Microchip's Accessory Framework for Android(tm)

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1 Introduction

Microchip's Accessory Framework for Android

for

Microchip Microcontrollers

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3 Release Notes

Microchip's Accessory Framework for Android Version 1.0.0, May 20, 2011

Peripherals

Type/Use	Specific/Configurable	Polled/Interrupt	Limitations (see page 11)
USB module in host mode	USB1 module	Interrupt	None

3.1 Terms and Definitions

This section defines some of the terms used in this document.

Open Accessory API or **Open Accessory Framework** - this is the API/framework in the Android development environment that allows the Android applications to transmit data in and out of the available USB port. This is provided by Google through the Android SDK.

Microchip's Accessory Framework for Android - This defines the firmware library and Android application examples provided in this package by Microchip.

3.2 Supported Demo Boards

The following demo boards are supported in this release:

- Accessory Development Starter Kit for Android (PIC24F Version) (DM240415)
- Explorer 16 (DM240001) with USB PICtail+ Board (AC164131) with any of the following Processor Modules:
  - PIC24FJ256GB110 PIM (MA240014)
  - PIC24FJ64GB004 PIM (MA240019)
  - PIC24FJ256GB210 PIM (MA240021)
  - PIC32MX460F512L PIM (MA320002)
  - PIC32MX795F512L PIM (MA320003)
- PIC24F Starter Kit 1 (DM240011)
- PIC32 USB Starter Kit I or II (DM320003-2)
- PIC32 Ethernet Starter Kit (DM320004)

Since each board has different hardware features, there may be limitations on some of the boards for each of the demos. For example, if the board does not have a potentiometer but the demo uses one, that feature of the demo will not work.

3.3 Requirements, Limitations, and Potential Issues

This section describes the limitations and requirements for using the Microchip's Accessory Framework for Android.

Requirements:

The Microchip's Accessory Framework for Android requires Android versions v2.3.4 or v3.1 or later. The Open Accessory API is not available in OS versions earlier than this. If the target device is using an older version than this, the library will not be able to connect to that device.

Please see the Creating the Setup (see page 33) section for details about how to get the correct tool versions. Please refer to the Creating the Android Application (see page 40) section for more information about how to select the right tool set when creating a new Android application.

Limitations and Potential Issues:

1. The read() function in the Android OS will not throw an IOException when the file stream under it is closed on file streams created from the USB Open Accessory API. This creates issues when applications or services close down and try to free resources. If a read is in progress, then this can result in the ParcelFileDescriptor object being locked until the accessory is detached from the Android device. This is present in version v2.3.4 and v3.1 of the Android OS.
2. The available() function in the Open Accessory API in the Android OS always throws an IOException error. This function is not available for use.
3. This release only shows connecting to an Android device with the Android device as the USB device. Most phones and tablets operate in this mode. A few Android devices at the time of this release are capable of being a USB host as well. Examples for using this mode of operation are not provided in this release. Firmware to talk to these host capable Android devices can be found at www.microchip.com/usb or www.microchip.com/mal. Application example to access accessories running in device mode will follow shortly. The Open Accessory API allows connections in either direction.

3.4 Getting the Source Code

If you are working from the pre-compiled version and would like to get the source code version of these projects, please visit www.microchip.com/mal. The source code is provided in that download (version 2011-06-xx or later).

3.5 What's Next?

This section describes what Microchip is working on or considering next. This section makes no statement that these items will ever actually be released. Projects on this list may be discontinued indefinitely.

1. Example boot loader for Android Accessories.
2. Examples using the Host mode features of the Open Accessory Framework

4 Using the Library

4.1 Library Architecture

The Android Accessory driver when in host mode is just a client driver on top on top of the Microchip USB host stack as seen in the below diagram.

Users interface through the Android driver API described in this document to access the Android device.

4.2 How the Library Works

4.2.1 Configuring the Library

There are two distributions of the Microchip's Accessory Framework for Android. One includes pre-compiled library files and the second includes the source code files.

The pre-compiled version can be found at www.microchip.com/android.

The source code version can be found at www.microchip.com/mal.

Please select the instructions in the following sections that correspond to the version that you are using.

4.2.1.1 Required USB callbacks

Microchip's Accessory Framework for Android is currently based off of Microchip's USB host stack. The USB host stack uses a couple of call back functions to allow the user to make key decisions about the stack operation at run time. These functions must be implemented for the library to compile correctly. These two functions are

`USB_ApplicationDataEventHandler()` and `USB_ApplicationEventHandler()` for the pre-compiled example. For the source example the function names are configurable through the usb_config.h (see page 14) file (see the usb_config.h (see page 14) section for more information). For more detailed information about these functions or the USB library, please refer to www.microchip.com/mal. This download includes the USB host library code as well as more detailed documentation about that library.

The data events are consumed by the Android client driver. So the user application data event handler doesn't need to do anything. It needs to be present for the library to link successfully but it can just return FALSE.

```
BOOL USB_ApplicationDataEventHandler( BYTE address, USB_EVENT event, void *data, DWORD size
)
{
    return FALSE;
}
```

The regular event handler has a little more work that needs to be done. This handler notifies the user of device attach and detach events. For Android devices this is covered in the Detecting a Connection/Disconnection to an Android Device (see page 17) section. This function also notifies the user about errors that might occur in the USB subsystem. These can be useful for debugging development issues or logging issue once released in the field. The last important duty that this function provides is determining if the power required by the attached device is available. This is done through the `EVENT_VBUS_REQUEST_POWER` event. Remember in this event that the amount of power requested through the USB bus is the power required/2, not the power required. Below is full implementation of the USB event handler that will work with a single attached Android device.

```
BOOL USB_ApplicationEventHandler( BYTE address, USB_EVENT event, void *data, DWORD size )
{
    switch( event )
    {
        case EVENT_VBUS_REQUEST_POWER:
            // The data pointer points to a byte that represents the amount of power
            // requested in mA, divided by two.  If the device wants too much power,
            // we reject it.
            if (((USB_VBUS_POWER_EVENT_DATA*)data)->current <= (MAX_ALLOWED_CURRENT / 2))
            {
                return TRUE;
            }
            else
            {
                DEBUG_ERROR( "Device requires too much current\r\n" );
            }
            break;

        case EVENT_VBUS_RELEASE_POWER:
        case EVENT_HUB_ATTACH:
        case EVENT_UNSUPPORTED_DEVICE:
        case EVENT_CANNOT_ENUMERATE:
        case EVENT_CLIENT_INIT_ERROR:
        case EVENT_OUT_OF_MEMORY:
        case EVENT_UNSPECIFIED_ERROR:
        case EVENT_DETACH:
             //Fall-through
        case EVENT_ANDROID_DETACH:
            device_attached = FALSE;
            return TRUE;
            break;

        // Android Specific events
        case EVENT_ANDROID_ATTACH:
            device_attached = TRUE;
            device_handle = data;
            return TRUE;

        default :
            break;
    }
    return FALSE;
}
```

4.2.1.2 HardwareProfile.h

HardwareProfile.h provides configuration information to the source version of the library. This tells the library and demo code information about the hardware that it needs to know for configuration, such as the system clock speed, which pins are being used for certain stack or demo features, etc.

When moving this library to your own hardware platform, you will need to create your own HardwareProfile.h file that specifies the requirements of your board.

4.2.1.3 usb_config.h

usb_config.h is used to configure the build options of the source version of this library. At the moment this is also required in the pre-compiled format as well.

When using with the pre-compiled format, please do not modify this file as it must match exactly how the library was built.

For users developing with the source version of the library, this file provides several configuration options for customizing the USB stack. There are a few options that are required.

The `USB_SUPPORT_HOST` option must be enabled.

The `USB_ENABLE_TRANSFER_EVENT` option must be enabled.

The `USB_HOST_APP_DATA_EVENT_HANDLER` must be defined and the function that is referenced must be implemented.

The `USB_ENABLE_1MS_EVENT` must be enabled.

