QNX® Neutrino® Device Drivers

Universal Serial Bus (USB) Devices

For QNX® Neutrino® 6.3.0 or later, or QNX® 4

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About the USB DDK

What you'll find in this guide

The USB Driver Development Kit will help you write drivers for Universal Serial Bus devices.

Our USB API is designed to work with either QNX Neutrino or QNX 4. Exceptions will be noted where appropriate.

The following table may help you find information quickly:

For information on:	See:
System requirements and other vital information	Before You Begin
How the OS supports USB	Overview
Command-line utilities	USB Utilities
USB driver interface calls	USB Library Reference

The USB DDK includes source code for several USB class drivers. Each class driver is contained in its own separate archive. Look under the */ddk_working_dir*`/usb/src/hardware/devu/class` directory on your system.

Assumptions

We assume you're familiar with the Universal Serial Bus (USB) Specification revision 2.0, especially the chapters on:

- Architectural Overview
- USB Data Flow Model
- USB Device Framework
- USB Host: Hardware and Software.

You'll need a good understanding of the concepts in those chapters in order to write USB client device drivers.

For up-to-date information on USB developments, visit **`www.usb.org`**.

Building DDKs

You can compile the DDK from the IDE or the command line.

- To compile the DDK from the IDE:

Please refer to the Managing Source Code chapter, and "QNX Source Package" in the Common Wizards Reference chapter of the *IDE User's Guide*.

- To compile the DDK from the command line:

  Please refer to the release notes or the installation notes for information on the location of the DDK archives.

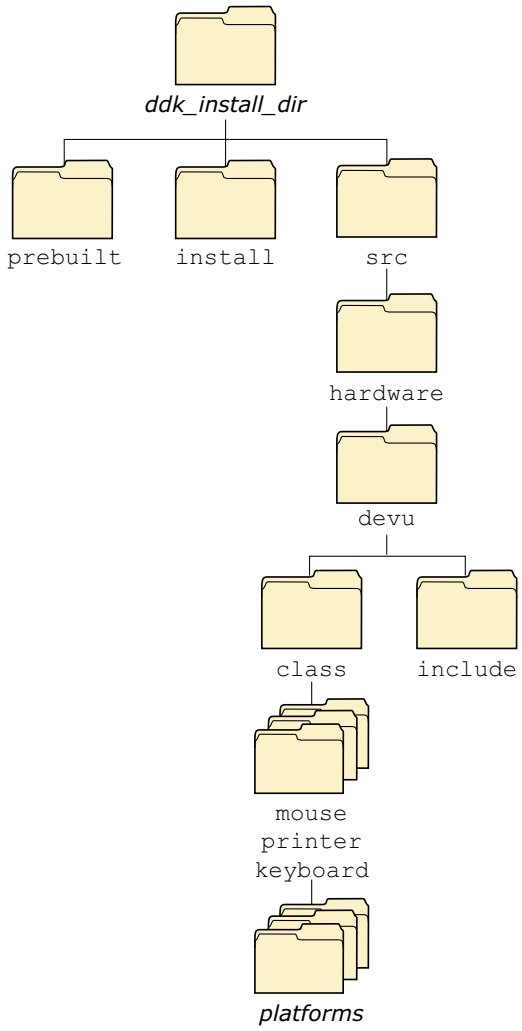
  DDKs are simple zipped archives, with no special requirements. You must manually expand their directory structure from the archive. You can install them into whichever directory you choose, assuming you have write permissions for the chosen directory.

  Historically, DDKs were placed in **`/usr/src/ddk_VERSION`** directory, e.g. **`/usr/src/ddk-6.2.1.`** This method is no longer required, as each DDK archive is completely self-contained.

  The following example indicates how you create a directory and unzip the archive file:

  ```
  # cd ~
  # mkdir my_DDK
  # cd my_DDK
  # unzip /path_to_ddks/ddk-device_type.zip
  ```

  The top-level directory structure for the DDK looks like this:



Directory structure for this DDK.

You must run:

```
. ./setenv.sh
```

before running **make**, or **make install**.

Additionally, on Windows hosts you'll need to run the **Bash** shell (**bash.exe**) before you run the **. ./setenv.sh** command.

If you fail to run the **. ./setenv.sh** shell script prior to building the DDK, you can overwrite existing binaries or libs that are installed in **$QNX_TARGET**.

Each time you start a new shell, run the **. ./setenv.sh** command. The shell needs to be initialized before you can compile the archive.

The script will be located in the same directory where you unzipped the archive file. It must be run in such a way that it modifies the current shell's environment, not a sub-shell environment.

In **ksh** and **bash** shells, All shell scripts are executed in a sub-shell by default. Therefore, it's important that you use the syntax

```
. <script>
```

which will prevent a sub-shell from being used.

Each DDK is rooted in whatever directory you copy it to. If you type **make** within this directory, you'll generate all of the buildable entities within that DDK no matter where you move the directory.

All binaries are placed in a scratch area within the DDK directory that mimics the layout of a target system.

When you build a DDK, everything it needs, aside from standard system headers, is pulled in from within its own directory. Nothing that's built is installed outside of the DDK's directory. The makefiles shipped with the DDKs copy the contents of the **prebuilt** directory into the **install** directory. The binaries are built from the source using include files and link libraries in the **install** directory.

Typographical conventions

Throughout this manual, we use certain typographical conventions to distinguish technical terms. In general, the conventions we use conform to those found in IEEE POSIX publications. The following table summarizes our conventions:

Reference	Example
Code examples	`if( stream == NULL )`
Command options	**-lR**
Commands	**make**
Environment variables	**PATH**
File and pathnames	**/dev/null**
Function names	*exit()*
Keyboard chords	Ctrl-Alt-Delete
Keyboard input	**something you type**
Keyboard keys	Enter
Program output	**login:**
Programming constants	NULL
Programming data types	**unsigned short**
Programming literals	**0xFF**, **"message string"**
Variable names	*stdin*

continued...

Reference	Example
User-interface components	**Cancel**

We use an arrow (→) in directions for accessing menu items, like this:

> You'll find the **Other...** menu item under **Perspective→Show View**.

We use notes, cautions, and warnings to highlight important messages:

Notes point out something important or useful.

CAUTION: Cautions tell you about commands or procedures that may have unwanted or undesirable side effects.

WARNING: Warnings tell you about commands or procedures that could be dangerous to your files, your hardware, or even yourself.

Note to Windows users

In our documentation, we use a forward slash (`/`) as a delimiter in *all* pathnames, including those pointing to Windows files.

We also generally follow POSIX/UNIX filesystem conventions.

Technical support

To obtain technical support for any QNX product, visit the **Support** area on our website (`www.qnx.com`). You'll find a wide range of support options, including community forums.

Chapter 1

Before You Begin

In this chapter. . .

System requirements

This USB DDK is designed to work with both QNX Neutrino 6 and with QNX 4.

For QNX Neutrino

You'll need the following:

- QNX Neutrino 6.3 or later
- GNU GCC 2.95.2 or later
- USB EHCI, OHCI or UHCI controller, version 1.1 and 2.0 compliant

For QNX 4

You'll need the following:

- QNX 4.25, patch D or later
- Watcom 10.6, patch B or later
- USB EHCI, OHCI or UHCI controller, version 1.1 and 2.0 compliant

USB devices supported

Type of device	Manufacturer	Model
Keyboard	Belkin	MediaBoard F8E211-USB
″	Micro Innovations	–
Mouse	Logitech	USB Wheel Mouse M-BB48
″	″	WingMan Gaming Mouse M-BC38
″	Microsoft	IntelliMouse
Hub	ADS Technologies	4-port
″	Belkin	4-port
Printer	Canon	BJC-85
″	Epson	Stylus Color 740
″	HP	DeskJet 895Cse

Known limitations

EHCI

Retrieving the "Other Speed Descriptor" has not been implemented.

Photon and text mode

If you're using Photon as well as text mode, you won't be able to switch between them and use a USB keyboard once the USB stack has been started.

From a cold boot, you'll be able to use a USB keyboard in text mode *before the USB stack has been started*. As soon as you start the USB stack, you can't use a USB keyboard in text mode.

CAUTION:

Make sure that the command line for **`devi-hirun`** (or **`Input`**) includes the option to *not* reset the keyboard controller. For example:

```
devi-hirun kbd -R fd -d/dev/usbkbd0 &
```

Or with QNX 4:

```
Input kbd -R fd -d/dev/usbkbd0 &
```

If you don't use the **`-R`** option, then the keyboard controller will be reset whenever you switch between Photon and text mode, and the machine may hang.

