This document describes the installation and use of the FTDI D2XX driver for FTxxxx devices in an Android environment.
Table of Contents

1 Introduction ........................................................................................................... 2
  1.1 Android Support ............................................................................................ 2
  1.2 Prerequisites .................................................................................................. 2

2 Using the FTDI Native Linux D2XX Library in Android .......................... 4
  2.1 Introduction and Usage ................................................................................... 4
  2.2 Limitations and Restrictions ......................................................................... 6
    2.2.1 Non-Default VID and PID Combinations .............................................. 6
    2.2.2 USB Device Permissions ......................................................................... 6

3 Using the New FTDI Android D2XX Library ............................................. 8
  3.1 Introduction and Usage ................................................................................... 8
  3.2 Limitations and Restrictions ........................................................................ 11
    3.2.1 Non-Default VID and PID Combinations ........................................... 11
    3.2.2 Currently Available D2XX Functions .................................................... 11

4 Contact Information ............................................................................................ 13

Appendix A - References ..................................................................................... 14
  Document References ......................................................................................... 14
  Acronyms and Abbreviations .............................................................................. 14

Appendix B – List of Tables & Figures ............................................................... 15
  List of Tables ........................................................................................................ 15
  List of Figures ....................................................................................................... 15

Appendix C – Revision History ............................................................................ 16
1 Introduction

FTDI provides the proprietary D2XX interface for easily communicating with its FTxxxx devices. The D2XX API is common across several operating systems supported by FTDI, namely Windows, Windows CE, Linux and Mac OS X.

1.1 Android Support

To support the popular Google Android OS, FTDI has prepared two D2XX solutions for different application scenarios.

1. A Java class which uses the JNI (Java Native Interface) to access the API of a pre-compiled Linux D2XX library. This solution is applicable to all versions of Android platforms, but requires special root privilege on USB related device nodes. This interface is useful when you want to reuse existing design for Linux in Android applications or create one of the kind projects for Android OS before version 3.1.

2. A Java class built on top of the emerging USB Host support available since Android version 3.1. This set of library is applicable to Android v3.1 or latter system, and requires no special root access privilege as previous solution do. As this requires no special root access privileges, FTDI recommends it for all applications on newer platforms.

FTDI provides these solutions in two separate packages, both contains library files and an easy to use sample Eclipse project. The library file for each solution is different by its nature. For the first package, the library provided a compiled native library (libftd2xx-jni.so), a D2XX Java class file (D2xx.java) as an interface for Android application; the source to the JNI portion of the native library is also available and is statically linked with the native libftd2xx.a library to produce the Java compatible libftd2xx-jni.so file. For the 2nd, there is still a native library called libj2xx-utils.so, which is used by j2xx.jar, to provide the easy to integrate D2XX API for end-user.

Both package and associated files are archived into one file and can be downloaded from the D2XX Drivers page on the FTDI website here - http://www.ftdichip.com/Drivers/D2XX.htm. After extracting the archive file the folder TN_147 contains a subdirectory called javad2xxdemo which contains files for solution #1. Folder AN_357 contains another subdirectory called javad2xxdemo which contains files for solution #2.

1.2 Prerequisites

In order to install the FTDI D2XX driver and test it successfully, the following are required:

- For the first solution, a hardware platform including a USB host device supported by the Android/Linux kernel.
  - FTDI testing was conducted using a BeagleBoard-xM Rev C.
- For the second solution, an Android device/BSP supporting Android USB Host API is also required,
  - FTDI suggests using a BSP corresponding to AOSP 4.0 or latter
  - If such a BSP is not available, any contemporary Android devices running v3.1 or latter OS, with USB Host or OTG interface will do. FTDI testing was conducted using a Google Nexus 7.
- An FTDI based device for testing with
  - FTDI testing was conducted with an FT232R based US232R cable.
In addition, to develop an application using the FTDI D2XX driver for Android, a development machine must have the Eclipse IDE and up-to-date Android SDK, including the ADB program and Android ADT Plugin installed. The installation and configuration of these tools is not within the scope of this document and is outlined on the Android developer web site (http://developer.android.com/sdk/index.html).

The Android device should also have USB Debugging enabled to allow access using the ADB utility. To accomplish this, navigate to Settings > Applications > Development and check the USB debugging option.

A summary of the required configuration is provided in the diagram below.

![Diagram](http://via.placeholder.com/150)

**Figure 1 - Android Development Configuration**
2 Using the FTDI Native Linux D2XX Library in Android

2.1 Introduction and Usage

To accompany the native D2XX library, FTDI have provided a Java class and a JNI wrapper which can be easily included in an application. The class provides access to all of the classic D2XX functions including EEPROM functions. The D2xx Java class can readily be included in an Android application project in Eclipse.

