BH02-BP30
Bluetooth Technical Specification

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1 Document Mission/Scope

1.1 Mission

This document provides the architecture of the BP30 Bluetooth subsystem and the description of requirements for BT in a mobile phone such as the power saving and the audio BT handling. The BT functionalities are specified by the Bluetooth Specification [1]

1.2 Scope

This document is intended for engineers who have in charge the Bluetooth development. The reader should have knowledge about the BT Specification [1]

2 List of Acronyms

Abbreviation / Term	Explanation / Definition
APOXI	Application Programming Object-Oriented Extendable Interface
BMU	BlueMoon Unicellular
BT	Bluetooth
BTAPI	BT Application Programmer Interface
CTS	Clear To Send
DSP	Digital Signal Processor
FW	Firmware
GOEP	Generich Object Exchange Profile
GPIO	General Purpose Input Output line
HCI	Host Controller Interface
HF (P)	HandsFree (Profile)
HS (P)	HeadSet (Profile)
HW	Hardware
I2S	Bidirectional Serial Audio Interface
L2CAP	Logical Link Control and Adaptation Protocol
LMP	Link Manager Protocol
OPP	Object Push Profile
PCM	Pulse Code Modulation
REFMMI	Reference Man Machine Interface
RTS	Ready to Send
Rx	Receiver

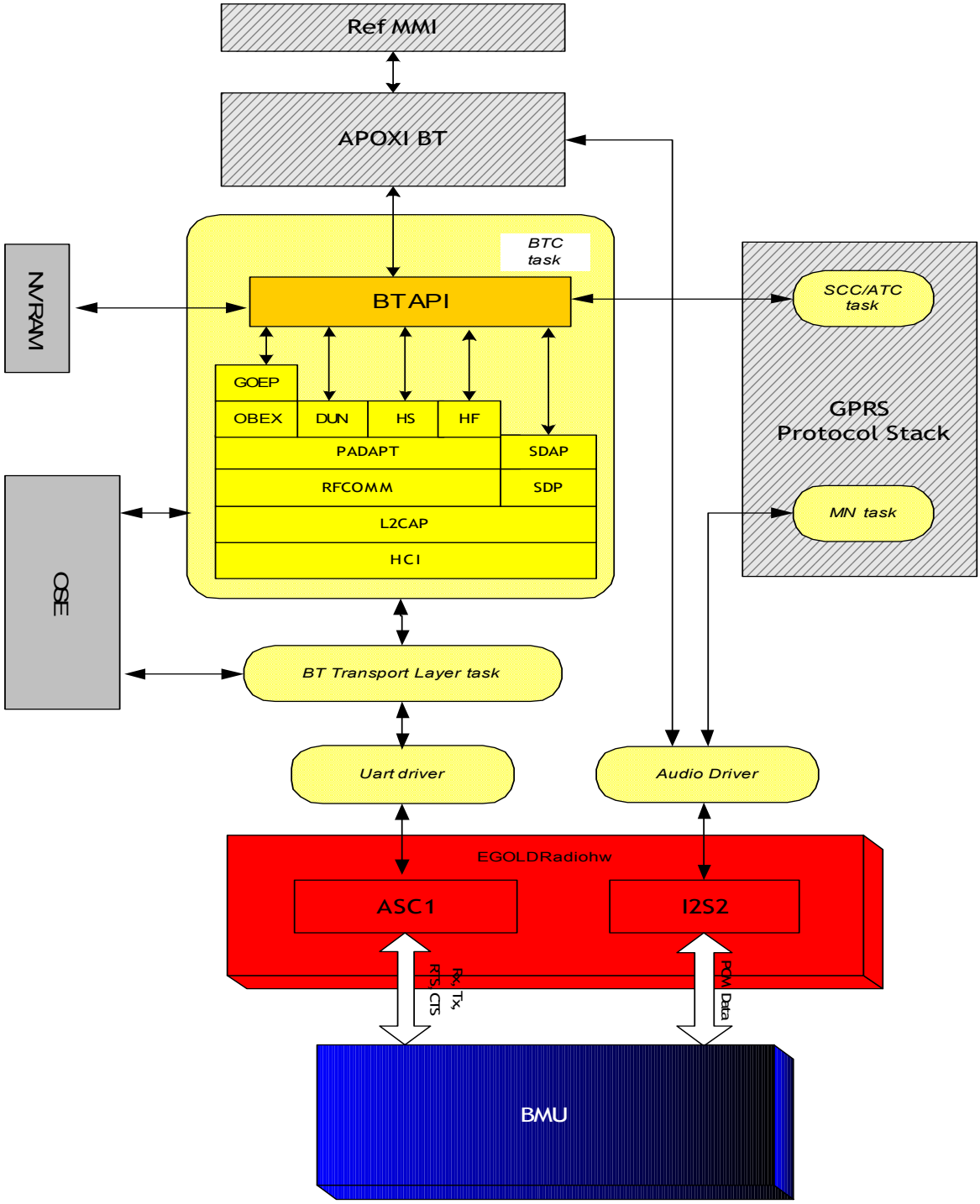
SCO	Synchronous Connection Oriented (related to the Bt audio links)
SDP	Service Discover Protocol
SDAP	Service Discover Application Profile
SW	Software
Tx	Transmitter
UART	Universal Asynchronous Rx Tx