The `AndroidTasks` (see page 25)`()` function should be added to the `USBTasks()` function call or it should be called periodically from the user application.

```
#define USBTasks()                  \
    {                               \
        USBHostTasks();             \
        AndroidTasks();          \
    }
```

The `USB_SUPPORT_BULK_TRANSFERS` should be defined.

For use with PIC32, the USB_PING_PONG_MODE option must be set to USB_PING_PONG__FULL_PING_PONG. This is also recommended for PIC24F but not required.

```
#define USB_PING_PONG_MODE  USB_PING_PONG__FULL_PING_PONG
```

If you modify the `TPL` in the usb_config.c (see page 15) file (see section usb_config.c (see page 15) for more details), then the `NUM_TPL_ENTRIES` and `NUM_CLIENT_DRIVER_ENTRIES` entries in the usb_config.h file should be updated to match.

Below is a complete example of a usb_config.h file for an Android accessory demo:

```
#define USB_SUPPORT_HOST

#define USB_PING_PONG_MODE  USB_PING_PONG__FULL_PING_PONG

#define NUM_TPL_ENTRIES 2
#define NUM_CLIENT_DRIVER_ENTRIES 1

#define USB_ENABLE_TRANSFER_EVENT

#define USB_HOST_APP_DATA_EVENT_HANDLER USB_ApplicationDataEventHandler
#define USB_ENABLE_1MS_EVENT

#define USB_MAX_GENERIC_DEVICES 1
#define USB_NUM_CONTROL_NAKS 20
#define USB_SUPPORT_INTERRUPT_TRANSFERS
```

```
#define USB_SUPPORT_BULK_TRANSFERS
#define USB_NUM_INTERRUPT_NAKS 3
#define USB_INITIAL_VBUS_CURRENT (100/2)
#define USB_INSERT_TIME (250+1)
#define USB_HOST_APP_EVENT_HANDLER USB_ApplicationEventHandler

#define USBTasks()                  \
    {                               \
        USBHostTasks();             \
        AndroidTasks();          \
    }

#define USBInitialize(x)            \
    {                               \
        USBHostInit(x);             \
    }
```

For more information about the usb_config.h file, please refer to the MCHPFSUSB stack help file.

4.2.1.4 usb_config.c

The usb_config.c file is only required for those working with the source code implementation of the library. This file is not used in the pre-compiled version of the library.

There are two main sections to the usb_config.c file. The first is the Targeted Peripheral List (TPL). The TPL is defied by the USB OTG specification as the list of devices that are allowed to enumerate on the device. The TPL is just an array of USB_TPL objects that specify the devices that can be attached. There are two ways that these devices are entered into the table. They are either entered as Class/Subclass/Protocol pairs (CL/SC/P). The second method is by Vendor ID (VID) and Product ID (PID) pairs. This will allow a specific device, not device type, to enumerate.

There are two entries that are needed for Android devices. Since each Android device may appear different to the host controller, there isn't an easy way to add support for a given Class/Subclass/Protocol pair since each Android device might expose different USB interface types. Likewise, since there isn't a list of all VID/PIDs for Android devices, and this implementation isn't future-proof, you can use the normal VID/PID entry either. For cases like these Microchip has implemented the VID/PID combination of 0xFFFF/0xFFFF to indicate that this driver should enumerate every device regardless of its interfaces or its actual VID/PID pair.

The other entry in the table is the entry for the Android device once it has actually entered accessory mode. This can be either entered using the CL/SC/P of the Accessory interface or the magic VID/PID combinations specified by Google Inc. The magic VID/PID combination method is probably the preferred method (seen below):

```
// ***************************************************************************
// USB Embedded Host Targeted Peripheral List (TPL)
// ***************************************************************************
USB_TPL usbTPL[] =
{
      /*[1] Device identification information
        [2] Initial USB configuration to use
        [3] Client driver table entry
        [4] Flags (HNP supported, client driver entry, SetConfiguration() commands allowed
    ---------------------------------------------------------------------
                [1]                      [2][3] [4]
    ---------------------------------------------------------------------*/
    { INIT_VID_PID( 0x18D1ul, 0x2D00ul ), 0, 0, {0} }, // Android accessory
    { INIT_VID_PID( 0x18D1ul, 0x2D01ul ), 0, 0, {0} }, // Android accessory
    { INIT_VID_PID( 0xFFFFul, 0xFFFFul ), 0, 0, {0} }, // Enumerates everything
};
```

All of the entries that correspond to the Android accessory device should point to the entry in the Client Driver table the corresponds to the Android drivers. In the above example all three entries point to the client driver entry 0 (as noted by entry [3] set to 0). The client driver table needs register the functions used by each driver. The functions that need to be registered are the Initialization function, the event handler, the data event handler (if implemented), and the initialization flags value (see example below).

```
// ***************************************************************************
```

```
// Client Driver Function Pointer Table for the USB Embedded Host foundation
// ****************************************************************************
CLIENT_DRIVER_TABLE usbClientDrvTable[] =
{
    {
        AndroidAppInitialize,
        AndroidAppEventHandler,
        AndroidAppDataEventHandler,
        0
    }
};
```

For more information about the usb_config.c file, please refer to the MCHPFSUSB documentation available in the installation found at www.microchip.com/mal.

4.2.2 Initialization

There are two main steps to initializing the firmware. The first is to initialize the USB host stack. This is done via the `USBInitialize()` function as seen below:

```
USBInitialize(0);
```

The second step that is required for the initialization is for the application to describe the accessory to the Android client driver so that it can pass this information to the Android device when attached. This is done through the `AndroidAppStart` (see page 24)() function. This function takes in a pointer an `ANDROID_ACCESSORY_INFORMATION` (see page 31) structure which contains all of the information about the accessory. An example is seen below:

```
//Define all of my string information here
char manufacturer[] = "Microchip Technology Inc.";
char model[] = "Basic Accessory Demo";
char description[] = "ADK - Accessory Development Starter Kit for Android (PIC24F)";
char version[] = "1.0";
char uri[] = "http://www.microchip.com/android";
char serial[] = "N/A";

//Pack all of the strings and their lengths into an
//  ANDROID_ACCESSORY_INFORMATION structure
ANDROID_ACCESSORY_INFORMATION myDeviceInfo =
{
    manufacturer,
    sizeof(manufacturer),
    model,
    sizeof(model),
    description,
    sizeof(description),
    version,
    sizeof(version),
    uri,
    sizeof(uri),
    serial,
    sizeof(serial)
};

int main(void)
{
    //Initialize the USB host stack
    USBInitialize(0);

    //Send my accessory information to the Android client driver.
    AndroidAppStart(&myDeviceInfo);

    //Go on with my application here...
```

Note that the `AndroidAppStarter()` function should be called before the Android device is attached. It is recommended to call this function after initializing the USB Android client driver but before calling the `USBTasks()` function.

4.2.3 Keeping the Stack Running

The Microchip USB host stack receives and logs events via an interrupt handler, but processes them as the USBTasks() (or USBHostTasks()) function is called. This limits the amount of time spent in an interrupt context and helps limit context related issues. This means that in order to keep the USB host stack running, the USBTasks() function needs to be called periodically in order to keep processing these events.

```
int main(void)
{
    //Initialize the USB stack
    USBInitialize(0);

    //Pass my accessory information to the Android client driver
    AndroidAppStart(&myDeviceInfo);

    while(1)
    {
        //Keep the USB stack running
        USBTasks();

        //Do my application specific stuff here
        //...
    }
}
```

The rate at which USBTasks() is called will contribute to determining the throughput that the stack is able to get, the timeliness of the data reception, and the accuracy and latency of the events thrown from the stack.

4.2.4 Detecting a Connection/Disconnection to an Android Device

The USB Host stack notifies users of attachment and detachment events through an event handler call back function. The name of this function is configurable in source code projects. In pre-compiled projects, this function is named `USB_ApplicationEventHandler()`.