Chapter 2

Overview

In this chapter. . .

The USB stack and library

USB (Universal Serial Bus) is a hardware and protocol specification for interconnecting various devices to a host controller. We supply a USB stack that implements the USB protocol and allows user-written class drivers to communicate with USB devices.

We also supply a USB driver library (*usbd_*()*) for class drivers to use in order to communicate with the USB stack. Note that a class driver can be considered a "client" of the USB stack.

The stack is implemented as a standalone process that registers the pathname of **/dev/io-usb/io-usb** (by default). Currently, the stack contains the hub class driver within it.

Host Controller Interface (HCI) types

The stack supports the three industry-standard HCI types:

- Open Host Controller Interface (OHCI)
- Universal Host Controller Interface (UHCI)
- Enhanced Host Controller Interface (EHCI)

We provide separate servers for each type (**devu-ohci.so**, **devu-uhci.so**, and **devu-ehci.so**). Note that USB devices don't care whether a computer has an OHCI, UHCI, or an EHCI controller.

Data buffers

The client library provides functions to allocate data buffers in shared memory; the stack manages these data buffers and gives the client library access to them. This means that all data transfers must use the provided buffers.

As a result, a class driver *must* reside on the same physical node as the USB stack. The *clients* of the class driver, however, can be network-distributed. The advantage of this approach is that no additional memory copy occurs between the time that the data is received by the USB stack and the time that it's delivered to the class driver (and vice versa).

USB enumerator

With the QNX Neutrino OS, the USB enumerator attaches to the USB stack and waits for device insertions. When a device insertion is detected, the enumerator looks in the configuration manager's database to see which class driver it should start. It then starts the appropriate driver, which provides for that class of device. For example, a USB Ethernet class driver would register with **io-pkt*** and bring the interface up.

For small, deeply embedded systems, the enumerator isn't required. The class drivers can be started individually — they'll wait around for their particular devices to be detected by the stack. At that point, they'll provide the appropriate services for that

class of device, just as if they'd been started by the enumerator. When a device is removed, the enumerator will shut down the class driver.

For more information about device enumeration, see the Controlling How Neutrino Starts chapter of the Neutrino *User's Guide*.

How a class driver works

A class driver typically performs the following operations:

1. Connect to the USB stack (*usbd_connect()*) and provide two callbacks: one for insertion and one for removal.
2. In the insertion callback:
   - **2a** Connect to the USB device (*usbd_attach()*).
   - **2b** Get descriptors (*usbd_descriptor()*).
   - **2c** Select the configuration (*usbd_select_config()*) and interface (*usbd_select_interface()*).
   - **2d** Set up communications pipes to the appropriate endpoint (*usbd_open_pipe()*).
3. In the removal callback, detach from the USB device (*usbd_detach()*).
4. Set up all data communications (e.g. reading and writing data, sending and receiving control information, etc.) via the *usbd_setup_*()* functions (*usbd_setup_bulk()*, *usbd_setup_interrupt()*, etc.).
5. Initiate data transfer using the *usbd_io()* function (with completion callbacks if required).

In this context, the term "pipe" is a USB-specific term that has *nothing* to do with standard POSIX "pipes" (as used, for example, in the command line **`ls | more`**). In USB terminology, a "pipe" is simply a handle; something that identifies a connection to an endpoint.

Chapter 3

USB Utilities

The USB Software Development Kit contains the following command-line utilities. For more information, see their entries in the *Utilities Reference*.

devu-ehci.so	USB manager for Enhanced Host Controller Interface standard controllers. (USB 2.0)
devu-ohci.so	USB manager for Open Host Controller Interface standard controllers. (USB 2.0)
devu-prn	Class Driver for USB printers.
devu-uhci.so	USB manager for Universal Host Controller Interface standard controllers. (USB 2.0)
io-usb	USB server.
usb	Display USB device configuration.

Chapter 4

USB Library Reference

In this chapter. . .

This chapter includes descriptions of the USB functions in alphabetical order, along with a listing of the functions arranged by category.

These functions are defined in the **`libusbdi`** library. Use the **`-l usbdi`** option to link against this library.

Functions arranged by category

The USB functions may be grouped into these categories:

- Connection functions
- Memory-management functions
- I/O functions
- Pipe-management functions
- Configuration/interface functions
- Miscellaneous functions

Connection functions

usbd_connect()	Connect a client driver to the USB stack.
usbd_disconnect()	Disconnect a client driver from the USB stack.
usbd_attach()	Attach to a USB device.
usbd_detach()	Detach from a USB device.

Memory-management functions

usbd_alloc()	Allocate memory area to use for data transfers.
usbd_free()	Free memory allocated by *usbd_alloc()*.
usbd_mphys()	Get the physical address of memory allocated by *usbd_alloc()*.
usbd_alloc_urb()	Allocate a USB Request Block for subsequent URB-based operations.
usbd_free_urb()	Free the URB allocated by *usbd_alloc_urb()*.

I/O functions

usbd_setup_bulk()	Set up a URB for a bulk data transfer.
usbd_setup_interrupt()	Set up a URB for an interrupt transfer.

usbd_setup_isochronous()
: Set up a URB for an isochronous transfer.

usbd_setup_vendor()
: Set up a URB for a vendor-specific transfer.

usbd_setup_control()
: Set up a URB for a control transfer.

usbd_io()
: Submit a previously set up URB to the USB stack.

usbd_feature()
: Control a feature for a USB device.

usbd_descriptor()
: Get or set USB descriptors.

usbd_status()
: Get specific device status.

Pipe-management functions

usbd_open_pipe()
: Initialize the pipe described by the device or endpoint descriptor.

usbd_close_pipe()
: Close a pipe previously opened by the *usbd_open_pipe()* function.

usbd_reset_pipe()
: Clear a stall condition on an endpoint identified by the *pipe* handle.

usbd_abort_pipe()
: Abort all requests on a pipe.

usbd_pipe_device()
: Retrieve the device associated with the pipe.

usbd_pipe_endpoint()
: Retrieve the endpoint number associated with the pipe.

Configuration and interface functions

usbd_select_config()
: Select the configuration for a USB device.

usbd_select_interface()
: Select the interface for a USB device.

Miscellaneous and convenience functions

usbd_args_lookup()
: Look up a driver's command-line arguments.

usbd_configuration_descriptor()
: Get the configuration descriptor for a specific configuration setting.

usbd_device_lookup()

Map the device instance identifier to an opaque device handle (from *usbd_attach()*).

usbd_device_extra() Retrieve a pointer to the device-specific extra memory allocated by *usbd_attach()*.

usbd_device_descriptor()

Get the device descriptor for a specific device.

usbd_endpoint_descriptor()

Get the endpoint descriptor for a specific endpoint setting.

usbd_get_frame() Get the current frame number and frame length for a device.

usbd_hcd_ext_info(), usbd_hcd_info()

Get information on the USB host controller and DDK library.

usbd_hub_descriptor()

Get the hub descriptor for a specific (hub) device.

usbd_interface_descriptor()

Get the interface descriptor for a specific interface setting.

usbd_languages_descriptor()

Get the table of supported LANGIDs for the given device.

usbd_parse_descriptors()

Parse device descriptors looking for a specific entry.

usbd_reset_device() Reset a USB device.

usbd_string() Get a string descriptor.

usbd_urb_status() Return status information on a URB.

usbd_topology(), usbd_topology_ext()

Get the USB bus physical topology.

Abort all requests on a pipe

Synopsis:

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

int usbd_abort_pipe( struct usbd_pipe *pipe );
```

Arguments:

pipe An opaque handle returned by *usbd_open_pipe()*.

Library:

libusbdi

Description:

The *usbd_abort_pipe()* function aborts all requests on the specified pipe. You can use this function during an error condition (e.g. to abort a pending operation) or during normal operation (e.g. to halt an isochronous transfer).

Returns:

EOK Success.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_open_pipe(), usbd_close_pipe(), usbd_pipe_endpoint(), usbd_reset_pipe()

usbd_alloc()

Allocate a memory area to use for data transfers

Synopsis:

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

void *usbd_alloc( size_t size );
```

Arguments:

size The size, in bytes, of the area to allocate.

Library:

libusbdi

Description:

The *usbd_alloc()* function allocates a memory area that can then be used for data transfers. You should use the memory area allocated by this function, because it's allocated efficiently and because its physical address is quickly obtained via *usbd_mphys()*.

The *usbd_setup_*()* functions require *usbd_alloc()*'d data buffers.

To free the memory, use *usbd_free()*.

Returns:

A pointer to the start of the allocated memory, or NULL if there's not enough memory.

