Bluetooth User Guide for Linux

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Revision History

Date	Version	Description	Author
2012/07/03	0.1	Initial revision of Bluetooth function	Terence Hsieh
2015/2/10	0.2	Update BD ADDR configuration	Luke Chen

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INTRODUCTION

This user guide is intended to give Ampak Bluetooth module users a general guide of how to enable the Bluetooth function.

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BLUETOOTH SOFTWARE ARCHITECTURE OVERVIEW

BlueZ is the official Linux Bluetooth stack as well as Android. It provides support for core Bluetooth layers and protocols. We use it to provide Bluetooth profiles on GB86XX and it consists of following components (see also figure 5):

- HCI Core
- HCI UART, USB and Virtual HCI device drivers
- L2CAP protocol module
- Configuration and testing utilities

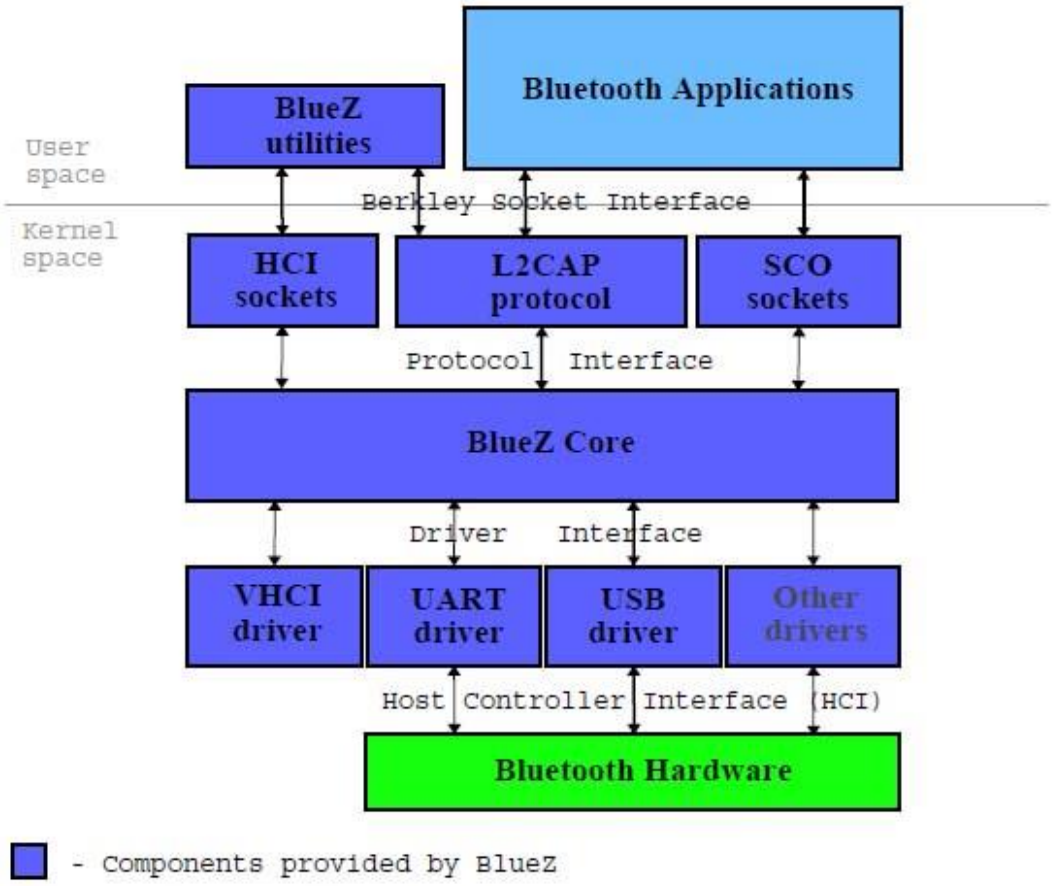

Figure 1: BlueZ Overview Diagram

In our case, we use UART as the Host Controller Interface (HCI) and GB86XX is the Bluetooth hardware in figure 5.

