Bluetooth User Guide for Android 4.2/4.3/4.4

Revision History

Date	Version	Description	Author
2013/03/07	0.1	1. Initial revision of Bluetooth	Luke Chen
2013/03/14	0.2	2. Update Bluetooth enable procedure	Luke Chen
2013/03/28	0.3	3. Add kernel configuration to support HID	Luke Chen
2013/12/11	0.4	4. Update Android 4.3/4.4 libbt path	Luke Chen
2014/9/3	0.5	5. Add USB interface module configuration	Luke Chen

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INTRODUCTION

This user guide is intended to give Ampak module users a general guide of how to enable the Bluetooth in Android operating system.

BLUETOOTH SOFTWARE ARCHITECTURE OVERVIEW

Android 4.2 release introduces a new Bluetooth stack optimized for use with Android devices. This new Bluetooth stack developed in collaboration between Google and Broadcom replaces the Bluetooth stack based on BlueZ. We use it to provide Bluetooth profiles on Ampak module and it consists of following components (see also figure 1):

- Bluetooth core stack library
- HCI library
- Vendor Specific HCI library
- UART, RFKILL,TUN/TAP and UHID device drivers

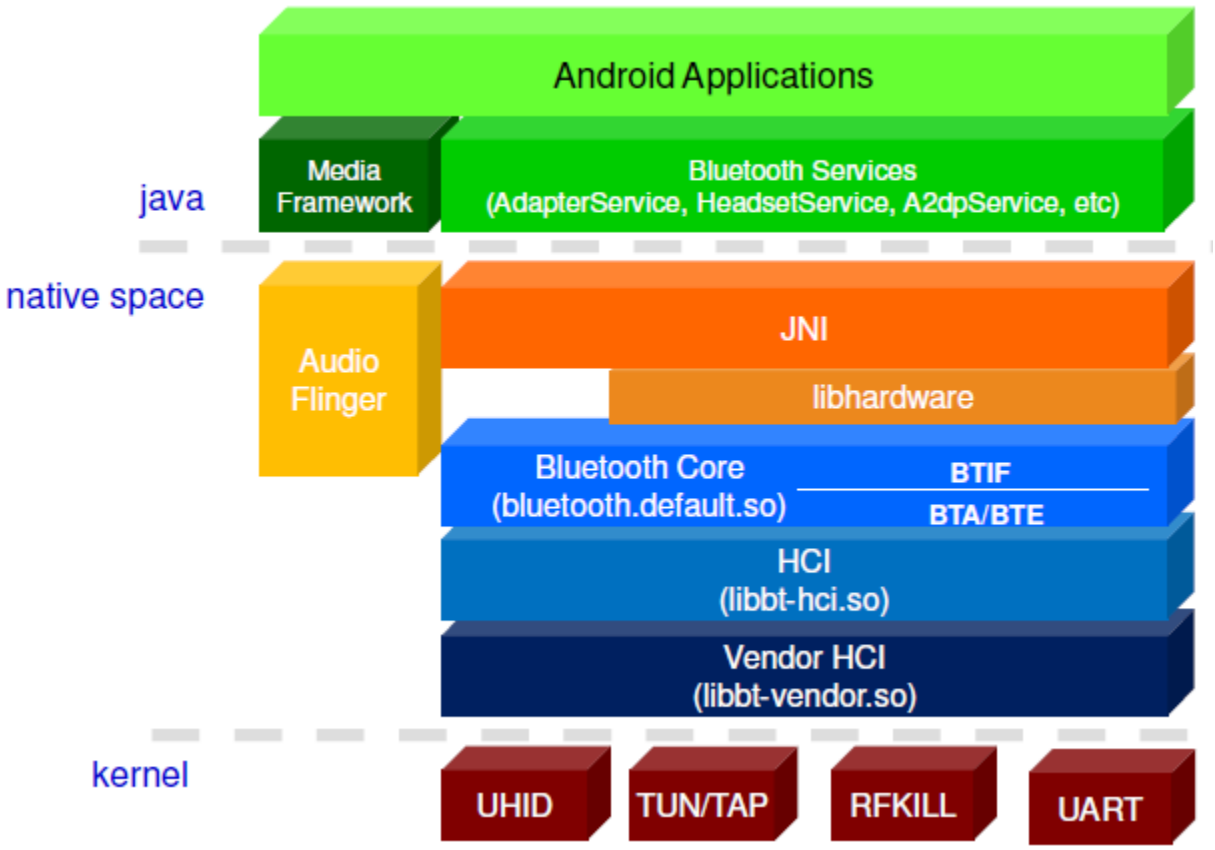

Figure 1: Bluedroid Overview Diagram

BLUETOOTH SOFTWARE PACKAGE

The provided Bluetooth software package contains following files:

- HCD configuration file
- Bluedroid from AOSP
- BTUSB driver for USB interface module

BLUETOOTH INSTALLATION

ENABLE BLUETOOTH FUNCTION OF LINUX KERNEL

Please add following items into your kernel configuration:

CONFIG_BT=y
CONFIG_BT_RFCOMM=y
CONFIG_BT_RFCOMM_TTY=y
CONFIG_BT_BNEP=y
CONFIG_BT_BNEP_MC_FILTER=y
CONFIG_BT_BNEP_PROTO_FILTER=y
CONFIG_BT_HIDP=y
CONFIG_TUN=y
CONFIG_UHID=y

BUILD BTUSB DRIVER

Skip this step if the module interface you are using is UART.

