



Linux Ubuntu 26.04 Manual Pages on command 'gai_error.3'

\$ man gai_error.3

getaddrinfo_a(3) Library Functions Manual getaddrinfo_a(3)

NAME

getaddrinfo_a, gai_suspend, gai_error, gai_cancel - asynchronous network address and service translation

LIBRARY

Asynchronous name lookup library (libanl, -lanl)

SYNOPSIS

```
#define _GNU_SOURCE            /* See feature_test_macros(7) */
#include <netdb.h>

int getaddrinfo_a(int mode, struct gaicb *list[restrict n],
                  int n, struct sigevent *restrict sevp);

int gai_suspend(const struct gaicb *const list[n], int n,
                const struct timespec *timeout);

int gai_error(struct gaicb *req);

int gai_cancel(struct gaicb *req);
```

DESCRIPTION

The `getaddrinfo_a()` function performs the same task as `getaddrinfo(3)`, but allows multiple name look-ups to be performed asynchronously, with optional notification on completion of look-up operations.

The mode argument has one of the following values:

GAI_WAIT

Perform the look-ups synchronously. The call blocks until the look-ups have completed.

GAI_NOWAIT

Perform the look-ups asynchronously. The call returns immediately, and the requests are resolved in the background. See the discussion of the `sevp` argument below.

The array list specifies the look-up requests to process. The `n` argument specifies the number of elements in list. The requested look-up operations are started in parallel. NULL elements in list are ignored. Each request is described by a `gaicb` structure, defined as follows:

```
struct gaicb {  
    const char      *ar_name;  
    const char      *ar_service;  
    const struct addrinfo *ar_request;  
    struct addrinfo  *ar_result;  
};
```

The elements of this structure correspond to the arguments of `getaddrinfo(3)`. Thus, `ar_name` corresponds to the node argument and `ar_service` to the service argument, identifying an Internet host and a service. The `ar_request` element corresponds to the hints argument, specifying the criteria for selecting the returned socket address structures. Finally, `ar_result` corresponds to the `res` argument; you do not need to initialize this element, it will be automatically set when the request is resolved. The `addrinfo` structure referenced by the last two elements is described in `getaddrinfo(3)`.

When `mode` is specified as `GAI_NOWAIT`, notifications about resolved requests can be obtained by employing the `sigevent` structure pointed to by the `sevp` argument. For the definition and general details of this structure, see `sigevent(3type)`. The `sevp->sigev_notify` field can have the following values:

SIGEV_NONE

Don't provide any notification.

SIGEV_SIGNAL

When a look-up completes, generate the signal `sigev_signo` for the process. See `sigevent(3type)` for general details. The `si_code` field of the `siginfo_t` structure will be set to `SI_ASYNCNL`.

SIGEV_THREAD

When a look-up completes, invoke `sigev_notify_function` as if it were the start function of a new thread. See `sigevent(3type)` for details.

For SIGEV_SIGNAL and SIGEV_THREAD, it may be useful to point `sevp->sigev_value.sival_ptr` to list.

The `gai_suspend()` function suspends execution of the calling thread, waiting for the completion of one or more requests in the array list. The `n` argument specifies the size of the array list. The call blocks until one of the following occurs:

- ? One or more of the operations in list completes.
- ? The call is interrupted by a signal that is caught.
- ? The time interval specified in `timeout` elapses. This argument specifies a timeout in seconds plus nanoseconds (see `nanosleep(2)` for details of the `timespec` structure). If `timeout` is `NULL`, then the call blocks indefinitely (until one of the events above occurs).

No explicit indication of which request was completed is given; you must determine which request(s) have completed by iterating with `gai_error()` over the list of requests.

The `gai_error()` function returns the status of the request `req`: either `EAI_INPROGRESS` if the request was not completed yet, 0 if it was handled successfully, or an error code if the request could not be resolved.

The `gai_cancel()` function cancels the request `req`. If the request has been canceled successfully, the error status of the request will be set to `EAI_CANCELED` and normal asynchronous notification will be performed. The request cannot be canceled if it is currently being processed; in that case, it will be handled as if `gai_cancel()` has never been called. If `req` is `NULL`, an attempt is made to cancel all outstanding requests that the process has made.

RETURN VALUE

The `getaddrinfo_a()` function returns 0 if all of the requests have been enqueued successfully, or one of the following nonzero error codes:

EAI_AGAIN

The resources necessary to enqueue the look-up requests were not available. The application may check the error status of each request to determine which ones failed.

EAI_MEMORY

Out of memory.

EAI_SYSTEM

mode is invalid.

The `gai_suspend()` function returns 0 if at least one of the listed requests has been completed.

