# USB Audio 2.0 with Communication Device Class (CDC) Abstract Control Model Library for Analog Devices ADSP-SC594 User's Guide Revision 1.02

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## Introduction

The Closed Loop Design (CLD) Audio 2.0 with CDC/ACM library creates a simplified interface for developing a USB Audio v2.0 and Communication Device Class (CDC) Abstract Control Model (ACM) Serial Emulation device using the Analog Devices EV-SOMCRR-EZKIT and the EV-SC594-SOM System-on-Module boards. The CLD SC594 Audio 2.0 with CDC library also includes support for timer functions that facilitate creating timed events quickly and easily. The library's User application interface is comprised of parameters used to customize the library's functionality as well as callback functions used to notify the User application of events. These parameters and functions are described in greater detail in the CLD SC594 Audio 2.0 with CDC Library API section of this document.

## USB Background

The following is a very basic overview of some of the USB concepts that are necessary to use the CLD SC594 Audio 2.0 with CDC Library. However, it is still recommended that developers have at least a basic understanding of the USB 2.0 protocol. The following are some resources to refer to when working with USB, USB Audio v2.0, and CDC 1.2 protocols:

- The USB 2.0 Specification
- The USB Device Class Definition for Audio Devices v2.0,
  The USB Device Class Definition for Audio Data Formats v.2.0
  The USB Device Class Definition for Terminal Types v.2.0
- The USB CDC Class specification v1.2
- USB in a Nutshell: A free online wiki that explains USB concepts.
  http://www.beyondlogic.org/usbnutshell/usb1.shtml
- "USB Complete" by Jan Axelson ISBN: 1931448086

USB is a polling based protocol where the Host initiates all transfers, all USB terminology is from the Host's perspective. For example an 'IN' transfer is when data is sent from a Device to the Host, and an 'OUT' transfer is when the Host sends data to a Device.

The USB 2.0 protocol defines a basic framework that devices must implement in order to work correctly. This framework is defined in the Chapter 9 of the USB 2.0 protocol, and is often referred to as the USB 'Chapter 9' functionality. Part of the Chapter 9 framework is standard USB requests that a USB Host uses to control the Device. Another part of the Chapter 9 framework is the USB Descriptors. These USB Descriptors are used to notify the Host of the Device's capabilities when the Device is attached. The USB Host uses the descriptors and the Chapter 9 standard requests to configure the Device. This process is called USB Enumeration. The CLD library includes support for the USB standard requests and USB Enumeration using some of the parameters specified by the User application when initializing the library. These parameters are discussed in the cld_sc594_audio_2_0_w_cdc_lib_init section of this document. The CLD library facilitates USB enumeration and is Chapter 9 compliant without User Application

intervention as shown in the flow chart below. For additional information on USB Chapter 9 functionality or USB Enumeration please refer to one of the USB resources listed above.

### CLD Library USB Enumeration Flow Chart


All USB data is transferred using Endpoints that act as a source or sink for data based on the endpoint's direction (IN or OUT). The USB protocol defines four types of Endpoints, each of which has unique characteristics that dictate how they are used. The four Endpoint types are: Control, Interrupt, Bulk and Isochronous. Data that is transmitted over USB is broken up into blocks of data called packets. For each

endpoint type there are restrictions on the allowed max packet size. The allowed max packet sizes also vary based on the USB connection speed. Please refer to the USB 2.0 protocol for more information about the max packet size supported by the four endpoint types.

The CLD SC594 Audio 2.0 with CDC Library uses Control, Bulk, and Isochronous endpoints, these endpoint types will be discussed in more detail below.

A Control Endpoint is the only bi-directional endpoint type, and is typically used for command and status transfers. A Control Endpoint transfer is made up of three stages (Setup Stage, Data Stage, and Status Stage). The Setup Stage sets the direction and size of the optional Data Stage. The Data Stage is where any data is transferred between the Host and Device. The Status Stage gives the Device the opportunity to report if an error was detected during the transfer. All USB Devices are required to include a default Control Endpoint at endpoint number 0, referred to as Endpoint 0. Endpoint 0 is used to implement all the USB Protocol defined Chapter 9 framework and USB Enumeration. In the CLD library Endpoint 0 is also used to handle the USB Audio Device Class v2.0 defined Set and Get requests as well as the CDC requests. These requests are discussed in more detail in the USB Audio Device Class v2.0 Background and CDC Abstract Control Model Background sections of this document

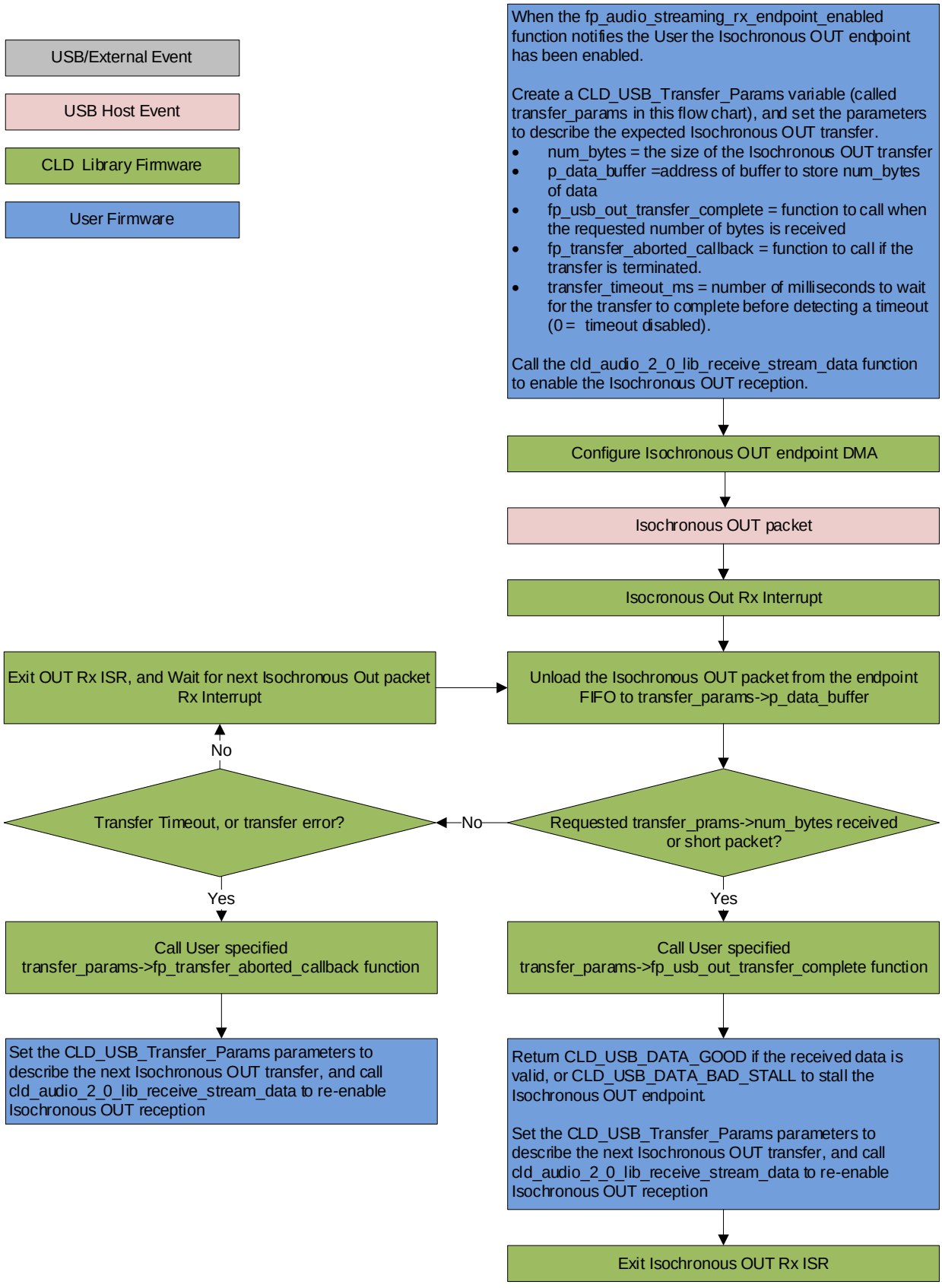
Isochronous Endpoints have the following characteristics which make them well suited for streaming audio data:

- Guaranteed USB bandwidth with bounded latency
- Constant data rate as long as data is provided to the endpoint.
- In the event of a transport error there is no retrying.

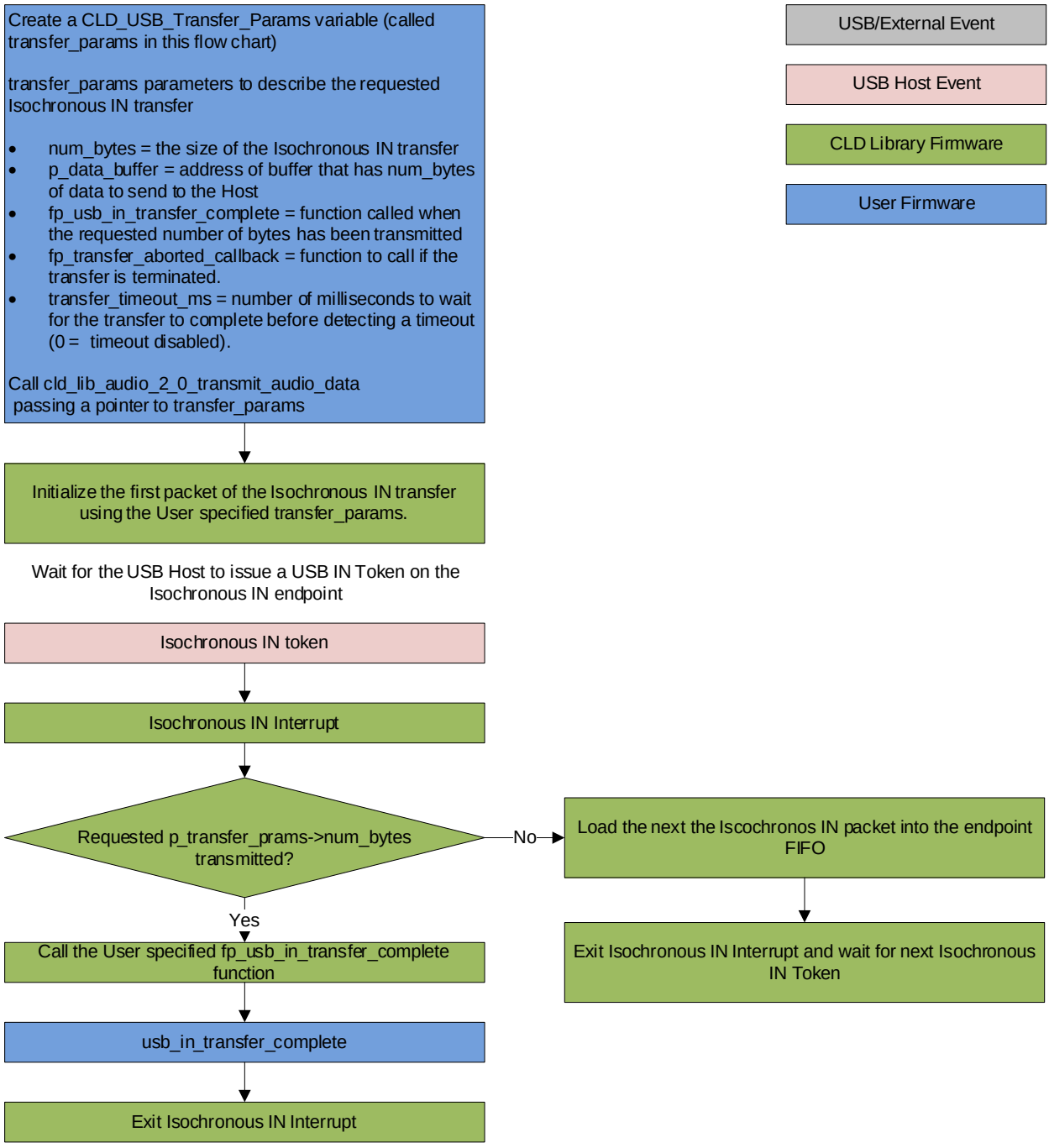
These characteristics allow for streaming audio data to be transmitted with deterministic timing. In the event of a USB transport error the audio data is dropped instead of being retried like a Bulk or Interrupt endpoint. This allows the streaming audio data to remain in sync. The CLD library supports an Isochronous IN and Isochronous OUT endpoint, which are used to send and receive streaming audio data with the USB Host, respectively.

The flow charts below give an overview of how the CLD library and the User firmware interact to process Isochronous OUT and Isochronous IN transfers. Additionally, the User firmware code snippets included at the end of this document provide a basic framework for implementing a USB Audio v2.0 device using the CLD SC594 Audio 2.0 with CDC Library.

## CLD Audio 2.0 Library Isochronous OUT Flow Chart



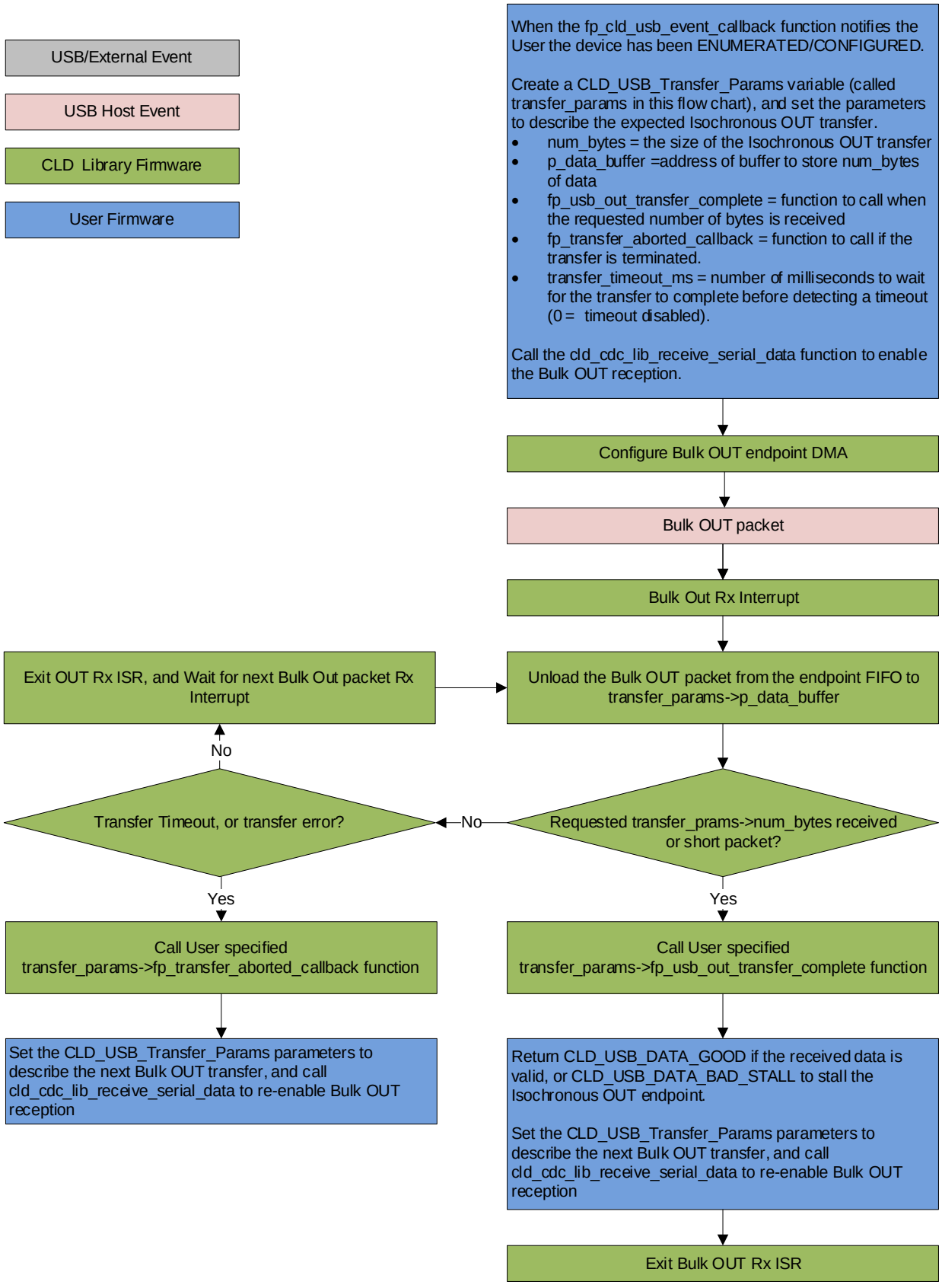
## CLD Audio 2.0 Library Isochronous IN Flow Chart



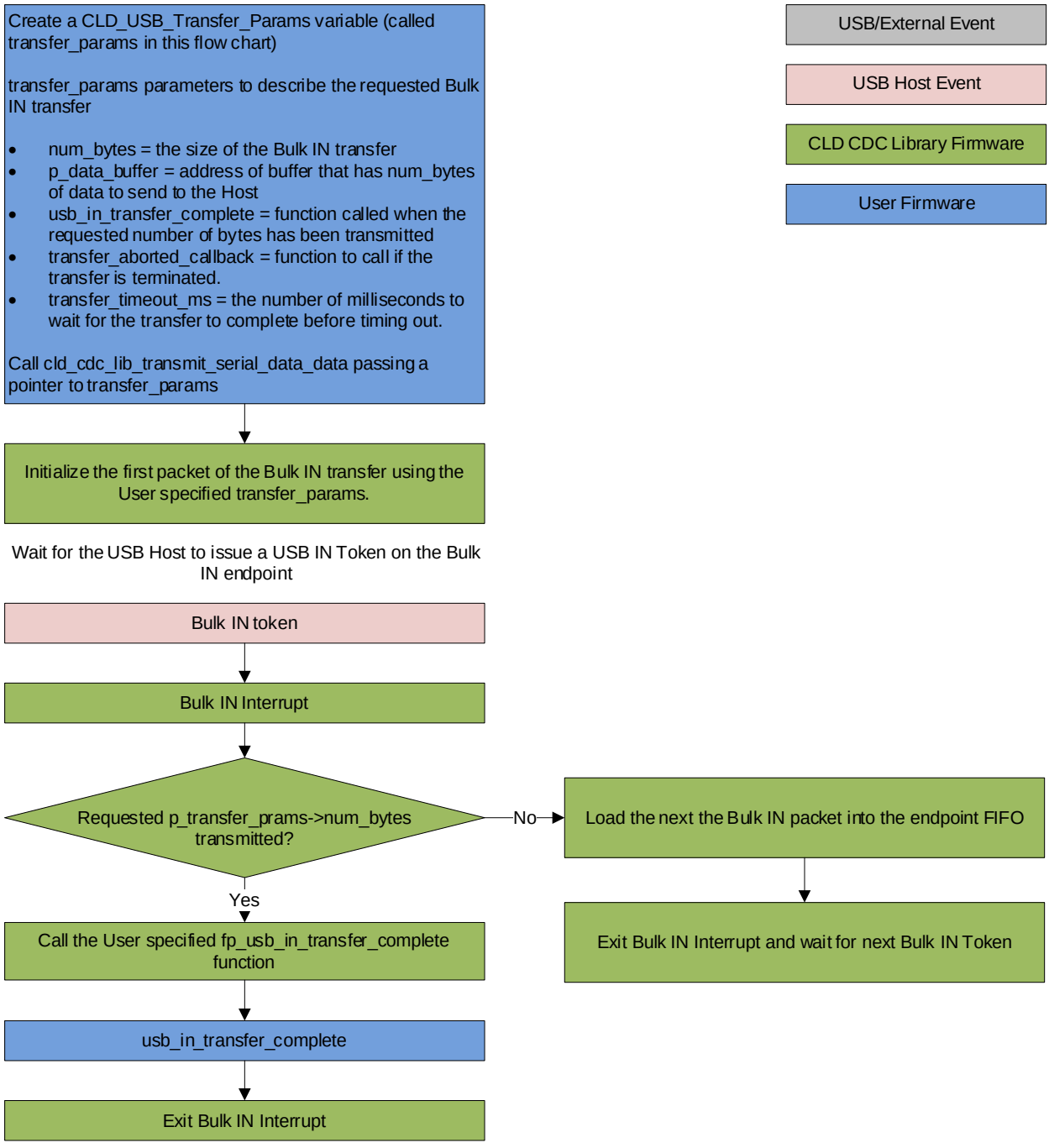
Bulk Endpoints are used to transfer large amounts of data where data integrity is critical, but does not require deterministic timing. A characteristic of Bulk Endpoints is that they can fill USB bandwidth that isn't used by the other endpoint types. This makes Bulk the lowest priority endpoint type, but it can also be the fastest as long as the other endpoints don't saturate the USB Bus. An example of a devices that uses Bulk endpoints is a Mass Storage Device (thumb drives). The CLD library includes a Bulk IN and Bulk OUT endpoint, which are used to send and receive serial data with the USB Host, respectively.