3 Introduction

The BT architecture is both hardware and software. The hardware related part is based on the BlueMoon Unicellular Bluetooth chipset PMB8753 [2], in compliance with the BT version 2.0 + EDR [1], which interacts with the E-GOLDradio chipset [3]. Both for the BMU and the E-GOLDradio there is a firmware part too. The firmare for the Bluetooth implements the BT Core System Package Controller part like Baseband, LMP and HCI protocols [1] while the System Package Host part [1] is not in firmware but is based on the Bluetooth Mecel stack which is executed in different tasks inside the EGOLDRadio (the host). The Mecel stack implements different profiles in compliance with [4]. The firmware part of the E-GOLDradio chipset [5] in strong relationship with the BT is the audio I2Sx/y interface firmware.

4 Bluetooth Architecture

The BT architecture is represented in the the following picture:



Please note:

- in grey are represented sw blocks like the GPRS protocol stack, the OSE operating system, the NVRAM manager or the APOXI framework;
- in red there is the E-GOLDradio hw blocks used for the BT functionalities
- in blue there is the Bluetooth chipset which acts like BT controller [1,2]

- in yellow are represented tasks in relationship with the BT functionalities which runs under the OSE operating system [9]

4.1 Logical description

The user interacts with the Bt functionalities through the MMI layer which is based on the APOXI framework, BT implementation. APOXI is interfaced with the Mecel Bt protocol stack sw through the BTAPI which is the top layer of the stack. In the BTAPI there are the sw interfaces for managing the Bt profiles integrated in the current BP30 solution: the HandsFree, HeadSet, DialUp Network and Generic Obex Exchange profiles. The Service Discover Application Profile is exposed on the BTAPI interface too and it manages the database of the remote discovered device and the Bt services available in the BP30 platform.
The profiles and the protocols of the BT stack run in the BTC task under the OSE operating system [9]. The lower layer of the stack, Host Controller Interface (HCI), copies its packets in the BTTL (BT Transport Layer) buffers. The BTTL is a different task which manages the i/o functions for writing and reading to the UART port of the E-GOLDradio: in this way protocols are isolated from the hw dependencies. The data flow from the Bt Host (the EGOLDradio which carries the Bt stack) to the Bt Controller (the BMU) is based on the serial port UART1. This UART1 is configured to support the HCI 4 Wire interface [2] [10] of the BMU.
All of the profiles which lie on the Serial Port Profile (SPP) can interact with the Protocol Stack through the SCC/AT task. Substantially they can talk with the protocol stack by means of AT commands through a virtual serial port.
Other than the protocol data flow the audio data path is enclosed in the architecture. The audio path is based on the I2S2 interface at the E-GOLDradio side and the PCM interface at the BMU side. The setting, activation and deactivation of the PCM interface is done through HCI commands for the BMU and through DSP commands for the E-GOLDradio. Both APOXI and the ATC GPRS protocol stack can supply the driver calls to the DSP.

4.2 Profiles available

The HF and HS profiles implements the Audio Gateway functionalities [6] [7]. The GOEP profile can register both client and server applications [8]. The implementation of profiles like the Object Push Pull are demanded to APOXI which implements the OPP functionality through the GOEP profile i.e. the OPP profile which teorethically belongs to the BT stack is moved outside in the BP30 solution. The FAX profile is available too but it is not included in the BP30 platform requirements.

5 System requirements

5.1 HCI interface

The UART1 has to be configured to support the HCI 4 Wire protocol plus the Infineon extensions for the Low Power Mode as described in [2]. The speed of the UART for the BMU chipset startup is 115200 bps, 8N1. Different speeds can be supported after the BMU initialization: 9600, 19200, 38400, 57600, 115200, 230400, 460800 and 921600 always 8N1.

5.2 BMU settings

The BMU initialization is done with the default parameters, called BD Data, suggested in [2]. Some of them are dependent on the BP30 hardware i.e. they must be set as followed reported:

Parameter	Value	Meaning
LPM_Conf	0xE0	The controller is allowed to enter low power modes without explicit reception of the Infineon_Enable_LPM command
LPM_Drift	0xFA	Low Power Mode clock drift is 250ppm (safety choice)
LPM_Threshold	0x12	Timee threshold before entering LPM in slot (a slot is 625 uS)
DDC_TI_Conf	0x02	HCI Uart transport layer 4 Wire enabled
UART_Baudrate	0x04	Uart baudrate at the startup is 115200 bps
UART_Pulls	0x02	BMU Uart Tx (i.e. host Rx) is pulled down during LPM. Please note that the UART driver sw waits for the framing error to identify the BMU LPM, i.e this pulled down plays an important role
Osc_Settle	0x40	Time in multiples of 125µs that it takes for the reference clock and the external power supply to stabilize after they have been requested by SLEEPX. On the BP30 platform there is need to wait at least 8 ms. See comments in the BMU Low Power Mode chapter
BB_Conf	0x4C	The default SCO interface (audio related) is the PCM. Sleepx signal is not inverted. The BD data are cleared on hw reset.
RF_Conf	0x00	The RF output power is attenuated of -4dBm

The initialization is done with the HCI manufacturer command Infineon_Write_BD_Data.