The Android client driver uses this same event handler function to notify the user of the attachment or detachment of Android devices. The Android client driver adds the `EVENT_ANDROID_ATTACH` (see page 30) and `EVENT_ANDROID_DETACH` (see page 30) events. These two events are key to interfacing to the attached Android device. The `data` field of the attach event provides the handle to the Android device. This handle must be passed to all of the read/write functions to it is important to save this information when it is received. Similarly the detach event specifies the handle of the device that detached so that the application knows which device detached (if multiple devices are attached).

```
void* device_handle = NULL;
static BOOL device_attached = FALSE;

int main(void)
{
    //Initialize the USB stack
    USBInitialize(0);

    //Send the accessory information to the Android client driver
    AndroidAppStart(&myDeviceInfo);

    while(1)
    {
        //Keep the USB stack running
        USBTasks();

        //If the device isn't attached yet,
```

```
        if(device_attached == FALSE)
        {
            //Continue to the top of the while loop to start the check over again.
            continue;
        }

        //If the accessory is ready, then this is where we run all of the demo code

        if(readInProgress == FALSE)
        {
            //This example shows how the handle is required for the transfer functions
            errorCode = AndroidAppRead(device_handle,
                                       (BYTE*)&command_packet,
                                       (DWORD)sizeof(ACCESSORY_APP_PACKET));
            //If the device is attached, then lets wait for a command from the application
            if( errorCode != USB_SUCCESS)
            {
                //Error
                DEBUG_ERROR("Error trying to start read");
            }
            else
            {
                readInProgress = TRUE;
            }
        }
    }
}

BOOL USB_ApplicationEventHandler( BYTE address, USB_EVENT event, void *data, DWORD size )
{
    switch( event )
    {
        //Android device has been removed.
        case EVENT_ANDROID_DETACH:
            device_attached = FALSE;
            device_handle = NULL;
            return TRUE;
            break;

        //Android device has been added.  Must record the device handle
        case EVENT_ANDROID_ATTACH:
            device_attached = TRUE;
            device_handle = data;
            return TRUE;

        //Handle other events here that are required...
        //...
```

4.2.5 Sending Data

There are two functions that are associated with sending data from the Accessory to the device: `AndroidAppIsWriteComplete` (see page 22)() and `AndroidAppWrite` (see page 25)(). The AndroidAppWrite (see page 25)() function is used to send data from the Accessory to the Android device. The AndroidAppIsWriteComplete (see page 22)() function is used to determine if a previous transfer has completed. Remember from the Keeping the Stack Running (see page 17) section that the `USBTasks()` function needs to be called in order to keep the stack running. This means that you shouldn't loop on the `AndroidAppIsWriteComplete` (see page 22)() function. Instead use either a state machine or booleans to indicate what you need to do.

```
    while(1)
    {
        USBTasks();

        //Do some extra stuff here to see if the buttons have updated

        if( writeInProgress == TRUE )
        {
```

```
            if(AndroidAppIsWriteComplete(device_handle, &errorCode, &size) == TRUE)
            {
                writeInProgress = FALSE;

                if(errorCode != USB_SUCCESS)
                {
                    //Error
                    DEBUG_ERROR("Error trying to complete write");
                }
            }
        }

        if((buttonsNeedUpdate == TRUE) && (writeInProgress == FALSE))
        {
            response_packet.command = COMMAND_UPDATE_PUSHBUTTONS;
            response_packet.data = pushButtonValues;

            errorCode = AndroidAppWrite(device_handle,(BYTE*)&response_packet, 2);
            if( errorCode != USB_SUCCESS )
            {
                DEBUG_ERROR("Error trying to send button update");
            }
            else
            {
                buttonsNeedUpdate = FALSE;
                writeInProgress = TRUE;
            }
        }
    }
```

4.2.6 Receiving Data

Receiving data from the Android device is very similar to sending data. There are two functions that are used: `AndroidAppIsReadComplete` (see page 21)() and `AndroidAppRead` (see page 23)().

The `AndroidAppRead` (see page 23)() function is used to start a read request from the Android device. In the situation where the Android device is the USB peripheral, this will initiate an IN request on the bus. If the Android device doesn't have any information it will respond with NAKs. One key thing to know about the read function is that the buffer passed to the read function must always be able to receive at least one packets worth of USB data. For full-speed USB devices this is 64 bytes.

The `AndroidAppIsReadComplete` (see page 21)() function is used to determine if a read request was completed. The read request will terminate if a couple of conditions occur. The first is if the total number of bytes requested has been read. The second is if a packet with less than the maximum packet length is received. This typically indicates that fewer bytes than requested are available and that no more packets are immediately pending. While this is true for most cases, it may not be true for every case. If the target application is one of those exceptions, keep in mind that you may have to call the read function multiple times in order to receive a complete transmission from the applications perspective. Remember from the Keeping the Stack Running (see page 17) section that the `USBTasks()` function needs to be called in order to keep the stack running. This means that you shouldn't loop on the `AndroidAppIsReadComplete` (see page 21)() function. Instead use either a state machine or booleans to indicate what you need to do.

```
while(1)
{
    //Keep the stack running
    USBTasks();

    //Do some extra stuff here

    if(readInProgress == FALSE)
    {
        errorCode = AndroidAppRead(device_handle,
                                   (BYTE*)&command_packet,
                                   (DWORD)sizeof(ACCESSORY_APP_PACKET));
        //If the device is attached, then lets wait for a command from the application
```

```
            if( errorCode != USB_SUCCESS)
            {
                //Error
                DEBUG_ERROR("Error trying to start read");
            }
            else
            {
                readInProgress = TRUE;
            }
        }

        if(AndroidAppIsReadComplete(device_handle, &errorCode, &size) == TRUE)
        {
            readInProgress = FALSE;

            //We've received a command over the USB from the Android device.
            if(errorCode == USB_SUCCESS)
            {
                //We've received data, process it here (or elsewhere if desired)
                switch(command_packet.command)
                {
                    case COMMAND_SET_LEDS:
                        SetLEDs(command_packet.data);
                        break;
                    default:
                        //Error, unknown command
                        DEBUG_ERROR("Error: unknown command received");
                        break;
                }
            }
            else
            {
                //Error
                DEBUG_ERROR("Error trying to complete read request");
            }

        }
    }
```

4

5 Firmware API

This section covers the API routines available in this distribution. These descriptions cover more of the interface of these functions. For example usages and more details about how to use these functions in conjunction with each other and in your system, please refer to the Using the Library (see page 12) section of the document.

5.1 API Functions

Functions

	Name	Description
	AndroidAppIsReadComplete (see page 21)	Check to see if the last read to the Android device was completed
	AndroidAppIsWriteComplete (see page 22)	Check to see if the last write to the Android device was completed
	AndroidAppRead (see page 23)	Attempts to read information from the specified Android device
	AndroidAppStart (see page 24)	Sets the accessory information and initializes the client driver information after the initial power cycles.
	AndroidAppWrite (see page 25)	Sends data to the Android device specified by the passed in handle.
	AndroidTasks (see page 25)	Tasks function that keeps the Android client driver moving

5.1.1 AndroidAppIsReadComplete Function

Check to see if the last read to the Android device was completed

File

usb_host_android.h

C

```
BOOL AndroidAppIsReadComplete(
    void* handle,
    BYTE* errorCode,
    DWORD* size
);
```

Description

Check to see if the last read to the Android device was completed. If complete, returns the amount of data that was sent and the corresponding error code for the transmission.

Remarks

Possible values for errorCode are:

- USB_SUCCESS - Transfer successful
- USB_UNKNOWN_DEVICE - Device not attached
- USB_ENDPOINT_STALLED - Endpoint STALL'd
- USB_ENDPOINT_ERROR_ILLEGAL_PID - Illegal PID returned

- USB_ENDPOINT_ERROR_BIT_STUFF
- USB_ENDPOINT_ERROR_DMA
- USB_ENDPOINT_ERROR_TIMEOUT
- USB_ENDPOINT_ERROR_DATA_FIELD
- USB_ENDPOINT_ERROR_CRC16
- USB_ENDPOINT_ERROR_END_OF_FRAME
- USB_ENDPOINT_ERROR_PID_CHECK
- USB_ENDPOINT_ERROR - Other error

Preconditions

Transfer has previously been requested from an Android device.