The flow charts below give an overview of how the CLD CLD SC594 Audio 2.0 with CDC Library and the User firmware interact to process Bulk OUT and Bulk IN transfers.

## CLD CDC Library Bulk OUT Flow Chart



## CLD CDC Library Bulk IN Flow Chart

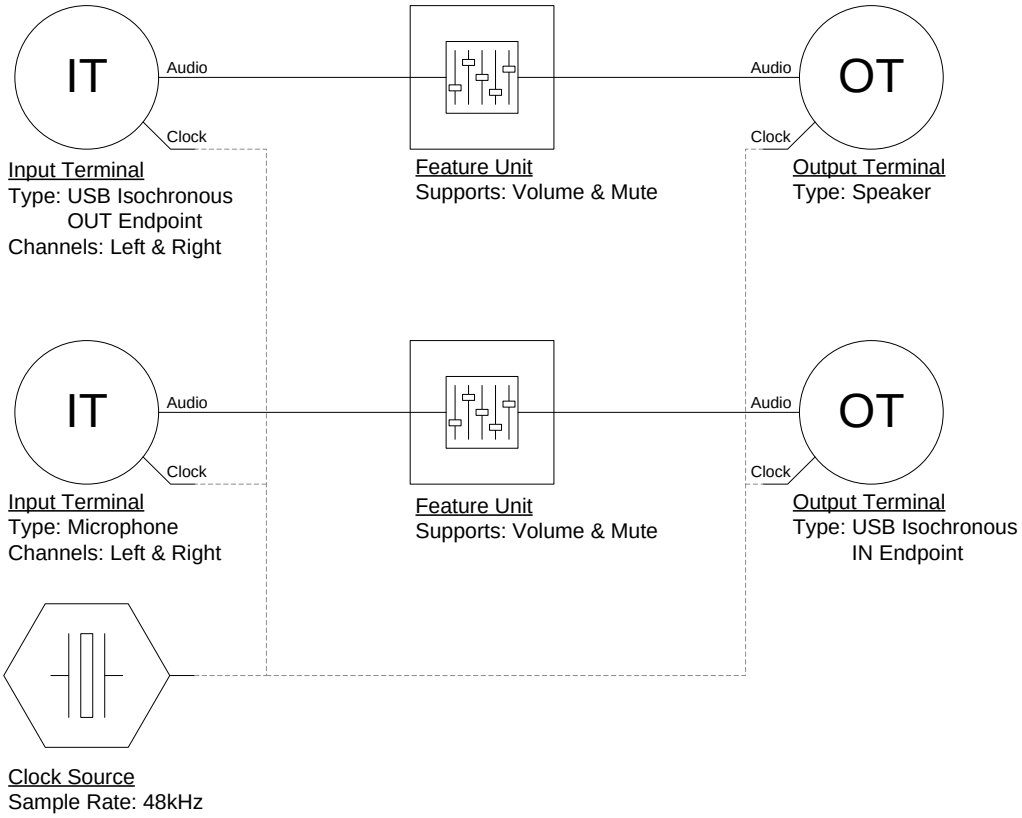


## USB Audio Device Class v2.0 Background

The following is a basic overview of some USB Audio Device v2.0 concepts that are necessary to use the CLD SC594 Audio 2.0 with CDC Library. However, it is recommended that developers have at least a basic understanding of the USB Audio Device Class v2.0 protocol.

The USB Audio Device Class v2.0 protocol is a USB Standard Class released by the USB IF committee, and it provides a standardized way for a device that is capable of audio input/output to communicate with a USB Host. The USB Audio Device Class v2.0 USB descriptors provide a detailed description of the Device's capabilities. This information includes the Device's supported audio sample rate(s), audio data format, input and output terminals and how the various audio processing components are connected and controlled.

The Device's audio processing capabilities are described using a series of USB Audio Class Terminal and Unit Descriptors. The Terminal Descriptors define how audio data is input and output (speakers, microphones, USB Isochronous endpoints, etc.). The Unit Descriptors describe the Device's audio processing capabilities and how they connect to the input/output Terminals. The diagram below shows how the audio Terminal and Unit entities are connected in the CLD example project to implement a basic device with a stereo speaker output, and stereo input.




More complex audio devices are created by connecting multiple Unit entities together to describe the Device's capabilities. For more information about the available Unit and Terminal entities, and how they are used please refer to the USB Audio Class Device v2.0 specification.

In order to successfully communicate with a USB Audio device the USB Host needs to know how the audio data is formatted. This is done using an audio stream format descriptor, which is part of the Streaming Audio Interface configuration. The USB Audio Device Class v2.0 specification supports multiple audio data formats which are described in the USB Device Class Definition for Audio Data Formats v2.0 specification.

### Isochronous Endpoint Bandwidth Allocation

As mentioned previously, one of the advantages of Isochronous endpoints is that they provide guaranteed USB bandwidth. However, this can also be a disadvantage when the bandwidth isn't being used as it is wasted.

To avoid this disadvantage the USB Audio Device Class v2.0 protocol requires that audio data streaming interfaces include two settings. The default setting does not include any Isochronous endpoints so its bandwidth requirement is zero. An alternate interface includes the required Isochronous endpoint(s). This allows the USB Host to enable the Isochronous endpoints when it needs to send or receive audio data, and disable them when the audio device is idle. This switch is done using the USB Chapter 9 Set Interface standard request.

When the CLD SC594 Audio 2.0 with CDC Library receives a Set Interface request the appropriate User callback function is called. Please refer to the fp_audio_streaming_rx_endpoint_enabled and fp_audio_streaming_tx_endpoint_enabled function pointer descriptions in the cld_sc594_audio_2_0_w_cdc_lib_init section of this document for more information.

### USB Audio Device Class v2.0 Control Endpoint Requests

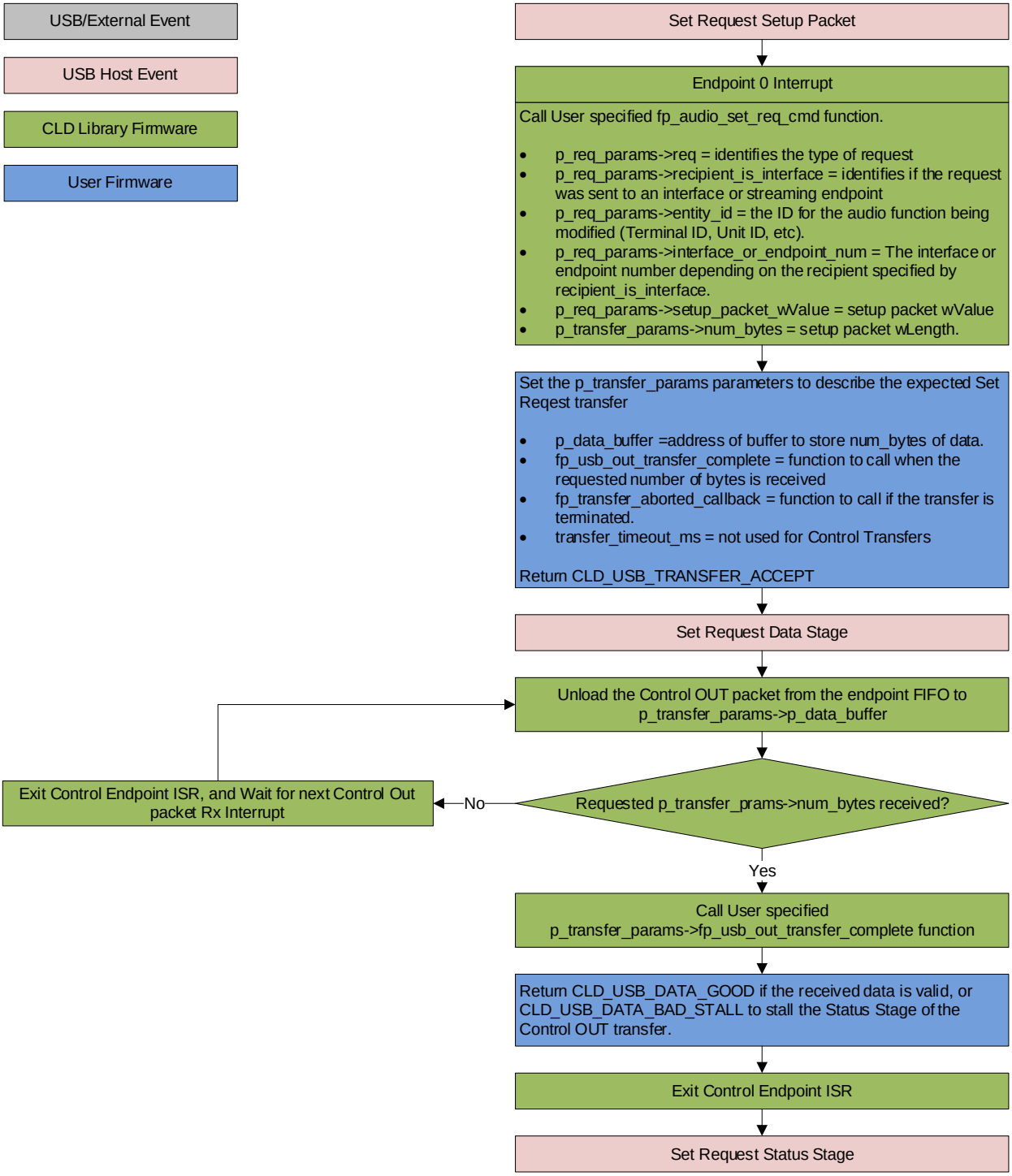
The USB Audio Device Class v2.0 control endpoint requests are broken down into Set and Get requests. These requests are used to control the various Terminal and Unit entities defined in the Configuration Descriptor. The CLD library support for these requests is explained in the following sections.

Additionally, the User firmware code snippets included at the end of this document provide a basic framework for implementing the USB audio Control Endpoint requests using the CLD library.

### *USB Audio Device Class v2.0 Set Request*

The USB Audio Device Class v2.0 Set Request is used to control the audio functions supported by the Device. This includes modifying the attributes if the Unit and Terminal entities as well as controlling features of the streaming audio endpoints.

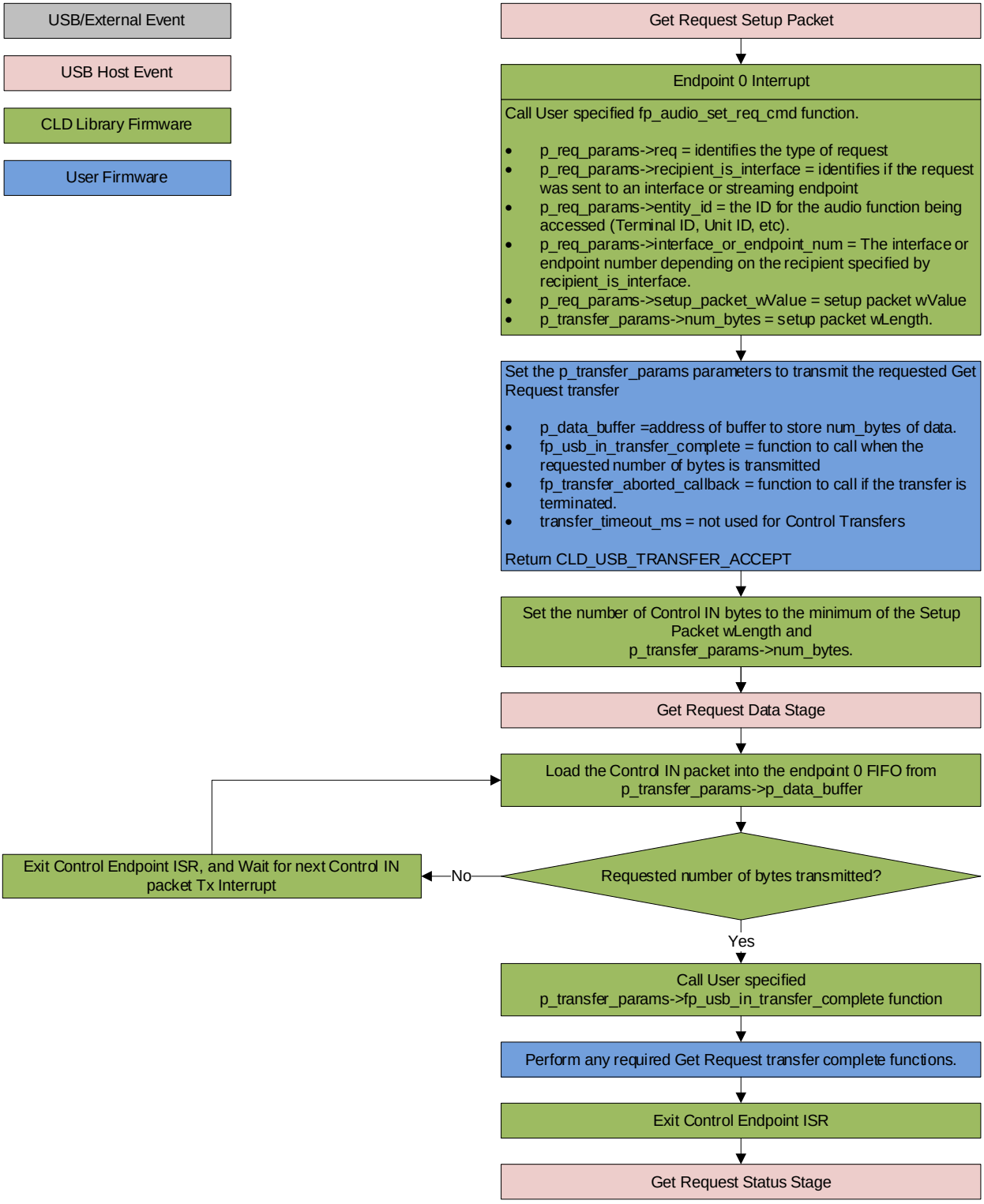
## CLD SC594 Audio Device Class v2.0 Set Request Flow Chart



### *USB Audio Device Class v2.0 Get Request*

The Get Request is a Control IN request used by the Host to request data from the audio functions supported by the Device. This includes requesting the attributes of the Unit and Terminal entities as well as features of the audio stream endpoints.

#### CLD SC594 Audio Device Class v2.0 Get Request Flow Chart



## CDC Abstract Control Model Background

The USB Communication Device Class (CDC) Abstract Control Model (ACM) protocol is a USB Standard Class protocol released by the USB IF committee. The Communication Device Class was created to provide a standardized way for USB communication devices to interface with a computer, and covers a wide range of communication devices. The CLD library implements an Abstract Control Model Serial Emulation device, so the scope of this document is limited to the CDC ACM Serial Emulation functionality.

A CDC device is comprised of two USB interfaces. The first interface uses the Communication Device Class. The second interface uses the Data Interface Class and includes a Bulk IN and Bulk OUT endpoint, which are used to transfer the serial emulation data with the USB Host.

### CDC Abstract Control Model Control Endpoint Requests

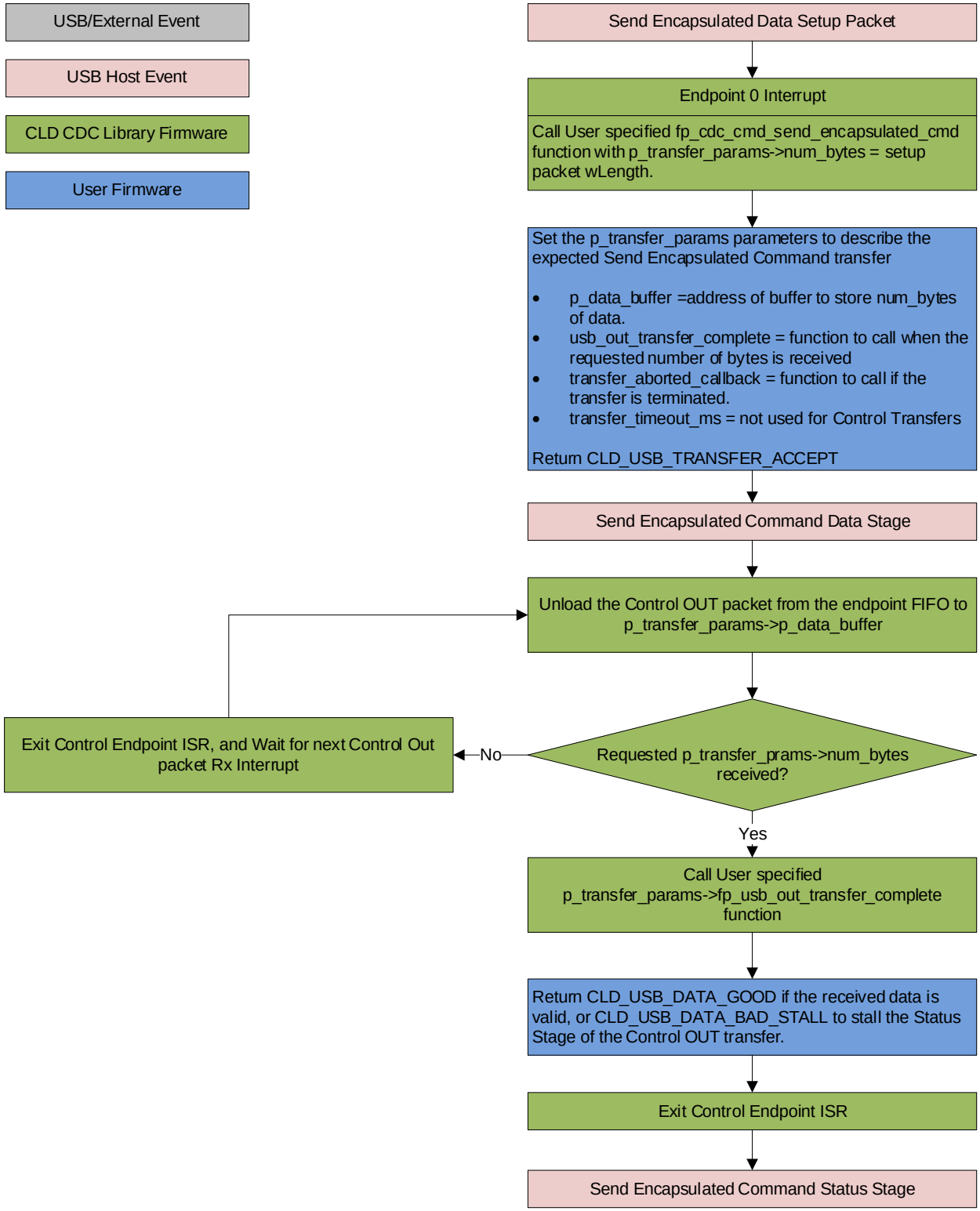
The CDC Abstract Control Model defines a couple Control Endpoint requests that a CDC peripheral is required to support as well as some optional Control Endpoint requests. The Control Endpoint requests used by the CLD library are explained in the following sections, and include flow charts showing how the CLD SC594 Audio 2.0 with CDC Library and the User firmware interact to the Control Endpoint requests.