The D2xx class (not to be confused with the D2XX native API) provides some static methods that allow access to driver-wide information such as the VID and PID combinations to match with and the device information list.

All other methods require a D2xx object to be created and subsequently opened using one of the four open methods (openByIndex, openBySerialNumber, openByDescription or openByLocation). Executing an open method (if successful) will cause the instance of the D2xx class to internally maintain a native handle value; this is used for all subsequent communication with the device. When the device is no longer required, the native handle can be closed with the close method.

Since the JNI calls ultimately call native D2XX functions, exception generation is included in the JNI layer. An exception of type D2xxException (extended from IOException) is thrown in the case of a native D2XX call returning an FT_STATUS code other than FT_OK. The exception also generates a message indicating the native status code and the native function that the exception occurred in.

The D2xx class is fully documented using the Javadoc standard. For information on the D2xx class methods, constants and sub-classes, please consult the Javadoc entry for the item of interest.

A sample application demonstrating how to use various methods in the D2xx class is also provided to assist custom application development. The sample application is shown below:
Figure 2 - D2XX Demo Application running on an Android phone

Figure 3 - D2XX Demo Application running on an Android tablet
Tapping the Information item in the sample application will display the number of devices available and the chip type of the first device in the device list.

Tapping the Loopback item and writes some text on the “Send Message” edit box, then tap “Send” button, will write the message to the device; if some text is toasted back, then it will show up in the “Receive Message” area. In the above screen shot, a loopback connector was fitted so the data received will be the same as the data sent.

At the time of writing, the Android D2XX driver is available as a beta release. Customers are encouraged to provide feedback on the release to FTDI support.

2.2 Limitations and Restrictions

2.2.1 Non-Default VID and PID Combinations

At the time of writing, the Android D2XX driver will support all default FTDI VID and PID combinations and can also support a single custom VID and PID combination via the setVIDPID Java method (FT_SetVIDPID function).

However, it is currently not possible to match several non-default VID and PID combinations simultaneously. This is due to the Android OS hanging on a call to dlopen which precludes the use of an external libtable library at this time.

2.2.2 USB Device Permissions

Many Android systems with USB host capability enumerate devices with application incompatible permissions (0660). These permissions are specified in the udevd.rc file as follows:

```
/dev/bus/usb/* 0660 root usb
```
In order to modify the default permissions for USB devices in the ueventd.rc file a user must have root access. This may render the D2XX library unusable on devices that have default permissions of 0660 and do not allow root access.

To make the device accessible, the ueventd.rc entry listed above should be changed to make the device world readable and world writeable as follows:

```
/dev/bus/usb/* 0666 root usb
```

**NOTE:** FTDI does not accept any responsibility for customers who choose to enable root access on their Android platform and subsequently damage the unit or void the warranty. Enabling root access on such devices is entirely at the user’s own risk.
3 Using the New FTDI Android D2XX Library

3.1 Introduction and Usage

To support versatile tablet usage scenario, Google has added USB Host API to Android since version 3.1. Before this very version, an Android application cannot access USB devices attached to system naturally without root access right. The Android USB Host API breaks through the limitation, now we can utilize USB gadgets attached to Android Host or OTG port without further ado.

But communicating via raw USB data to gadgets is not easy for developer. FTDI have provided a Java class library which can be easily adapted in applications, developer can focus on desired I/O read and write, without caring complex USB device setup. The goal of class library design is to provide access to all of the classic D2XX functions including EEPROM functions, but at the time of writing this document, the D2XX library is still in alpha phase, thus offer limited functionality. Available API is listed in the limitation section.

The D2xx Java library can be readily included in an Android application project in Eclipse. The D2xx class (not to be confused with the previous D2XX interface to native API) provides some static methods that allow access to driver-wide information such as the VID and PID combinations to match with and the device information list.

All other methods require a D2xx object to be created and subsequently opened using one of the four open methods (openByIndex, openBySerialNumber, openByDescription or openByLocation). Executing an open method, if successful, will cause the instance of the D2xx class to internally maintain a native handle value; this is used for all subsequent communication with the device. When the device is no longer required, the native handle can be closed with the close method.

The D2xx class is fully documented using the Javadoc standard. For information on the D2xx class methods, constants and sub-classes, please consult the Javadoc entry for the item of interest.

A sample application demonstrating how to use various methods in the D2xx class is also provided to assist custom application development. The sample application is shown below:
Figure 5 - D2XX Demo Application using the new API running on an Android tablet

Figure 6 - D2XX Demo Application using the new API to get device information
Tapping the Information item in the sample application will display the number of devices available and the chip type of the first device in the device list.