Errors:

ENOMEM Insufficient memory available.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_alloc_urb(), usbd_free(), usbd_free_urb(), usbd_mphys()

usbd_alloc_urb()

Allocate a USB Request Block for subsequent URB-based operations

Synopsis:

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

struct usbd_urb *usbd_alloc_urb( struct usbd_urb *link );
```

Arguments:

link Specifies multiple URBs linked together. (*Not yet implemented*.)

Library:

libusbdi

Description:

The *usbd_alloc_urb()* function allocates a USB Request Block (URB) to be used for subsequent URB-based I/O transfers.

To free the block, use *usbd_free_urb()*.

Returns:

A pointer to the start of the allocated block, or NULL if there isn't enough memory.

Errors:

ENOMEM Insufficient memory available.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_alloc(), usbd_free(), usbd_free_urb(), usbd_mphys()

usbd_args_lookup()

Look up a driver's command-line arguments

Synopsis:

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

void usbd_args_lookup(struct usbd_connection *connection,
                      int *argc,
                      char ***argv );
```

Arguments:

connection Identifies the USB stack (from *usbd_connect()*).

Library:

libusbdi

Description:

The *usbd_args_lookup()* function lets you look up a device driver's command-line arguments at insertion/attach time.

The command-line arguments are held in *argc* and *argv* within the **usbd_connect_parm** data structure. See *usbd_connect()* for details.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_configuration_descriptor(), usbd_connect(), usbd_device_lookup(), usbd_device_extra(), usbd_device_descriptor(), usbd_endpoint_descriptor(), usbd_hcd_info(), usbd_hub_descriptor(), usbd_interface_descriptor(), usbd_languages_descriptor(), usbd_parse_descriptors(), usbd_string(), usbd_urb_status()

Synopsis:

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

int usbd_attach( struct usbd_connection *connection,
                 usbd_device_instance_t *instance,
                 size_t extra,
                 struct usbd_device **device );
```

Arguments:

connection	An opaque handle that identifies the USB stack (from *usbd_connect()*).
instance	Describes which device you wish to attach to.
extra	The size of additional memory you'd like allocated with the device. You can use *usbd_device_extra()* later to get a pointer to this additional memory. Typically, the class driver would store various status/config/device-specific details in here (if needed).
device	An opaque handle used to identify the device in later calls.

Library:

libusbdi

Description:

You use the *usbd_attach()* function to attach to a USB device. Typically, you do this out of the insertion callback (made when the device matched your filter), which will give you the *connection* and *instance* parameters involved. The insertion callback is prototyped as follows:

```
void (*insertion)(struct usbd_connection *, usbd_device_instance_t *instance)
```

The **usbd_device_instance_t** structure looks like this:

```
typedef struct usbd_device_instance {
    uint8_t                    path;
    uint8_t                    devno;
    uint16_t                   generation;
    usbd_device_ident_t       ident;
    uint32_t                   config;
    uint32_t                   iface;
    uint32_t                   alternate;
} usbd_device_instance_t;
```

Looping

Another way to attach is to loop and attach to *all* devices (in which case you build the *instance* yourself). For example:

```
for (busno = 0; busno < 10; ++busno) {
    for (devno = 0; devno < 64; ++devno) {
        memset(&instance, USBD_CONNECT_WILDCARD, sizeof(usbd_device_instance_t));
        instance.path = busno, instance.devno = devno;
        if (usbd_attach(connection, &instance, 0, &device) == EOK) {
          ......
        }
    }
}
```

The degree of "attachedness" depends on how you connected:

- If you specified insertion/removal callback functions, then you'll get exclusive access to the device and can make I/O to it.
- If you didn't use callbacks and you attached as in the loop above, you get *shared access*, so you can only read device configuration.

Returns:

EOK	Success.
ENODEV	Specified device doesn't exist. If in a loop, then there's nothing at that *devno*. If from a callback, then the device has since been removed.
EBUSY	A shared/exclusive conflict.
ENOMEM	No memory for internal device structures.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_connect(), *usbd_detach()*, *usbd_device_extra()*, *usbd_disconnect()*

usbd_close_pipe()

Close a pipe previously opened by usbd_open_pipe()

Synopsis:

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

int usbd_close_pipe( struct usbd_pipe *pipe );
```

Arguments:

pipe An opaque handle returned by *usbd_open_pipe()*.

Library:

libusbdi

Description:

You use the *usbd_close_pipe()* function to close a pipe that was previously opened via *usbd_open_pipe()*.

Returns:

EOK Success.

EBUSY Active or pending I/O.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_abort_pipe(), *usbd_open_pipe()*, *usbd_pipe_endpoint()*, *usbd_reset_pipe()*

usbd_configuration_descriptor()

Get the configuration descriptor for a specific configuration setting

Synopsis:

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

usbd_configuration_descriptor_t
    *usbd_configuration_descriptor(
        struct usbd_device *device,
        uint8_t cfg,
        struct usbd_desc_node **node );
```

Arguments:

device An opaque handle used to identify the USB device.

cfg The device's configuration identifier (**bConfigurationValue**).

node Indicates the descriptor's location for rooting future requests (e.g. interfaces of this configuration).

Library:

libusbdi

Description:

The *usbd_configuration_descriptor()* function lets you obtain the configuration descriptor for a specific configuration setting.

The **usbd_configuration_descriptor_t** structure looks like this:

```
typedef struct usbd_configuration_descriptor {
    uint8_t                 bLength;
    uint8_t                 bDescriptorType;
    uint16_t                wTotalLength;
    uint8_t                 bNumInterfaces;
    uint8_t                 bConfigurationValue;
    uint8_t                 iConfiguration;
    uint8_t                 bmAttributes;
    uint8_t                 MaxPower;
} usbd_configuration_descriptor_t;
```

Returns:

A pointer to **usbd_configuration_descriptor_t** on success, or NULL on error.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_args_lookup(), usbd_device_lookup(), usbd_device_extra(), usbd_device_descriptor(), usbd_endpoint_descriptor(), usbd_hcd_info(), usbd_hub_descriptor(), usbd_interface_descriptor(), usbd_languages_descriptor(), usbd_parse_descriptors(), usbd_string(), usbd_urb_status()

usbd_connect()

Connect a client driver to the USB stack

Synopsis:

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

int usbd_connect( usbd_connect_parm_t *parm,
                  struct usbd_connection **connection );
```

Arguments:

parm	Connection parameters describing how to connect to the USB stack and how you intend to operate with it.
connection	An opaque handle returned on a successful connection; it's used to pass into other routines to identify the connection.

Library:

libusbdi

Description:

You use the *usbd_connect()* function to connect to a USB device and to provide insertion/removal callbacks (in the **usbd_connect_parm_t** data structure).

Data structures

```
typedef struct usbd_connect_parm {
    const char                      *path;
    uint16_t                         vusb;
    uint16_t                         vusbd;
    uint32_t                         flags;
    int                              argc;
    char                            **argv;
    uint32_t                         evtbufsz;
    usbd_device_ident_t              *ident;
    usbd_funcs_t                     *funcs;
    uint16_t                         connect_wait
} usbd_connect_parm_t;
```

path	Name of the stack (NULL means **/dev/io-usb/io-usb**, the default name).
vusb and *vusbd*	Versions of the USB stack (USB_VERSION) and DDK (USBD_VERSION).
flags	Currently none defined. Pass 0.
argc and *argv*	Command-line arguments to the device driver that can be made available via *usbd_args_lookup()* at insertion/attach time.
evtbufsz	Size of the event buffer used by the handler thread to buffer events from the USB stack. For the default size, pass 0.

ident A pointer to a **usbd_device_ident_t** structure that identifies the devices you're interested in receiving insertion/removal callbacks for (a filter):

```
typedef struct usbd_device_ident {
    uint32_t                    vendor;
    uint32_t                    device;
    uint32_t                    dclass;
    uint32_t                    subclass;
    uint32_t                    protocol;
} usbd_device_ident_t;
```

You can set the fields to USBD_CONNECT_WILDCARD or to an explicit value. You would typically make the **usbd_device_ident_t** structure be a filter for devices you support from this specific class driver.

funcs A pointer to a **usbd_funcs_t** structure that specifies the insertion/removal callbacks:

```
typedef struct usbd_funcs {
   uint32_t   nentries;
   void       (*insertion)(struct usbd_connection *, usbd_device_instance_t *instance);
   void       (*removal)(struct usbd_connection *, usbd_device_instance_t *instance);
   void       (*event)(struct usbd_connection *, usbd_device_instance_t *instance,
                       uint16_t type);
} usbd_funcs_t;
```

The **usbd_funcs_t** structure includes the following members:

nentries The number of entries in the structure. Set this to _USBDI_NFUNCS.

insertion The function to call when a device that matches the defined filter is detected.

removal The function to call when a device is removed.

event A future extension for various other event notifications (e.g. bandwidth problems).