Parameters

Parameters	Description
void* handle	the handle passed to the device in the EVENT_ANDROID_ATTACH (see page 30) event
BYTE* errorCode	a pointer to the location where the resulting error code should be written
DWORD* size	a pointer to the location where the resulting size information should be written

Return Values

Return Values	Description
TRUE	Transfer is complete.
FALSE	Transfer is not complete.

Function

BOOL AndroidAppIsReadComplete(void* handle, BYTE* errorCode, DWORD* size)

5.1.2 AndroidAppIsWriteComplete Function

Check to see if the last write to the Android device was completed

File

usb_host_android.h

C

```
BOOL AndroidAppIsWriteComplete(
    void* handle,
    BYTE* errorCode,
    DWORD* size
);
```

Description

Check to see if the last write to the Android device was completed. If complete, returns the amount of data that was sent and the corresponding error code for the transmission.

Remarks

Possible values for errorCode are:

- USB_SUCCESS - Transfer successful
- USB_UNKNOWN_DEVICE - Device not attached
- USB_ENDPOINT_STALLED - Endpoint STALL'd
- USB_ENDPOINT_ERROR_ILLEGAL_PID - Illegal PID returned

- USB_ENDPOINT_ERROR_BIT_STUFF
- USB_ENDPOINT_ERROR_DMA
- USB_ENDPOINT_ERROR_TIMEOUT
- USB_ENDPOINT_ERROR_DATA_FIELD
- USB_ENDPOINT_ERROR_CRC16
- USB_ENDPOINT_ERROR_END_OF_FRAME
- USB_ENDPOINT_ERROR_PID_CHECK
- USB_ENDPOINT_ERROR - Other error

Preconditions

Transfer has previously been sent to Android device.

Parameters

Parameters	Description
void* handle	the handle passed to the device in the EVENT_ANDROID_ATTACH (see page 30) event
BYTE* errorCode	a pointer to the location where the resulting error code should be written
DWORD* size	a pointer to the location where the resulting size information should be written

Return Values

Return Values	Description
TRUE	Transfer is complete.
FALSE	Transfer is not complete.

Function

BOOL AndroidAppIsWriteComplete(void* handle, BYTE* errorCode, DWORD* size)

5.1.3 AndroidAppRead Function

Attempts to read information from the specified Android device

File

usb_host_android.h

C

```
BYTE AndroidAppRead(
    void* handle,
    BYTE* data,
    DWORD size
);
```

Description

Attempts to read information from the specified Android device. This function does not block. Data availability is checked via the AndroidAppIsReadComplete (see page 21)() function.

Remarks

None

Preconditions

A read request is not already in progress and an Android device is attached.

Parameters

Parameters	Description
void* handle	the handle passed to the device in the EVENT_ANDROID_ATTACH (see page 30) event
BYTE* data	a pointer to the location of where the data should be stored. This location should be accessible by the USB module
DWORD size	the amount of data to read.

Return Values

Return Values	Description
USB_SUCCESS	Read started successfully.
USB_UNKNOWN_DEVICE	Device with the specified address not found.
USB_INVALID_STATE	We are not in a normal running state.
USB_ENDPOINT_ILLEGAL_TYPE	Must use USBHostControlRead to read from a control endpoint.
USB_ENDPOINT_ILLEGAL_DIRECTION	Must read from an IN endpoint.
USB_ENDPOINT_STALLED	Endpoint is stalled. Must be cleared by the application.
USB_ENDPOINT_ERROR	Endpoint has too many errors. Must be cleared by the application.
USB_ENDPOINT_BUSY	A Read is already in progress.
USB_ENDPOINT_NOT_FOUND	Invalid endpoint.
USB_ERROR_BUFFER_TOO_SMALL (see page 26)	The buffer passed to the read function was smaller than the endpoint size being used (buffer must be larger than or equal to the endpoint size).

Function

BYTE AndroidAppRead(void* handle, BYTE* data, DWORD size)

5.1.4 AndroidAppStart Function

Sets the accessory information and initializes the client driver information after the initial power cycles.

File

usb_host_android.h

C

```
void AndroidAppStart(
    ANDROID_ACCESSORY_INFORMATION* accessoryInfo
);
```

Description

Sets the accessory information and initializes the client driver information after the initial power cycles. Since this resets all device information this function should be used only after a compete system reset. This should not be called while the USB is active or while connected to a device.

Remarks

None

Preconditions

USB module should not be in operation

Parameters

Parameters	Description
ANDROID_ACCESSORY_INFORMATION *info	the information about the Android accessory

Function

void AndroidAppStart(ANDROID_ACCESSORY_INFORMATION (see page 31) *info)

5.1.5 AndroidAppWrite Function

Sends data to the Android device specified by the passed in handle.

File

usb_host_android.h

C

```
BYTE AndroidAppWrite(
    void* handle,
    BYTE* data,
    DWORD size
);
```

Description

Sends data to the Android device specified by the passed in handle.

Remarks

None

Preconditions

Transfer is not already in progress. USB module is initialized and Android device has attached.

Parameters

Parameters	Description
void* handle	the handle passed to the device in the EVENT_ANDROID_ATTACH (see page 30) event
BYTE* data	the data to send to the Android device
DWORD size	the size of the data that needs to be sent

Return Values

Return Values	Description
USB_SUCCESS	Write started successfully.
USB_UNKNOWN_DEVICE	Device with the specified address not found.
USB_INVALID_STATE	We are not in a normal running state.
USB_ENDPOINT_ILLEGAL_TYPE	Must use USBHostControlWrite to write to a control endpoint.
USB_ENDPOINT_ILLEGAL_DIRECTION	Must write to an OUT endpoint.
USB_ENDPOINT_STALLED	Endpoint is stalled. Must be cleared by the application.
USB_ENDPOINT_ERROR	Endpoint has too many errors. Must be cleared by the application.
USB_ENDPOINT_BUSY	A Write is already in progress.
USB_ENDPOINT_NOT_FOUND	Invalid endpoint.

Function

BYTE AndroidAppWrite(void* handle, BYTE* data, DWORD size)

5.1.6 AndroidTasks Function

Tasks function that keeps the Android client driver moving

File

usb_host_android.h

C

```
void AndroidTasks();
```

Description

Tasks function that keeps the Android client driver moving. Keeps the driver processing requests and handling events. This function should be called periodically (the same frequency as USBHostTasks() would be helpful).

Remarks

This function should be called periodically to keep the Android driver moving.

Preconditions

AndroidAppStart (see page 24)() function has been called before the first calling of this function

Function

void AndroidTasks(void)

5.2 Error Codes

Macros

	Name	Description
	USB_ERROR_BUFFER_TOO_SMALL (see page 26)	Error code indicating that the buffer passed to the read function was too small. Since the USB host can't control how much data it will receive in a single packet, the user must provide a buffer that is at least the size of the endpoint of the attached device. If a buffer is passed in that is too small, the read will not start and this error is returned to the user.

5.2.1 USB_ERROR_BUFFER_TOO_SMALL Macro

File

usb_host_android.h

C

```
#define USB_ERROR_BUFFER_TOO_SMALL USB_ERROR_CLASS_DEFINED + 0
```

Description

Error code indicating that the buffer passed to the read function was too small. Since the USB host can't control how much data it will receive in a single packet, the user must provide a buffer that is at least the size of the endpoint of the attached device. If a buffer is passed in that is too small, the read will not start and this error is returned to the user.