Additionally, the User firmware code snippets included at the end of this document provide a basic framework for implementing the CDC control requests using the CLD library.

### *Send Encapsulated Command (required)*

Send Encapsulated Command is a Control OUT request and is used by the Host to send protocol specific data to the device.

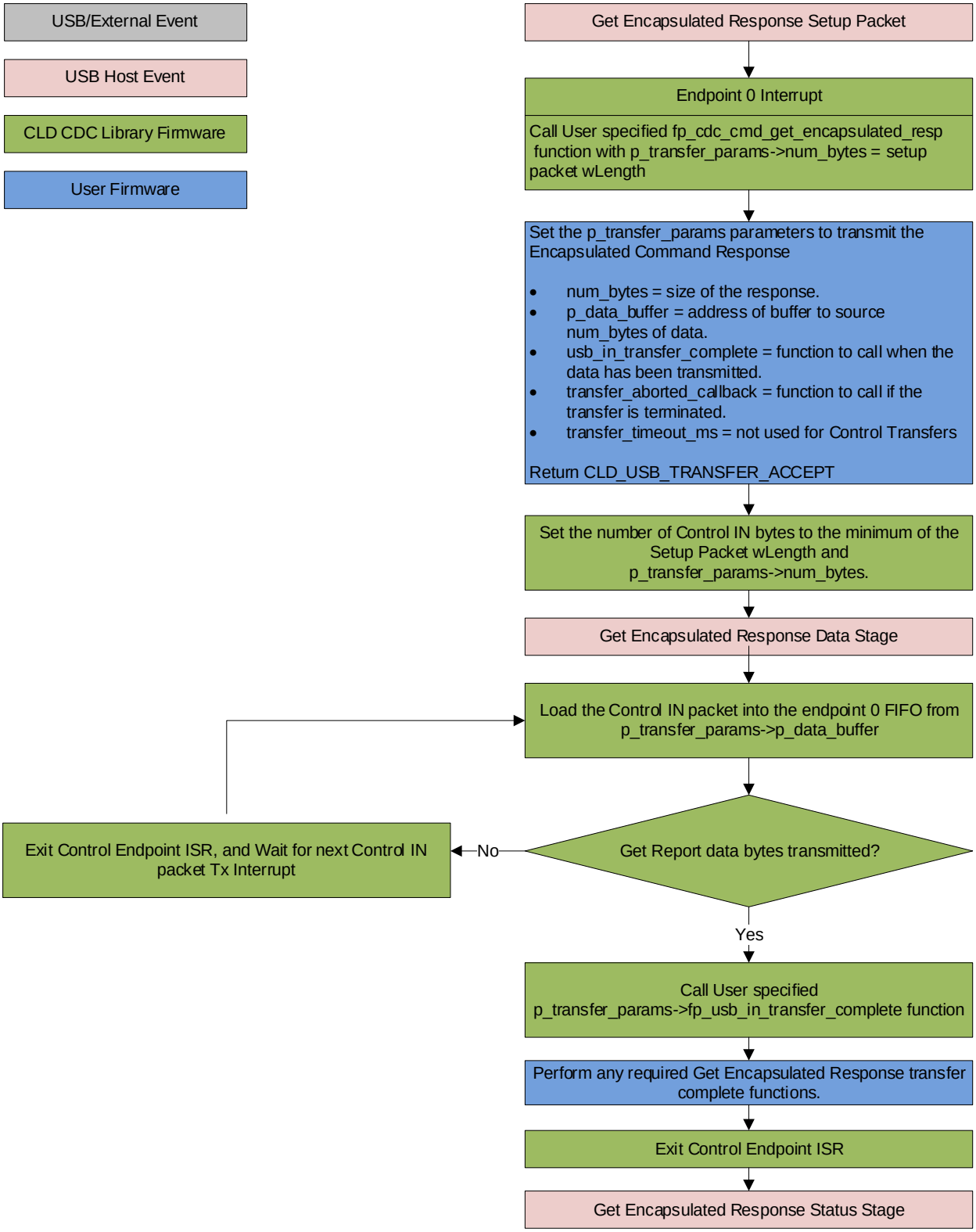
#### CLD CDC Library Send Encapsulated Command Flow Chart



### *Get Encapsulated Command (required)*

Get Encapsulated Command is a Control IN request used by the Host to request protocol specified data.

CLD CDC Library Get Encapsulated Command Flow Chart



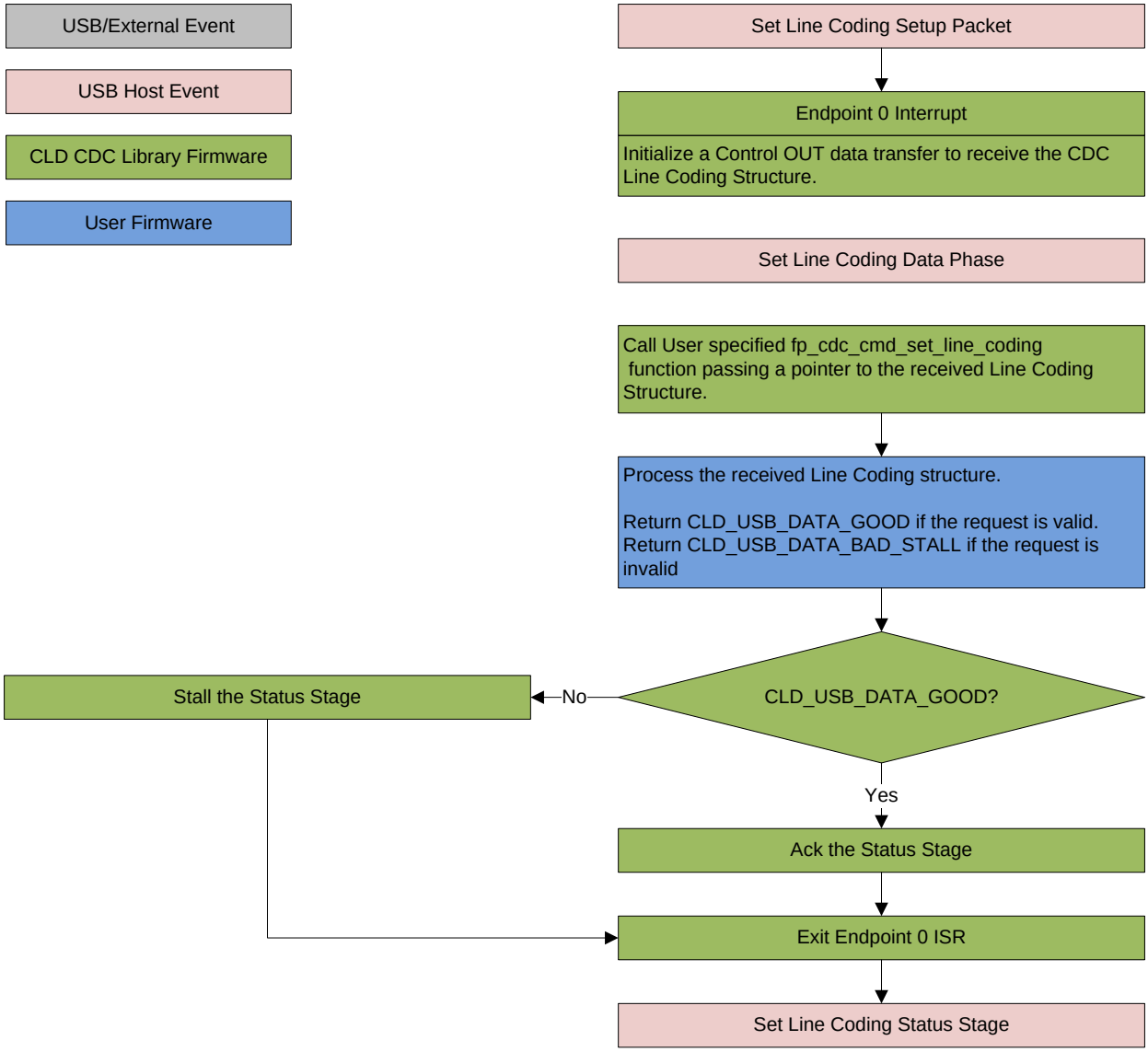
### *Set Line Coding (optional)*

The Set Line Coding Control OUT request is used by the Host configure the UART parameters of emulated serial port. The Set Line Coding request includes the following line coding structure in the Control OUT Data Phase.

```
typedef struct
{
    unsigned long data_terminal_rate;          /* CDC Data Terminal Rate in
                                                   bits per second. */
    unsigned char num_stop_bits;               /* CDC Number of stop bits
                                                   0 = 1 stop bit
                                                   1 = 1.5 stop bits
                                                   2 = 2 stop bits */
    unsigned char parity;                      /* CDC Parity setting
                                                   0 = None
                                                   1 = Odd
                                                   2 = Even
                                                   3 = Mark
                                                   4 = Space */
    unsigned char num_data_bits;               /* CDC number of data bits
                                                   (Only 5, 6, 7, 8 and 16
                                                    allowed) */
} CLD_CDC_Line_Coding;
```

In response to a Set Line Coding command the CDC device should implement the requested configuration, or stall the endpoint if the request is invalid.

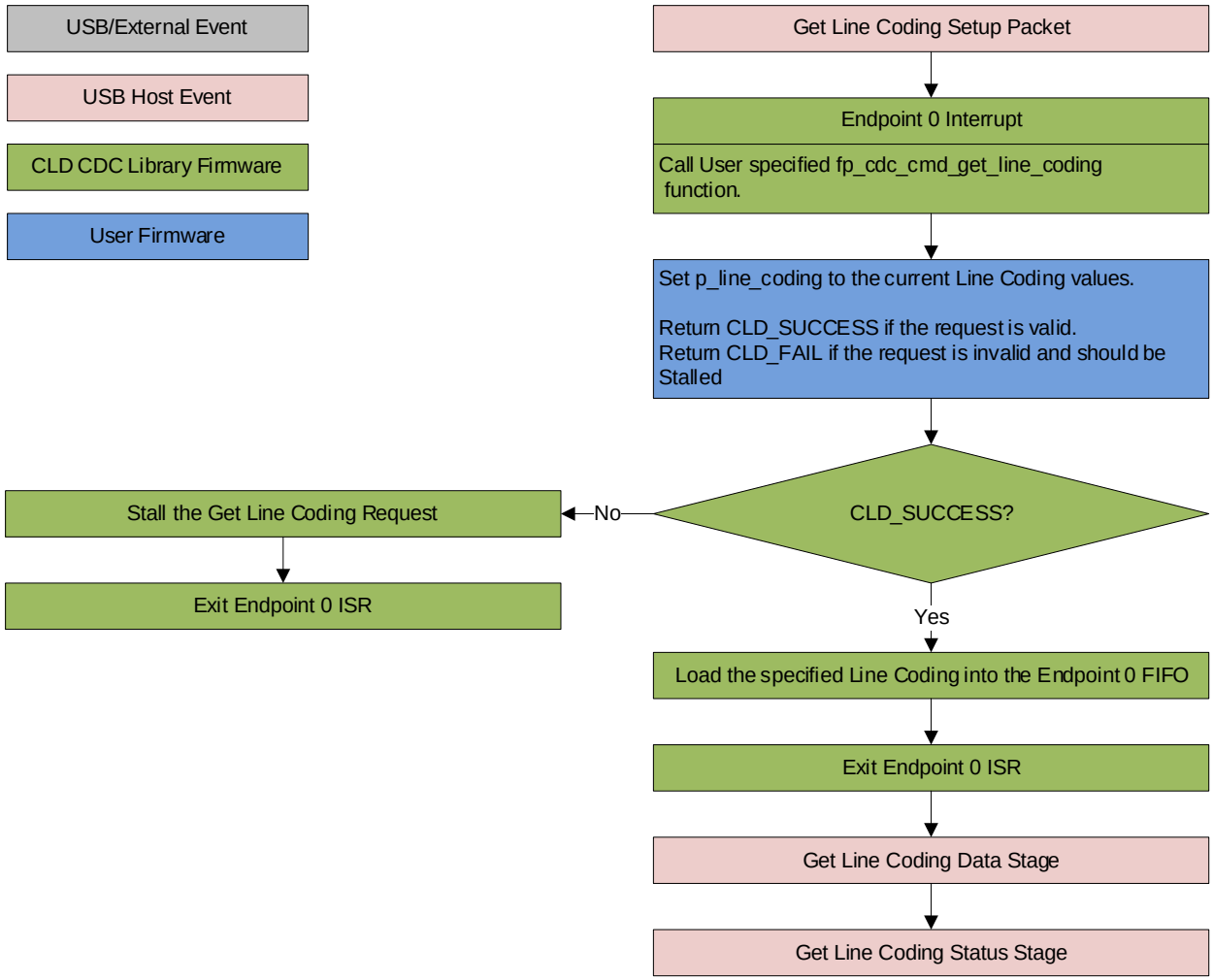
## CLD CDC Library Set Line Coding Flow Chart



### *Get Line Coding (optional)*

The Get Line Coding Control IN request is used by the Host request current UART parameters of emulated serial port. The Get Line Coding request includes line coding structure described in the Set Line Coding section in the Control IN Data Phase.

## CLD CDC Library Get Line Coding Flow Chart

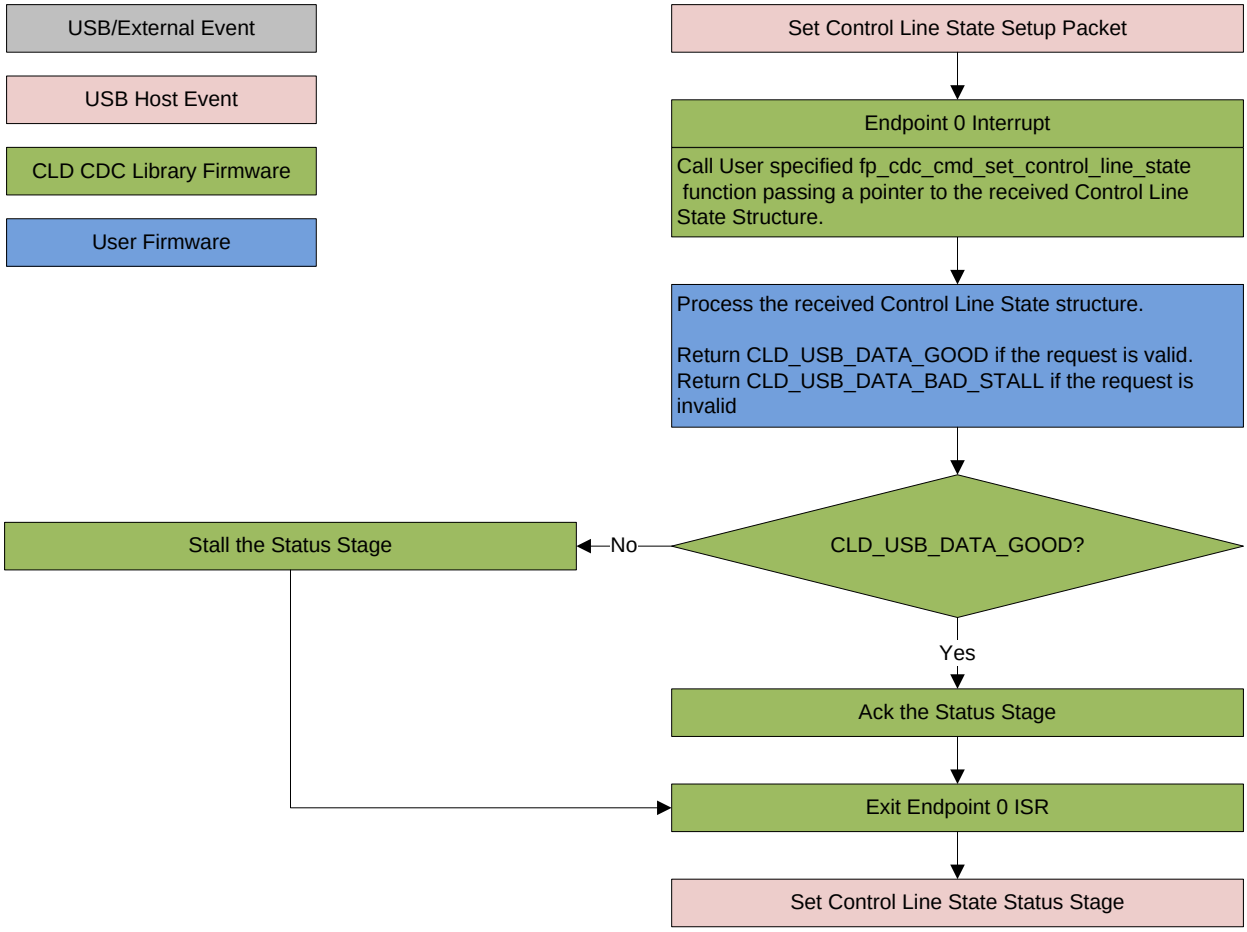


### *Set Control Line State (optional)*

The Set Control Line State Control OUT request is used by the Host to set the value of the emulated serial port RS-232 RTS and DTR control signals. The Set Control Line State request includes the following control signal structure in the Control OUT Data Phase.

```
typedef struct
{
    union
    {
        struct
        {
            unsigned short dte_present   : 1;          /* Indicates to DCE if DTE is
                                                          present or not.
                                                          This signal corresponds to
                                                          V.24 signal 108/2
                                                          and RS-232 signal DTR.
                                                             0 - Not Present
                                                             1 - Present  */
            unsigned short activate_carrier : 1;       /* Carrier control for half
                                                          duplex modems.
                                                          This signal corresponds to
                                                          V.24 signal 105 and RS-232
                                                          signal RTS.
                                                             0 - Deactivate carrier
                                                             1 - Activate carrier
                                                          The device ignores the
                                                          value of this bit when
                                                          operating in full duplex
                                                          mode.  */
            unsigned short reserved         : 14;
        } bits;
        unsigned short state;
    } u;
} CLD_CDC_Control_Line_State;
```

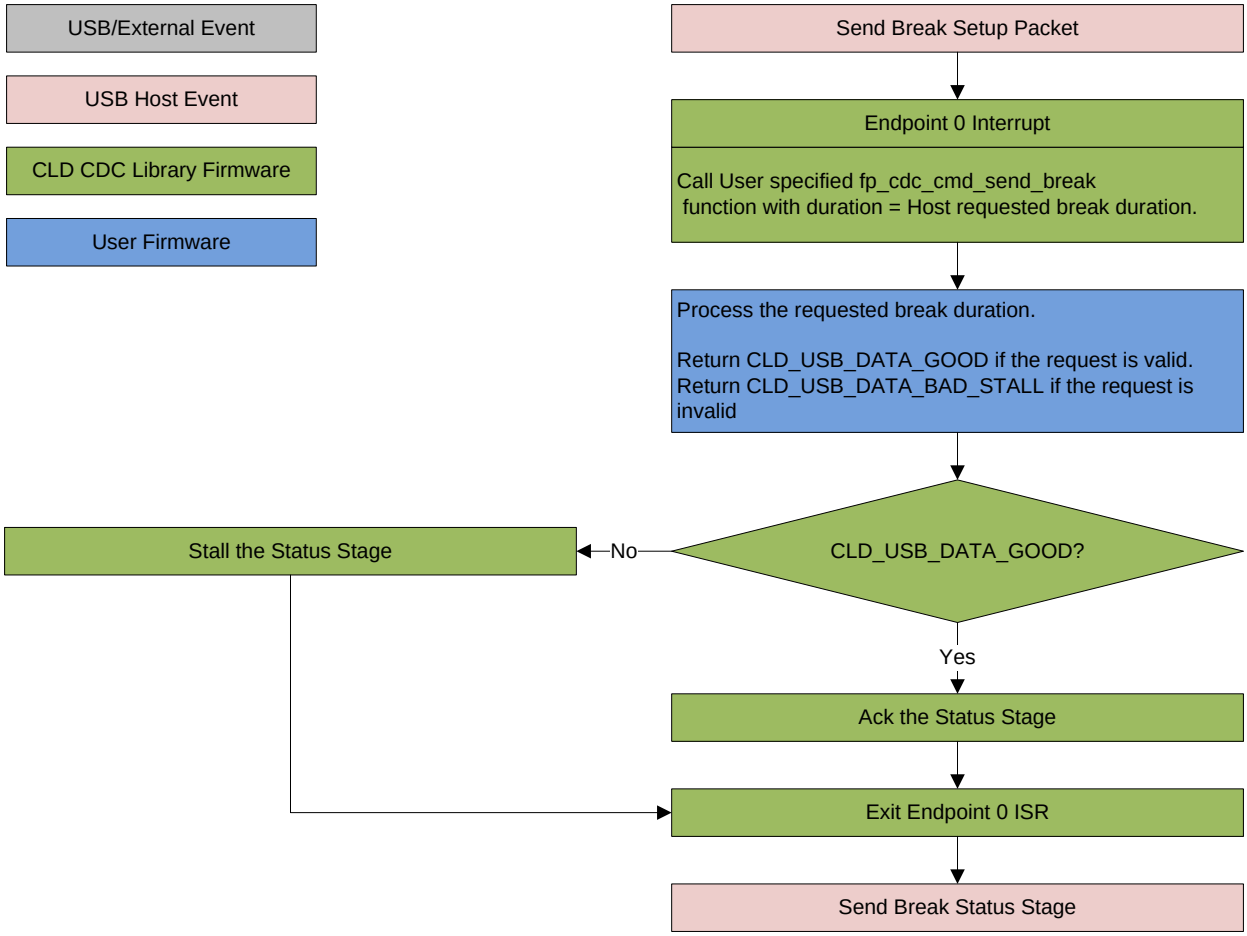
## CLD CDC Library Set Control Line State Flow Chart



### *Send Break (optional)*

The Send Break Control OUT request is used by the Host request the device to generate a RS-232 style break for the specified duration (in milliseconds). If the duration is set to 0xFFFF the device should generate a break until a another Send Break command is received with a duration of 0.