By passing NULL as the *usbd_funcs*, you're saying that you're not interested in receiving dynamic insertion/removal notifications, which means that you won't be a fully operational class driver. No asynchronous I/O will be allowed, no event thread, etc. This approach is taken, for example, by the **usb** display utility.

connect_wait A value (in seconds) or USBD_CONNECT_WAIT.

Returns:

EOK Success.

EPROGMISMATCH
Versionitis.

ENOMEM No memory for internal connect structures.

ESRCH	USB server not running.
EACCES	Permission denied to USB server.
EAGAIN	Can't create async/callback thread.

Examples:

A class driver (in its *main()*, probably) for a 3COM Ethernet card might connect like this:

```
usbd_device_ident_t        interest = {
                            USB_VENDOR_3COM,
                            USB_PRODUCT_3COM_3C19250,
                            USBD_CONNECT_WILDCARD,
                            USBD_CONNECT_WILDCARD,
                            USBD_CONNECT_WILDCARD,
                           };
usbd_funcs_t               funcs = {
                            _USBDI_NFUNCS,
                            insertion,
                            removal,
                            NULL
                           };
usbd_connect_parm_t        cparms = {
                            NULL,
                            USB_VERSION,
                            USBD_VERSION,
                            0,
                            argc,
                            argv,
                            0,
                            &interest,
                            &funcs
                           };
struct usbd_connection     *connection;
int                        error;

    error = usbd_connect(&cparms, &connection);
```

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

Caveats:

The *usbd_connect()* function creates a thread on your behalf that's used by the library to monitor the USB stack for device insertion or removal. Since your insertion and removal callback functions are called by this new thread, you *must* ensure that any common resources used between that thread and any other thread(s) in your class driver are properly protected (e.g. via a mutex).

See also:

usbd_args_lookup(), *usbd_attach()*, *usbd_detach()*, *usbd_disconnect()*

Synopsis:

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

int usbd_descriptor( struct usbd_device *device,
                     int set,
                     uint8_t type,
                     uint16_t rtype,
                     uint8_t index,
                     uint16_t langid,
                     uint8_t *desc,
                     size_t len );
```

Arguments:

device	An opaque handle used to identify the USB device.
set	A flag that says to either get or set a descriptor.
type	Type of descriptor (e.g. USB_DESC_DEVICE, USB_DESC_CONFIGURATION, USB_DESC_STRING, USB_DESC_HUB).
rtype	Type of request (e.g. USB_RECIPIENT_DEVICE, USB_RECIPIENT_INTERFACE, USB_RECIPIENT_ENDPOINT, USB_RECIPIENT_OTHER, USB_TYPE_STANDARD, USB_TYPE_CLASS, USB_TYPE_VENDOR).
index	This varies, depending on the request. It's used for passing a parameter to the device.
langid	Identifies the language supported in strings (according to the LANGID table).
desc	Pointer at buffer to put descriptors.
len	The length of the data transfer in bytes.

Library:

libusbdi

Description:

The *usbd_descriptor()* function lets you obtain the USB descriptors.

Returns:

EMSGSIZE	Buffer too small for descriptor.
ENOMEM	No memory for URB.

ENODEV	Device was removed.
EIO	I/O error on USB device.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_feature() usbd_io(), usbd_parse_descriptors(), usbd_setup_bulk(), usbd_setup_control(), usbd_setup_interrupt(), usbd_setup_isochronous(), usbd_setup_vendor(), usbd_status()

Synopsis:

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

int usbd_detach( struct usbd_device *device );
```

Arguments:

device An opaque handle from *usbd_attach()*.

Library:

libusbdi

Description:

You use the *usbd_detach()* function to disconnect from a USB device that you previously had attached to via *usbd_attach()*.

The *usbd_detach()* function automatically closes any pipes previously opened via *usbd_open_pipe()*.

Returns:

EOK Success.

EBUSY I/O pending on the device.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

Caveats:

Don’t try to detach if there’s I/O pending on the device. If there is, *usbd_detach()* will fail.

See also:

usbd_attach(), *usbd_close_pipe()*, *usbd_connect()*, *usbd_disconnect()*, *usbd_open_pipe()*

Synopsis:

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

usbd_device_descriptor_t
  *usbd_device_descriptor(
    struct usbd_device *device,
    struct usbd_desc_node **node );
```

Arguments:

device A handle obtained by calling *usbd_attach()*.

node The address of a pointer to a **usbd_device_descriptor_t** structure where the function stores the device descriptor.

Library:

libusbdi

Description:

The *usbd_device_descriptor()* function lets you obtain the device descriptor for a specific device.

The *node* parameter tells you where a descriptor was found to root future requests from (e.g. configurations of the device).

The **usbd_device_descriptor_t** structure looks like this:

```
typedef struct usbd_device_descriptor {
    uint8_t                 bLength;
    uint8_t                 bDescriptorType;
    uint16_t                bcdUSB;
    uint8_t                 bDeviceClass;
    uint8_t                 bDeviceSubClass;
    uint8_t                 bDeviceProtocol;
    uint8_t                 bMaxPacketSize0;
    uint16_t                idVendor;
    uint16_t                idProduct;
    uint16_t                bcdDevice;
    uint8_t                 iManufacturer;
    uint8_t                 iProduct;
    uint8_t                 iSerialNumber;
    uint8_t                 bNumConfigurations;
} usbd_device_descriptor_t;
```

Returns:

A pointer to **usbd_device_descriptor_t** on success, or NULL on error.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_args_lookup(), usbd_configuration_descriptor(), usbd_device_lookup(), usbd_device_extra(), usbd_endpoint_descriptor(), usbd_hcd_info(), usbd_hub_descriptor(), usbd_interface_descriptor(), usbd_languages_descriptor(), usbd_parse_descriptors(), usbd_string(), usbd_urb_status()

usbd_device_extra()

Get a pointer to the memory allocated by the extra parameter

Synopsis:

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

void *usbd_device_extra( struct usbd_device *device );
```

Arguments:

device A handle obtained by calling *usbd_attach()*.

Library:

libusbdi

Description:

You use the *usbd_device_extra()* function to get a pointer to the additional memory allocated via the *extra* parameter in *usbd_attach()*.

Returns:

A pointer to the additional memory, or NULL if no device-specific memory was allocated by *usbd_attach()*.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_args_lookup(), usbd_attach() usbd_configuration_descriptor(), usbd_device_lookup(), usbd_device_descriptor(), usbd_endpoint_descriptor(), usbd_hcd_info(), usbd_hub_descriptor(), usbd_interface_descriptor(), usbd_languages_descriptor(), usbd_parse_descriptors(), usbd_string(), usbd_urb_status()

usbd_device_lookup()

Map the device instance identifier to an opaque device handle (from usbd_attach())

Synopsis:

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

struct usbd_device *usbd_device_lookup(
                      struct usbd_connection *connection,
                      usbd_device_instance_t *instance );
```

Arguments:

connection A handle obtained by calling *usbd_connect()*.

instance The device instance identifier obtained by calling *usbd_attach()*.

Library:

libusbdi

Description:

You use the *usbd_device_lookup()* function to map the device instance identifier to an opaque device handle. This is typically required in the removal callback.

Returns:

An opaque device handle, or NULL.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_args_lookup(), usbd_attach(), usbd_configuration_descriptor(), usbd_device_extra(), usbd_device_descriptor(), usbd_endpoint_descriptor(), usbd_hcd_info(), usbd_hub_descriptor(), usbd_interface_descriptor(), usbd_languages_descriptor(), usbd_parse_descriptors(), usbd_string(), usbd_urb_status()

usbd_disconnect()

Disconnect a client driver from the USB stack

Synopsis:

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

int usbd_disconnect( struct usbd_connection *connection );
```

Arguments:

connection A handle for the USB stack, obtained by calling *usbd_connect()*.

Library:

libusbdi

Description:

You use the *usbd_disconnect()* to disconnect a client driver that had been previously connected to the USB stack via the *usbd_connect()* function.

The *usbd_disconnect()* function automatically closes any pipes previously opened via *usbd_attach()*.