5.3 Configuration Definitions

Macros

	Name	Description
	NUM_ANDROID_DEVICES_SUPPORTED (see page 27)	Defines the number of concurrent Android devices this implementation is allowed to talk to. This definition is only used for implementations where the accessory is the host and the Android device is the slave. This is also most often defined to be 1. If this is not defined by the user, a default of 1 is used. This option is only used when compiling the source version of the library. This value is set to 1 for pre-compiled versions of the library.

5.3.1 NUM_ANDROID_DEVICES_SUPPORTED Macro

File

usb_host_android.h

C

```
#define NUM_ANDROID_DEVICES_SUPPORTED 1
```

Description

Defines the number of concurrent Android devices this implementation is allowed to talk to. This definition is only used for implementations where the accessory is the host and the Android device is the slave. This is also most often defined to be 1. If this is not defined by the user, a default of 1 is used.

This option is only used when compiling the source version of the library. This value is set to 1 for pre-compiled versions of the library.

5.4 Configuration Functions

Functions

	Name	Description
	AndroidAppDataEventHandler (see page 27)	Handles data events from the host stack
	AndroidAppEventHandler (see page 28)	Handles events from the host stack
	AndroidAppInitialize (see page 29)	Per instance client driver for Android device. Called by USB host stack from the client driver table.

5.4.1 AndroidAppDataEventHandler Function

Handles data events from the host stack

File

usb_host_android.h

C

```
BOOL AndroidAppDataEventHandler(
    BYTE address,
    USB_EVENT event,
    void * data,
    DWORD size
);
```

Description

Handles data events from the host stack

Remarks

This is a internal API only. This should not be called by anything other than the USB host stack via the client driver table

Preconditions

None

Parameters

Parameters	Description
BYTE address	the address of the device that caused the event
USB_EVENT event	the event that occured
void* data	the data for the event
DWORD size	the size of the data in bytes

Return Values

Return Values	Description
TRUE	the event was handled
FALSE	the event was not handled

Function

BOOL AndroidAppDataEventHandler(BYTE address, USB_EVENT event, void *data, DWORD size)

5.4.2 AndroidAppEventHandler Function

Handles events from the host stack

File

usb_host_android.h

C

```
BOOL AndroidAppEventHandler(
    BYTE address,
    USB_EVENT event,
    void * data,
    DWORD size
);
```

Description

Handles events from the host stack

Remarks

This is a internal API only. This should not be called by anything other than the USB host stack via the client driver table

Preconditions

None

Parameters

Parameters	Description
BYTE address	the address of the device that caused the event
USB_EVENT event	the event that occured
void* data	the data for the event
DWORD size	the size of the data in bytes

Return Values

Return Values	Description
TRUE	the event was handled
FALSE	the event was not handled

Function

BOOL AndroidAppEventHandler(BYTE address, USB_EVENT event, void *data, DWORD size)

5.4.3 AndroidAppInitialize Function

Per instance client driver for Android device. Called by USB host stack from the client driver table.

File

usb_host_android.h

C

```
BOOL AndroidAppInitialize(
    BYTE address,
    DWORD flags,
    BYTE clientDriverID
);
```

Description

Per instance client driver for Android device. Called by USB host stack from the client driver table.

Remarks

This is a internal API only. This should not be called by anything other than the USB host stack via the client driver table

Preconditions

None

Parameters

Parameters	Description
BYTE address	the address of the device that is being initialized
DWORD flags	the initialization flags for the device
BYTE clientDriverID	the clientDriverID for the device

Return Values

Return Values	Description
TRUE	initialized successfully
FALSE	does not support this device

Function

BOOL AndroidAppInitialize(BYTE address, DWORD flags, BYTE clientDriverID)

5.5 Events

Macros

	Name	Description
	EVENT_ANDROID_ATTACH (see page 30)	This event is thrown when an Android device is attached and successfully entered into accessory mode already. The data portion of this event is the handle that is required to communicate to the device and should be saved so that it can be passed to all of the transfer functions. Always use this definition in the code and never put a static value as the value of this event may change based on various build options.
	EVENT_ANDROID_DETACH (see page 30)	This event is thrown when an Android device is removed. The data portion of the event is the handle of the device that has been removed. Always use this definition in the code and never put a static value as the value of this event may change based on various build options.

5.5.1 EVENT_ANDROID_ATTACH Macro

File

usb_host_android.h

C

```
#define EVENT_ANDROID_ATTACH ANDROID_EVENT_BASE + 0
```

Description

This event is thrown when an Android device is attached and successfully entered into accessory mode already. The data portion of this event is the handle that is required to communicate to the device and should be saved so that it can be passed to all of the transfer functions. Always use this definition in the code and never put a static value as the value of this event may change based on various build options.

5.5.2 EVENT_ANDROID_DETACH Macro

File

usb_host_android.h

C

```
#define EVENT_ANDROID_DETACH ANDROID_EVENT_BASE + 1
```

Description

This event is thrown when an Android device is removed. The data portion of the event is the handle of the device that has been removed. Always use this definition in the code and never put a static value as the value of this event may change based on various build options.

5.6 Type Definitions

Structures

	Name	Description
	ANDROID_ACCESSORY_INFORMATION (see page 31)	This structure contains the informatin that is required to successfully create a link between the Android device and the accessory. This information must match the information entered in the accessory filter in the Android application in order for the Android application to access the device. An instance of this structure should be passed into the AndroidAppStart (see page 24)() at initialization.

5.6.1 ANDROID_ACCESSORY_INFORMATION Structure

File

usb_host_android.h

C

```
typedef struct {
  char* manufacturer;
  BYTE manufacturer_size;
  char* model;
  BYTE model_size;
  char* description;
  BYTE description_size;
  char* version;
  BYTE version_size;
  char* URI;
  BYTE URI_size;
  char* serial;
  BYTE serial_size;
} ANDROID_ACCESSORY_INFORMATION;
```

Members

Members	Description
char* manufacturer;	String: manufacturer name
BYTE manufacturer_size;	length of manufacturer string
char* model;	String: model name
BYTE model_size;	length of model name string
char* description;	String: description of the accessory
BYTE description_size;	length of the description string
char* version;	String: version number
BYTE version_size;	length of the version number string
char* URI;	String: URI for the accessory (most commonly a URL)
BYTE URI_size;	length of the URI string
char* serial;	String: serial number of the device
BYTE serial_size;	length of the serial number string

Description

This structure contains the informatin that is required to successfully create a link between the Android device and the accessory. This information must match the information entered in the accessory filter in the Android application in order for

the Android application to access the device. An instance of this structure should be passed into the AndroidAppStart (see page 24)() at initialization.

6 Running the Demos

6.1 Creating the Setup

6.1.1 New to Microchip

This section covers where to find Microchip tools and how to set those tools up for those that are new to Microchip.

6.1.1.1 Getting the Tools

If you are new to Microchip, then we welcome you to development on our line of processors. There are a few tools that you will need in order to get started developing.

You will need our IDE, MPLAB. There are two versions of the IDE available. The current released version of the IDE is available for Windows based computers and can be downloaded from www.microchip.com/mplab. For Macintosh or Linux users, you are welcome to use the beta version of MPLAB X, our upcoming IDE version, from http://ww1.microchip.com/downloads/mplab/X_Beta/index.html.

You will need a compiler. Windows users can download the appropriate compilers from www.microchip.com/c30 for the 16-bit based processors and www.microchip.com/c32 for the 32-based processors. Linux or Macintosh users can download versions of the compilers at http://ww1.microchip.com/downloads/mplab/X_Beta/index.html.

Finally you will need a programmer or debugger. If you order the Accessory Development Starter Kit for Android, you will have received our PICkit 3 programmer/debugger with that board. This is one of our lower end programmer/debuggers. Other programmer/debuggers are available from the following links:

- www.microchip.com/icd3
- www.microchip.com/realice

6.1.2 New to Android

This section points users to resources and tools for those that are new to developing on the Android platform.

Description

If you are new to developing under Android, there is extensive information available from the Android developer's website: http://developer.android.com/index.html.