## CLD CDC Library Send Break Flow Chart



## Dependencies

In order to function properly, the CLD SC594 Audio 2.0 with CDC Library requires the following resources:

- ULPI (8-PIN interface) compliant USB PHY which outputs a USB clock to the processor.
- The CLD library uses DMA for all USB transfers. Requiring all data transferred over USB to be located in un-cached memory, and be 32-bit aligned. Including buffers used by the CLD library which are located in an ".usb_lib_uncached" memory section. In order for the library to work properly, the User must define the usb_lib_uncached section in their loader file and configure the cache accordingly.
- The User firmware is responsible for enabling the USBC I/O pins in the CCES project Pin Multiplexing project settings.
- The User firmware is responsible for configuring all other non-USB specific peripherals, including clocks, power modes, etc.

## CLD SC594 Audio 2.0 with CDC Library Scope and Intended Use

The CLD SC594 Audio 2.0 with CDC Library implements the USB Audio Device Class v2.0 and CDC/ACM required functionality to implement a USB Audio and CDC device, as well as providing time measurements functionality. The CLD library is designed to be added to an existing User project, and as such only includes the functionality needed to implement the above mentioned USB, and timer keeping features. All other aspects of SC594 processor configuration must be implemented by the User code.

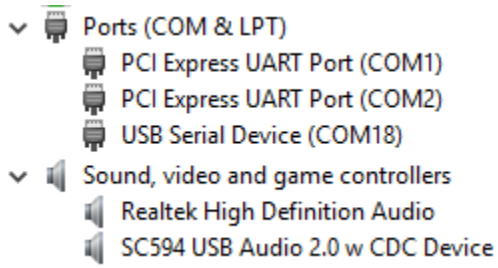
## CLD Audio 2.0 with CDC (2-Channel) Example v1.01 Description

The CLD example project provided with the CLD SC594 Audio 2.0 with CDC Library implements a basic USB audio device that supports a single stereo input and stereo output loopback, and a CDC Abstract Control model USB serial port echo.

### Running the Example Project

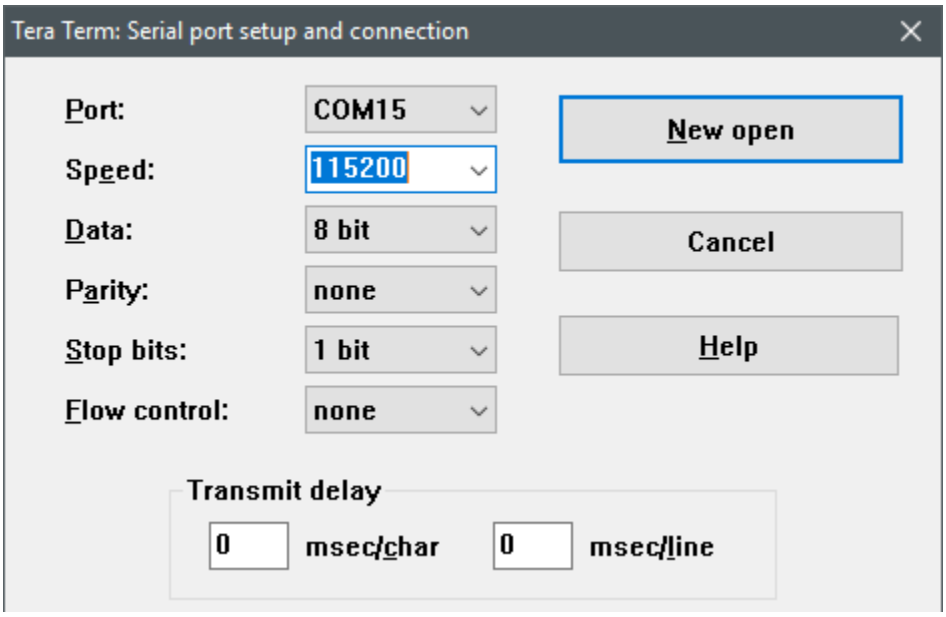
1. With the example project was developed using the ADSP SC594 SOM and carrier board, and toggles the LED connected to GPIO port C pin 3 every 250 milliseconds to provide a visual indicator the project is running.

2. Once the example project is running on the EZ Board connect a USB mini-b cable from a PC to the “USB Phy” connector of the carrier board. Windows 10 will install its built-in CDC/ACM and USB Audio 2.0 drivers, and the device will be listed in the Device Manager as shown below:

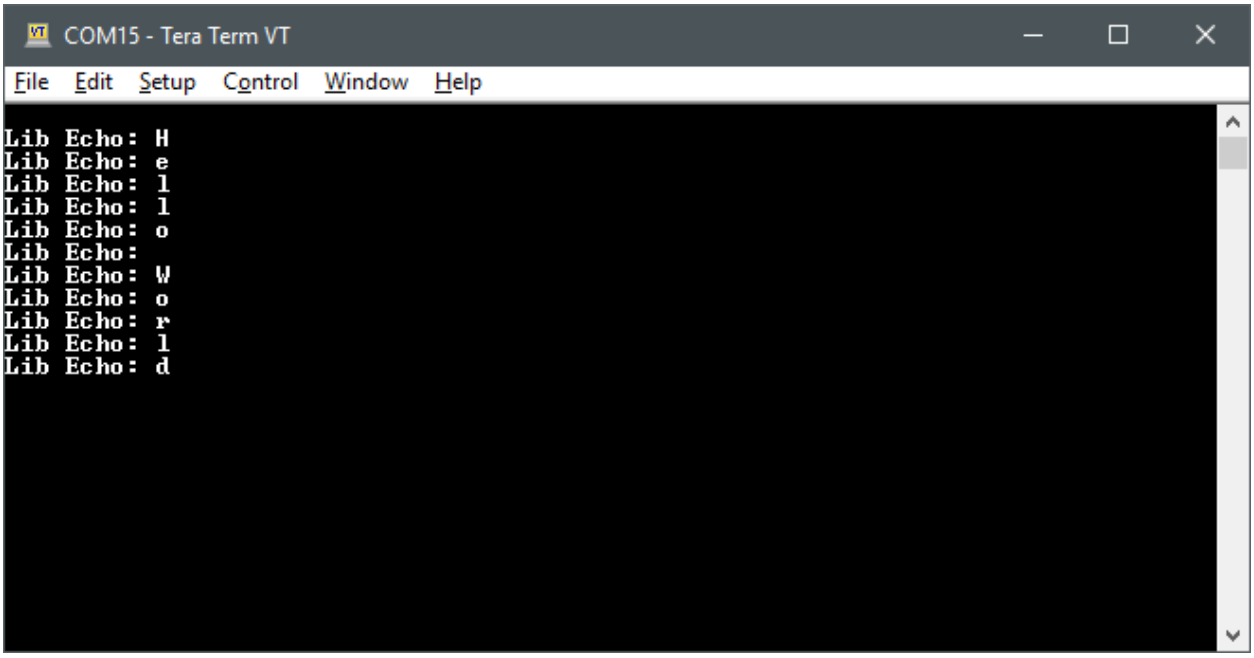


### Testing CDC

1. Using TeraTerm, or another serial terminal program, connect to the new serial port as shown below and click New Open:

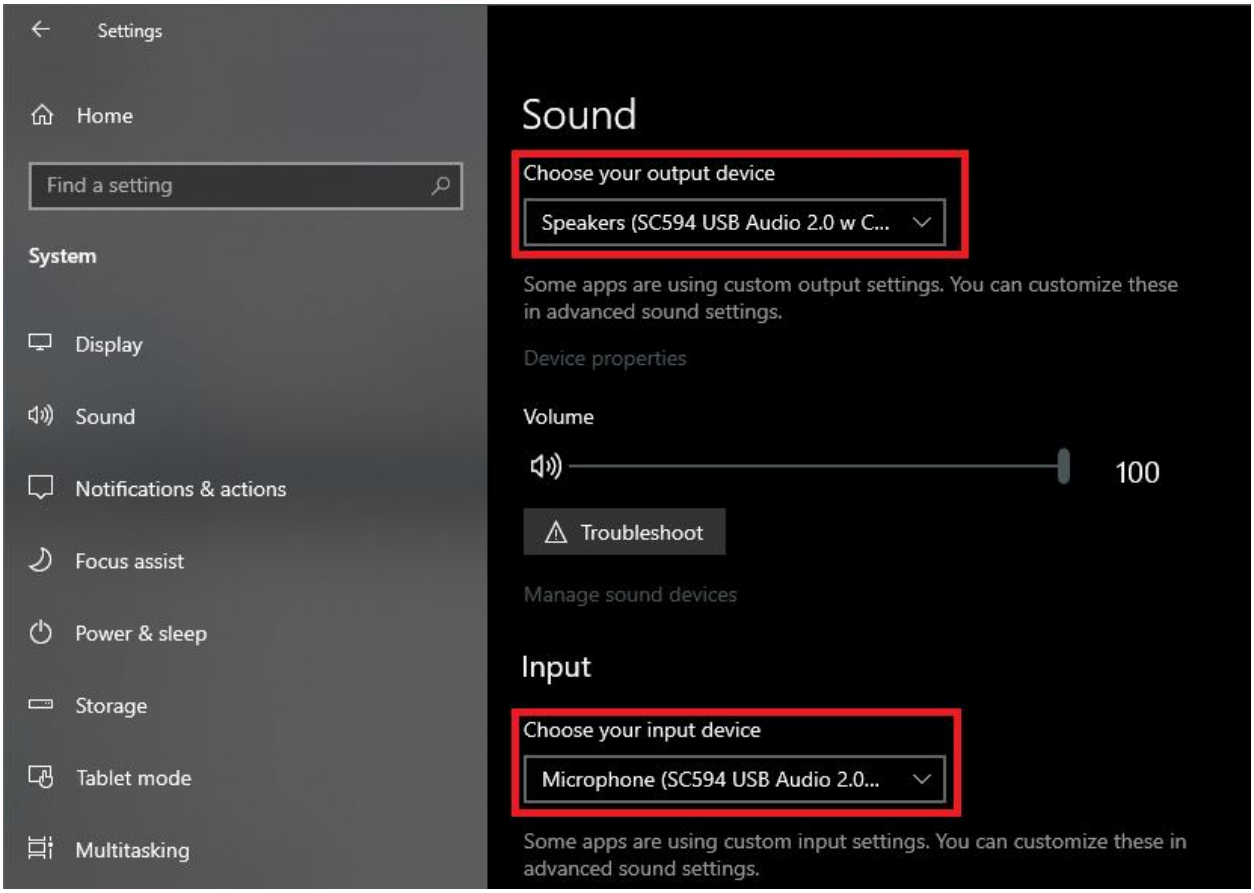



2. The example project will echo the data it received over USB prepended with "Lib Echo:" as shown below:




### Testing Audio 2.0

1. Under the Sound setting for Windows 10, select the SC594 USB Audio v2.0 with CDC device as the output and input device as shown below:




2. Play an audio file, movie, or other means of outputting audio.

3. The example project will echo the received audio data using its microphone input, which can be seen using Audacity or other audio recording software.

## CLD SC594 Audio 2.0 with CDC Library API

The following CLD library API descriptions include callback functions that are called by the library based on USB events. The following color code is used to identify if the callback function is called from the USB interrupt service routine, or from mainline. The callback functions called from the USB interrupt service routine are also italicized so they can be identified when printed in black and white.

| |
|---|
| Callback called from the mainline context |
| *Callback called from the USB interrupt service routine* |

### cld_sc594_audio_2_0_w_cdc_lib_init

```
CLD_RV cld_sc594_audio_2_0_w_cdc_lib_init
(CLD_SC594_Audio_2_0_w_CDC_Lib_Init_Params * p_lib_params)
```

Initializes the CLD SC594 Audio 2.0 with CDC Library.

#### *Arguments*

| | |
|---|---|
| p_lib_params | Pointer to a CLD_SC594_Audio_2_0 _w_CDC_Lib_Init_Params structure that has been initialized with the User Application specific data. |

#### *Return Value*

This function returns the CLD_RV type which represents the status of the CLD library initialization process. The CLD_RV type has the following values:

| | |
|---|---|
| CLD_SUCCESS | The library was initialized successfully |
| CLD_FAIL | There was a problem initializing the library |
| CLD_ONGOING | The library initialization is being processed |

#### *Details*

The cld_sc594_audio_2_0_w_cdc_lib_init function is called as part of the device initialization and must be repeatedly called until the function returns CLD_SUCCESS or CLD_FAIL. If CLD_FAIL is returned the library will output an error message identifying the cause of the failure using the fp_cld_lib_status function if defined by the User application. Once the library has been initialized successfully the main program loop can start.

The CLD_SC594_Audio_2_0_w_CDC_Lib_Init_Params structure is described below:

```
typedef struct
{
    unsigned short vendor_id;
    unsigned short product_id;
    unsigned char  usb_bus_max_power
    unsigned short device_descriptor_bcdDevice
    unsigned char  phy_hs_timeout_calibration;
    unsigned char  phy_fs_timeout_calibration;
    CLD_Boolean    phy_delay_req_after_ulip_chirp_cmd;

    CLD_RV (*fp_init_usb_phy) (void);
```

```
unsigned char  audio_control_category_code;

unsigned char * p_unit_and_terminal_descriptors;
unsigned short  unit_and_terminal_descriptors_length;

CLD_Audio_2_0_Stream_Interface_Params *
              p_audio_streaming_rx_interface_params;

CLD_Audio_2_0_Rate_Feedback_Params * p_audio_rate_feedback_rx_params;

CLD_Audio_2_0_Stream_Interface_Params *
              p_audio_streaming_tx_interface_params;

CLD_USB_Transfer_Request_Return_Type (*fp_audio_set_req_cmd)
              (CLD_Audio_2_0_Cmd_Req_Parameters * p_req_params,
               CLD_USB_Transfer_Params * p_transfer_data);

CLD_USB_Transfer_Request_Return_Type (*fp_audio_get_req_cmd)
              (CLD_Audio_2_0_Cmd_Req_Parameters * p_req_params,
               CLD_USB_Transfer_Params * p_transfer_data);

void (*fp_audio_streaming_rx_endpoint_enabled) (CLD_Boolean enabled);
void (*fp_audio_streaming_tx_endpoint_enabled) (CLD_Boolean enabled);

CLD_Serial_Data_Bulk_Endpoint_Params * p_serial_data_rx_endpoint_params;
CLD_Serial_Data_Bulk_Endpoint_Params * p_serial_data_tx_endpoint_params;

CLD_USB_Transfer_Request_Return_Type (*fp_cdc_cmd_send_encapsulated_cmd)
              (CLD_USB_Transfer_Params * p_transfer_data);

CLD_USB_Transfer_Request_Return_Type (*fp_cdc_cmd_get_encapsulated_resp)
              (CLD_USB_Transfer_Params * p_transfer_data);

CLD_USB_Data_Received_Return_Type (*fp_cdc_cmd_set_line_coding)
              (CLD_CDC_Line_Coding * p_line_coding);

CLD_RV (*fp_cdc_cmd_get_line_coding) (CLD_CDC_Line_Coding *
              p_line_coding);

CLD_USB_Data_Received_Return_Type (*fp_cdc_cmd_set_control_line_state)
              (CLD_CDC_Control_Line_State * p_control_line_state);

CLD_USB_Data_Received_Return_Type (*fp_cdc_cmd_send_break) (unsigned
              short duration);
unsigned char support_cdc_network_connection;
unsigned short cdc_class_bcd_version;
unsigned char  cdc_class_control_protocol_code;

const char * p_usb_string_manufacturer;
const char * p_usb_string_product;
const char * p_usb_string_serial_number;
const char * p_usb_string_configuration;
const char * p_usb_string_audio_control_interface;
const char * p_usb_string_audio_streaming_out_interface;
const char * p_usb_string_audio_streaming_in_interface;
const char * p_usb_string_communication_class_interface;
const char * p_usb_string_data_class_interface;
```

```
    unsigned char user_string_descriptor_table_num_entries;
    CLD_ Audio_2_0_Lib_User_String_Descriptors *
                  p_user_string_descriptor_table;

    unsigned short usb_string_language_id;

    void (*fp_cld_usb_event_callback) (CLD_USB_Event event);


    void (*fp_cld_lib_status) (unsigned short status_code,
                               void * p_additional_data,
                               unsigned short additional_data_size);


} CLD_SC594_Audio_2_0_w_CDC_Lib_Init_Params;
```

A description of the CLD_SC594_Audio_2_0_w_CDC_Lib_Init_Params structure elements is included below:

<table>
<tr><th>Structure Element</th><th>Description</th></tr>
<tr><td>vendor_id</td><td>The 16-bit USB vendor ID that is returned to the USB Host in the USB Device Descriptor.<br>USB Vendor ID's are assigned by the USB-IF and can be purchased through their website (www.usb.org).</td></tr>
<tr><td>product_id</td><td>The 16-bit product ID that is returned to the USB Host in the USB Device Descriptor.</td></tr>
<tr><td>usb_bus_max_power</td><td>USB Configuration Descriptor bMaxPower value (0 = self-powered).<br>Refer to the USB 2.0 protocol section 9.6.3.</td></tr>
<tr><td>device_descriptor_bcd_device</td><td>USB Device Descriptor bcdDevice value.<br>Refer to the USB 2.0 protocol section 9.6.1.</td></tr>
<tr><td>phy_hs_timeout_calibration</td><td>High Speed USB timeout PHY calibration value See ADSP-SC59x Hw Reference Manual bits 2:0 of the USBC_CFG register</td></tr>
<tr><td>phy_fs_timeout_calibration</td><td>High Speed USB timeout PHY calibration value See ADSP-SC59x Hw Reference Manual bits 2:0 of the USBC_CFG register</td></tr>
<tr><td>fp_init_usb_phy</td><td>User defined function used to initialize and reset the USB Phy<br><br>The fp_init_usb_phy function returns the CLD_RV type, which has the following values:
<table>
<tr><th>Return Value</th><th>Description</th></tr>
<tr><td>CLD_ONGOING</td><td>Results in this function getting additional runtime.</td></tr>
<tr><td>CLD_SUCCESS</td><td>USB Phy initialized successfully.</td></tr>
<tr><td>CLD_FAIL</td><td>Phy initialization failed, causes USB library initialization failure.</td></tr>
</table>
</td></tr>
<tr><td>audio_control_category_code</td><td>Audio Control Interface Header Descriptor bCategory code (refer to: USB Device Class Definition of Audio Devices v 2.0 section 4.7.2)</td></tr>
<tr><td>p_unit_and_terminal_descriptors</td><td>Pointer to the Unit and Terminal Descriptors which are part of the Audio Control interface in the USB Configuration Descriptor.</td></tr>
</table>