EAI AGAIN

EAI_ALLDONE

EAI_INTR

The `gai_error()` function can return `EAI_INPROGRESS` for an unfinished look-up request, 0 for a successfully completed look-up (as described above), one of the error codes that could be returned by `getaddrinfo(3)`, or the error code `EAI_CANCELED` if the request has been canceled explicitly before it could be finished.

The `gai_cancel()` function can return one of these values:

EAI CANCELED

The request has been canceled successfully.

EAI NOTCANCELED

The request has not been canceled.

EAI ALLDONE

The request has already completed.

The `gai_strerror(3)` function translates these error codes to a human readable string, suitable for error reporting.

ATTRIBUTES

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

[illegible]

?	Interface	?	Attribute	?	Value	?
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[illegible]

? getaddrinfo a(), gai_suspend(), gai_error(), gai_cancel() ? Thread safety ? MT-Safe ?

[illegible]

STANDARDS

GNU.

HISTORY

qlibc 2.2.3.

The interface of `getaddrinfo_a()` was modeled after the `lio_listio(3)` interface.

EXAMPLES

Two examples are provided: a simple example that resolves several requests in parallel synchronously, and a complex example showing some of the asynchronous capabilities.

Synchronous example

The program below simply resolves several hostnames in parallel, giving a speed-up compared to resolving the hostnames sequentially using `getaddrinfo(3)`. The program might be used like this:

```
$ ./a.out mirrors.kernel.org enoent.linuxfoundation.org gnu.org;

mirrors.kernel.org: 139.178.88.99

enoent.linuxfoundation.org: Name or service not known

gnu.org: 209.51.188.116
```

Here is the program source code

```
#define _GNU_SOURCE

#include <err.h>

#include <netdb.h>

#include <stdio.h>

#include <stdlib.h>

#include <string.h>

#define MALLOC(n, type) ((type *) reallocarray(NULL, n, sizeof(type)))

int

main(int argc, char *argv[])

{

    int ret;

    struct gaicb *reqs[argc - 1];

    char host[NI_MAXHOST];

    struct addrinfo *res;

    if (argc < 2) {

        fprintf(stderr, "Usage: %s HOST...\n", argv[0]);

        exit(EXIT_FAILURE);

    }

    for (size_t i = 0; i < argc - 1; i++) {

        reqs[i] = MALLOC(1, struct gaicb);

        if (reqs[i] == NULL)
```

```

        err(EXIT_FAILURE, "malloc");

    memset(reqs[i], 0, sizeof(*reqs[0]));

    reqs[i]->ar_name = argv[i + 1];
}

ret = getaddrinfo_a(GAI_WAIT, reqs, argc - 1, NULL);
if (ret != 0) {
    fprintf(stderr, "getaddrinfo_a() failed: %s\n",
            gai_strerror(ret));
    exit(EXIT_FAILURE);
}

for (size_t i = 0; i < argc - 1; i++) {
    printf("%s: ", reqs[i]->ar_name);
    ret = gai_error(reqs[i]);
    if (ret == 0) {
        res = reqs[i]->ar_result;
        ret = getnameinfo(res->ai_addr, res->ai_addrlen,
                host, sizeof(host),
                NULL, 0, NI_NUMERICHOST);

        if (ret != 0) {
            fprintf(stderr, "getnameinfo() failed: %s\n",
                    gai_strerror(ret));
            exit(EXIT_FAILURE);
        }

        puts(host);
    } else {
        puts(gai_strerror(ret));
    }
}

exit(EXIT_SUCCESS);
}

```

Asynchronous example

This example shows a simple interactive `getaddrinfo_a()` front-end. The notification facility is not demonstrated.

An example session might look like this:

```
$ ./a.out;  
  
> a mirrors.kernel.org enoent.linuxfoundation.org gnu.org  
  
> c 2  
  
[2] gnu.org: Request not canceled  
  
> w 0 1  
  
[00] mirrors.kernel.org: Finished  
  
> l  
  
[00] mirrors.kernel.org: 139.178.88.99  
  
[01] enoent.linuxfoundation.org: Processing request in progress  
  
[02] gnu.org: 209.51.188.116  
  
> l  
  
[00] mirrors.kernel.org: 139.178.88.99  
  
[01] enoent.linuxfoundation.org: Name or service not known  
  
[02] gnu.org: 209.51.188.116
```