BLUETOOTH SOFTWARE PACKAGE

The provided Bluetooth software package contains following files:

- HCD configuration file (bcmdhd.hcd)
- brcm_patchram_plus program
- hciconfig from BlueZ
- hcitool from BlueZ

BLUETOOTH INSTALLATION

ENABLE BLUETOOTH FUNCTION OF LINUX KERNEL

Please add following items into your kernel configuration:

CONFIG_BT_HCIUART=y
CONFIG_BT_HCIUART_H4=y
CONFIG_BT=y
CONFIG_BT_L2CAP=y
CONFIG_BT_SCO=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

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ENABLE BLUETOOTH

1. Initialization Steps
   A. # brcm_patchram_plus -d --enable_hci --no2bytes --tosleep 200000 --baudrate 3000000 --patchram /system/etc/firmware/bcmdhd.hcd /dev/ttyS0 &
      cmd: HCI_Reset
      cmd: HCI_Download_Minidriver
      Sleep 200ms before downloading...
      Downloaded
      cmd: HCI_Reset
      Done setting line discpline
      Device setup complete
      pid : 1819

   B. #hciconfig hci0 up

2. Check Bluetooth device status
   # hciconfig
   hci0: Type: BR/EDR Bus: UART
      BD Address: 43:30:B1:00:00:00 ACL MTU: 1021:8 SCO MTU: 64:1
      UP RUNNING
      RX bytes:1011 acl:0 sco:0 events:39 errors:0
      TX bytes:208 acl:0 sco:0 commands:39 errors:0

3. Scan Bluetooth devices

hcitool scan
Scanning ...

00:22:43:A0:A7:0A	n/a
00:10:60:56:56:7B	hhhh
00:1A:6B:85:F3:67	n/a
00:22:43:A0:A7:48	AmUrO
00:1F:E1:E1:A1:8F	GEMTEK-8AE51F68

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BLUETOOTH POWER SAVING MODE

Bluetooth supports a special Sleep Mode to reduce power consumption. The Sleep Mode is **DISABLED** in firmware by default and must be enabled by the host through following command.

SOFTWARE COMMAND FOR ENABLE SLEEP MODE

#./hcitool cmd A B C D E F G H I J K

Parameter	Description
A	(ogf) must be 0x3F
B	(ocf) must be 0x0027
C	Sleep_Mode (1 bytes) 0x00: No Sleep Mode 0x01: UART Sleep Mode 0x02: UART Sleep Mode with messaging 0x03: USB Sleep Mode 0x05: USB Sleep Mode with Host Wake
D	Idle_Threshold_Host(1 bytes) 0xXX: Host Idle Threshold, applicable to Sleep Mode 1, 2, 5. This is the number of firmware loops executed with no activity before the Host Wake line is deasserted. Activity includes HCI traffic excluding certain sleep mode commands and the presence of SCO connection if the "Allow Host Sleep During SCO" flag is not to set 1. Each count of this parameter is roughly equivalent to 300 ms. For example, when the parameter is set to 16 (0x10), the Host wake line will be deasserted after approximately 4.8 seconds of inactivity.
E	Idle_Threshhold_HC (1 byte) 0xXX: Host Control Idle Treshod, applicable to Sleep Mode 1, 2, 3, 5. This is the number of firmware loops executed with no activity before the HC is considered idle. Depending on the mode, HC may then attempt to sleep. Activity includes HC traffic excluding certain sleep mode commands and the presence of ACL/SCO connections. Each count of this parameter is roughly equivalent to 300 ms. when the parameter is set to 16 (0x10), the HC will be considered after approximately 4.8 seconds of inactivity.