<table>
<tr><td>unit_and_terminal_descriptors_length</td><td>The length of the Unit and Terminal Descriptors addressed by p_unit_and_terminal_descriptors.</td></tr>
<tr><td>p_audio_streaming_rx_interface_params</td><td>Pointer to a CLD_Audio_2_0_Stream_Interface_Params structure that describes how the Isochronous OUT endpoint and related USB Audio Streaming interface should be configured. The a CLD_Audio_2_0_Stream_Interface_Params structure contains the following elements:<br><br>
<table>
<tr><th>Structure Element</th><th>Description</th></tr>
<tr><td>endpoint_num</td><td>Sets the USB endpoint number of the Isochronous endpoint. The endpoint number must be within the following range:<br><br>1 ≤ endpoint num ≤ 12. Any other endpoint number will result in the cld_sc594_audio_2_0_w_cdc_lib_init function returning CLD_FAIL</td></tr>
<tr><td>max_packet_size_full_speed</td><td>Sets the Isochronous endpoint's max packet size when operating at Full Speed. The maximum max packet size is 1023 bytes.</td></tr>
<tr><td>max_packet_size_high_speed</td><td>Sets the Isochronous endpoint's max packet size when operating at High Speed. The maximum max packet size is 1024 bytes.</td></tr>
<tr><td>b_interval_full_speed</td><td>Full-Speed polling interval in the USB Endpoint Descriptor. (See USB 2.0 section 9.6.6)</td></tr>
<tr><td>b_interval_high_speed</td><td>High-Speed polling interval in the USB Endpoint Descriptor. (See USB 2.0 section 9.6.6)</td></tr>
<tr><td>b_terminal_link</td><td>The Terminal ID of the Terminal connected to this endpoint.</td></tr>
<tr><td>b_format_type</td><td>Format type of the streaming interface</td></tr>
<tr><td>bm_formats</td><td>Supported audio format bitmap.</td></tr>
<tr><td>b_nr_channels</td><td>Number of audio channels supported by the streaming interface.</td></tr>
<tr><td>i_channel_config</td><td>Index of the string descriptor describing the first physical channel. These strings should</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td></td><td>be defined in the user_string_descriptor_table.</td></tr>
<tr><td>p_encoder_descriptor</td><td>Pointer to an optional USB Audio 2.0 Encoder descriptor.</td></tr>
<tr><td>p_decoder_descriptor</td><td>Pointer to an optional USB Audio 2.0 Decoder descriptor.</td></tr>
<tr><td>p_format_descriptor</td><td>Pointer to the format descriptor defined in the USB Device Class Definition for Audio Data Formats v2.0 specification.</td></tr>
<tr><td>p_audio_stream_endpoint_data_descriptor</td><td>Pointer to the Audio Streaming endpoint data descriptor (See USB Device Class Definition for Audio Devices v2.0 section 4.10.1.2).</td></tr>
</table>
</td></tr>
<tr><td>p_audio_rate_feedback_rx_params</td><td>Pointer to a CLD_Audio_2_0_Rate_Feedback_Params structure that describes how the Isochronous IN feedback endpoint. The a CLD_Audio_2_0_Rate_Feedback_Params structure contains the following elements:
<table>
<tr><td>Structure Element</td><td>Description</td></tr>
<tr><td>max_packet_size_full_speed</td><td>Sets the Isochronous endpoint's max packet size when operating at Full Speed. The maximum max packet size is 1023 bytes.</td></tr>
<tr><td>max_packet_size_high_speed</td><td>Sets the Isochronous endpoint's max packet size when operating at High Speed. The maximum max packet size is 1024 bytes.</td></tr>
<tr><td>b_interval_full_speed</td><td>Full-Speed polling interval in the USB Endpoint Descriptor. (See USB 2.0 section 9.6.6)</td></tr>
<tr><td>b_interval_high_speed</td><td>High-Speed polling interval in the USB Endpoint Descriptor. (See USB 2.0 section 9.6.6)</td></tr>
</table>
</td></tr>
<tr><td>p_audio_streaming_tx_interface_params</td><td>Pointer to a CLD_Audio_2_0_Stream_Interface_Params structure that describes how the Isochronous IN endpoint and related USB Audio Streaming interface should be configured.<br>Refer to the p_audio_streaming_rx_interface_params description (above) for information about the CLD_SC594_Audio_2_0_Stream_Interface_Params structure.</td></tr>
<tr><td>fp_audio_set_req_cmd</td><td>Pointer to the function that is called when a USB Audio Device Class v2.0 Set Request is received. This function has a pointer to the CLD_USB_Transfer_Params structure ('p_transfer_data'), and a pointer to the CLD_ Audio_2_0_Cmd_Req_Parameters (p_req_params) as its parameters.</td></tr>
</table>

The following CLD_Audio_2_0_Cmd_Req_Parameters structure elements are used to processed a Set Request:

| Structure Element | Description |
|---|---|
| req | Identifies the type of request. The valid types if requests are listed below:<br>`CLD_REQ_CURRENT`<br>`CLD_REQ_RANGE`<br>`CLD_REQ_MEMORY` |
| recipient_is_interface | Identifies if the request was sent to an interface or Audio streaming endpoint |
| entity_id | The ID for the audio function being modified (Terminal ID, Unit ID, etc) |
| interface_or_endpoint_num | The interface or endpoint number for the request depending on the recipient specified by the recipient_is_interface parameter. |
| setup_packet_wValue | wValue field from the USB Setup Packet. |

The following CLD_USB_Transfer_Params structure elements are used to processed a Set Request:

| Structure Element | Description |
|---|---|
| num_bytes | The number of bytes from the Setup Packet wLength field, which is the number of bytes that will be transferred to p_data_buffer before calling the fp_usb_out_transfer_complete callback function. |
| p_data_buffer | Pointer to the data buffer to store the Set Reqeust data. The size of the buffer should be greater than or equal to the value in num_bytes. |
| *fp_usb_out_transfer_complete* | Function called when num_bytes of data has been written to the p_data_buffer memory. |
| *fp_transfer_aborted_callback* | Function called if there is a problem receiving the data, or if the transfer is interrupted. |
| transfer_timeout_ms | Not used for Control Requests since the Host has the ability |

| | |
|---|---|
| | to interrupt any Control transfer. |

The fp_audio_set_req_cmd function returns the CLD_USB_Transfer_Request_Return_Type, which has the following values:

| Return Value | Description |
|---|---|
| CLD_USB_TRANSFER_ACCEPT | Notifies the CLD Library that the Set Request data should be accepted using the p_transfer_data values. |
| CLD_USB_TRANSFER_PAUSE | Requests that the CLD Library pause the Set Request transfer. This causes the Control Endpoint to be nak'ed until the transfer is resumed by calling cld_audio_2_0_lib_ resume_paused_control_ transfer. |
| CLD_USB_TRANSFER_DISCARD | Requests that the CLD Library discard the number of bytes specified in p_transfer_params-> num_bytes. In this case the library accepts the Set Request from the USB Host but discards the data. |
| CLD_USB_TRANSFER_STALL | This notifies the CLD Library that there is an error and the request should be stalled. |

*fp_audio_get_req_cmd*

Pointer to the function that is called when a USB Audio Device Class v2.0 Get Request is received. This function has a pointer to the CLD_USB_Transfer_Params structure ('p_transfer_data'), and a pointer to the CLD_Audio_2_0_Cmd_Req_Parameters (p_req_params) as its parameters.

The following CLD_Audio_2_0_Cmd_Req_Parameters structure elements are used to processed a Get Request:

| Structure Element | Description |
|---|---|
| req | Identifies the type of request. The valid types if requests are listed below:<br>`CLD_REQ_CURRENT`<br>`CLD_REQ_RANGE`<br>`CLD_REQ_MEMORY` |
| recipient_is_interface | Identifies if the request was sent to an interface or Audio streaming endpoint |

| | |
|---|---|
| entity_id | The ID for the audio function being accessed (Terminal ID, Unit ID, etc) |
| interface_or_endpoint_num | The interface or endpoint number for the request depending on the recipient specified by the recipient_is_interface parameter. |
| setup_packet_wValue | wValue field from the USB Setup Packet. |

The following CLD_USB_Transfer_Params structure elements are used to processed a Set Request:

| Structure Element | Description |
|---|---|
| num_bytes | The number of bytes from the Setup Packet wLength field, which is the number of bytes that the device can send from p_data_buffer before calling the fp_usb_out_transfer_ complete callback function. |
| p_data_buffer | Pointer to the data buffer used to source the Get Request data. The size of the buffer should be greater than or equal to the value in num_bytes. |
| *fp_usb_in_transfer_complete* | Function called when num_bytes of data has been transmitted to the USB Host. |
| *fp_transfer_aborted_callback* | Function called if there is a problem transmitting the data, or if the transfer is interrupted. |
| transfer_timeout_ms | Not used for Control Requests since the Host has the ability to interrupt any Control transfer. |

The fp_audio_get_req_cmd function returns the CLD_USB_Transfer_Request_Return_Type, which has the following values:

| Return Value | Description |
|---|---|
| CLD_USB_TRANSFER_ACCEPT | Notifies the CLD library that the Get Request data should be transmitted using the p_transfer_data values. |
| CLD_USB_TRANSFER_PAUSE | Requests that the CLD library pause the Get Request transfer. |

<table>
<tr><td></td><td>
<table>
<tr><td></td><td>This causes the Control Endpoint to be nak'ed until the transfer is resumed by calling cld_audio_2_0_lib_ resume_paused_control_ transfer.</td></tr>
<tr><td>CLD_USB_TRANSFER_DISCARD</td><td>Requests that the CLD library to return a zero length packet in response to the Get Request.</td></tr>
<tr><td>CLD_USB_TRANSFER_STALL</td><td>This notifies the CLD library that there is an error and the request should be stalled.</td></tr>
</table>
</td></tr>
<tr><td>fp_audio_streaming_rx_endpoint_ enabled</td><td>Function called when the Isochronous OUT streaming interface is enabled/disabled by the USB Host using the Set Interface command.</td></tr>
<tr><td>fp_audio_streaming_tx_endpoint_ enabled</td><td>Function called when the Isochronous IN streaming interface is enabled/disabled by the USB Host using the Set Interface command.</td></tr>
<tr><td>p_serial_data_rx_endpoint_params</td><td>Pointer to a CLD_Serial_Data_Bulk_Endpoint_Params structure that describes how the Bulk OUT endpoint should be configured. The CLD_Serial_Data_Bulk_Endpoint_Params structure contains the following elements:
<table>
<tr><td>Structure Element</td><td>Description</td></tr>
<tr><td>endpoint_num</td><td>Sets the USB endpoint number of the Bulk endpoint. The endpoint number must be within the following range: 1 ≤ endpoint_num ≤ 12. Any other endpoint number will result in the cld_sc594_audio_2_0_w_cdc_ lib_init function returning CLD_FAIL</td></tr>
<tr><td>max_packet_size_full_speed</td><td>Sets the Bulk endpoint's max packet size when operating at Full Speed. The valid Bulk endpoint max packet sizes are as follows:<br>8, 16, 32, and 64 bytes.</td></tr>
<tr><td>max_packet_size_high_speed</td><td>Sets the Bulk endpoint's max packet size when operating at High Speed. The valid Bulk endpoint max packet sizes are as follows:<br>8, 16, 32, 64 and 512 bytes.</td></tr>
</table>
</td></tr>
<tr><td>p_serial_data_tx_endpoint_params</td><td>Pointer to a CLD_Serial_Data_Bulk_Endpoint_Params structure that describes how the Bulk IN endpoint should be configured. The CLD_Serial_Data_Bulk_Endpoint_Params structure contains the following elements:</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><th>Structure Element</th><th>Description</th></tr>
<tr><td>endpoint_num</td><td>Sets the USB endpoint number of the Bulk endpoint. The endpoint number must be within the following range: 1 ≤ endpoint_num ≤ 12. Any other endpoint number will result in the cld_sc594_audio_2_0_w_cdc_lib_init function returning CLD_FAIL</td></tr>
<tr><td>max_packet_size_full_speed</td><td>Sets the Bulk endpoint's max packet size when operating at Full Speed. The valid Bulk endpoint max packet sizes are as follows:<br>8, 16, 32, and 64 bytes.</td></tr>
<tr><td>max_packet_size_high_speed</td><td>Sets the Bulk endpoint's max packet size when operating at High Speed. The valid Bulk endpoint max packet sizes are as follows:<br>8, 16, 32, 64 and 512 bytes.</td></tr>
</table>
</td></tr>
<tr><td>fp_cdc_cmd_send_encapsulated_cmd</td><td>Pointer to the function that is called when a CDC Send Encapsulated Command request is received. This function a pointer to the CLD_USB_Transfer_Params structure ('p_transfer_data') as its parameters.<br><br>The following CLD_USB_Transfer_Params structure elements are used to processed a Send Encapsulated Command transfer:<br><br>
<table>
<tr><th>Structure Element</th><th>Description</th></tr>
<tr><td>num_bytes</td><td>The number of bytes from the Setup Packet wLength field, which is the number of bytes that will be transferred to p_data_buffer before calling the fp_usb_out_transfer_ complete callback function.</td></tr>
<tr><td>p_data_buffer</td><td>Pointer to the data buffer to store the Send Encapsulated Command data. The size of the buffer should be greater than or equal to the value in num_bytes.</td></tr>
<tr><td>fp_usb_out_transfer_complete</td><td>Function called when num_bytes of data has been</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td></td><td>written to the p_data_buffer memory.</td></tr>
<tr><td>fp_transfer_aborted_callback</td><td>Function called if there is a problem receiving the data, or if the transfer is interrupted.</td></tr>
<tr><td>transfer_timeout_ms</td><td>Not used for Control Requests since the Host has the ability to interrupt any Control transfer.</td></tr>
</table>
<br>The fp_cdc_cmd_send_encapsulated_cmd function returns the CLD_USB_Transfer_Request_Return_Type, which has the following values:
<table>
<tr><td>Return Value</td><td>Description</td></tr>
<tr><td>CLD_USB_TRANSFER_ACCEPT</td><td>Notifies the CLD library that the Send Encapsulated Command data should be accepted using the p_transfer_data values.</td></tr>
<tr><td>CLD_USB_TRANSFER_PAUSE</td><td>Requests that the CLD library pause the Set Report transfer. This causes the Control Endpoint to be nak'ed until the transfer is resumed by calling cld_ audio_2_0_w_cdc_lib_resu me_ paused_control_transfer.</td></tr>
<tr><td>CLD_USB_TRANSFER_DISCARD</td><td>Requests that the CLD library discard the number of bytes specified in p_transfer_params-> num_bytes. In this case the library accepts the Send Encapsulated Command from the USB Host but discards the data. This is similar to the concepts of frame dropping in audio/video applications.</td></tr>
<tr><td>CLD_USB_TRANSFER_STALL</td><td>This notifies the CLD library that there is an error and the request should be stalled.</td></tr>
</table>
</td></tr>
<tr><td>fp_cdc_cmd_get_encapsulated_resp</td><td>Pointer to the function that is called when a CDC Get Encapsulated Response request is received. This function takes a pointer to the CLD_USB_Transfer_Params structure ('p_transfer_data') as its parameters.</td></tr>
</table>

The following CLD_USB_Transfer_Params structure elements are used to processed a Get Encapsulated Response request:

| Structure Element | Description |
|---|---|
| num_bytes | The number of bytes from the Setup Packet wLength field. |
| p_data_buffer | Pointer to the data buffer to source the Get Encapsulated Response data. The size of the buffer should be greater than or equal to the value in num_bytes. |
| *fp_usb_in_transfer_complete* | Function called when Get Encapsulated Response data has been transferred to the Host. |
| *fp_transfer_aborted_callback* | Function called if there is a problem transferring the data, or if the transfer is interrupted |
| transfer_timeout_ms | Not used for Control Requests since the Host has the ability to interrupt any Control transfer. |

The fp_cdc_cmd_get_encapsulated_resp function returns the CLD_USB_Transfer_Request_Return_Type, which has the following values:

| Return Value | Description |
|---|---|
| CLD_USB_TRANSFER_ACCEPT | Notifies the CLD library that the Get Encapsulated Response data should be transferred using the p_transfer_data values. |
| CLD_USB_TRANSFER_PAUSE | Requests that the CLD library pause the Get Encapsulated Response transfer. This causes the Control Endpoint to be nak'ed until the transfer is resumed by calling cld_ audio_2_0_w_cdc_lib_resu me_ paused_control_transfer. |
| CLD_USB_TRANSFER_DISCARD | Requests that the CLD library to return a zero length packet in response to the Get Encapsulated Response request. |

<table>
<tr><td></td><td>
<table>
<tr><td>CLD_USB_TRANSFER_STALL</td><td>This notifies the CLD library that there is an error and the request should be stalled.</td></tr>
</table>
</td></tr>
<tr><td>fp_cdc_cmd_set_line_coding</td><td>
Pointer to the function that is called when a CDC Set Line Coding request is received. This function takes a pointer to the Host specified CLD_CDC_Line_Coding structure ('p_line_coding') as its parameters.<br><br>
The following CLD_CDC_Line_Coding structure elements are used to processed a Set Line Coding request:
<table>
<tr><td>Structure Element</td><td>Description</td></tr>
<tr><td>data_terminal_rate</td><td>Serial baud rate in bits per second.</td></tr>
<tr><td>num_stop_bits</td><td>CDC Number of stop bits.<br>0 = 1 stop bit<br>1 = 1.5 stop bits<br>2 = 2 stop bits.</td></tr>
<tr><td>parity</td><td>CDC parity setting<br>0 = None<br>1 = Odd<br>2 = Even<br>3 = Mark<br>4 = Space</td></tr>
<tr><td>num_data_bits</td><td>CDC Number of data bits (only 5, 6, 7, 8 and 16 are valid).</td></tr>
</table>
<br>
The fp_cdc_cmd_set_line_coding function returns the CLD_USB_Data_Received_Return_Type, which has the following values:
<table>
<tr><td>Return Value</td><td>Description</td></tr>
<tr><td>CLD_USB_DATA_GOOD</td><td>Notifies the CLD library that the request is valid.</td></tr>
<tr><td>CLD_USB_DATA_BAD_STALL</td><td>Notifies the CLD library that the request is invalid, and should be stalled.</td></tr>
</table>
</td></tr>
<tr><td>fp_cdc_cmd_get_line_coding</td><td>
Pointer to the function that is called when a CDC Get Line Coding request is received. This function takes a pointer to CLD_CDC_Line_Coding structure ('p_line_coding') as its parameters. The User firmware should set the p_line_coding structure values based on its active settings.<br><br>
The following CLD_CDC_Line_Coding structure elements are used to processed a Get Line Coding request:
<table>
<tr><td>Structure Element</td><td>Description</td></tr>
<tr><td>data_terminal_rate</td><td>Serial baud rate in bits per second.</td></tr>
<tr><td>num_stop_bits</td><td>CDC Number of stop bits.<br>0 = 1 stop bit<br>1 = 1.5 stop bits<br>2 = 2 stop bits.</td></tr>
<tr><td>parity</td><td>CDC parity setting</td></tr>
</table>
</td></tr>
</table>

| | |
|---|---|
| | 0 = None<br>1 = Odd<br>2 = Even<br>3 = Mark<br>4 = Space |
| num_data_bits | CDC Number of data bits (only 5, 6, 7, 8 and 16 are valid). |

The fp_cdc_cmd_get_line_coding function returns CLD_RV, which has the following values:

| Return Value | Description |
|---|---|
| CLD_SUCCESS | Notifies the CLD library that the request is valid and the p_line_coding value should be returned to the Host. |
| CLD_FAIL | Notifies the CLD library that the request is invalid, and should be stalled. |

*fp_cdc_cmd_set_control_line_state*

Pointer to the function that is called when a CDC Set Control Line State request is received. This function takes a pointer to the Host specified CLD_CDC_Control_Line_State structure ('p_control_line_state') as its parameters.