For instructions on where to find the development tools and how to install them, please refer to the following links:

- http://developer.android.com/sdk/index.html
- http://developer.android.com/sdk/installing.html

Once the tools are installed, we recommend that you follow through a few of the example tutorials provided below as well as read through some of the below web pages for more information about Android development before moving forward to your

Open Accessory project:

- http://developer.android.com/guide/index.html
- http://developer.android.com/guide/topics/fundamentals.html
- http://developer.android.com/resources/tutorials/hello-world.html

6.1.3 Updating the Android OS

Description

This section describes how to update the Android device to the versions required for use with the Open Accessory framework.

6.1.3.1 Nexus S

This section covers how to update the Nexus S to Android OS version 2.3.4.

Description

1. Look at the phones current version number by going to “Settings->About Phone->Android Version”. If the version number is 2.3, go to step 2. If the version number is 2.3.1, go to step 4, if the version number is 2.3.2, go to step 6, if the version number is 2.3.3, go to step 8, if the version number is 2.3.4, then skip all of these instructions and just go to the firmware/APK file installation instructions.
2. Download the following file to your computer: http://android.clients.google.com/packages/ota/google_crespo/a71a2082d553.signed-soju-GRH78-from-GRH55.a71a2082.zip
3. Rename the file update_v2_3_1.zip
4. Download the following file to your computer: http://android.clients.google.com/packages/ota/google_crespo/353e267378cd.signed-soju-GRH78C-from-GRH78.353e2673.zip
5. Rename the file update_v2_3_2.zip
6. Download the following file to your computer: http://android.clients.google.com/packages/ota/google_crespo/98f3836cef9e.signed-soju-GRI40-from-GRH78C.98f3836c.zip
7. Rename the file update_v2_3_3.zip
8. Download the following file to your computer: http://android.clients.google.com/packages/ota/google_crespo/a14a2dd09749.signed-soju-GRJ22-from-GRI40.a14a2dd0.zip
9. Rename the file update_v2_3_4.zip
10. Now connect the Nexus S phone to your computer. Enable the USB Mass Storage drive support on your phone (if it doesn’t pop-up with the request, then slide down the notification bar from the top to enable it).
11. Copy all of the .zip files to the root directory of the drive created by the phone.
12. Make sure that the phone as at least ¼ of a charge left. Disconnect the phone from the computer.
13. Turn the phone off by holding the power button and selecting the Power-off option.
14. Hold down the up volume button on the phone.
15. While still holding the volume up button, press and hold the power button. The phone should boot into a boot loader menu. You may now let go of the buttons.
16. Use the volume down button to go to the “Recovery” option of the boot loader. Press the power button. This will make it appear as if the phone is rebooting. It will stop at a screen that has a triangle with a “!” mark inside of it.

17. Press and hold the power button. While still holding the power button, press the up volume button.
18. You will now see a system recovery menu. From this menu use the volume down button to select “apply update from /sdcard”. Press the power button to select this option.
19. Use the volume down button to navigate to the lowest version number of files that you loaded onto the phone (so if you are running v2.3.1, you will need to point to the update_v2_3_2.zip file, etc). Press the power button to install that file.
20. Repeat steps 18-19 until you have applied all of the updates for all of the versions successfully.
21. Once compete, select the reboot system option from the menu. Verify that the phone version is now v2.3.4.

6.1.4 Updating the SDK

Description

This section discusses how to update to the correct API version to call the Open Accessory framework API.

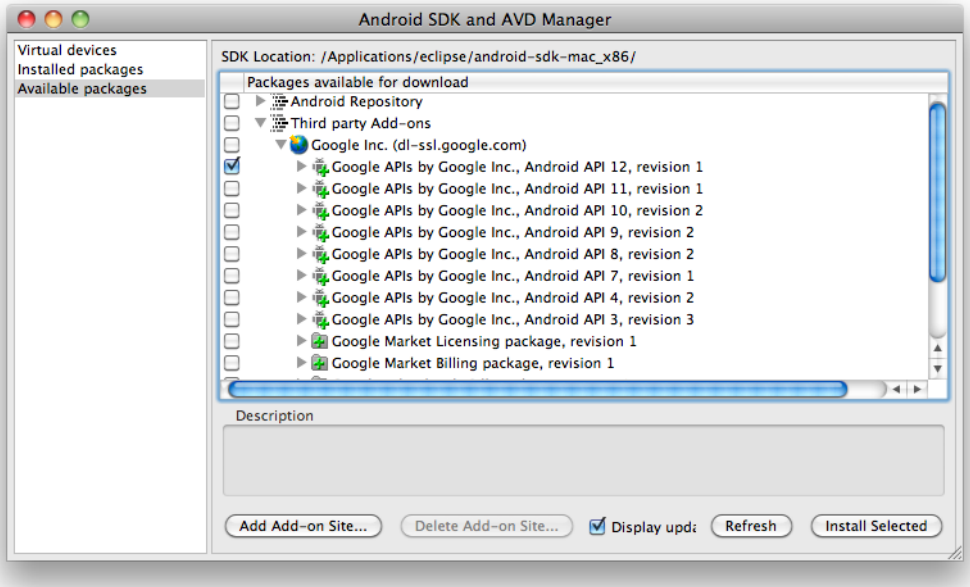
6.1.4.1 Eclipse IDE

The Open Accessory API is available in API level 12. There are two different ways to get API level 12 based on which OS version you are developing for.

6.1.4.1.1 Version v2.3.x

To enable development for the Gingerbread OS line, versions v2.3.4 and later, you will need to get the API level 12 add-on for the Eclipse IDE.

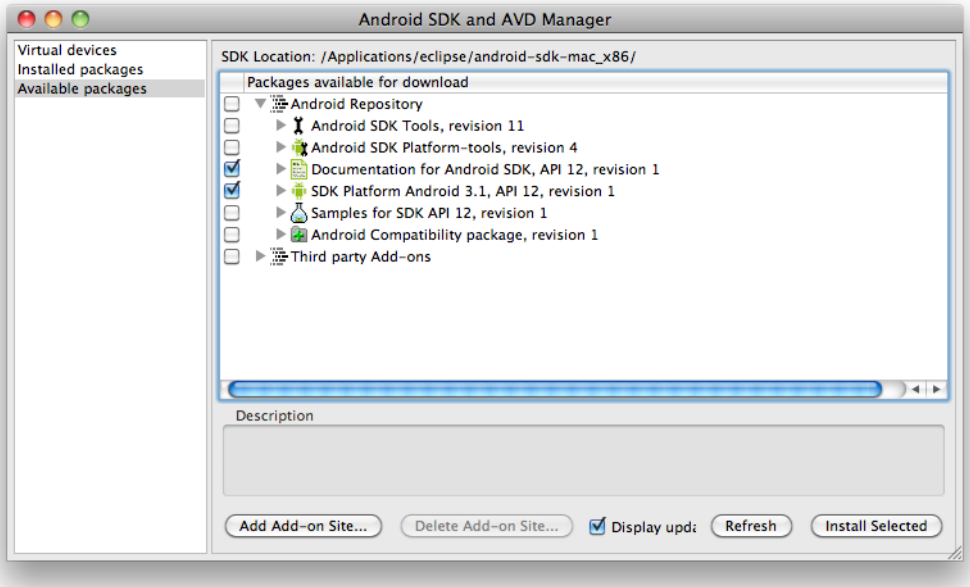
1. Launch the "Android SDK and AVD Manager" either through the Eclipse IDE or through the command line.
2. In the manager window's leftmost panel, select "Available Packages".
3. Expand the "Third Party Add-ons" option
4. Expand the "Google Inc. (dl-ssl.google.com)" option
5. Check the box next to the "Google APIs by Google Inc., Android API 12" option. You may also select other software packages or APIs that you wish to download.
6. Click the "Install Selected" button.



6.1.4.1.2 Version v3.x

To enable development for the Honeycomb OS line, versions v3.x and later, you will need to get the API level 12 add-on for the Eclipse IDE.