Returns:

EOK Success.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_attach(), *usbd_connect()*, *usbd_detach()*

usbd_endpoint_descriptor()

Get the endpoint descriptor for a specific endpoint setting

Synopsis:

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

usbd_endpoint_descriptor_t
   *usbd_endpoint_descriptor(
        struct usbd_device *device,
        uint8_t config,
        uint8_t iface,
        uint8_t alt,
        uint8_t endpoint,
        struct usbd_desc_node **node );
```

Arguments:

device	An opaque handle used to identify the USB device.
config	Configuration identifier (**bConfigurationValue**).
ifc	Interface identifier (**bInterfaceNumber**).
alt	Alternate identifier (**bAlternateSetting**).
endpoint	Endpoint identifier (**bEndpointAddress**).
node	Indicates the descriptor's location for rooting future requests.

Library:

libusbdi

Description:

The *usbd_endpoint_descriptor()* function lets you obtain the endpoint descriptor for a specific endpoint on a configuration/interface.

The **endpoint_descriptor_t** structure looks like this:

```
typedef struct usbd_endpoint_descriptor {
    uint8_t                     bLength;
    uint8_t                     bDescriptorType;
    uint8_t                     bEndpointAddress;
    uint8_t                     bmAttributes;
    uint16_t                    wMaxPacketSize;
    uint8_t                     bInterval;
} usbd_endpoint_descriptor_t;
```

Returns:

A pointer to **usbd_endpoint_descriptor_t** on success, or NULL on error.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_args_lookup(), *usbd_configuration_descriptor()*, *usbd_device_lookup()*, *usbd_device_extra()*, *usbd_device_descriptor()*, *usbd_hcd_info()*, *usbd_hub_descriptor()*, *usbd_interface_descriptor()*, *usbd_languages_descriptor()*, *usbd_parse_descriptors()*, *usbd_string()*, *usbd_urb_status()*

Synopsis:

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

int usbd_feature( struct usbd_device *device,
                  int set,
                  uint16_t feature,
                  uint16_t rtype,
                  uint16_t index );
```

Arguments:

device	An opaque handle used to identify the USB device.
set	Set or clear a feature on the USB device.
feature	A specific feature on the device.
rtype	Type of request (e.g. USB_RECIPIENT_DEVICE, USB_RECIPIENT_INTERFACE, USB_RECIPIENT_ENDPOINT, USB_RECIPIENT_OTHER, USB_TYPE_STANDARD, USB_TYPE_CLASS, USB_TYPE_VENDOR).
index	This varies, depending on the request. It's used for passing a parameter to the device.

Library:

libusbdi

Description:

The *usbd_feature()* function lets you control a specific feature on a USB device.

Returns:

EOK	Success.
ENOMEM	No memory for URB.
ENODEV	Device was removed.
EIO	I/O error on USB device.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_descriptor(), *usbd_io()*, *usbd_setup_bulk()*, *usbd_setup_control()*, *usbd_setup_interrupt()*, *usbd_setup_isochronous()*, *usbd_setup_vendor()*, *usbd_status()*

usbd_free()

Free the memory area allocated by usbd_alloc()

Synopsis:

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

void usbd_free( void* ptr );
```

Arguments:

ptr A pointer to the memory area to be freed.

Library:

libusbdi

Description:

The *usbd_free()* function frees the memory allocated by *usbd_alloc()*. The function deallocates the memory area specified by *ptr*, which was previously returned by a call to *usbd_mphys()*.

It's safe to call *usbd_free()* with a NULL *ptr*.

Returns:

EOK Success.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_alloc(), *usbd_alloc_urb()*, *usbd_free_urb()*, *usbd_mphys()*

usbd_free_urb()

Free the USB Request Block allocated by usbd_alloc_urb()

Synopsis:

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

struct usbd_urb *usbd_free_urb( struct usbd_urb *urb );
```

Arguments:

urb A pointer to the URB to be freed.

Library:

libusbdi

Description:

The *usbd_free_urb()* function frees the memory allocated by *usbd_alloc_urb()*.

Returns:

EOK Success.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_alloc(), *usbd_alloc_urb()*, *usbd_free()*, *usbd_mphys()*

usbd_get_frame()

Get the current frame number and frame length for a device

Synopsis:

```
int usbd_get_frame( struct usdb_device *device,
                    int32_t *fnum,
                    int32_t *flen );
```

Arguments:

device The handle for the device, obtained by calling *usbd_attach()*.

fnum If non-NULL, this is set to the frame number.

flen If non-NULL, this is set to the frame length.

Library:

libusbdi

Description:

This function gets the current frame number and frame length for the specified device.

Returns:

EOK Success.

ENODEV The device has been removed.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_attach()

Synopsis:

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

int usbd_hcd_ext_info( struct usbd_connection *connection,
                       uint32_t cindex,
                       usbd_hcd_info_t *info );

int usbd_hcd_info( struct usbd_connection *connection,
                   usbd_hcd_info_t *info );
```

Arguments:

connection The handle for the connection to the USB stack, obtained by calling *usbd_connect()*.

cindex (*usbd_hcd_ext_info()* only) The index of the host controller.

info A pointer to a **usbd_hcd_info_t** data structure that this function fills in.

Library:

libusbdi

Description:

You can use the *usbd_hcd_ext_info()* or *usbd_hcd_info()* function to obtain information from the USB host controller and DDK library.

If your system has more than one USB chip, you can call *usbd_hcd_ext_info()* to get information about a specific one. The *usbd_hcd_info()* function gets information about the first USB chip; calling it is the same as calling *usbd_hcd_ext_info()* with a *cindex* argument of 0.

The **usbd_hcd_info_t** structure is defined as follows:

```
typedef struct usbd_hcd_info {
    uint16_t                vusb;
    uint16_t                vusbd;
    char                    controller[8];
    uint32_t                capabilities;
    uint8_t                 ndev;
    uint8_t                 cindex;
    uint16_t                vhcd;
    uint32_t                max_td_io;
    uint8_t                 reserved[12];
  } usbd_hcd_info_t;
```

It contains at least the following:

vusb The version number of the USB stack.

vusbd	The version number of the USB DDK.
controller	The name of the USB host controller.
capabilities	The capabilities of the USB host controller.
ndev	The number of devices currently connected.
cindex	The index of the host controller.
vhcd	The version number of the USB HCD.
max_td_io	The maximum number of bytes per HC TD.

Returns:

EOK	Success.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_args_lookup(), usbd_configuration_descriptor(), usbd_device_lookup(), usbd_device_extra(), usbd_device_descriptor(), usbd_endpoint_descriptor(), usbd_hub_descriptor(), usbd_interface_descriptor(), usbd_languages_descriptor(), usbd_parse_descriptors(), usbd_string(), usbd_urb_status()

Get the hub descriptor for a specific (hub) device

Synopsis:

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

usbd_hub_descriptor_t *usbd_hub_descriptor(
                          struct usbd_device *device,
                          struct usbd_desc_node **node );
```

Arguments:

device An opaque handle used to identify the USB device.

node Indicates the descriptor's location for rooting future requests.

Library:

libusbdi

Description:

The *usbd_hub_descriptor()* function lets you obtain a hub descriptor.

The **usbd_hub_descriptor_t** data structure looks like this:

```
typedef struct usbd_hub_descriptor {
    uint8_t                 bLength;
    uint8_t                 bDescriptorType;
    uint8_t                 bNbrPorts;
    uint16_t                wHubCharacteristics;
    uint8_t                 bPwrOn2PwrGood;
    uint8_t                 bHubContrCurrent;
    uint8_t                 DeviceRemovable[1];
    uint8_t                 PortPwrCtrlMask[1];
} usbd_hub_descriptor_t;
```

Returns:

A pointer to **usbd_hub_descriptor_t** on success, or NULL on error.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_args_lookup(), usbd_configuration_descriptor(), usbd_device_lookup(), usbd_device_extra(), usbd_device_descriptor(), usbd_endpoint_descriptor(), usbd_hcd_info(), usbd_interface_descriptor(), usbd_languages_descriptor(), usbd_parse_descriptors(), usbd_string(), usbd_urb_status()

Synopsis:

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

usbd_interface_descriptor_t
   *usbd_interface_descriptor(
        struct usbd_device *device,
        uint8_t cfg,
        uint8_t ifc,
        uint8_t alt,
        struct usbd_desc_node **node );
```

Arguments:

device	An opaque handle used to identify the USB device.
cfg	The device's configuration identifier (**bConfigurationValue**).
ifc	Interface identifier (**bInterfaceNumber**).
alt	Alternate identifier (**bAlternateSetting**).
node	Indicates the descriptor's location for rooting future requests (e.g. endpoints of this interface).

Library:

libusbdi

Description:

The *usbd_interface_descriptor()* function lets you obtain the interface descriptor for a specific interface setting.

The **usbd_interface_descriptor_t** structure looks like this:

```
typedef struct usbd_interface_descriptor {
    uint8_t                 bLength;
    uint8_t                 bDescriptorType;
    uint8_t                 bInterfaceNumber;
    uint8_t                 bAlternateSetting;
    uint8_t                 bNumEndpoints;
    uint8_t                 bInterfaceClass;
    uint8_t                 bInterfaceSubClass;
    uint8_t                 bInterfaceProtocol;
    uint8_t                 iInterface;
} usbd_interface_descriptor_t;
```

Returns:

A pointer to **`usbd_interface_descriptor_t`** on success, or NULL on error.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_args_lookup(), usbd_configuration_descriptor(), usbd_device_lookup(), usbd_device_extra(), usbd_device_descriptor(), usbd_endpoint_descriptor(), usbd_hcd_info(), usbd_hub_descriptor(), usbd_languages_descriptor(), usbd_parse_descriptors(), usbd_string(), usbd_urb_status()

Synopsis:

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

int usbd_io( struct usbd_urb *urb,
             struct usbd_pipe *pipe,
             void (*func)(struct usbd_urb *,
                          struct usbd_pipe *, void *),
             void *handle,
             uint32_t timeout );
```

Arguments:

urb	A pointer to a USB Request Block.
pipe	An opaque handle returned by *usbd_open_pipe()*.
func	Callback at I/O completion, given URB, pipe, plus *handle*.
handle	User data.
timeout	A value (in milliseconds) or USBD_TIME_DEFAULT or USBD_TIME_INFINITY.

Library:

libusbdi

Description:

This routine submits a previously set up URB to the USB stack. The URB would have been set up from one of these functions:

- *usbd_setup_bulk()*
- *usbd_setup_control()*
- *usbd_setup_interrupt()*
- *usbd_setup_isochronous()*
- *usbd_setup_vendor()*

For this release of the USB DDK, vendor requests are *synchronous* only. Therefore, the *func* parameter in *usbd_io()* must be NULL.

The *usbd_io()* function is the one that actually makes the data transfer happen; the setup functions simply set up the URB for the data transfer.

Returns:

EBADF	Improper *usbd_connect()* call.
EINVAL	Improper *usbd_connect()* call.
ENODEV	Device was removed.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_descriptor(), *usbd_feature()*, *usbd_setup_control()*, *usbd_setup_bulk()*, *usbd_setup_interrupt()*, *usbd_setup_isochronous()*, *usbd_setup_vendor()*, *usbd_status()*

usbd_languages_descriptor()

Get the table of supported LANGIDs for the given device

Synopsis:

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

usbd_string_descriptor_t
   *usbd_languages_descriptor(
     struct usbd_device *device,
     struct usbd_desc_node **node );
```

Arguments:

device An opaque handle used to identify the USB device.

node Indicates the descriptor's location for rooting future requests.

Library:

libusbdi

Description:

The *usbd_languages_descriptor()* function lets you obtain the table of supported language IDs for the device.

The **usbd_string_descriptor_t** structure looks like this:

```
typedef struct usbd_string_descriptor {
    uint8_t                 bLength;
    uint8_t                 bDescriptorType;
    uint16_t                bString[1];
} usbd_string_descriptor_t;
```

Returns:

A pointer **usbd_string_descriptor_t** on success, or NULL on error.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_args_lookup(), usbd_configuration_descriptor(), usbd_device_lookup(), usbd_device_extra(), usbd_device_descriptor(), usbd_endpoint_descriptor(), usbd_hcd_info(), usbd_hub_descriptor(), usbd_interface_descriptor(), usbd_parse_descriptors(), usbd_string(), usbd_urb_status()

usbd_mphys()

Get the physical address of memory allocated by usbd_alloc()

Synopsis:

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

paddr_t usbd_mphys( const void *ptr );
```

Arguments:

ptr A pointer to the block of memory.

Library:

libusbdi

Description:

The *usbd_mphys()* function obtains the physical address used by *usbd_alloc()* to allocate memory for a data transfer.

Returns:

Physical address.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_alloc(), usbd_alloc_urb(), usbd_free(), usbd_free_urb(), usbd_mphys()

usbd_open_pipe()

Initialize the pipe described by the device or endpoint descriptor

Synopsis:

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

int usbd_open_pipe( struct usbd_device *device,
                    usbd_descriptors_t *desc,
                    struct usbd_pipe **pipe );
```

Arguments:

device An opaque handle used to identify the USB device.

desc A pointer to the device or endpoint descriptor that was returned from *usbd_parse_descriptors()*.

pipe An opaque handle returned by *usbd_open_pipe()*.

Library:

libusbdi

Description:

You use the *usbd_open_pipe()* function to initialize the pipe described by the endpoint descriptor.

Returns:

EOK Success.

EINVAL The descriptor isn't a device or endpoint.

ENOMEM No memory for internal pipe structures.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_abort_pipe(), usbd_close_pipe(), usbd_pipe_endpoint(), usbd_reset_pipe()

usbd_parse_descriptors()

Parse device descriptors looking for a specific entry

Synopsis:

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

usbd_descriptors_t *usbd_parse_descriptors(
                        struct usbd_device *device,
                        struct usbd_desc_node *root,
                        uint8_t type,
                        int index,
                        struct usbd_desc_node **node );
```

Arguments:

device	The opaque handle for the device whose descriptors you want to search.
root	Where in the tree to begin parsing (pass NULL to start at the base).
type	The type of descriptor to find (USB_DESC_*), or 0 to match any type.
index	The occurrence of the descriptor that you want to find.
node	A pointer to a location where the function stores a pointer to the descriptor that it found. You can use this as the root for future requests.

Library:

libusbdi

Description:

When you call it the first time, the *usbd_parse_descriptors()* function loads all the descriptors from the USB device:

- device
- configuration
- interface
- endpoint
- hub
- string

The function uses *usbd_descriptor()* to get each raw USB descriptor. The data is then endian-ized, made alignment-safe, and built into an in-memory tree structure to facilitate future parsing requests.

Each node in this tree is a **struct usbd_desc_node**. The *root* parameter lets you say where in the tree to begin parsing (NULL is base). The *node* parameter tells you where a descriptor was found to root future requests from.

The tree looks like this:

```
(ROOT)
  |
  (DEVICE)  -  (HUB)  -  (LANGUAGE TABLE)
    |
    (CONFIG)  -  .....  (CONFIG)
      |
      (INTERFACE)  -  .....  (INTERFACE)
        |
        (ENDPOINT)  -  .....  (ENDPOINT)
```

Any vendor-specific or class-specific descriptors that are embedded into the standard descriptor output are also inserted into this tree at the appropriate point.

Although a descriptor for endpoint 0 (control) isn't present on the wire, one is constructed and placed in the tree (to simplify enumeration within the class driver).

You use *type* for specifying the type of descriptor to find; *index* is the *n*th occurrence. Note that type 0 will match any descriptor type; you can use it to retrieve *any* embedded class or vendor-specific descriptors if you don't know their type.

Here's an example that will walk all endpoints for an interface:

```
for (eix = 0; (desc = usbd_parse_descriptors(device, ifc, USB_DESC_ENDPOINT,
                eix, &ept)) != NULL; ++eix)
    ;
```

where *ifc* is the appropriate (INTERFACE) node (found by a previous call to *usbd_parse_descriptors()* or *usbd_interface_descriptor()*.

Returns:

A pointer to the descriptor on success, or NULL on error.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_args_lookup(), *usbd_configuration_descriptor()*, *usbd_descriptor()*, *usbd_device_lookup()*, *usbd_device_extra()*, *usbd_device_descriptor()*, *usbd_endpoint_descriptor()*, *usbd_hcd_info()*, *usbd_hub_descriptor()*, *usbd_interface_descriptor()*, *usbd_languages_descriptor()*, *usbd_string()*, *usbd_urb_status()*

usbd_pipe_device()

Retrieve the device associated with the pipe

Synopsis:

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

struct usbd_device*
  usbd_pipe_device( struct usbd_pipe *pipe );
```

Arguments:

pipe An opaque handle returned by *usbd_open_pipe()*.

Library:

libusbdi

Description:

You use the *usbd_pipe_device()* to retrieve the device associated with *pipe*.

Returns:

A pointer to a **usbd_device** structure that describes the device.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_abort_pipe(), *usbd_open_pipe()*, *usbd_close_pipe()*, *usbd_reset_pipe()*

Retrieve the endpoint number associated with the pipe

Synopsis:

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

uint32_t usbd_pipe_endpoint( struct usbd_pipe *pipe );
```

Arguments:

pipe An opaque handle returned by *usbd_open_pipe()*.