The following CLD_CDC_Control_Line_State structure elements are used to processed a Set Control Line State request:

| Structure Element | Description |
|---|---|
| dte_present | Controls if the DTE is present or not. This corresponds to the RS-232 DTR signal.<br>0 = Not Present<br>1 = Present |
| activate_carrier | Carrier control used in half duplex serial links. This signal corresponds to the RS-232 RTS signal.<br>0 = Disabled<br>1 = Active |

The fp_cdc_cmd_set_control_line_state function returns the CLD_USB_Data_Received_Return_Type, which has the following values:

| Return Value | Description |
|---|---|
| CLD_USB_DATA_GOOD | Notifies the CLD library that the request is valid. |
| CLD_USB_DATA_BAD_STALL | Notifies the CLD library that the request is invalid, and should be stalled. |

*fp_cdc_cmd_send_break*

Pointer to the function that is called when a CDC Send Break request is received. This function takes the host specified duration in milliseconds ('duration') as its parameters.

The fp_cdc_cmd_send_break function returns the CLD_USB_Data_Received_Return_Type, which has the following values:

| Return Value | Description |
|---|---|

| | |
|---|---|
| | CLD_USB_DATA_GOOD: Notifies the CLD library that the request is valid.<br>CLD_USB_DATA_BAD_STALL: Notifies the CLD library that the request is invalid, and should be stalled. |
| support_cdc_network_connection | Tells the CLD library if the User firmware supports the CDC Network Connection Notification.<br>0 = Not supported<br>1 = Supported |
| cdc_class_bcd_version | CDC Class Version in BCD. Returned in the CDC Header Functional Descriptor's bcdCDC field. (refer to the CDC specification v1.2 section 5.3.2.1). |
| cdc_class_control_protocol_code | Value used in the CDC interface descriptor's bInterfaceProtocol field. The valid CDC Protocol codes are defined in the CDC v.1.2 specification in Table 5 on page 13. |
| p_usb_string_manufacturer | Pointer to the null-terminated string. This string is used by the library to generate the Manufacturer USB String Descriptor. If the Manufacturer String Descriptor is not used set p_usb_string_manufacturer to CLD_NULL. |
| p_usb_string_product | Pointer to the null-terminated string. This string is used by the CLD library to generate the Product USB String Descriptor. If the Product String Descriptor is not used set p_usb_string_product to CLD_NULL. |
| p_usb_string_serial_number | Pointer to the null-terminated string. This string is used by the CLD library to generate the Serial Number USB String Descriptor. If the Serial Number String Descriptor is not used set p_usb_string_serial_number to CLD_NULL. |
| p_usb_string_configuration | Pointer to the null-terminated string. This string is used by the CLD library to generate the Configuration USB String Descriptor. If the Configuration String Descriptor is not used set p_usb_string_configuration to CLD_NULL. |
| p_usb_string_audio_control_interface | Pointer to the null-terminated string. This string is used by the CLD library to generate the Audio Control Interface USB String Descriptor. If this interface String Descriptor is not used set it to CLD_NULL. |
| p_usb_string_audio_streaming_ out_interface | Pointer to the null-terminated string. This string is used by the CLD library to generate the Audio OUT Streaming Interface USB String Descriptor. If this interface String Descriptor is not used set it to CLD_NULL. |
| p_usb_string_audio_streaming_in _interface | Pointer to the null-terminated string. This string is used by the CLD library to generate the Audio IN Streaming Interface USB String Descriptor. If this interface String Descriptor is not used set it to CLD_NULL. |
| p_usb_string_communication_clas s_interface | Pointer to the null-terminated string. This string is used by the CLD library to generate the CDC Interface USB String Descriptor. If the CDC Interface String Descriptor is not used set p_usb_string_communication_class_interface to CLD_NULL. |
| p_usb_string_data_class_interface | Pointer to the null-terminated string. This string is used by the CLD library to generate the Data Class Interface USB String Descriptor. |

<table>
<tr><td></td><td>If the Data Interface String Descriptor is not used set p_usb_string_data_class_interface to CLD_NULL.</td></tr>
<tr><td>user_string_descriptor_table_num_entries</td><td>The number of entries in the array of CLD_Audio_2_0_Lib_User_String_Descriptors structures addressed by p_user_string_descriptor_table. Set to 0 if p_user_string_descriptor_table is set to CLD_NULL.</td></tr>
<tr><td>p_user_string_descriptor_table</td><td>Pointer to an array of CLD_Audio_2_0_w_CDC_Lib_User_String_Descriptors structures used to define any custom User defined USB string descriptors. This table is used to define any USB String descriptors for any string descriptor indexes that are used in the Terminal or Unit Descriptors.<br><br>Set to CLD_NULL is not used.<br><br>The CLD_Audio_2_0_Lib_User_String_Descriptors structure elements are explained below:
<table>
<tr><th>Structure Element</th><th>Description</th></tr>
<tr><td>string_index</td><td>The USB String Descriptor index for the string. The string_index value is set to the index specified in the Terminal or Unit Descriptor associated with this string.</td></tr>
<tr><td>p_string</td><td>Pointer to a null terminated string.</td></tr>
</table></td></tr>
<tr><td>usb_string_language_id</td><td>16-bit USB String Descriptor Language ID Code as defined in the USB Language Identifiers (LANGIDs) document (www.usb.org/developers/docs/USB_LANGIDs.pdf).<br>0x0409 = English (United States)</td></tr>
<tr><td>fp_cld_usb_event_callback</td><td>Function that is called when one of the following USB events occurs. This function has a single CLD_USB_Event parameter.<br><br>Note: This callback can be called from the USB interrupt or mainline context depending on which USB event was detected. The CLD_USB_Event values in the table below are highlighted to show the context the callback is called for each event.<br><br>The CLD_USB_Event has the following values:
<table>
<tr><th>Return Value</th><th>Description</th></tr>
<tr><td>CLD_USB_CABLE_CONNECTED</td><td>USB Cable Connected.</td></tr>
<tr><td>CLD_USB_CABLE_DISCONNECTED</td><td>USB Cable Disconnected</td></tr>
<tr><td>CLD_USB_ENUMERATED_CONFIGURED_FS</td><td>USB device enumerated (USB Configuration set to a non-zero value) at Full-Speed</td></tr>
<tr><td>CLD_USB_ENUMERATED_CONFIGURED_HS</td><td>USB device enumerated (USB Configuration set to a non-zero value) at High-Speed</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>CLD_USB_UN_CONFIGURED</td><td>USB Configuration set to 0</td></tr>
<tr><td>CLD_USB_BUS_RESET</td><td>USB Bus reset received</td></tr>
</table>
<br>Note: Set to CLD_NULL if not required by application</td></tr>
<tr><td>fp_cld_lib_status</td><td>Pointer to the function that is called when the CLD library has a status to report. This function has the following parameters:<br><br>
<table>
<tr><td>Parameter</td><td>Description</td></tr>
<tr><td>status_code</td><td>16-bit status code. If the most significant bit is a '1' the status being reported is an Error.</td></tr>
<tr><td>p_additional_data</td><td>Pointer to additional data included with the status.</td></tr>
<tr><td>additional_data_size</td><td>The number of bytes in the specified additional data.</td></tr>
</table>
<br>If the User plans on processing outside of the fp_cld_lib_status function they will need to copy the additional data to a User buffer.</td></tr>
</table>

### cld_sc594_audio_2_0_w_cdc_lib_main

```
void cld_sc594_audio_2_0_w_cdc_lib_main (void)
```

CLD SC594 Audio 2.0 with CDC Library mainline function

#### *Arguments*

None

#### *Return Value*

None.

#### *Details*

The cld_sc594_audio_2_0_w_cdc_lib_main function is the CLD library mainline function that must be called in every iteration of the main program loop in order for the library to function properly.

### cld_audio_2_0_lib_receive_stream_data

```
CLD_USB_Data_Receive_Return_Type cld_audio_2_0_lib_receive_stream_data
(CLD_USB_Transfer_Params * p_transfer_data)
```

CLD Audio 2.0 Library function used to receive data over the Isochronous OUT endpoint.

#### *Arguments*

| | |
|---|---|
| p_transfer_data | Pointer to a CLD_USB_Transfer_Params structure used to describe the data being received. |

#### *Return Value*

This function returns the CLD_USB_Data_Receive_Return_Type type which reports if the Isochronous OUT transmission has been configured. CLD_USB_Data_Receive_Return_Type has the following values:

| | |
|---|---|
| CLD_USB_TRANSMIT_SUCCESSFUL | The library has configured the requested Isochronous IN transfer. |
| CLD_USB_TRANSMIT_FAILED | The library failed to configure the requested Isochronous OUT transfer. This will happen if the Isochronous OUT endpoint is busy, or if the p_transfer_data-> data_buffer is set to CLD_NULL |
| CLD_USB_RECEIVE_FAILED_MISALIGNED | The requested USB transfer failed because the specified memory location isn't 32-bit aligned. |
| CLD_USB_RECEIVE_FAILED_NUM_BYTES | The transfer failed because the num_bytes field of the passed CLD_USB_Transfer_Params structure was not a multiple of the endpoint max packet size. Note: the max packet size is determined based on the values specified by the User, and the enumerated USB speed. |

#### *Details*

The cld_audio_2_0_lib_receive_stream_data enables the Isochronous OUT endpoint to receive the data specified by the p_transfer_data parameter from the USB Host. This function should be called when the streaming RX endpoint is enabled, in fp_usb_out_transfer_complete, and in fp_transfer_aborted_callback.

The CLD_USB_Transfer_Params structure is described below.

```
typedef struct
{
    unsigned long num_bytes;
    unsigned char * p_data_buffer;
    union
    {
        CLD_USB_Data_Received_Return_Type (*fp_usb_out_transfer_complete)(unsigned
int num_bytes);
        void (*fp_usb_in_transfer_complete) (void);
    }callback;
    void (*fp_transfer_aborted_callback) (void);
```

```
    CLD_Time transfer_timeout_ms;
} CLD_USB_Transfer_Params;
```

A description of the CLD_USB_Transfer_Params structure elements is included below:

| Structure Element | Description |
|---|---|
| num_bytes | The number of bytes to transfer to the USB Host. Once the specified number of bytes has been transmitted the fp_usb_in_transfer_complete callback function will be called. |
| p_data_buffer | Pointer to the data to be sent to the USB Host. This buffer must include the number of bytes specified by num_bytes. |
| fp_usb_out_*transfer*_complete | Function called when the specified data has been received, or the Host send a short packet (less than the max packet size) signaling the end of a transfer. This function is passed the number of received bytes. |
| *fp_usb_in_transfer_complete* | Not used for OUT transfers. |
| *fp_transfer_aborted_callback* | Function called if there is a problem receiving the data to the USB Host. This function can be set to CLD_NULL if the User application doesn't want to be notified if a problem occurs. |
| transfer_timeout_ms | Isochronous OUT transfer timeout in milliseconds. If the Isochronous OUT transfer takes longer then this timeout the transfer is aborted and the fp_transfer_aborted_callback is called. Setting the timeout to 0 disables the timeout |

### cld_audio_2_0_lib_transmit_audio_data

```
CLD_USB_Data_Transmit_Return_Type cld_audio_2_0_lib_transmit_audio_data
      (CLD_USB_Transfer_Params * p_transfer_data)
```

CLD Audio 2.0 Library function used to send data over the Isochronous IN endpoint.

#### *Arguments*

| | |
|---|---|
| p_transfer_data | Pointer to a CLD_USB_Transfer_Params structure used to describe the data being transmitted. |

#### *Return Value*

This function returns the CLD_USB_Data_Transmit_Return_Type type which reports if the Isochronous IN transmission request was started. The CLD_USB_Data_Transmit_Return_Type type has the following values:

| | |
|---|---|
| CLD_USB_TRANSMIT_SUCCESSFUL | The library has started the requested Isochronous IN transfer. |
| CLD_USB_TRANSMIT_FAILED | The library failed to start the requested Isochronous IN transfer. This will happen if the Isochronous IN endpoint is busy, or if the p_transfer_data-> data_buffer is set to CLD_NULL |
| CLD_USB_TRANSMIT_FAILED_MISALIGNED | The requested USB transfer failed because the specified memory location isn't 32-bit aligned. |

#### *Details*

The cld_audio_2_0_lib_transmit_audio_data function transmits the data specified by the p_transfer_data parameter to the USB Host using the Device's Isochronous IN endpoint.

The CLD_USB_Transfer_Params structure is described below.

```
typedef struct
{
    unsigned long num_bytes;
    unsigned char * p_data_buffer;
    union
    {
        CLD_USB_Data_Received_Return_Type (*fp_usb_out_transfer_complete)(void);
        void (*fp_usb_in_transfer_complete) (void);
    }callback;
    void (*fp_transfer_aborted_callback) (void);
    CLD_Time transfer_timeout_ms;
} CLD_USB_Transfer_Params;
```

A description of the CLD_USB_Transfer_Params structure elements is included below:

| Structure Element | Description |
|---|---|
| num_bytes | The number of bytes to transfer to the USB Host. Once the specified number of bytes has been transmitted the fp_usb_in_transfer_complete callback function will be called. |

| | |
|---|---|
| p_data_buffer | Pointer to the data to be sent to the USB Host. This buffer must include the number of bytes specified by num_bytes. |
| fp_usb_out_transfer_complete | Not Used for Isochronous IN transfers |
| *fp_usb_in_transfer_complete* | Function called when the specified data has been transmitted to the USB Host. This function pointer can be set to CLD_NULL if the User application doesn't want to be notified when the data has been transferred. |
| *fp_transfer_aborted_callback* | Function called if there is a problem transmitting the data to the USB Host. This function can be set to CLD_NULL if the User application doesn't want to be notified if a problem occurs. |
| transfer_timeout_ms | Isochronous IN transfer timeout in milliseconds. If the Isochronous IN transfer takes longer then this timeout the transfer is aborted and the fp_transfer_aborted_callback is called.<br>Setting the timeout to 0 disables the timeout |

### cld_audio_2_0_lib_transmit_audio_rate_feedback_data

```
CLD_USB_Data_Transmit_Return_Type
cld_audio_2_0_lib_transmit_audio_rate_feedback_data
      (CLD_USB_Audio_Feedback_Params * p_transfer_data)
```

CLD Audio 2.0 Library function used to transfer audio OUT rate feedback data over the optional rate feedback Isochronous IN endpoint.

#### *Arguments*

| | |
|---|---|
| CLD_USB_Audio_Feedback_Params | Pointer to a CLD_USB_Audio_Feedback_Params structure used to describe the data being transmitted. |

#### *Return Value*

This function returns the CLD_USB_Data_Transmit_Return_Type type which reports if the Interrupt IN transmission request was started. The CLD_USB_Data_Transmit_Return_Type type has the following values:

| | |
|---|---|
| CLD_USB_TRANSMIT_SUCCESSFUL | The library has scheduled the requested Isochronous IN transfer. |
| CLD_USB_TRANSMIT_FAILED | The library failed to schedule the requested Isochronous IN transfer. This will happen if the Isochronous IN endpoint is disabled, or busy. |

#### *Details*

The cld_audio_2_0_lib_transmit_audio_rate_feedback_data function transmits the data specified by the p_transfer_data parameter to the USB Host using the Device's Isochronous IN endpoint.

The CLD_USB_Audio_Feedback_Params structure is described below.

```
typedef struct
{
    float desired_data_rate;
    void (*fp_usb_in_transfer_complete) (void);
    void (*fp_transfer_aborted_callback) (void);
    CLD_Time transfer_timeout_ms;
} CLD_USB_Audio_Feedback_Params;
```

A description of the CLD_USB_Audio_Feedback_Params structure elements is included below:

| Structure Element | Description |
|---|---|
| desired_data_rate | Feeback value in kHz (for example use 44.1 for 44.1kHz) |
| *fp_usb_in_transfer_complete* | Function called when the specified data has been transmitted to the USB Host. This function pointer can be set to CLD_NULL if the User application doesn't want to be notified when the data has been transferred. |
| *fp_transfer_aborted_callback* | Function called if there is a problem transmitting the data to the USB Host. This function can be set to CLD_NULL if the User application doesn't want to be notified if a problem occurs. |

| | |
|---|---|
| transfer_timeout_ms | Interrupt IN transfer timeout in milliseconds. If the Interrupt IN transfer takes longer then this timeout the transfer is aborted and the fp_transfer_aborted_callback is called.<br>Setting the timeout to 0 disables the timeout |

### cld_cdc_lib_receive_serial_data

```
CLD_USB_Data_Receive_Return_Type cld_cdc_lib_receive_serial_data
(CLD_USB_Transfer_Params * p_transfer_data)
```

CLD CDC Library function used to receive data over the Bulk OUT endpoint.

#### *Arguments*

| | |
|---|---|
| p_transfer_data | Pointer to a CLD_USB_Transfer_Params structure used to describe the data being received. |

#### *Return Value*

This function returns the CLD_USB_Data_Receive_Return_Type type which reports if the Isochronous OUT transmission has been configured. CLD_USB_Data_Receive_Return_Type has the following values:

| | |
|---|---|
| CLD_USB_RECEIVE_SUCCESSFUL | The library has configured the requested Bulk OUT transfer. |
| CLD_USB_RECEIVE_FAILED | The library failed to configure the requested Bulk OUT transfer. This will happen if the Bulk OUT endpoint is busy, or if the p_transfer_data-> data_buffer is set to CLD_NULL |
| CLD_USB_RECEIVE_FAILED_MISALIGNED | The requested USB transfer failed because the specified memory location isn't 32-bit aligned. |
| CLD_USB_RECEIVE_FAILED_NUM_BYTES | The transfer failed because the num_bytes field of the passed CLD_USB_Transfer_Params structure was not a multiple of the endpoint max packet size. Note: the max packet size is determined based on the values specified by the User, and the enumerated USB speed. |

#### *Details*

The cld_cdc_lib_receive_serial_data enables the Bulk OUT endpoint to receive the data specified by the p_transfer_data parameter from the USB Host. This function should be called when the device has been enumerated/configured, in fp_usb_out_transfer_complete, and in fp_transfer_aborted_callback.

The CLD_USB_Transfer_Params structure is described below.

```
typedef struct
{
    unsigned long num_bytes;
    unsigned char * p_data_buffer;
    union
    {
        CLD_USB_Data_Received_Return_Type (*fp_usb_out_transfer_complete)(unsigned
int num_bytes);
        void (*fp_usb_in_transfer_complete) (void);
    }callback;
    void (*fp_transfer_aborted_callback) (void);
    CLD_Time transfer_timeout_ms;
} CLD_USB_Transfer_Params;
```

A description of the CLD_USB_Transfer_Params structure elements is included below:

| Structure Element | Description |
|---|---|
| num_bytes | The number of bytes to transfer to the USB Host. Once the specified number of bytes has been received the fp_usb_in_transfer_complete callback function will be called. |
| p_data_buffer | Pointer to the data to store the received data from the USB Host. This buffer must include the number of bytes specified by num_bytes. |
| fp_usb_out_*transfer*_complete | Function called when the specified data has been received, or the Host send a short packet (less than the max packet size) signaling the end of a transfer. This function is passed the number of received bytes. |
| *fp_usb_in_transfer_complete* | Not used for OUT transfers. |
| *fp_transfer_aborted_callback* | Function called if there is a problem receiving the data to the USB Host. This function can be set to CLD_NULL if the User application doesn't want to be notified if a problem occurs. |
| transfer_timeout_ms | Bulk OUT transfer timeout in milliseconds. If the Bulk OUT transfer takes longer then this timeout the transfer is aborted and the fp_transfer_aborted_callback is called.<br>Setting the timeout to 0 disables the timeout |

### cld_cdc_lib_transmit_serial_data

```
CLD_USB_Data_Transmit_Return_Type cld_cdc_lib_transmit_serial_data
      (CLD_USB_Transfer_Params * p_transfer_data)
```

CLD CDC Library function used to send serial over the Bulk IN endpoint.

