() where it is available.

Additional glibc features

The GNU C library defines an additional type, and two functions that attempt to abstract some of the details of reading and writing on an eventfd file descriptor:

```
typedef uint64_t eventfd_t;  
  
int eventfd_read(int fd, eventfd_t *value);
```

```
int eventfd_write(int fd, eventfd_t value);
```

The functions perform the read and write operations on an eventfd file descriptor, returning 0 if the correct number of bytes was transferred, or -1 otherwise.

EXAMPLES

The following program creates an eventfd file descriptor and then forks to create a child process. While the parent briefly sleeps, the child writes each of the integers supplied in the program's command-line arguments to the eventfd file descriptor. When the parent has finished sleeping, it reads from the eventfd file descriptor.

The following shell session shows a sample run of the program:

```
$ ./a.out 1 2 4 7 14
Child writing 1 to efd
Child writing 2 to efd
Child writing 4 to efd
Child writing 7 to efd
Child writing 14 to efd
Child completed write loop
Parent about to read
Parent read 28 (0x1c) from efd
```

Program source

```
#include <sys/eventfd.h>
#include <unistd.h>
#include <inttypes.h>      /* Definition of PRlu64 & PRlx64 */
#include <stdlib.h>
#include <stdio.h>
#include <stdint.h>       /* Definition of uint64_t */
#define handle_error(msg) \
do { perror(msg); exit(EXIT_FAILURE); } while (0)
int
main(int argc, char *argv[])
{
    int efd;
```

```

uint64_t u;

ssize_t s;

if (argc < 2) {
    fprintf(stderr, "Usage: %s <num>...\n", argv[0]);
    exit(EXIT_FAILURE);
}

efd = eventfd(0, 0);

if (efd == -1)
    handle_error("eventfd");

switch (fork()) {
case 0:
    for (int j = 1; j < argc; j++) {
        printf("Child writing %s to efd\n", argv[j]);
        u = strtoull(argv[j], NULL, 0);
        /* strtoull() allows various bases */
        s = write(efd, &u, sizeof(uint64_t));
        if (s != sizeof(uint64_t))
            handle_error("write");
    }
    printf("Child completed write loop\n");
    exit(EXIT_SUCCESS);
default:
    sleep(2);
    printf("Parent about to read\n");
    s = read(efd, &u, sizeof(uint64_t));
    if (s != sizeof(uint64_t))
        handle_error("read");
    printf("Parent read %"PRIu64" (%#"PRIx64") from efd\n", u, u);
    exit(EXIT_SUCCESS);
case -1:
    handle_error("fork");
}
}

```

SEE ALSO

futex(2), pipe(2), poll(2), read(2), select(2), signalfd(2),
timerfd_create(2), write(2), epoll(7), sem_overview(7)

COLOPHON

This page is part of release 5.10 of the Linux man-pages project. A description of the project, information about reporting bugs, and the latest version of this page, can be found at <https://www.kernel.org/doc/man-pages/>.

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2020-11-01

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