The program source is as follows:

```
#define _GNU_SOURCE  
  
#include <assert.h>  
  
#include <err.h>  
  
#include <netdb.h>  
  
#include <stdio.h>  
  
#include <stdlib.h>  
  
#include <string.h>  
  
#define CALLOC(n, type) ((type *) calloc(n, sizeof(type)))  
#define REALLOCF(ptr, n, type) \\\n({ \\\n    static_assert(__builtin_types_compatible_p(typeof(ptr), type *)); \\\n    \\\n    (type *) reallocarray(ptr, n, sizeof(type)); \\\n})  
  
static struct gaicb **reqs = NULL;  
  
static size_t nreqs = 0;  
  
static inline void *
```

```

reallocarrayf(void *p, size_t n, size_t size)
{
    void *q;

    q = reallocarray(p, n, size);

    if (q == NULL && n != 0 && size != 0)
        free(p);

    return q;
}

static char *
getcmd(void)
{
    static char buf[256];

    fputs("> ", stdout);

    fflush(stdout);

    if (fgets(buf, sizeof(buf), stdin) == NULL)
        return NULL;

    if (buf[strlen(buf) - 1] == '\n')
        buf[strlen(buf) - 1] = 0;

    return buf;
}

/* Add requests for specified hostnames. */

static void
add_requests(void)
{
    size_t nreqs_base = nreqs;

    char *host;

    int ret;

    while ((host = strtok(NULL, " ")) {
        nreqs++;

        reqs = REALLOCF(reqs, nreqs, struct gaicb *);

        if (reqs == NULL)
            err(EXIT_FAILURE, "reallocf");

        reqs[nreqs - 1] = CALLOC(1, struct gaicb);
    }
}

```



```

    if (reqs[nreqs - 1] == NULL)
        err(EXIT_FAILURE, "calloc");

    reqs[nreqs - 1]->ar_name = strdup(host);
}

/* Queue nreqs_base..nreqs requests. */
ret = getaddrinfo_a(GAI_NOWAIT, &reqs[nreqs_base],
                    nreqs - nreqs_base, NULL);

if (ret) {
    fprintf(stderr, "getaddrinfo_a() failed: %s\n",
            gai_strerror(ret));
    exit(EXIT_FAILURE);
}
}

/* Wait until at least one of specified requests completes. */
static void
wait_requests(void)
{
    char *id;
    int ret;
    size_t n;
    struct gaicb const **wait_reqs;
    wait_reqs = CALLOC(nreqs, const struct gaicb *);
    if (wait_reqs == NULL)
        err(EXIT_FAILURE, "calloc");

    /* NULL elements are ignored by gai_suspend(). */
    while ((id = strtok(NULL, " ")) != NULL) {
        n = atoi(id);
        if (n >= nreqs) {
            printf("Bad request number: %s\n", id);
            return;
        }
        wait_reqs[n] = reqs[n];
    }
}

```

```

ret = gai_suspend(wait_reqs, nreqs, NULL);

if (ret) {
    printf("gai_suspend(): %s\n", gai_strerror(ret));
    return;
}

for (size_t i = 0; i < nreqs; i++) {
    if (wait_reqs[i] == NULL)
        continue;

    ret = gai_error(reqs[i]);

    if (ret == EAI_INPROGRESS)
        continue;

    printf("[%02zu] %s: %s\n", i, reqs[i]->ar_name,
        ret == 0 ? "Finished" : gai_strerror(ret));
}
}

/* Cancel specified requests. */

static void
cancel_requests(void)
{
    char *id;
    int ret;
    size_t n;
    while ((id = strtok(NULL, " ")) != NULL) {
        n = atoi(id);
        if (n >= nreqs) {
            printf("Bad request number: %s\n", id);
            return;
        }
        ret = gai_cancel(reqs[n]);
        printf("[%s] %s: %s\n", id, reqs[atoi(id)]->ar_name,
            gai_strerror(ret));
    }
}

```

```

/* List all requests. */

static void
list_requests(void)
{
    int ret;

    char host[NI_MAXHOST];

    struct addrinfo *res;

    for (size_t i = 0; i < nreqs; i++) {

        printf("[%02zu] %s: ", i, reqs[i]->ar_name);

        ret = gai_error(reqs[i]);

        if (!ret) {

            res = reqs[i]->ar_result;

            ret = getnameinfo(res->ai_addr, res->ai_addrlen,

                               host, sizeof(host),

                               NULL, 0, NI_NUMERICHOST);

            if (ret) {

                fprintf(stderr, "getnameinfo() failed: %s\n",

                        gai_strerror(ret));

                exit(EXIT_FAILURE);

            }

            puts(host);

        } else {

            puts(gai_strerror(ret));

        }

    }
}

int
main(void)
{
    char *cmdline;

    char *cmd;

    while ((cmdline = getcmd()) != NULL) {

        cmd = strtok(cmdline, " ");

```

```

if (cmd == NULL) {
    list_requests();
} else {
    switch (cmd[0]) {
        case 'a':
            add_requests();
            break;
        case 'w':
            wait_requests();
            break;
        case 'c':
            cancel_requests();
            break;
        case 'l':
            list_requests();
            break;
        default:
            fprintf(stderr, "Bad command: %c\n", cmd[0]);
            break;
    }
}

exit(EXIT_SUCCESS);
}

```

SEE ALSO

getaddrinfo(3), inet(3), lio_listio(3), hostname(7), ip(7), sigevent(3type)