1. **Specify kernel build location to KDIR of Makefile**

```
#KDIR       := /lib/modules/$(shell  uname -r)/build
KDIR       := ~/Projects/linux-3.3/
```

2. **Use cross compiler to build the driver.**

```
# make ARCH=arm CROSS_COMPILE=arm-linux-gnueabi-
```

3. **Insert the module and you should see a USB device enumerated as /dev/btusb0**

ENABLE BLUETOOTH FUNCTION

4. Add the following configuration to BoardConfig.mk

#Bluetooth

BOARD_HAVE_BLUETOOTH : = true

BOARD_HAVE_BLUETOOTH_BCM := true

5. Set baud rate in libbt vendor library <mydroid>/device/common/libbt[1] at build-time.

Skip this step if the module interface you are using is USB

Create a new file named <mydroid>/device/common/libbt/include/vnd_<target>.txt[2]

#Set baudrate to 2M (Please change the baudrate to what your platform can support)

UART_TARGET_BAUD_RATE=2000000

6. Set UART port, firmware folder patch, and firmware name in runtime configuration files.

Create a folder to store the runtime configuration file and it would be copied to /etc/bluetooth/bt_vendor.conf as runtime configuration file. We use AP6210 as an example on this document. Create <mydroid>/device/common/libbt/conf/AP6210[3] which include Android.mk and bt_stack.conf. In this example, we set UART port to /dev/ttyS1, firmware path to /etc/bluetooth, and firmware name to bcm20710a1.hcd. For USB interface module, you should set the port to /dev/btusb0

```
luke@luke-K45VD:/tmp/libbt/conf/AP6210$ ls
Android.mk  bt_vendor.conf
luke@luke-K45VD:/tmp/libbt/conf/AP6210$ cat Android.mk
LOCAL_PATH := $(call my-dir)

include $(CLEAR_VARS)

LOCAL_MODULE := bt_vendor.conf
LOCAL_MODULE_CLASS := ETC
LOCAL_MODULE_PATH := $(TARGET_OUT)/etc/bluetooth

LOCAL_MODULE_TAGS := eng

LOCAL_SRC_FILES := $(LOCAL_MODULE)

include $(BUILD_PREBUILT)

luke@luke-K45VD:/tmp/libbt/conf/AP6210$ cat bt_vendor.conf
# UART device port where Bluetooth controller is attached
UartPort = /dev/ttyS1

# Firmware patch file location
FwPatchFilePath = /etc/bluetooth/

# Firmware Name
FwPatchFileName = bcm20710a1.hcd
```


[1] Libbt path is changed to <mydroid>/hardware/broadcom/libbt on Android 4.3 and 4.4

[2] For Android 4.3 and 4.4, the path is <mydroid>/hardware/broadcom/libbt/include/vnd_<target>.txt

[3] For Android 4.3 and 4.4, the path is <mydroid>/hardware/broadcom/libbt/conf/AP6210.

Add "*include $(LOCAL_PATH)/conf/AP6210/Android.mk"* to <mydroid>/device/common/libbt/Android.mk[4]

ifeq ($(TARGET_PRODUCT), full_wingray)
include $(LOCAL_PATH)/conf/moto/wingray/Android.mk
endif

include $(LOCAL_PATH)/conf/AP6210/Android.mk
endif # BOARD_HAVE_BLUETOOTH_BCM

7. Push your Bluetooth firmware into corresponding folder.

In this example, you should put bluetooth firmware to /etc/bluetooth/bcm20710a1.hcd

8. Pull high BT_WAKE pin by default

9. Enjoy!

[4] For Android 4.3 and 4.4, the path is <mydroid>/hardware/broadcom/libbt/Android.mk

ADVANCED BLUETOOTH CONFIGURATION

BUILD-TIME CONFIGURATION: CORE STACK

"bt_target.h" which is located at <mydroid>/external/bluetooth/bluedroid/include/bt_target.h has most pre-defined symbols.