1. Launch the "Android SDK and AVD Manager" either through the Eclipse IDE or through the command line.
2. In the manager window's leftmost panel, select "Available Packages".
3. Expand the "Android Repository" option
4. Check the box next to the "SDK Platform Android 3.1, API 12" option and the "Documentation for Android SDK, API 12" options. You may also select other software packages or APIs that you wish to download.
5. Click the "Install Selected" button.



6.2 Basic Accessory Demo

This is the basic accessory demo that shows simple bi-directional communication from the Android device to the attached accessory.

6.2.1 Getting the Android Application

There are several methods for getting the example Android application running on the target Android device. Before attempting any of these methods, please insure that the Android device is running the appropriate version of the Android OS (Updating the Android OS (see page 34)).

Once the proper OS version is installed, please use one of the following methods to get the application into the Android device.

6.2.1.1 From source

The source code for the example Android application is included in this installation. You should be able to compile and use the IDE of your choice to directly load the example application as you would any other Android example program. Once the application is loaded on the Android device you can remove the USB connection to the IDE and connect it to target accessory to run the demo.

6.2.1.2 From Android Marketplace

The example application can be downloaded from the Android Marketplace. You should be able to find the demo application by searching for "Microchip" and looking for the "Basic Accessory Demo" application.

You can also download the file by:

1) Go the the following link in the browser:

https://market.android.com/details?id=com.microchip.android.BasicAccessoryDemo&feature=search_result

2) Click on the below link from an Android device capable of running the demo:

market://details?id=com.microchip.android.BasicAccessoryDemo

3) Use a bar code scanner to scan the following QR code:

6.2.2 Preparing the Hardware

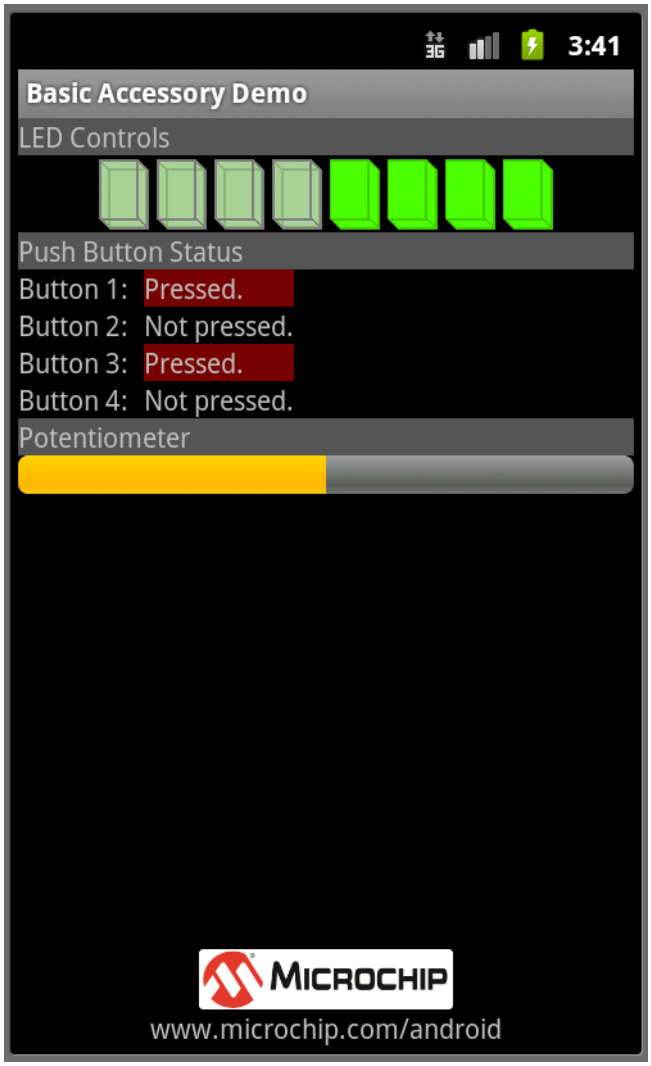
Before attempting to run the demo application, insure that the correct firmware for the demo application has been loaded into the target firmware.

The firmware for this example can be found in the "Basic Accessory Demo/Firmware" folder of this distribution. Open the correct project file for your hardware platform for MPLAB 8. If you are using MPLAB X, open the MPLAB.X project folder and change the configuration in the configuration drop down box. Compile and program the firmware into the device.

6.2.3 Running the demo

1. Attach the Accessory Development Starter Board to the Android device using the connector provided by the Android device's manufacturer. Please make sure that the accessory is attached to the Android device before launching the application.

2. Once the demonstration application has been loaded, go to the Application folder on the Android device. Open the "Basic Accessory Demo" application.



When the application launches, there are three general sections to the application:

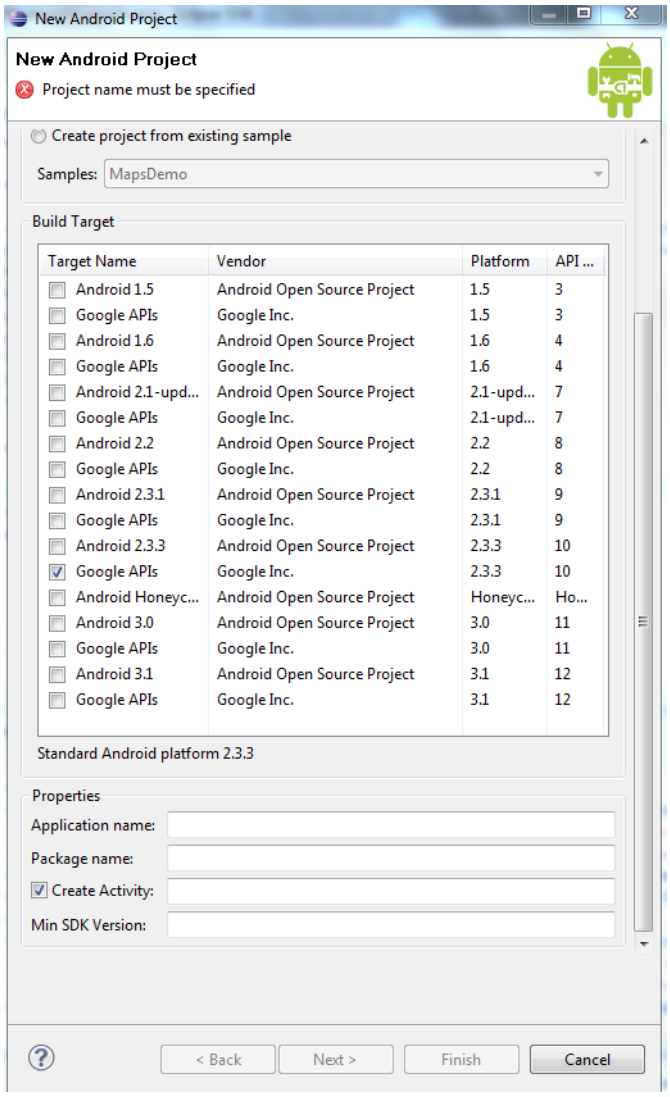
- LED Controls – Pressing any of the 8 buttons on the Android screen sends a command from the Android device to the accessory, indicating that the LED status has changed and provides the new LED settings. The image on the screen toggles to show the state of the LEDs.
- Push Button Status – This section indicates the status of the push buttons on the accessory board. When a button is pressed, the text will change to Pressed.
- Potentiometer – This indicates the percentage of the potentiometer on the accessory board.

