Bluetooth User Guide for Android 9

Revision History

Date	Version	Description	Author
2019/4/15	0.1	1. Initial revision of Android 9	Luke Chen
2019/7/15	0.2	2. Add PCM configuration description	Luke Chen
2020/2/3	0.3	3. Provide more detail step to bring up bluetooth	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 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. For bluetooth power control, we need rfkill driver which rfkill type is bluetooth to control BT_REG_ON pin. Android libbt would use /sys/class/rfkillX/rfkill/state to control the power. Please refer to init_rfkill() and upio_set_bluetooth_power() in hardware/broadcom/libbt/src/upio.c to know how it control BT_REG_ON via rfkill driver.

5. Add the following configuration to BoardConfig.mk/Device.mk

#Bluetooth
BOARD_HAVE_BLUETOOTH : = true
BOARD_HAVE_BLUETOOTH_BCM := true
 # Bluetooth HAL
*PRODUCT_PACKAGES += *
*libbt-vendor *
*android.hardware.bluetooth@1.0-impl *
*android.hardware.bluetooth@1.0-service *
android.hardware.bluetooth@1.0-service.rc

6. Set correct file permission for rfkill and UART device node

Below is the example on hikey960 platform. The UART device node is /dev/ttyAMA3

```
diff --git a/init.common.rc b/init.common.rc
index 6d66ca7f..85a24d51 100644
--- a/init.common.rc
+++ b/init.common.rc
@@ -53,6 +53,12 @@ on post-fs
     setprop status.battery.level_raw  50
     setprop status.battery.level_scale 9

+# Configure bluetooth
+    chmod 0660 /sys/class/rfkill/rfkill0/state
+    chmod 0660 /dev/ttyAMA3
+    chown bluetooth bluetooth /sys/class/rfkill/rfkill0/state
+    chown bluetooth bluetooth /dev/ttyAMA3
+
 # Set supported opengles version
     setprop ro.hardware.hwcomposer drm
```

7. Set add sepolicy rule

Below is hikey960 platform example. The UART device node is /dev/ttyAMA3.

```
diff --git a/sepolicy/file_contexts b/sepolicy/file_contexts
index dacdb9f4..b4028804 100644
--- a/sepolicy/file_contexts
+++ b/sepolicy/file_contexts
@@ -1,5 +1,4 @@
 /dev/ttyAMA0                u:object_r:console_device:s0
-/dev/ttyAMA3                u:object_r:console_device:s0
 /dev/ttyAMA5                u:object_r:console_device:s0
 /dev/ttyFIQ0                u:object_r:console_device:s0
 /dev/mali                   u:object_r:gpu_device:s0
@@ -9,6 +8,7 @@
 /dev/dri/card0              u:object_r:gpu_device:s0
 /dev/hci_tty                u:object_r:hci_attach_dev:s0
 /dev/ttyAMA1                u:object_r:hci_attach_dev:s0
+/dev/ttyAMA3                u:object_r:hci_attach_dev:s0

diff --git a/sepolicy/hal_bluetooth_default.te b/sepolicy/hal_bluetooth_default.te
new file mode 100644
index 00000000..7c4e6b65
--- /dev/null
+++ b/sepolicy/hal_bluetooth_default.te
@@ -0,0 +1 @@
+allow hal_bluetooth_default sysfs:file write;
```

8. Set baud rate in libbt vendor library <mydroid>/hardware/broadcom/libbt at build-time.

Create a new file named <mydroid>/hardware/broadcom/libbt/include/vnd_<target>.txt

```
#Set baudrate to 2M (Please change the baudrate to what your platform can support, skip this if USB interface module is used)
UART_TARGET_BAUD_RATE=2000000
#Set UART device port
BLUETOOTH_UART_DEVICE_PORT = "/dev/ttyAMA3"
#Set the FW settlement delay to 250ms
FW_PATCH_SETTLEMENT_DELAY_MS = 250
#Set the FW patch file localtion
FW_PATCHFILE_LOCATION = "/vendor/etc/bluetooth/"
#Set LPM sleep mode to false
```

LPM_SLEEP_MODE = FALSE

#Set to use bluetooth controller bluetooth address

USE_CONTROLLER_BDADDR = TRUE

9. Push your Bluetooth firmware into corresponding folder.

Put bluetooth firmware to /vendor/etc/bluetooth/ and check if FW is correctly loaded when bluetooth is turning on.

The FW is correctly loaded into module.

D/bt_hwcfg(19689): Chipset BCM4345C0

D/bt_hwcfg(19689): Target name = [BCM4345C0]

I/bt_hwcfg(19689): Found patchfile: /vendor/etc/bluetooth/modules/

BCM4345C0_003.001.025.0165.0310.hcd

If you see logs as below, it means that it must be something wrong and you should check if the path is correct and if the file is available in this path.

D/bt_hwcfg(19689): Chipset BCM4345C0

D/bt_hwcfg(19689): Target name = [BCM4345C0]

E/bt_hwcfg(19689): vendor lib preload failed to locate firmware patch file

Libbt would search the FW name according to the module target name. You can also specify the FW file name by add FwPatchFileName=xxx.hcd into /etc/bluetooth/bt_vendor.conf

10. Enjoy!

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>/hardware/broadcom/libbt/include/vnd_<target>.txt

#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

Bluetooth MAC Address Configuration

If USE_CONTROLLER_BDADDR is set to TRUE in libbt, stack would use the BD address which programmed in module. if you would like to set your own bd address, you can refer to below step:

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

Starting from android O, SCO would be established by Enhanced Setup Synchronous Connection command if it's supported by controller. Here we would give how to set the PCM parameter by change the INPUT_DATA_PATH and OUTPUT_DATA_PATH of Enhance Setup Synchronous Command.

7.1.45 Enhanced Setup Synchronous Connection Command

Command	OCF	Command Parameters	Return Parameters
HCI_Enhanced_Setup_ Synchronous_Connection	0x003D	Connection_Handle, Transmit_Bandwidth, Receive_Bandwidth, Transmit_Coding_Format, Receive_Coding_Format, Transmit_Codec_Frame_Size, Receive_Codec_Frame_Size, Input_Bandwidth, Output_Bandwidth, Input_Coding_Format, Output_Coding_Format, Input_Coded_Data_Size, Output_Coded_Data_Size, Input_PCM_Data_Format, Output_PCM_Data_Format, Input_PCM_Sample_Payload_ MSB_Position, Output_PCM_Sample_Payload_ MSB_Position, Input_Data_Path, Output_Data_Path,	

Value	Description	Meaning
0	TRANSPORT	SCO data is routed to transport via HCI
1	PCM	PCM is used. Role is set in patchram
3	I2S	I2S is used. Role is set in patchram
4	PCM_MASTER	PCM is used on PCM interface. It generates PCM_CLK,PCM_SYNC
5	I2S_MASTER	I2S is used on PCM interface. It generates I2S_CLK,I2S_WS
6	PCM_SLAVE	PCM is used on PCM interface. It's PCM slave role
7	I2S_SLAVE	I2S is used on PCM interface. It's I2S slave role

You may check the value from stack as below:

```
device/include/esco_parameters.h
// SCO Data Path
#define ESCO_DATA_PATH_PCM 1                    /* 0x01-0xFE (PCM Chan) */
```

When PCM is used, the CLK rate is

*PCM_CLK=sample_rate*16bit*2