<mydroid>/external/bluetooth/bluedroid/include/bt_target.h

```
#ifdef BUILDCFG

#if !defined(HAS_BDROID_BUILDCFG) && !defined(HAS_NO_BDROID_BUILDCFG)
#error "An Android.mk file did not include bdroid_CFLAGS and possibly not bdorid_C_INCLUDES"
#endif

#ifdef HAS_BDROID_BUILDCFG
#include "bdroid_buildcfg.h"
#endif

#endif
```

Figure 2: BUILD-TIME CONFIGURATION: CORE STACK

"bdroid_buildcfg.h" gives the overwritten definitions. You can skip the following steps if you don't need any overwritten definitions.

1. Provide bdroid_buildcfg.h in <mydroid>/device/<vendor>/<target>/bluetooth/ folder.
2. Define BOARD_BLUETOOTH_BDROID_BUILDCFG_INCLUDE_DIR in BoardConfig.mk

```
BOARD_BLUETOOTH_BDROID_BUILDCFG_INCLUDE_DIR :=
device/samsung/maguro/bluetooth/
```

Figure 3: Define BOARD_BLUETOOTH_BDROID_BUILDCFG_INCLUDE_DIR example

BLUETOOTH POWER SAVING MODE

Skip this section if module is USB interface

Bluetooth supports a special Sleep Mode to reduce power consumption. The Sleep Mode is **ENABLED** in bluedroid by default. To disable power saving mode, you should add "LPM_SLEEP_MODE = FALSE" to <mydroid>/device/common/libbt/include/vnd_<target>.txt[5]

#Set baudrate to 2M
UART_TARGET_BAUD_RATE=2000000
#Disable low power mode
LPM_SLEEP_MODE = FALSE

WAKE UP FROM SLEEP MODE

The Bluetooth can be woken from sleep mode only by the below two methods.

1. The host assert BT_WAKE pin
2. The remote Bluetooth device communicates with it via radio

[5] For Android 4.3 and 4.4, the path is <mydroid>/hardware/broadcom//libbt/include/vnd_<target>.txt

BLUETOOTH MAC ADDRESS CONFIGURATION

1. Add Bluetooth address to /system/etc/firmware/**bd_addr.txt** as following content.
   11:22:33:44:55:66

2. Add following to init.rc
   setprop ro.bt.bdaddr_path /system/etc/firmware/bd_addr.txt

3. Enable Bluetooth.
   Bluedroid will get bluetooth address from the path of android property ro.bt.bdaddr_path.

BLUETOOTH PCM CONFIGURATION

Please modify <mydroid>/device/common/libbt/include/vnd_<target>.txt[6] to set pcm configuration as following.

SCO_PCM_ROUTING
SCO_PCM_IF_CLOCK_RATE
SCO_PCM_IF_FRAME_TYPE
SCO_PCM_IF_SYNC_MODE
SCO_PCM_IF_CLOCK_MODE
PCM_DATA_FMT_SHIFT_MODE
PCM_DATA_FMT_FILL_BITS
PCM_DATA_FMT_FILL_METHOD
PCM_DATA_FMT_FILL_NUM
PCM_DATA_FMT_JUSTIFY_MODE

SCO_PCM_ROUTING	Hex value
SCO data will be routed to/from the PCM interface	0x00
SCO data will be routed to/from the HCI interface	0x01

SCO_PCM_IF_CLOCK_RATE	Hex value
PCM clock rate is 128 kbps	0x00
PCM clock rate is 256 kbps	0x01
PCM clock rate is 512 kbps	0x02
PCM clock rate is 1024 kbps	0x03
PCM clock rate is 2048 kbps	0x04

SCO_PCM_IF_FRAME_TYPE	Hex value
Short Frame Sync	0x00
Long Frame Sync	0x01

SCO_PCM_IF_SYNC_MODE	Hex value
Slave Sync Mode	0x00
Master Sync Mode	0x01

[6] For Android 4.3 and 4.4, the path is <mydroid>/hardware/broadcom//libbt/include/vnd_<target>.txt

SCO_PCM_IF_CLOCK_MODE	Hex value
Slave Sync Mode	0x00
Master Sync Mode	0x01

PCM_DATA_FMT_SHIFT_MODE	Hex value
Most Significant Bit is shifted out first	0x00
Least Significant Bit is shifted out first	0x01

PCM_DATA_FMT_FILL_BITS	Hex value
Specifies the value with which to fill unused bits if Fill_Method is set to programmable	0x00 - 0x03

PCM_DATA_FMT_FILL_METHOD	Hex value
0's	0x00
1's	0x01
Signed	0x02
Programmable	0x03

PCM_DATA_FMT_FILL_NUM	Hex value
Specifies the number of bits to be fille	0xXX

PCM_DATA_FMT_JUSTIFY_MODE	Hex value
Left Justify the data (fill data is shifted out last)	0x00
Right Justify the data (fill data is shifted out first)	0x01