7 Creating an Android Accessory Application using the Open Accessory Framework

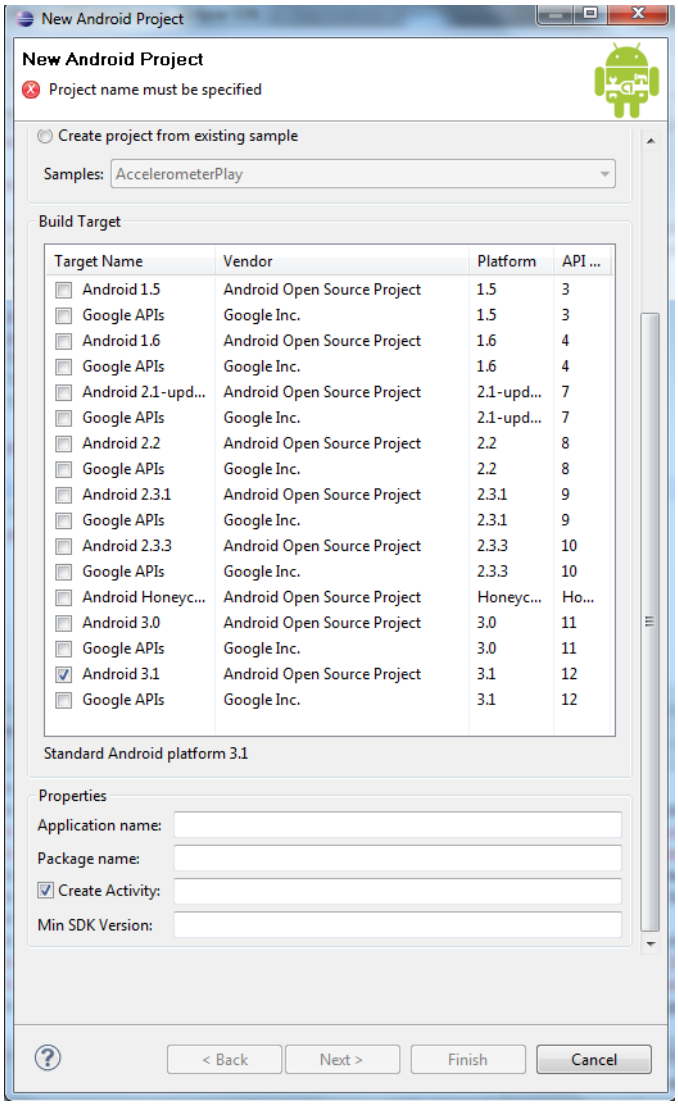
7.1 Creating the Project

When creating a new Android application that is going to be using the Open Accessory framework, it is important to select the correct API settings in order to be able to build the project successfully. Please make sure that your SDK is up to date and has the correct components by following the instructions in the Updating the SDK (see page 35). Also insure that the device that you will working with as the correct OS version that enables these features (Updating the Android OS (see page 34) section).

When creating the Android Application project that will use the Open Accessory Framework, you need to make sure select the correct Target OS version. For Gingerbread devices (v2.3.4 or later) you need to select API level 10 with the additional Google APIs (seen below).



For Honeycomb devices (v3.1 or later), select any of the API 12 versions (seen below):



This is the only special requirement for developing an application for Android accessories.

7.2 Accessing the Accessory From the Application

There are several steps that are required in order to gain access to the accessory from the application. These topics are covered in detail at the following link: http://developer.android.com/guide/topics/usb/index.html. This site covers all of the steps required to access the device in either of the modes. Please also refer to the demo applications provided in this distribution.

8 FAQs, Tips, and Troubleshooting

8.1 My PIC32 project gets a run time exception. What could be wrong?

There are several issues that could be causing the runtime exceptions in a PIC32 project. Here are some things to check that might help you find the source of the issue.

1. Check to make sure that you have a heap size defined. The USB host stack uses dynamic memory allocation, thus needs a heap size defined. To add a heap to the project, go to the linker settings. This can be found in the "Project->Build Options->Project->MPLAB PIC32 Linker" menu in MPLAB 8. This can be found in the "File->Project Properties->(current build configuration)->C32->pic32-ld" in MPLAB X.

2. If a heap size is defined you can use the general exception vector to trap the error and determine what address caused the exception. This can be done using something similar to the following code:

```
#if defined(__C32__)
    void _general_exception_handler(unsigned cause, unsigned status)
    {
        unsigned long address = _CP0_GET_EPC();

        DEBUG_ERROR("exception");
        while(1){}
    }
#endif
```

This will catch the exception and lock the code in a while(1). From this point you can halt the code and look at the address variable to see what address caused the exception. Use the disassembly listing to determine the corresponding line of C code.

8.2 How do I debug without access to ADB?

Though the USB is connected to the accessory now instead of the IDE for debugging, you can still access the ADB interface through a network. Please see http://developer.android.com/guide/topics/usb/index.html for more information about how to set this up.

You might also consider using a USB analyzer to determine what is actually happening on the USB bus. Please refer to the Debugging the USB connection section for more details.

8.3 What if I need design assistance creating my accessory?

If you have questions about the library, our parts, or any of our reference codes/boards, please feel free to contact Microchip for support (What if I need more support than what is here? (see page 45)).

If you need someone to assist you in creating a portion of your design, Microchip has design partners that can assist in the portion of your design that you need help with. You can find a list of design partners at the following address: http://microchip.newanglemedia.com/partner_matrix. At the moment there isn't an option to filter for Android specialists. The best option to filter by right now is USB.

8.4 The firmware stops working when I hit a breakpoint.

The USB protocol has periodic packets sent out that keep the attached device active. Without this packet, the bus goes into an idle state. Normally when a breakpoint is hit in the code both the CPU and all peripherals halt at that instruction. This causes the USB module to stop running resulting in the attached peripheral to go into the idle state. The firmware still thinks that the peripheral is active. This results in a break in communication.

There is a way to tell the microcontroller to leave the peripheral enabled when a breakpoint is hit. This will allow the USB module to continue to run and sent out the Start-of-Frame(SOF) packets required to keep the bus alive. This is done via the following methods:

MPLAB 8

Under the debugger->settings menu option, select the "Freeze on Halt" tab. Uncheck the "USB" or "U1CNFG" setting in the list. If neither of these items are in the list of peripherals, uncheck the "All other peripherals" option at the bottom of the list.

MPLAB X

Go under "File->Project Properties". In the project configuration window, select the project configuration that you are using. Under that configuration, select the debugger that is in use. In the resulting debugger menu, select the "Freeze Peripherals" option in the drop down box. Uncheck the "USB" or "U1CNFG" options if you see them. If you don't see these options, uncheck the "All other peripherals" option.

8.5 If I hit the "Home" or "Back" buttons while the accessory is attached, the demo no longer works.

If you hit the "Home" or "Back" buttons while the accessory is attached and the demo no longer runs, the code likely tried to close the FileInputStream to release control of the accessory. v2.3.4 and v3.1 of the Android OS have an issue where closing the ParcelFileDescriptor or FileInputStream will not cause an IOException in a read() call on the FileInputStream. This results in the ParcelFileDescriptor being locked until either the accessory detaches or until the read function returns for

some other reason. Please see the Requirements, Limitations, and Potential Issues (see page 11) section for other known issues or limitations.

8.6 Why don't all of the features of the demo work?

The demo application on the Android device was written with the assumption that there were 8 LEDs, 4 push buttons, and a potentiometer available on the accessory. Not all of these features are available on the supported hardware platforms. Where these features are not available, these functions do not work.

The Explorer 16 board is an even more complex situation. Even though the base board does include these features, some processor modules don't have all of these features routed to the processor. Also on some processor modules the features are routed to the same pin as other features so both can't be used easily in the same demo.

8.7 What if I need more support than what is here?

There are several options that you can use to get various kinds of help.

- You can try our forums at forum.microchip.com. The answers provided here will be by fellow developers and typically not from Microchip employees. The forum often provides a way to get answers very quickly to questions that might take longer for other support routes to answer.
- You can contact your local sales office for support. You can find the local office from www.microchip.com/sales. The local sales team should be able to direct you to a local support team that can help address some issues.
- You can submit support requests to our support system at support.microchip.com or search through the existing hot topics.
- You can also contact androidsupport@microchip.com for support.

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