White Paper

WP_001

Connecting Peripherals to an Android Platform

Version 1.0

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This white paper will describe some of the options for connecting peripheral accessories to Android OS based tablets/phones. The main focus will be the use of the Android Open Accessory Initiative.

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1 Introduction

This white paper will describe some of the options for connecting peripheral accessories to Android OS based tablets/phones. The main focus will be the use of the Android Open Accessory Initiative.

1.1 What is Android?

Android is a Linux based operating system that is becoming very popular in mobile devices such as phones and tablets. The processor in current generation Android platforms is typically ARM based with the OS being optimised to support the hardware on the platform. This means the minimum required drivers to support the platform hardware are included in the OS which is often locked by the device supplier to prevent users customising their OS. The OS is regularly updated with many new features being added with each release. Figure 1 shows the historical progression of Android releases.

2008	2009	2009	2009	2009	2010	2010	2011	2011
V1.0	V1.1	V1.5	V1.6	V2.0	V2.2	V2.3.x	V3.x	V4.x
		Cupcake	Donut	Eclair	Froyo	Ginger Bread	Honey-comb	Ice Cream Sandwich

Figure 1.1 Android OS releases

1.2 Connecting peripherals

With mobile phones the concept of connecting peripheral accessories was rarely considered, but with tablets this is less likely to be the case. In "conventional" hardware such as laptops and desktops, there will be a wide variety of connectors and driver support for connecting peripherals such a mice, printers etc. With the mobile tablet where size, weight and power consumption are critical concerns there are less likely to be all these connectors available.

Many Android platforms are now supplied with On The Go (OTG) USB ports, allowing for the USB port to be either a host or a device. Some of these OTG ports will be USB device only i.e. they can only connect to a USB host as a USB device.

Some of the newer generation devices will be full OTG offering host and device capabilities. However the potential issue with the host port is that a particular peripheral may require a special driver to be loaded which may mean the owner of the platform has to ROOT their device to get the permissions to allow access for installing new drivers.

Rooting a device may invalidate a manufacturer's warranty and is not really a task that a typical consumer could/should be expected to perform.

Fortunately from version 3.1 (Honeycomb) onwards Android have provided a new and novel solution to the problem, called Android Open Accessory Mode.Features

2 Android Open Accessory Mode

2.1 What is Android Open Accessory Mode?

Android Open Accessory Mode allows for connecting peripherals to an Android platform where the Android is the USB device and the peripheral (accessory) is the USB host. This is the complete reverse of conventional interconnect.

This game changing approach to attaching peripherals allows for 3 key advantages:

- No need to develop special drivers for the hardware.
- No need to root devices to alter permissions for loading drivers.
- The power to use the port is provided by the peripheral ensuring the mobile device battery is not drained faster by the external hardware being attached.

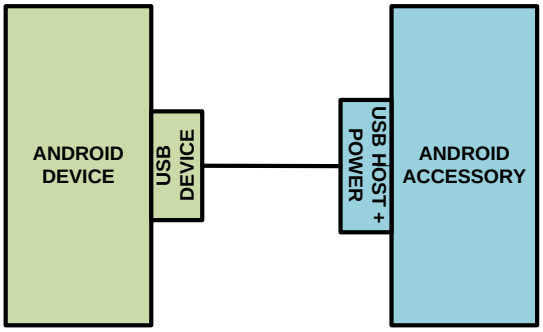

Figure 2.1 Android Open Accessory Mode Connection

2.2 How a peripheral attaches to an Android in Open Accessory Mode

To connect to an Android platform in Open Accessory Mode the platform must first support the mode.

This is true of OS version 3.1 onwards, but may also be available on OS versions as far back as 2.3.4 if the OEM has back ported the feature to this OS version.

When an Open Accessory device is connected to the Android it must send a vendor request to the Android to enquire if the device supports Open Accessory Mode. This is the Get_Protocol command.

If the reply is no then the communication stops there. However, if the reply is yes then the peripheral sends its own unique descriptor strings to identify itself. There is then another USB vendor request to enable the Open Accessory Mode and re-enumerate the Android device in this configuration.

When enumerated as an Open Accessory Mode device there will be one USB BULK IN endpoint and one USB BULK OUT endpoint as well as the control endpoint.

This interface will be full speed (12Mbit/s) USB allowing for data transfer in and out.