5.3 PCM interfaces

There are two interfaces (which talks together) to be set:

- the I2S2 interface on the E-GOLDradio;
- the PCM interface on the BMU.

The PCM burst mode is used with E-GOLDradio like master (clock source) and the BMU like slave. The frame sync is provided by the E-GOLDradio too. The PCM clock frequency is 128 Khz (audio sampling rate), the frame length is 16bit, one channel.

5.3.1 I2S2 settings

The desidered PCM type configuration can be achieved on the E-GOLDradio through DSP settings:

1. There are two I2S physical interfaces, I2S2 and I2S1, while the DSP fw manages two logical I2S, I2Sx and I2Sy, which can be attached to the two physical I2S. The I2Sx is in relationship with the uplink/downlink GSM audio path and has to be used i.e. the I2S2 has to be configured like I2Sx. The DSP command I2S_SWAP with parameter 1 has to be performed, see [5]. Please note that this setting is lost durign the E-GOLDradio power saving i.e. the previous command has to be sent after each power saving phase.
2. Registers of the DSP have to be set according to the table:

Register	Value	Comment
CSEL	0x0030	PCM burst master mode
DEN0	0x0659	NUM and DEN are the fractional divider to provide the. Values are taken from the table 8-10 in [3], with a reference internal DSP clock of104Mhz
NUM0	0x0009	
TXCONF	0x8001	Transmit on clock rising edge, pulse length is one clock cycle
RXCONF	0x8001	Acquire data on clock rising edge, pulse length is one clock cycle

3. The parameters in the previous item 2 become effective when the VB_ON command is sent to the DSP with parameter 3 or 4, see [5].

5.3.2 PCM BMU settings

The desidered PCM type configuration can be achieved on the BMU through the Hci command Infineon_Write_PCM_Mode, see [2]. The parameters for the command are:

Parameter	Value	Meaning
PCM_Mode	0x1103	One sync frame, PCM Frame sync signal not inverted, early frame mode, PCM clock not inverted, clock slave mode, frame slave mode
Frame_Length	0x10	16 bit frame, 1 PCM channel, 128Khz
Frame_Signal_Length	0x01	1 clock cycle is the lenght of the frame sync
Channel_Pos	0x000000	channel start position
LPM_Level	0x0108	defaults

In relationship with the audio data there is the voice coding over the SCO link once a BT audio connection is taken up. The coding can be set through the Hci_Write_Voice_Setting command with the next parameter:

Parameter	Value	Meaning
Voice settings	0x0260	audio input coding A law, 2 complement; CVSD coding over the air

5.4 BMU Low Power Mode

For the BMU LPM support, the ASC1 (UART) lines of the E-GOLDRadio are reconfigured like GPIOs till the BMU awake the host: the UART functionalities have to be disabled when the BMU is in LPM to prevent frame errors (because the TX and RX lines of the ASC1 are forced to the low state and this is not in accord with the standard UART functionalities [3]).

6 References

6.1 External

[1] Bluetooth Specification version 2.0 + EDR, 4 November 2004
[2] Infineon Tecnology AG, T8753-V2_04-P7-R1-7600 System Release Note, December 2005

[3] Infineon Tecnology AG, E-GOLDradio PMB 7870 GSM/GPRS Single Chip Solution, Design Specification, Rev. 1.04, 30/5/2005
[4] All of the profiles are specified in www.bluetooth.org. They are not a strictly part of the Bluetooth Spec. version 2.0 + EDR, some profiles can be described in old but not obsolete versions of the Bluetooth Spec.
[5] Infineon Tecnology AG, E-GOLDradio PMB 7870 GSM/GPRS Single Chip Solution, Firmware Manual, Rev. 1.00, June 2005
[6] Bluetooth Specification, HandsFree Profile v.1.5, v.10r00, 25/11/2005
[7] Bluetooth Specification, version 1.1, Part K:6, Headset Profile, February 22, 2001
[8] Bluetooth Specification, version 1.1, Part K:10, Generic Object Exchange Profile, February 22, 2001
[9] OSE for C166 Kernel Reference Manual, version 3.0, Ose Systems Inc., 2001
[10] Bluetoooth Specification version 2.0 + EDR, Host Controller Interface Functional Specification, Part E, 4 November 2004

6.2 Internal

Title	Doc ID

7 Document change report

	Change Reference		Record of changes made to previous released version	
Rev	**Date**	**CR**	**Section**	**Comment**
R1.0	16/02/2006	N.A.		Document Created

8 Approval

Revision	Approver(s)	Date	Source/signature
1.0	Stefano Godeas	20/02/2006	Document stored on server