Library:

libusbdi

Description:

You use the *usbd_pipe_endpoint()* to retrieve the endpoint number associated with *pipe*.

Returns:

A pipe/endpoint number.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_abort_pipe(), *usbd_open_pipe()*, *usbd_close_pipe()*, *usbd_reset_pipe()*

usbd_reset_device()

Reset a USB device

Synopsis:

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

int usbd_reset_device( struct usbd_device *device );
```

Arguments:

device The handle of a device.

Library:

libusbdi

Description:

You use the *usbd_reset_device()* function to reset the specified *device*.

Returns:

EOK	Success.
ENODEV	Device was removed.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_attach(), *usbd_connect()*

usbd_reset_pipe()

Clear a stall condition on an endpoint identified by the pipe handle

Synopsis:

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

int usbd_reset_pipe( struct usbd_pipe *pipe );
```

Arguments:

pipe An opaque handle returned by *usbd_open_pipe()*.

Library:

libusbdi

Description:

You use the *usbd_reset_pipe()* function to clear a stall condition on an endpoint identified by the *pipe* handle.

Returns:

EOK	Success.
ENOMEM	No memory for URB.
ENODEV	Device was removed.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_abort_pipe() usbd_open_pipe(), usbd_close_pipe(), usbd_pipe_endpoint(),

usbd_select_config()

Select the configuration for a USB device

Synopsis:

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

int usbd_select_config( struct usbd_device *device,
                        uint8_t cfg );
```

Arguments:

device An opaque handle used to identify the USB device.

cfg The device's configuration identifier (**bConfigurationValue**).

Library:

libusbdi

Description:

You use the *usbd_select_config()* function to select the configuration for a USB device.

Returns:

EOK	Success.
ENOMEM	No memory for URB.
ENODEV	Device was removed.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_select_interface()

usbd_select_interface()

Select the interface for a USB device

Synopsis:

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

int usbd_select_interface( struct usbd_device *device,
                           uint8_t ifc,
                           uint8_t alt );
```

Arguments:

device	An opaque handle used to identify the USB device.
ifc	Interface identifier (**`bInterfaceNumber`**).
alt	Alternate identifier (**`bAlternateSetting`**).

Library:

`libusbdi`

Description:

You use the *usbd_select_interface()* function to select the interface for a USB device.

Returns:

EOK	Success.
ENOMEM	No memory for URB.
ENODEV	Device was removed.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_select_config()

Synopsis:

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

int usbd_setup_bulk( struct usbd_urb *urb,
                     uint32_t flags,
                     void *addr,
                     uint32_t len );
```

Arguments:

urb An opaque handle (from *usbd_alloc_urb()*).

flags One of the following:

- URB_DIR_IN—specify incoming (device-to-PC) transfer.
- URB_DIR_OUT—specify outgoing (PC-to-device) transfer.
- URB_DIR_NONE—don't specify the direction.

You can optionally OR in the following:

- URB_SHORT_XFER_OK—allow short transfers.

addr The address for the start of the transfer. You *must* use the buffer allocated by *usbd_alloc()*.

len The length (in bytes) of the data transfer.

Library:

libusbdi

Description:

This routine sets up a URB for a bulk data transfer.

Returns:

EOK Success.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No

continued...

Safety	
Signal handler	No
Thread	Yes

Caveats:

To ensure that the correct physical address will be used, you *must* use the buffer allocated by *usbd_alloc()* for the *addr* parameter.

See also:

usbd_descriptor(), *usbd_feature()*, *usbd_io()*, *usbd_setup_control()*, *usbd_setup_interrupt()*, *usbd_setup_isochronous()*, *usbd_setup_vendor()*, *usbd_status()*

This function isn't currently implemented. To set up a URB for a control transfer, use *usbd_setup_vendor()* instead.

Synopsis:

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

usbd_setup_control( struct usbd_urb *urb,
                    uint32_t flags,
                    uint16_t request,
                    uint16_t rtype,
                    uint16_t value,
                    uint16_t index,
                    void *addr,
                    uint32_t len );
```

Arguments:

urb An opaque handle (from *usbd_alloc_urb()*).

flags One of the following:

- URB_DIR_IN—specify incoming (device-to-PC) transfer.
- URB_DIR_OUT—specify outgoing (PC-to-device) transfer.
- URB_DIR_NONE—don't specify the direction.

You can optionally OR in the following:

- URB_SHORT_XFER_OK—allow short transfers.

request A device-specific request.

rtype The type of request; one of the following:

- USB_RECIPIENT_DEVICE
- USB_RECIPIENT_INTERFACE
- USB_RECIPIENT_ENDPOINT
- USB_RECIPIENT_OTHER

ORed with one of the following:

- USB_TYPE_STANDARD
- USB_TYPE_CLASS
- USB_TYPE_VENDOR

value This varies, depending on the request. It's used for passing a parameter to the device.

index This varies, depending on the request. It's used for passing a parameter to the device.

addr The address for the start of the transfer. You *must* use the buffer allocated by *usbd_alloc()*.
len The length (in bytes) of the data transfer.

Library:

libusbdi

Description:

This routine sets up a URB for a control transfer.

Returns:

EOK Success.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

Caveats:

To ensure that the correct physical address will be used, you *must* use the buffer allocated by *usbd_alloc()* for the *addr* parameter.

See also:

usbd_descriptor(), *usbd_feature()*, *usbd_io()*, *usbd_setup_bulk()*, *usbd_setup_interrupt()*, *usbd_setup_isochronous()*, *usbd_setup_vendor()*, *usbd_status()*

usbd_setup_interrupt()

Set up a URB for an interrupt transfer

Synopsis:

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

int usbd_setup_interrupt( struct usbd_urb *urb,
                          uint32_t flags,
                          void *addr,
                          uint32_t len );
```

Arguments:

urb An opaque handle (from *usbd_alloc_urb()*).

flags One of the following:

- URB_DIR_IN—specify incoming (device-to-PC) transfer.
- URB_DIR_OUT—specify outgoing (PC-to-device) transfer.
- URB_DIR_NONE—don't specify the direction.

You can optionally OR in the following:

- URB_SHORT_XFER_OK—allow short transfers.

addr The address for the start of the transfer. You *must* use the buffer allocated by *usbd_alloc()*.

len The length (in bytes) of the data transfer.

Library:

libusbdi

Description:

This routine sets up a URB for an interrupt transfer.

Returns:

EOK Success.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No

continued...

Safety	
Signal handler	No
Thread	Yes

See also:

usbd_setup_bulk(), *usbd_setup_control()*, *usbd_setup_isochronous()*, *usbd_setup_vendor()*

usbd_setup_isochronous()

Set up a URB for an isochronous transfer

Synopsis:

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

int usbd_setup_isochronous( struct usbd_urb *urb,
                            uint32_t flags,
                            int32_t frame,
                            void *addr,
                            uint32_t len );
```

Arguments:

urb An opaque handle (from *usbd_alloc_urb()*).

flags One of the following:

- URB_DIR_IN—specify incoming (device-to-PC) transfer.
- URB_DIR_OUT—specify outgoing (PC-to-device) transfer.
- URB_DIR_NONE—don't specify the direction.

You can optionally OR in either or both of the following:

- URB_ISOCH_ASAP—allow transfer as soon as possible (overrides *frame*).
- URB_SHORT_XFER_OK—allow short transfers.

frame The device frame number. This is ignored if URB_ISOCH_ASAP is set.

addr The address for the start of the transfer. You *must* use the buffer allocated by *usbd_alloc()*.

len The length (in bytes) of the data transfer.

Library:

libusbdi

Description:

This routine sets up a URB for an isochronous transfer.