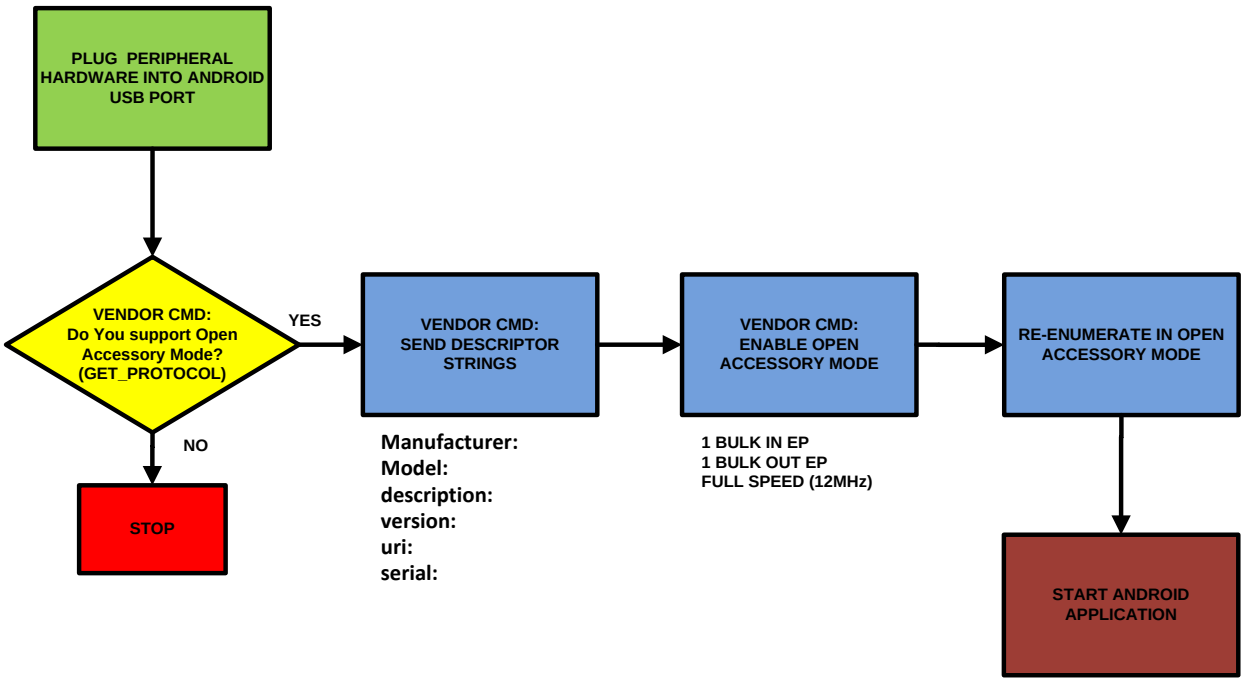

Figure 2.2 Android Open Accessory Mode Enabling

3 Software Applications

3.1 Connecting the software application to the hardware

Typically an application will connect to hardware via drivers. However Android Open Accessory Mode does not require users to install extra drivers.

Each Open Accessory Mode USB host has a set of string descriptors that the Android OS is capable of reading. These strings will match an application on the Android OS. The application then uses these strings to auto start the application when the hardware is connected.

The strings that must be sent are:

Manufacturer: Used to declare the peripheral manufacturer.

Model: Used to declare the hardware model.

Version: Used to provide a version number for the peripheral.

Additional identifier strings may also be sent:

description: Used to provide a descriptive name for the peripheral

uri: Used to provide a URL for obtaining more information from the internet. If no installed application matches the strings supplied, the OS will display a message box with a link to the web site specified in the URI string (if supplied).

serial: Used to provide a serial number for the peripheral

3.2 Data consuming applications

The Android OS is a full OS with ever increasing processing capabilities. Making full use of this power can be realised by adding peripherals to the basic Android device such as temperature sensors, pressure sensors and CANBus engine management controllers that will provide raw data to be processed on the Android platform itself.

3.3 Data producing applications

The flip side to receiving lots of data for offline processing is to be a data producer controlling hardware. A typical example may be to send data to a printer to obtain hard copies of data or to make use of the GPS capabilities of the Android platform to then control a robot and move it into position.

4 Summary

Android powered devices are so much more than just mobile phones. Unleashing the full potential is about adding peripherals (accessories) to the basic mobile device. By making use of the Open Accessory Mode, the development is simplified (no drivers) and the battery life is not compromised either as the peripheral must provide the power. There are already a few manufacturers waking up to this possibility, including FTDI, who want to make connectivity to the mobile platforms a reality and Open Accessory Mode may just be the future, delivered now.

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Appendix A – References

Document References

Replace this text. List FTDI and external datasheets, application notes, website links and other documents. Notice the hyperlink in the example.

AN_146 USB Hardware Design Guides for FTDI ICs

Acronyms and Abbreviations

Terms	Description
USB	Universal Serial Bus
USB-IF	USB Implementers Forum

Appendix B – List of Tables & Figures

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Appendix C – Revision History

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