#### *Arguments*

| | |
|---|---|
| p_transfer_data | Pointer to a CLD_USB_Transfer_Params structure used to describe the data being transmitted. |

#### *Return Value*

This function returns the CLD_USB_Data_Transmit_Return_Type type which reports if the Bulk IN transmission request was started. The CLD_USB_Data_Transmit_Return_Type type has the following values:

| | |
|---|---|
| CLD_USB_TRANSMIT_SUCCESSFUL | The library has started the requested Bulk IN transfer. |
| CLD_USB_TRANSMIT_FAILED | The library failed to start the requested Bulk IN transfer. This will happen if the Bulk IN endpoint is busy, or if the p_transfer_data-> data_buffer is set to NULL |
| CLD_USB_TRANSMIT_FAILED_MISALIGNED | The requested USB transfer failed because the specified memory location isn't 32-bit aligned. |

#### *Details*

The cld_cdc_lib_transmit_serial_data function transmits the data specified by the p_transfer_data parameter to the USB Host using the Device's Bulk IN endpoint.

The CLD_USB_Transfer_Params structure is described below.

```
typedef struct
{
    unsigned long num_bytes;
    unsigned char * p_data_buffer;
    union
    {
        CLD_USB_Data_Received_Return_Type (*fp_usb_out_transfer_complete)(void);
        void (*fp_usb_in_transfer_complete) (void);
    }callback;
    void (*fp_transfer_aborted_callback) (void);
    void transfer_timeout_ms;
} CLD_USB_Transfer_Params;
```

A description of the CLD_USB_Transfer_Params structure elements is included below:

| Structure Element | Description |
|---|---|
| num_bytes | The number of bytes to transfer to the USB Host. Once the specified number of bytes have been transmitted the usb_in_transfer_complete callback function will be called. |

| | |
|---|---|
| p_data_buffer | Pointer to the data to be sent to the USB Host. This buffer must include the number of bytes specified by num_bytes. |
| fp_usb_out_transfer_complete | Not Used for Bulk IN transfers |
| *fp_usb_in_transfer_complete* | Function called when the specified data has been transmitted to the USB host. This function pointer can be set to CLD_NULL if the User application doesn't want to be notified when the data has been transferred. |
| *fp_transfer_aborted_callback* | Function called if there is a problem transmitting the data to the USB Host. This function can be set to CLD_NULL if the User application doesn't want to be notified if a problem occurs. |
| transfer_timeout_ms | USB transfer timeout in milliseconds. If the Bulk IN transfer takes longer then this timeout the transfer is aborted and the fp_transfer_aborted_callback is called.<br>Setting the timeout to 0 disables the timeout |

### cld_audio_2_0_w_cdc_lib_resume_paused_control_transfer

```
void cld_audio_2_0_w_cdc_lib_resume_paused_control_transfer (void)
```

CLD library function used to resume a paused Control endpoint transfer.

#### *Arguments*

None

#### *Return Value*

None.

#### *Details*

The cld_audio_2_0_w_cdc_lib_resume_paused_control_transfer function is used to resume a Control transfer which was paused by the `fp_audio_set_req_cmd`, `fp_audio_get_req_cmd`, `fp_cdc_cmd_send_encapsulated_cmd` or `fp_cdc_cmd_get_encapsulated_resp` function returning CLD_USB_TRANSFER_PAUSE. When called the cld_audio_2_0_lib_resume_paused_control_transfer function will call the User application's fp`_audio_set_req_cmd`, `fp_audio_get_req_cmd`, `fp_cdc_cmd_send_encapsulated_cmd` or `fp_cdc_cmd_get_encapsulated_resp` function passing the CLD_USB_Transfer_Params of the original paused transfer. The User function can then chose to accept, discard, or stall the Control endpoint request.

### cld_lib_usb_connect

```
void cld_lib_usb_connect (void)
```

CLD Library function used to connect to the USB Host.

#### *Return Value*
None.

#### *Details*
The cld_lib_usb_connect function is called after the CLD library has been initialized to connect the USB device to the Host.

### cld_ lib_usb_disconnect

```
void cld_lib_usb_disconnect (void)
```

CLD library function used to disconnect from the USB Host.

#### *Return Value*
None.

#### *Details*
The cld_lib_usb_disconnect function is called after the CLD library has been initialized to disconnect the USB device to the Host.

### cld_time_125us_tick

```
void cld_time_125us_tick (void)
```

CLD library timer function that should be called once per 125 microseconds.

#### *Arguments*
None

#### *Return Value*
None.

#### *Details*
This function should be called once every 125 microseconds in order to the CLD to processed periodic events.

### cld_usb0_isr_callback

```
void cld_usb0_isr_callback (void)
```

CLD library USB interrupt service routines

#### *Arguments*
None

#### *Return Value*
None.

#### *Details*
These USB ISR functions should be called from the corresponding USB Port Interrupt Service Routines as shown in the CLD provided example projects.

### cld_time_get

```
CLD_Time cld_time_get(void)
```

CLD library function used to get the current CLD time in milliseconds.

#### *Arguments*
None

#### *Return Value*
The current CLD library time.

#### *Details*
The cld_time_get function is used in conjunction with the cld_time_passed_ms function to measure how much time has passed between the cld_time_get and the cld_time_passed_ms function calls in milliseconds.

### cld_time_passed_ms

```
CLD_Time cld_time_passed_ms(CLD_Time time)
```

CLD library function used to measure the amount of time that has passed in milliseconds.

#### *Arguments*

| | |
|---|---|
| time | A CLD_Time value returned by a cld_time_get function call. |

#### *Return Value*

The number of milliseconds that have passed since the cld_time_get function call that returned the CLD_Time value passed to the cld_time_passed_ms function.

#### *Details*

The cld_time_passed_ms function is used in conjunction with the cld_time_get function to measure how much time has passed between the cld_time_get and the cld_time_passed_ms function calls in milliseconds.

### cld_time_get_125us

```
CLD_Time cld_time_get_125us(void)
```

CLD library function used to get the current CLD time in 125 microsecond increments.

#### *Arguments*

None

#### *Return Value*

The current CLD library time.

#### *Details*

The cld_time_get_125us function is used in conjunction with the cld_time_passed_125us function to measure how much time has passed between the cld_time_get_125us and the cld_time_passed_125us function calls in 125 microsecond increments.

### cld_time_passed_125us

```
CLD_Time cld_time_passed_125us(CLD_Time time)
```

CLD library function used to measure the amount of time that has passed in 125 microsecond increments.

#### *Arguments*

| | |
|---|---|
| time | A CLD_Time value returned by a cld_time_get_125us function call. |

#### *Return Value*

The number of 125microsecond increments that have passed since the cld_time_get_125us function call that returned the CLD_Time value passed to the cld_time_passed_125us function.

#### *Details*

The cld_time_passed_125us function is used in conjunction with the cld_time_get_125us function to measure how much time has passed between the cld_time_get_125us and the cld_time_passed_125us function calls in 125 microsecond increments.

### cld_lib_status_decode

```
char * cld_lib_status_decode (unsigned short status_cod,
                              void * p_additional_data,
                              unsigned short additional_data_size)
```

CLD Library function that returns a NULL terminated string describing the status passed to the function.

#### *Arguments*

| | |
|---|---|
| status_code | 16-bit status code returned by the CLD library.<br><br>Note: If the most significant bit is a '1' the status is an error. |
| p_additional_data | Pointer to the additional data returned by the CLD library (if any). |
| additional_data_size | Size of the additional data returned by the CLD library. |

#### *Return Value*

This function returns a decoded Null terminated ASCII string.

#### *Details*

The cld_lib_status_decode function can be used to generate an ASCII string which describes the CLD library status passed to the function. The resulting string can be used by the User to determine the meaning of the status codes returned by the CLD library.

### cld_lib_access_usb_phy_reg

```
CLD_RV cld_lib_access_usb_phy_reg (CLD_USB_PHY_Access_Params * p_params)
```

CLD Library function used to read or write the USB phy registers.

#### *Arguments*

| | |
|---|---|
| p_params | Pointer to the CLD_USB_PHY_Access_Params structure describing the phy access. |

#### *Return Value*

CLD_SUCCESS – USB phy access complete.
CLD_ONGOING – USB phy access in progress, continue calling cld_lib_access_usb_phy_reg until it returns CLD_SUCCESS or CLD_FAIL.
CLD_FAIL – Error occurred while accessing the phy.

#### *Details*

The cld_lib_access_usb_phy_reg function performs the USB phy access described by the p_params parameter.

The CLD_USB_PHY_Access_Params structure is described below.

```
typedef struct
{
    CLD_Boolean write;
    unsigned char reg_addr;
    unsigned char v_ctrl;
    unsigned char reg_data;
} CLD_USB_PHY_Access_Params;
```

A description of the CLD_USB_PHY_Access_Params structure elements is included below:

| Structure Element | Description |
|---|---|
| write | TRUE = register write, FALSE = register read |
| reg_addr | Address of the USB phy register being accessed |
| v_ctrl | ULPI Vendor Control Register Address |
| reg_data | Data being written to, or read from, the USB phy register. |

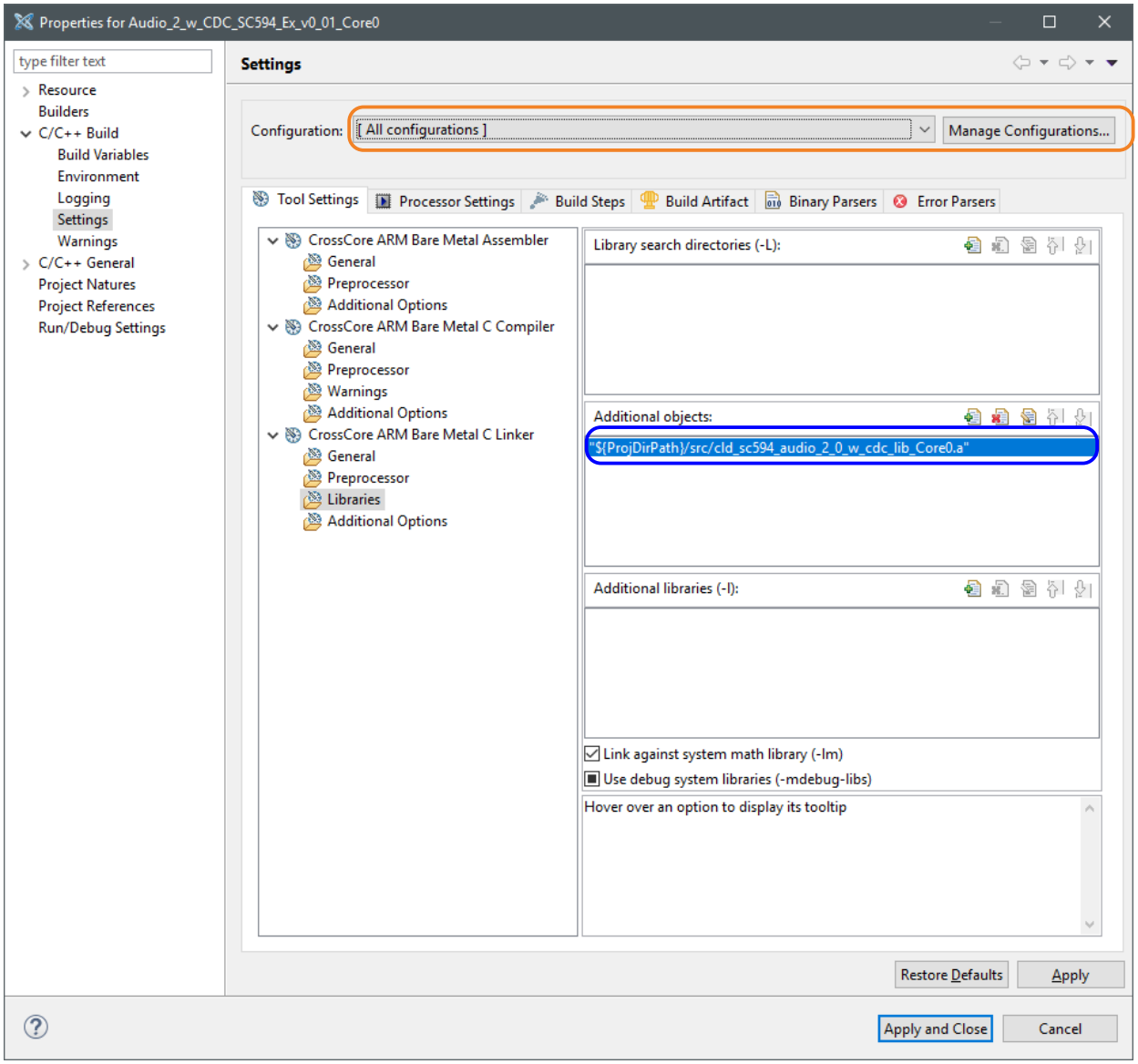
## Adding the CLD SC594 Audio 2.0 with CDC Library to an Existing CrossCore Embedded Studio Project

In order to include the CLD SC594 Audio 2.0 with CDC Library in a CrossCore Embedded Studio (CCES) project you must configure the project linker settings so it can locate the library. The following steps outline how this is done.

1. Copy the cld_sc594_audio_2_0_w_cdc_lib.h and cld_sc594_audio_2_0_w_cdc_lib_Core0.a files to the project's src directory.
2. Open the project in CrossCore Embedded Studio.
3. Right click the project in the 'C/C++ Projects' window and select Properties.

   If you cannot find the 'C/C++ Projects" window, make sure C/C++ Perspective is active. If the C/C++ Perspective is active and you still cannot locate the 'C/C++ Projects' window select Window → Show View → C/C++ Projects.
4. You should now see a project properties window similar to the one shown below.

   Navigate to the C/C++ Build → Settings page and select the CrossCore ARM Bare Metal C Linker's Libraries page. The CLD SC594 Audio 2.0 with CDC Library needs to be included in the projects 'Additional objects' as shown in the diagram below (circled in blue). This lets the linker know where the cld_sc594_audio_2_0_w_cdc_lib_Core0.a file is located.




5. The 'Additional objects' setting needs to be set for all configurations (Debug, Release, etc). This can be done individually for each configuration, or all at once by selecting the [All Configurations] option as shown in the previous figure (circled in orange).

## User Firmware Code Snippets

The following code snippets are not complete, and are meant to be a starting point for the User firmware. For a functional User firmware example that uses the CLD SC594 Audio 2.0 with CDC Library please refer to the CLD example projects included available with the CLD SC594 Audio 2.0 with CDC Library.

### main.c

```
void main(void)
{
    Main_States main_state = MAIN_STATE_SYSTEM_INIT;

    while (1)
    {
        switch (main_state)
        {
            case MAIN_STATE_SYSTEM_INIT:
                /* Initialize the clock, and power systems.*/

                main_state = MAIN_STATE_USER_INIT;
            break;
            case MAIN_STATE_USER_INIT:
                rv = user_init();
                if (rv == USER_INIT_SUCCESS)
                {
                    main_state = MAIN_STATE_RUN;
                }
                else if (rv == USER_INIT_FAILED)
                {
                    main_state = MAIN_STATE_ERROR;
                }
            break;

            case MAIN_STATE_RUN:
                 user_main();
            break;

            case MAIN_STATE_ERROR:

            break;
        }
    }
}
```