Returns:

EOK Success.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_descriptor(), usbd_feature(), usbd_io(), usbd_setup_bulk(), usbd_setup_control(), usbd_setup_interrupt(), usbd_setup_vendor(), usbd_status()

Synopsis:

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

int usbd_setup_vendor( struct usbd_urb *urb,
                       uint32_t flags,
                       uint16_t request,
                       uint16_t rtype,
                       uint16_t value,
                       uint16_t index,
                       void *addr,
                       uint32_t len );
```

Arguments:

urb An opaque handle (from *usbd_alloc_urb()*).

flags One of the following:

- URB_DIR_IN—specify incoming (device-to-PC) transfer.
- URB_DIR_OUT—specify outgoing (PC-to-device) transfer.
- URB_DIR_NONE—don't specify the direction.

You can optionally OR in the following:

- URB_SHORT_XFER_OK—allow short transfers.

request A device-specific request.

rtype The type of request; one of the following:

- USB_RECIPIENT_DEVICE
- USB_RECIPIENT_INTERFACE
- USB_RECIPIENT_ENDPOINT
- USB_RECIPIENT_OTHER

ORed with one of the following:

- USB_TYPE_STANDARD
- USB_TYPE_CLASS
- USB_TYPE_VENDOR

value This varies, depending on the request. It's used for passing a parameter to the device.

index This varies, depending on the request. It's used for passing a parameter to the device.

addr The address for the start of the transfer. You *must* use the buffer allocated by *usbd_alloc()*.

len The length (in bytes) of the data transfer.

Library:

`libusbdi`

Description:

This routine sets up a URB for a vendor-specific transfer.

For this release of the USB DDK, vendor requests are *synchronous* only. Therefore, the *func* parameter in *usbd_io()* must be NULL.

Returns:

EOK Success.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

Caveats:

To ensure that the correct physical address will be used, you *must* use the buffer allocated by *usbd_alloc()* for the *addr* parameter.

See also:

usbd_descriptor(), *usbd_feature()*, *usbd_io()*, *usbd_setup_bulk()*, *usbd_setup_control()*, *usbd_setup_interrupt()*, *usbd_setup_isochronous()*, *usbd_status()*

Synopsis:

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

int usbd_status( struct usbd_device *device,
                 uint16_t rtype,
                 uint16_t index,
                 void *addr,
                 uint32_t len )
```

Arguments:

device	An opaque handle used to identify the USB device.
rtype	Type of request (e.g. USB_RECIPIENT_DEVICE, USB_RECIPIENT_INTERFACE, USB_RECIPIENT_ENDPOINT, USB_RECIPIENT_OTHER, USB_TYPE_STANDARD, USB_TYPE_CLASS, USB_TYPE_VENDOR).
index	This varies, depending on the request. It's used for passing a parameter to the device.
addr	Address for start of transfer — you *must* use the buffer allocated by *usbd_alloc()*.
len	The length (in bytes) of the data transfer.

Library:

libusbdi

Description:

You use the *usbd_status()* function to get specific device status.

Returns:

EOK	Success.
EMSGSIZE	Buffer too small for descriptor.
ENOMEM	No memory for URB.
ENODEV	Device was removed.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_descriptor(), usbd_feature(), usbd_io(), usbd_setup_bulk(), usbd_setup_control(), usbd_setup_interrupt(), usbd_setup_isochronous(), usbd_setup_vendor()

Synopsis:

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

char *usbd_string( struct usbd_device *device,
                   uint8_t index,
                   int langid );
```

Arguments:

device An opaque handle used to identify the USB device.

index An index into the device's (optional) string table.

langid The language ID. The *usbd_languages_descriptor()* function provides the supported language IDs for the device. If you specify 0, *usbd_string()* selects the first or only supported language.

Library:

libusbdi

Description:

The *usbd_string()* function lets you obtain a string from the USB device's table of strings, which typically contains the names of the vendor, the product, etc. The string table is optional.

The strings are actually in Unicode/wide characters, so *usb_string()* converts them to UTF-8 (byte stream) for you and places the resulting string in a static buffer that's reused every time the function is called. The returned string includes a terminating null character.

Returns:

A pointer to the string in an internal static buffer, or NULL on error or if the string table doesn't exist.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No

continued...

Safety	
Signal handler	No
Thread	No

See also:

usbd_args_lookup(), usbd_configuration_descriptor(), usbd_device_lookup(), usbd_device_extra(), usbd_device_descriptor(), usbd_endpoint_descriptor(), usbd_hcd_info(), usbd_hub_descriptor(), usbd_interface_descriptor(), usbd_languages_descriptor(), usbd_parse_descriptors(), usbd_urb_status()

Synopsis:

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

int usbd_topology( struct usbd_connection *connection,
                   usbd_bus_topology_t *tp )

int usbd_topology_ext( struct usbd_connection *connection,
                       uint8_t busno,
                       usbd_bus_topology_t *tp )
```

Arguments:

connection	An opaque handle that identifies the USB stack, obtained by calling *usbd_connect()*.
bus	(*usbd_topology_ext()* only) The index of the bus that you want the topology for.
tp	A pointer to a **usbd_bus_topology_t** data structure that this function fills in; see below.

Library:

libusbdi

Description:

You can use the *usbd_topology()* or *usbd_topology_ext()* function to get the USB bus physical topology.

For more information on USB bus topology, see sections 4.1.1 and 5.2.3 in the USB Specification v1.1.

If your system has more than one bus, you can call *usbd_topology_ext()* to get information about a specific one. The *usbd_topology()* function gets information about the first bus; calling it is the same as calling *usbd_topology()* with a *bus* argument of 0.

The **usbd_bus_topology_t** structure is defined as follows:

```
typedef struct usbd_port_attachment {
    uint8_t  upstream_devno;
    uint8_t  upstream_port;
    uint8_t  upstream_port_speed;
    uint8_t  upstream_hc;
    uint8_t  _reserved[4];
} usbd_port_attachment_t;

typedef struct usbd_bus_topology {
    usbd_port_attachment_t    ports[64];
} usbd_bus_topology_t;
```

The structure contains an array of **`usb_port_attachment_t`** structures, one per device. The **`usb_port_attachment_t`** structure contains at least the following:

upstream_devno The device number of the upstream hub (0 if it's a root port).

upstream_port The port number the device is connected to.

upstream_port_speed
The port speed that the device is operating at; one of the following:

- 0 — full
- 1 — low
- 2 — high

upstream_hc The bus or host controller that the device is connected to.

The *upstream_devno* field will contain a value other than **`0xff`** to indicate a valid attachment.

Returns:

EOK Success.

ENODEV The device was removed.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	Yes
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_connect()

Synopsis:

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

int usbd_urb_status( struct usbd_urb *urb,
                     uint32_t *status,
                     uint32_t *len )
```

Arguments:

urb An opaque handle (from *usbd_alloc_urb()*).

status Completion status (see below).

len The *actual* length (in bytes) of the data transfer.

Library:

libusbdi

Description:

You use the *usbd_urb_status()* function to extract completion status and data-transfer length from a URB.

Completion status

The *status* field contains the completion status information, which includes the following flags:

USBD_STATUS_INPROG
: The operation is in progress.

USBD_STATUS_CMP
: The operation is complete.

USBD_STATUS_CMP_ERR
: The operation is complete, but an error occurred.

USBD_STATUS_TIMEOUT
: The operation timed out.

USBD_STATUS_ABORTED
: The operation aborted.

USBD_STATUS_CRC_ERR
: The last packet from the endpoint contained a CRC error.

USBD_STATUS_BITSTUFFING

The last packet from the endpoint contained a bit-stuffing violation.

USBD_STATUS_TOGGLE_MISMATCH

The last packet from the endpoint had the wrong data-toggle PID.

USBD_STATUS_STALL

The endpoint returned a STALL PID.

USBD_STATUS_DEV_NOANSWER

Device didn't respond to token (IN) or didn't provide a handshake (OUT).

USBD_STATUS_PID_FAILURE

Check bits on PID from endpoint failed on data PID (IN) or handshake (OUT).

USBD_STATUS_BAD_PID

Receive PID was invalid or undefined.

USBD_STATUS_DATA_OVERRUN

The endpoint returned more data than the allowable maximum.

USBD_STATUS_DATA_UNDERRUN

The endpoint didn't return enough data to fill the specified buffer.

USBD_STATUS_BUFFER_OVERRUN

During an IN, the host controller received data from the endpoint faster than it could be written to system memory.

USBD_STATUS_BUFFER_UNDERRUN

During an OUT, the host controller couldn't retrieve data fast enough.

USBD_STATUS_NOT_ACCESSED

Controller didn't execute request.

Returns:

EOK	Success.
EBUSY	URB I/O still active.
ETIMEDOUT	Timeout occurred.
EINTR	Operation aborted/interrupted.
ENODEV	Device removed.
EIO	I/O error.

Classification:

QNX Neutrino, QNX 4

Safety	
Cancellation point	No
Interrupt handler	No
Signal handler	No
Thread	Yes

See also:

usbd_args_lookup(), *usbd_configuration_descriptor()*, *usbd_device_lookup()*, *usbd_device_extra()*, *usbd_device_descriptor()*, *usbd_endpoint_descriptor()*, *usbd_hcd_info()*, *usbd_hub_descriptor()*, *usbd_interface_descriptor()*, *usbd_languages_descriptor()*, *usbd_parse_descriptors()*, *usbd_string()*

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