Tapping the Loopback item and writing some text on the "Send Message" edit box, then tap "Send" button, will write the message to the device; if some text is toasted back, then it will show up in the "Receive Message" area. In the above screen shot, a loopback connector was fitted so the data received will be the same as the data sent.
3.2 Limitations and Restrictions

3.2.1 Non-Default VID and PID Combinations

At the time of writing, the Android D2XX driver will support all default FTDI VID and PID combinations and can also support a single custom VID and PID combination via the setVIDPID Java method (FT_SetVIDPID function).

However, it is currently not possible to match several non-default VID and PID combinations simultaneously. This is due to the Android OS hanging on a call to dlopen which precludes the use of an external libtable library at this time.

3.2.2 Currently Available D2XX Functions

As this solution is still in alpha phase, only part of classical D2XX API is supported, here is a table of useable API in this release:

<table>
<thead>
<tr>
<th>API</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>setVIDPID</td>
<td>Set a specific combination of VID/PID pair to use</td>
</tr>
<tr>
<td>createDeviceInfoList</td>
<td>This method builds an internal device information list and returns the number of D2XX devices connected to the system.</td>
</tr>
<tr>
<td>getDeviceInfoList</td>
<td>This method returns the device list created with a prior call to createDeviceInfoList</td>
</tr>
<tr>
<td>getDeviceInfoListDetail</td>
<td>This method returns information for a single device from the internal device list.</td>
</tr>
<tr>
<td>openByIndex</td>
<td>This method opens the device at the specified index for use.</td>
</tr>
<tr>
<td>openBySerialNumber</td>
<td>This method opens the device with the specified serial number for use.</td>
</tr>
<tr>
<td>openByDescription</td>
<td>This method opens the device with the specified description for use.</td>
</tr>
<tr>
<td>openByLocation</td>
<td>This method opens the device at the specified location for use.</td>
</tr>
<tr>
<td>isOpen</td>
<td>Returns the open status of the device.</td>
</tr>
<tr>
<td>close</td>
<td>This method closes an opened device.</td>
</tr>
<tr>
<td>read</td>
<td>This method reads data from the device in to the Java application buffer.</td>
</tr>
<tr>
<td>write</td>
<td>This method writes data to the device from the Java application buffer.</td>
</tr>
<tr>
<td>setBaudRate</td>
<td>This method sends a vendor command to the device to change the baud rate generator value.</td>
</tr>
<tr>
<td>setDataCharacteristics</td>
<td>This method dictates the data format that the device will use.</td>
</tr>
<tr>
<td>setFlowControl</td>
<td>This method specifies the flow control method that the device should use.</td>
</tr>
<tr>
<td>Method</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>setDtr</td>
<td>This method allows the DTR modem control line to be manually asserted.</td>
</tr>
<tr>
<td>clrDtr</td>
<td>This method allows the DTR modem control line to be manually de-asserted.</td>
</tr>
<tr>
<td>setRts</td>
<td>This method allows the RTS modem control line to be manually asserted.</td>
</tr>
<tr>
<td>clrRts</td>
<td>This method allows the RTS modem control line to be manually de-asserted.</td>
</tr>
<tr>
<td>getQueueStatus</td>
<td>This method retrieves the number of bytes available to read from the native driver Rx buffer.</td>
</tr>
<tr>
<td>purge</td>
<td>Discards any data from the specified driver buffer and also flushes data from the device.</td>
</tr>
<tr>
<td>resetDevice</td>
<td>This method sends vendor commands to the device to cause a reset and flush any data from the device buffers.</td>
</tr>
<tr>
<td>getDeviceInfo</td>
<td>This method retrieves information on the device that is currently open.</td>
</tr>
<tr>
<td>setLatencyTimer</td>
<td>This method allows the latency timer value for the device to be specified.</td>
</tr>
<tr>
<td>getLatencyTimer</td>
<td>This method retrieves the latency timer value from the specified device.</td>
</tr>
<tr>
<td>setBitMode</td>
<td>This method allows the device to use alternative interface modes such as bit-bang, MPSSE and CPU target mode.</td>
</tr>
</tbody>
</table>

**Table 1 – API & Description**
4 Contact Information

Head Office – Glasgow, UK
Future Technology Devices International Limited
Unit 1, 2 Seaward Place, Centurion Business Park
Glasgow G41 1HH
United Kingdom
Tel: +44 (0) 141 429 2777
Fax: +44 (0) 141 429 2758
E-mail (Sales) sales1@ftdichip.com
E-mail (Support) support1@ftdichip.com
E-mail (General Enquiries) admin1@ftdichip.com