## user.c

```
#pragma pack (1)
/*
   USB Audio v2.0 Unit and Terminal descriptors that describe a simple
   audio device comprised of the following:

    Input Terminal - USB Streaming Endpoint
        ID = 0x01
        Channels: Left, Right
    Input Terminal - Microphone
        ID = 0x02
        Channels: Left, Right
    Output Terminal - Speaker
        ID = 0x06
        Source ID = 0x09
    Output Terminal - USB Streaming Endpoint
        ID = 0x07
        Source ID = 0x0a
    Feature Unit
        ID = 0x09
        Source ID = 0x01
        Controls:
            Master Channel 0: Mute (Control 1)
            Channel 1 (Left): Volume (Control 2)
            Channel 2 (Right): Volume (Control 2)
    Feature Unit
        ID = 0x0a
        Source ID = 0x02
        Controls:
            Master Channel 0: Volume (Control 2)
 */
/* USB Audio v2.0 Unit and Terminal descriptors that describe a simple audio device.*/
static const unsigned char user_audio_unit_and_terminal_descriptor[] =
{
    /* Input Terminal Descriptor - USB Endpoint */
    0x11,                   /* bLength */
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x02,                   /* bDescriptorSubType = Input Terminal */
    0x01,                   /* bTerminalID */
    0x01, 0x01,             /* wTerminalType = USB Streaming */
    0x00,                   /* bAssocTerminal */
    0x03,                   /* bCSourceID */
    0x02,                   /* bNRChannels */
    0x03, 0x00, 0x00,0x00,  /* wChannelConfig (Left & Right Present) */
    0x00,                   /* iChannelNames */
    0x00,0x00,              /* bmControls */
    0x00,                   /* iTerminal */
    /* Input Terminal Descriptor - Microphone */
    0x11,                   /* bLength */
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x02,                   /* bDescriptorSubType = Input Terminal */
    0x02,                   /* bTerminalID */
    0x01, 0x02,             /* wTerminalType = Microphone */
    0x00,                   /* bAssocTerminal */
    0x03,                   /* bCSourceID */
    0x02,                   /* bNRChannels */
    0x03, 0x00, 0x00,0x00,  /* wChannelConfig (Left & Right Present) */
    0x00,                   /* iChannelNames */
    0x00,0x00,              /* bmControls */
    0x00,                   /* iTerminal */
    /* Output Terminal Descriptor - Speaker */
    0x0c,                   /* bLength */
```

```
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x03,                   /* bDescriptorSubType = Output Terminal */
    0x06,                   /* bTerminalID */
    0x01, 0x03,             /* wTerminalType - Speaker */
    0x00,                   /* bAssocTerminal */
    0x09,                   /* bSourceID */
    0x03,                   /* bCSourceID */
    0x00, 0x00,             /* bmControls */
    0x00,                   /* iTerminal */
    /* Output Terminal Descriptor - USB Endpoint */
    0x0c,                   /* bLength */
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x03,                   /* bDescriptorSubType = Output Terminal */
    0x07,                   /* bTerminalID */
    0x01, 0x01,             /* wTerminalType - USB Streaming */
    0x00,                   /* bAssocTerminal */
    0x0a,                   /* bSourceID */
    0x03,                   /* bCSourceID */
    0x00, 0x00,             /* bmControls */
    0x00,                   /* iTerminal */
    /* Feature Unit Descriptor */
    0x12,                   /* bLength */
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x06,                   /* bDescriptorSubType = Feature Unit */
    0x09,                   /* bUnitID */
    0x01,                   /* bSourceID */
    0x0f, 0x00, 0x00, 0x00, /* bmaControls - Master */
    0x0f, 0x00, 0x00, 0x00, /* bmaControls - Left */
    0x0f, 0x00, 0x00, 0x00, /* bmaControls - Right */
    0x00,                   /* iFeature */
    /* Feature Unit Descriptor */
    0x12,                   /* bLength */
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x06,                   /* bDescriptorSubType = Feature Unit */
    0x0A,                   /* bUnitID */
    0x02,                   /* bSourceID */
    0x0f, 0x00, 0x00, 0x00, /* bmaControls - Master */
    0x0f, 0x00, 0x00, 0x00, /* bmaControls - Left */
    0x0f, 0x00, 0x00, 0x00, /* bmaControls - Right */
    0x00,                   /* iFeature */
    /* Clock Source Descriptor */
    0x08,                   /* bLength */
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x0a,                   /* bDescriptorSubType = Clock Source */
    0x03,                   /* ClockID */
    0x01,                   /* bmAttributes - Internal Fixed Clock */
    0x00,                   /* bmControls */
    0x00,                   /* bAssocTerminal */
    0x00,                   /* iClockSource */
};

/* Isochronous IN endpoint PCM format descriptor */
static const unsigned char user_audio_in_stream_format_descriptor[] =
{
    0x06,               /* bLength */
    0x24,               /* bDescriptorType - Class Specific Interface */
    0x02,               /* bDescriptorSubType - Format Type */
    0x01,               /* bFormatType - Format Type 1 */
    0x04,               /* bSubSlotSize */
    0x20,               /* bBitResolution */
};
```

```
/* Isochronous OUT endpoint PCM format descriptor */
static const unsigned char user_audio_out_stream_format_descriptor[] =
{
    0x06,               /* bLength */
    0x24,               /* bDescriptorType - Class Specific Interface */
    0x02,               /* bDescriptorSubType - Format Type */
    0x01,               /* bFormatType - Format Type 1 */
    0x04,               /* bSubSlotSize */
    0x20,               /* bBitResolution */
};


#pragma pack ()

/* IN Audio Stream Interface Endpoint Data Descriptor */
static const CLD_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor
user_audio_in_stream_endpoint_desc =
{
    .b_length = sizeof(CLD_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor),
    .b_descriptor_type                  = 0x25,   /* Class Specific Endpoint */
    .b_descriptor_subtype               = 0x01,   /* Endpoint - General */
    .bm_attributes                      = 0x00,   /* max packet only set to 0 */
    .bm_controls                        = 0x00,
    .b_lock_delay_units                 = 0x00,
    .w_lock_delay                       = 0x00,
};

/* OUT Audio Stream Interface Endpoint Data Descriptor */
static const CLD_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor
user_audio_out_stream_endpoint_desc =
{
    .b_length = sizeof(CLD_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor),
    .b_descriptor_type                  = 0x25,   /* Class Specific Endpoint */
    .b_descriptor_subtype               = 0x01,   /* Endpoint - General */
    .bm_attributes                      = 0x00,   /* max packet only set to 0 */
    .bm_controls                        = 0x00,
    .b_lock_delay_units                 = 0x02,   /* Milliseconds */
    .w_lock_delay                       = 0x01,   /* 1 Millisecond */
};

/* Audio Stream IN Interface parameters */
static CLD_Audio_2_0_Stream_Interface_Params user_audio_in_endpoint_params =
{
    .endpoint_number            = 2,              /* Isochronous endpoint number */
                                  /* Isochronous endpoint full-speed max packet size */
    .max_packet_size_full_speed = USER_AUDIO_MAX_PACKET_SIZE,
                                  /* Isochronous endpoint high-speed max packet size */
    .max_packet_size_high_speed = USER_AUDIO_MAX_PACKET_SIZE,
    .b_interval_full_speed      = 1,  /* Isochronous endpoint full-speed bInterval */
                    /* Isochronous endpoint high-speed bInterval - 1 millisecond */
    .b_interval_high_speed      = 4,
                                  /* Terminal ID of the associated Output Terminal */
    .b_terminal_link            = 7,
    .b_format_type              = 1,            /* Type 1 Format */
    .bm_formats                 = 0x00000001,   /* Type 1 - PCM format */
    .b_nr_channels              = 2,            /* 2 Channels */
    .bm_channel_config          = 0x00000003,   /* Front Left & Front Right Channels */
    .p_encoder_descriptor       = CLD_NULL,
    .p_decoder_descriptor       = CLD_NULL,
    .p_format_descriptor        = (unsigned char*)
user_audio_in_stream_format_descriptor,
    .p_audio_stream_endpoint_data_descriptor =
(CLD_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor*)&user_audio_in_stream_endpoi
```

```
nt_desc,
};

/* Audio Stream OUT Interface parameters */
static CLD_Audio_2_0_Stream_Interface_Params user_audio_out_endpoint_params =
{
    .endpoint_number            = 2,            /* Isochronous endpoint number */
                        /* Isochronous endpoint full-speed max packet size */
    .max_packet_size_full_speed = USER_AUDIO_MAX_PACKET_SIZE,
                        /* Isochronous endpoint high-speed max packet size */
    .max_packet_size_high_speed = USER_AUDIO_MAX_PACKET_SIZE,
                        /* Isochronous endpoint full-speed bInterval */
    .b_interval_full_speed      = 1,
                    /* Isochronous endpoint high-speed bInterval - 1 millisecond */
    .b_interval_high_speed      = 4,
                        /* Terminal ID of the associated Output Terminal */
    .b_terminal_link            = 1,
    .b_format_type              = 1,          /* Type 1 Format */
    .bm_formats                 = 0x00000001, /* Type 1 - PCM format */
    .b_nr_channels              = 2,          /* 2 Channels */
    .bm_channel_config          = 0x00000003, /* Front Left & Front Right Channels */
    .p_encoder_descriptor       = CLD_NULL,
    .p_decoder_descriptor       = CLD_NULL,
    .p_format_descriptor        = (unsigned char*)
                                  user_audio_out_stream_format_descriptor,
    .p_audio_stream_endpoint_data_descriptor =
              (CLD_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor*)
      &user_audio_out_stream_endpoint_desc,
};

/* Audio Control Interrupt IN endpoint parameters */
static CLD_Audio_2_0_Control_Interrupt_Params user_audio_interrupt_in_params =
{
    .endpoint_number            = 1, /* Endpoint number */
    .b_interval_full_speed      = 1, /* Interrupt IN endpoint full-speed bInterval */
    .b_interval_high_speed      = 4, /* Interrupt IN endpoint high-speed bInterval */
};

/*!< CDC Serial Data Bulk OUT endpoint parameters. */
static CLD_Serial_Data_Bulk_Endpoint_Params user_cdc_serial_data_rx_ep_params =
{
    .endpoint_number              = 5,
    .max_packet_size_full_speed   = 64,
    .max_packet_size_high_speed   = 512,
};

/*!< CDC Serial Data Bulk IN endpoint parameters. */
static CLD_Serial_Data_Bulk_Endpoint_Params user_cdc_serial_data_tx_ep_params =
{
    .endpoint_number              = 5,
    .max_packet_size_full_speed   = 64,
    .max_packet_size_high_speed   = 512,
};


/*!< CLD Library initialization data. */
static CLD_SC594_Audio_2_0_w_CDC_Lib_Init_Params user_audio_w_cdc_init_params =
{
    .vendor_id = 0x064b,        /* Analog Devices Vendor ID */
    .product_id = 0x0008,       /* Product ID. */
    .usb_bus_max_power = 0,
```

```
.device_descriptor_bcdDevice = 0x0100,
.audio_control_category_code = 0x01,  /* Desktop Speaker */

.phy_hs_timeout_calibration     = 0, /* TODO: set based on USB Phy. */
.phy_fs_timeout_calibration     = 0, /* TODO: set based on USB Phy. */
.phy_delay_req_after_ulip_chirp_cmd = CLD_TRUE, /* TODO: set based on USB Phy. */

.fp_init_usb_phy                = user_init_usb_phy,

 /* Unit and Terminal descriptor */
.p_unit_and_terminal_descriptors = (unsigned char*)
         user_audio_unit_and_terminal_descriptor,
.unit_and_terminal_descriptors_length =
         sizeof(user_audio_unit_and_terminal_descriptor),

/* Pointer to the Interface parameters for the Audio Stream Rx interface. */
.p_audio_streaming_rx_interface_params = &user_audio_out_endpoint_params,

/* Pointer to the feedback parameters for the Audio Stream Rx interface. */
.p_audio_rate_feedback_rx_params       = &user_audio_rate_feedback_params,

/* Pointer to the Interface parameters for the Audio Stream Tx interface. */
.p_audio_streaming_tx_interface_params = &user_audio_in_endpoint_params,

/* Function called when an USB Audio 2.0 Set Request is received.*/
.fp_audio_set_req_cmd = user_audio_set_req_cmd,

/* Function called when an USB Audio 2.0 Get Request is received. */
.fp_audio_get_req_cmd = user_audio_get_req_cmd,

/* Function called when the Isochronous OUT interface is enabled/disabled */
.fp_audio_streaming_rx_endpoint_enabled =
         user_audio_streaming_rx_endpoint_enabled,
/* Function called when the Isochronous IN interface is enabled/disabled */
.fp_audio_streaming_tx_endpoint_enabled =
         user_audio_streaming_tx_endpoint_enabled,

.p_serial_data_rx_endpoint_params = &user_cdc_serial_data_rx_ep_params,
.p_serial_data_tx_endpoint_params = &user_cdc_serial_data_tx_ep_params,

.fp_cdc_cmd_send_encapsulated_cmd = user_cdc_cmd_send_encapsulated_cmd,
.fp_cdc_cmd_get_encapsulated_resp = user_cdc_cmd_get_encapsulated_resp,

.fp_cdc_cmd_set_line_coding       = user_cdc_cmd_set_line_coding,
.fp_cdc_cmd_get_line_coding       = user_cdc_cmd_get_line_coding,

.fp_cdc_cmd_set_control_line_state= user_cdc_cmd_set_control_line_state,

.fp_cdc_cmd_send_break            = user_cdc_cmd_send_break,

.support_cdc_network_connection   = 1,
.cdc_class_bcd_version            = 0x0120,       /* CDC Version 1.2 */
.cdc_class_control_protocol_code  = 0,            /* No Class Specific protocol */

/* USB string descriptors - Set to CLD_NULL if not required */
.p_usb_string_manufacturer  = "Analog Devices Inc",
.p_usb_string_product       = "SC594 Audio v2.0 w CDC Device",
.p_usb_string_serial_number = CLD_NULL,
.p_usb_string_configuration = CLD_NULL,
.p_usb_string_audio_control_interface        = CLD_NULL,
.p_usb_string_audio_streaming_out_interface  = "USB Audio Output",
.p_usb_string_audio_streaming_in_interface   = "USB Audio Input",
```

```
    .p_usb_string_communication_class_interface  = "CLD CDC Ctrl",
    .p_usb_string_data_class_interface           = "CLD CDC Data",

    .user_string_descriptor_table_num_entries = 0,
    .p_user_string_descriptor_table = CLD_NULL,

    .usb_string_language_id     = 0x0409,               /* English (US) language ID */

    /* Function called when a USB events occurs on USB0. */
    .fp_cld_usb_event_callback = user_usb_event,

    /* Function called when the CLD library reports a status. */
    .fp_cld_lib_status         = user_cld_lib_status,
};
```

```
User_Init_Return_Code user_init (void)
{
    static unsigned char user_init_state = 0;
    CLD_RV cld_rv = CLD_ONGOING;
    User_Init_Return_Code init_return_code = USER_INIT_ONGOING;

    switch (user_init_state)
    {
        case 0:

            /* TODO: add any custom User firmware initialization */

            user_init_state++;
        break;
        case 1:
            /* Initialize the CLD Library */
            cld_rv =
cld_sc594_audio_2_0_w_cdc_lib_init(&user_audio_w_cdc_init_params);

            if (cld_rv == CLD_SUCCESS)
            {
                /* Connect to the USB Host */
                cld_lib_usb_connect();

                init_return_code = USER_INIT_SUCCESS;
            }
            else if (cld_rv == CLD_FAIL)
            {
                init_return_code = USER_INIT_FAILED;
            }
            else
            {
                init_return_code = USER_INIT_ONGOING;
            }
    }
    return init_return_code;
}

void user_main (void)
{
    cld_sc594_audio_2_0_w_cdc_lib_main();

}

static CLD_RV user_init_usb_phy (void)
{
    /* TODO: Reset and configure the USB Phy. */
}

static void user_usb_event (CLD_USB_Event event)
{
    switch (event)
    {
        case CLD_USB_CABLE_CONNECTED:
            /* TODO: Add any User firmware processed when a USB cable is connected. */
        break;
        case CLD_USB_CABLE_DISCONNECTED:
            /* TODO: Add any User firmware processed when a USB cable is
               disconnected.*/
        break;
        case CLD_USB_ENUMERATED_CONFIGURED_HS:
```

```
        case CLD_USB_ENUMERATED_CONFIGURED_HF:

            /* TODO: Add any User firmware processed when a Device has been
               enumerated.*/
            break;
            case CLD_USB_UN_CONFIGURED:
            /* TODO: Add any User firmware processed when a Device USB Configuration
               is set to 0.*/
            break;
            case CLD_USB_BUS_RESET:
            /* TODO: Add any User firmware processed when a USB Bus Reset occurs. */
            break;
    }
}

/* The following function will transmit the specified memory using
   the Isochronous IN endpoint. */
static user_audio_transmit_isochronous_in_data (void)
{
    static CLD_USB_Transfer_Params transfer_params;

    transfer_params.num_bytes = /* TODO: Set number of IN bytes */
    transfer_params.p_data_buffer = /* TODO: address data */
    transfer_params.callback.fp_usb_in_transfer_complete = /* TODO: Set to User
                                                              callback function or
                                                              CLD_NULL */;
    transfer_params.callback.fp_transfer_aborted_callback = /* TODO: Set to User
                                                               callback function or
                                                               CLD_NULL */;
    transfer_params.transfer_timeout_ms = /* TODO: Set to desired timeout */;

    if (cld_audio_2_0_lib_transmit_audio_data (&transfer_params) ==
            CLD_USB_TRANSMIT_SUCCESSFUL)
    {
        /* Isochronous IN transfer initiated successfully */
    }
    else /* Isochronous IN transfer was unsuccessful */
    {
    }
}

/* Function called when a Set Request is received */
static CLD_USB_Transfer_Request_Return_Type user_audio_set_req_cmd
             (CLD_Audio_2_0_Cmd_Req_Parameters * p_req_params,
              CLD_USB_Transfer_Params * p_transfer_data)
{
    p_transfer_data->p_data_buffer = /* TODO: address to store data */
    p_transfer_data->callback.fp_usb_out_transfer_complete =
                                    user_audio_set_req_cmd_transfer_complete;
    p_transfer_data->fp_transfer_aborted_callback = /* TODO: Set to User callback
                                                       function or CLD_NULL */
     /* TODO: Return how the Control transfer should be handled (Accept, Pause,
              Discard, or Stall */
}

/* Function called when the Set Request data is received */
static CLD_USB_Data_Received_Return_Type user_audio_set_req_cmd_transfer_complete
       (void)
{
    /* TODO: Return if the received data is good (CLD_USB_DATA_GOOD) or bad
       (CLD_USB_DATA_BAD_STALL) */
}
```

```
/* Function called when a Get Request is received */
static CLD_USB_Transfer_Request_Return_Type user_audio_get_req_cmd
             (CLD_Audio_2_0_Cmd_Req_Parameters * p_req_params,
              CLD_USB_Transfer_Params * p_transfer_data)
{
    p_transfer_data->p_data_buffer = /* TODO: address to source data */
    p_transfer_data->callback.fp_usb_in_transfer_complete =
                                        user_audio_get_req_cmd_transfer_complete;
    p_transfer_data->fp_transfer_aborted_callback = /* TODO: Set to User callback
                                                          function or CLD_NULL */
     /* TODO: Return how the Control transfer should be handled (Accept, Pause,
            Discard, or Stall */
}

/* Function called when the Get Request data has been transmitted */
static void user_audio_get_req_cmd_transfer_complete (void)
{
    /* TODO: The Get Request data has been sent to the Host, add any
       User functionality. */
}


static void user_audio_streaming_rx_endpoint_enabled (CLD_Boolean enabled)
{
    if (enabled == CLD_TRUE)
    {
        /* TODO: Add Isochronous OUT endpoint enabled User functionality. */
    }
    else
    {
        /* TODO: Add Isochronous OUT endpoint disabled User functionality. */
    }
}


static void user_audio_streaming_tx_endpoint_enabled (CLD_Boolean enabled)
{
    if (enabled == CLD_TRUE)
    {
        /* TODO: Add Isochronous IN endpoint enabled User functionality. */
    }
    else
    {
        /* TODO: Add Isochronous IN endpoint disabled User functionality. */
    }
}

/* Function called when a Send Encapsulated Command request is received */
static CLD_USB_Transfer_Request_Return_Type user_cdc_cmd_send_encapsulated_cmd
             (CLD_USB_Transfer_Params * p_transfer_data)
{
    p_transfer_data->p_data_buffer = /* TODO: address to store data */
    p_transfer_data->callback.usb_out_transfer_complete =
                                  user_cdc_send_encapsilated_cmd_transfer_complete;
    p_transfer_data->fp_transfer_aborted_callback = /* TODO: Set to User callback
                                                         function or CLD_NULL
*/
     /* TODO: Return how the Control transfer should be handled (Accept, Pause,
            Discard, or Stall */
}

/* Function called when the Send Encapsulated Command data is received */
```

```
static CLD_USB_Data_Received_Return_Type
       user_cdc_send_encapsilated_cmd_transfer_complete (void)
{
    /* TODO: Return if the received data is good (CLD_USB_DATA_GOOD) or bad
       (CLD_USB_DATA_BAD_STALL) */
}
```

```
/* Function called when a Get Encapsulated Response request is received */
static CLD_USB_Transfer_Request_Return_Type user_cdc_cmd_get_encapsulated_resp
             (CLD_USB_Transfer_Params * p_transfer_data)
{
    p_transfer_data->num_bytes = /* TODO: Set to size of response */
    p_transfer_data->p_data_buffer = /* TODO: address to source the response data */
    p_transfer_data->callback.usb_in_transfer_complete =
                                 user_cdc_get_encapsulated_resp_transfer_complete;
    p_transfer_data->fp_transfer_aborted_callback = /* TODO: Set to User callback
                                                       function or NULL */
     /* TODO: Return how the Control transfer should be handled (Accept, Pause,
            Discard, or Stall */
}


/* Function called when a Get Encapsulated Response has been transmitted */
static void user_cdc_get_encapsulated_resp_transfer_complete (void)
{
    /* TODO: The Get Encapsulated Response data has been sent to the Host, add any
       User functionality. */
}

/* Function called when a Set Line Coding Request has been received*/
CLD_USB_Data_Received_Return_Type user_cdc_cmd_set_line_coding
       (CLD_CDC_Line_Coding * p_line_coding)
{
    if ( /* TODO: Check if CDC Line Coding is valid */ )
    {
        /* TODO: Save the requested CDC Line Coding and process it accordingly */
        return CLD_USB_DATA_GOOD;
    }
    else
    {
        return CLD_USB_DATA_BAD_STALL;
    }
}

/* Function called when a Get Line Coding Request has been received*/
CLD_RV user_cdc_cmd_get_line_coding (CLD_CDC_Line_Coding * p_line_coding)
{
    if ( /* TODO: Check if Get CDC Line Coding request is valid */ )
    {
        /* TODO: Copy the current CDC Line Coding into the p_line_coding structure */
        return CLD_SUCCESS;
    }
    else
    {
        return CLD_FAIL;
    }
}
```

```
/* Function called when a CDC Set Control Line State Request has been received*/
CLD_USB_Data_Received_Return_Type user_cdc_cmd_set_control_line_state
       (CLD_CDC_Control_Line_State * p_control_line_state)
{
    if ( /* TODO: Check if CDC Control Line state is valid */ )
    {
        /* TODO: Process the CDC Control Line State */
        return CLD_USB_DATA_GOOD;
    }
    else
    {
        return CLD_USB_DATA_BAD_STALL;
    }
}

/* Function called when a CDC Send Break Request has been received*/
static void user_cdc_cmd_send_break (unsigned short duration)
{
    /* TODO: Process the requested break duration */
}

static void user_cld_lib_status (unsigned short status_code, void * p_additional_data,
                                 unsigned short additional_data_size)
{
    /* TODO: Process the library status if needed.  The status can also be decoded to
             a USB readable string using cld_lib_status_decode as shown below: */

    char * p_str = cld_lib_status_decode(status_code, p_additional_data,
                                         additional_data_size);
}
```