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F	GPIO_0_Active_Mode(1 byte) 0x00: Active Low 0x01: Active High
G	GPIO_3_Active_Mode (1 byte) 0x00: Active Low 0x01: Active High
H	Allow_Host_Sleep_During_SCO (1 byte) 0x00-0x01: Applicable to Sleep Mode 1, 2, 3, 5. When this flag is set to 0, the host is not allowed to sleep while an SCO connection is active. In modes 1 and 2, the device will keep the host wake line asserted while an SCO connection is active. In mode 3, the device will immediately issue a USB RESUME if the host issues a SUSPEND. When this flag is set to 1, the host can sleep while an SCO is active. This flag should only be set to 1 if SCO traffic is directed to the PCM interface.
I	Combine_Sleep_Mode_And_LPM (1bytes) 0x00-0x01: Applicable to Sleep Mode 1, 2, 3, 5. In mode 0, always set byte 7 to 0. In all sleep modes, device always requires permission to sleep between scans / periodic inquiries regardless of the setting of this byte. In modes 1 and 2, if the byte is set, device must have “permission” to sleep during the low power modes of sniff, hold, and park. If byte is not set, device can sleep without permission during these modes. Permission to sleep mode 1 is obtained if the BT_WAKE signal is not asserted. Permission to sleep mode 2 occurs after the Sleep Request / Sleep Reguest ACK exchange. In modes 3 and 5, if the byte is set to 0, the device will not be able to sleep during the lower power modes. If it is set to 1, the device will be able to sleep during the lower power modes.
J	Enable_Tristate_Control_Of_UART_Tx_Line (1bytes) 0x00-0x01: Applicable to Sleep Mode 1 and 2. When set to 0, the device will not tristate its UART TX line before going to sleep. When set to 1, the device will tristate its UART TX line before going to sleep.
K	Active_Connection_Handling_On_Suspend(1bytes) 0x00-0x01: Suspend Behavior, applicable to modes 3 and 5.

Table 1: Bluetooth Sleep Mode Command Parameters

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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

OPERATION

Following is an example showing how to enter sleep mode and wake up.
Let's assume BT_Wake pin connects to the GPIO pin 45 of the host CPU.

```
#gpio get 45
0

#./hcitool cmd 0x3f 0x0027 0x01 0x0 0x0 0x1 0x0 0x0 0x0 0x0 0x0
< HCI Command: ogf 0x3f, ocf 0x0027, plen 9
   01 00 00 01 00 00 00 00 00
> HCI Event: 0x0e plen 4
   01 27 FC 00

# hcitool scan
Scanning ...
Inquiry failed: Connection timed out

# gpio set 45 1

# hcitool scan
Scanning ...
      00:1E:45:E3:9A:0C    K800i
      F0:7B:CB:A8:86:52    BEN-99
      00:15:83:36:18:9F    andy-desktop-0
      00:1F:E1:E1:A1:8F    GEMTEK-8AE51F68

# gpio set 45 0
```

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```
# hcitool scan
Scanning ...
Inquiry failed: Connection timed out

# gpio set 45 1

# hcitool scan
Scanning ...
        F0:7B:CB:A8:86:52       BEN-99
        00:15:AF:FD:4A:7D       MYPC-E180EB2C24
        00:1C:26:EB:30:32       COCO-PC
        00:1E:45:E3:9A:0C       K800i.
        00:1F:E1:E1:A1:8F       GEMTEK-8AE51F68
```

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BLUETOOTH MAC ADDRESS CONFIGURATION

1. Enable Bluetooth.

brcm_patchram_plus -d --enable_hci --no2bytes --tosleep 200000 --baudrate 3000000 --patchram /system/etc/firmware/bcmdhd.hcd **--bd_addr 11:22:33:44:55:66** /dev/ttyS0 &

```
    cmd: HCI_Reset
    cmd: HCI_Download_Minidriver
    Sleep 200ms before downloading...
    Downloaded
    cmd: HCI_Reset
    cmd: HCI_Write_BD_ADDR
    Done setting line discpline
    Device setup complete
    pid : 1948
```

hciconfig hci0 up

hciconfig

```
hci0:   Type: BR/EDR   Bus: UART
        BD Address: 11:22:33:44:55:66   ACL MTU: 1021:8   SCO MTU: 64:1
        UP RUNNING
        RX bytes:1011 acl:0 sco:0 events:39 errors:0
        TX bytes:208 acl:0 sco:0 commands:39 errors:0
```

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