Branch Office – Tigard, Oregon, USA
Future Technology Devices International Limited (USA)
7130 SW Fir Loop
Tigard, OR 97223-8160
USA
Tel: +1 (503) 547 0988
Fax: +1 (503) 547 0987
E-mail (Sales) us.sales@ftdichip.com
E-mail (Support) us.support@ftdichip.com
E-mail (General Enquiries) us.admin@ftdichip.com

Branch Office – Taipei, Taiwan
Future Technology Devices International Limited (Taiwan)
2F, No. 516, Sec. 1, NeiHu Road
Taipei 114
Taiwan, R.O.C.
Tel: +886 (0) 2 8791 3570
Fax: +886 (0) 2 8791 3576
E-mail (Sales) tw.sales1@ftdichip.com
E-mail (Support) tw.support1@ftdichip.com
E-mail (General Enquiries) tw.admin1@ftdichip.com

Branch Office – Shanghai, China
Future Technology Devices International Limited (China)
Room 1103, No. 666 West Huaihai Road,
Shanghai, 200052
China
Tel: +86 21 62351596
Fax: +86 21 62351595
E-mail (Sales) cn.sales@ftdichip.com
E-mail (Support) cn.support@ftdichip.com
E-mail (General Enquiries) cn.admin@ftdichip.com

Web Site
http://ftdichip.com

Distributor and Sales Representatives
Please visit the Sales Network page of the FTDI Web site for the contact details of our distributor(s) and sales representative(s) in your country.

System and equipment manufacturers and designers are responsible to ensure that their systems, and any Future Technology Devices International Ltd (FTDI) devices incorporated in their systems, meet all applicable safety, regulatory and system-level performance requirements. All application-related information in this document (including application descriptions, suggested FTDI devices and other materials) is provided for reference only. While FTDI has taken care to assure it is accurate, this information is subject to customer confirmation, and FTDI disclaims all liability for system designs and for any applications assistance provided by FTDI. Use of FTDI devices in life support and/or safety applications is entirely at the user’s risk, and the user agrees to defend, indemnify and hold harmless FTDI from any and all damages, claims, suits or expense resulting from such use. This document is subject to change without notice. No freedom to use patents or other intellectual property rights is implied by the publication of this document. Neither the whole nor any part of the information contained in, or the product described in this document, may be adapted or reproduced in any material or electronic form without the prior written consent of the copyright holder. Future Technology Devices International Ltd, Unit 1, 2 Seaward Place, Centurion Business Park, Glasgow G41 1HH, United Kingdom. Scotland Registered Company Number: SC136640
Appendix A - References

Document References

NA

Other References

http://developer.android.com
http://code.google.com/p/rowboat/wiki/JellybeanOnBeagleboard_WithSGX
http://beagleboard.org/hardware-xM

Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Terms</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADT</td>
<td>Android Development Tools</td>
</tr>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>EEPROM</td>
<td>Electrically Erasable Programmable Read-Only Memory</td>
</tr>
<tr>
<td>FTDI</td>
<td>Future Technology Devices Internaional</td>
</tr>
<tr>
<td>JNI</td>
<td>Java Native Interface</td>
</tr>
<tr>
<td>OS</td>
<td>Operating System</td>
</tr>
<tr>
<td>SDK</td>
<td>Software Development Kit</td>
</tr>
<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
</tr>
</tbody>
</table>
Appendix B – List of Tables & Figures

List of Tables

Table 1 – API & Description ........................................................................................................... 12

List of Figures

Figure 1 - Android Development Configuration ............................................................................. 3
Figure 2 - D2XX Demo Application running on an Android phone .................................................. 5
Figure 3 - D2XX Demo Application running on an Android tablet ................................................ 5
Figure 4 - D2XX Loopback test running on a tablet........................................................................ 6
Figure 5 - D2XX Demo Application using the new API running on an Android tablet....................... 9
Figure 6 - D2XX Demo Application using the new API to get device information............................ 9
Figure 7 - D2XX Loopback test using the new API ......................................................................... 10
Appendix C – Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Changes</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Initial Release for beta test</td>
<td>2011-09-29</td>
</tr>
<tr>
<td>1.1</td>
<td>Modifications file path of adb push in section 2</td>
<td>2012-08-16</td>
</tr>
<tr>
<td>1.2</td>
<td>Modifications for new sample application</td>
<td>2012-09-17</td>
</tr>
<tr>
<td>1.3</td>
<td>Corrected the broken link to driver; Updated Contact Info details and Copyright information</td>
<td>2017-06-08</td>
</tr>
</tbody>
</table>