
How to replace a low-speed wired connection using a BLE link

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Main components	
BlueNRG-MS	Upgradable Bluetooth® Low Energy network processor
SPBTLE-RF	Very low power module for Bluetooth® Smart v4.1
BlueNRG-1	Bluetooth® low energy wireless system-on-chip

Purpose and benefits

The BlueNRG-MS is a very low power Bluetooth Low Energy (BLE) single-mode network processor, compliant with Bluetooth Specification Core v4.1. The entire BLE stack runs on the embedded Cortex M0 core. The device interfaces with an external host microcontroller using the SPI transport layer and a set of APIs composed of standard Host Controller Interface (HCI) commands and vendor-specific Application Command Interface (ACI) commands.

The scope of this document is to provide the customer with a reference on how to replace a low-speed wired connection, like a UART link, with a wireless connection over a BLE link using the BlueNRG-MS device and the ACI vendor specific commands.

Note that the content of this document applies to the SPBTLE-RF module and BlueNRG-1 devices.

Description

In the Bluetooth Specification Core v2.0, the Serial Port Profile (SPP) has been introduced for the EDR Bluetooth Controllers. The SPP does not apply to the Low Energy Controller, which has been introduced in the Bluetooth Core Specification since version 4.0 and onwards. Nevertheless, it is still possible to implement a similar feature while working with a BLE-only Controller. This can be achieved by defining a vendor-specific profile that allows a transmitter and a receiver to exchange data over the link using Vendor Specific BLE Services and Characteristics.

A reference SW implementation that demonstrates a simple 2-way communication between two BlueNRG-MS devices is available in the BlueNRG-MS Software Development Kit (SDK). The project is named "BLE Chat", located in the folder "Projects\Projects_STD_Library\BLE_Chat\EWARM_BlueNRG-MS" within the STEVAL-IDB005V1 or STEVAL-IDB006V1 evaluation kits. If the user works with the NucleoL152RE and X-NUCLEO-IDB05A1 evaluation kit, the project can be found in the folder "Projects\Projects_Cube\BLE_Chat\EWARM_BlueNRG-MS".

Note: if working with the BlueNRG-1 evaluation kit STEVAL-IDB007V1, the project can be found in the BlueNRG-1 SDK and is in the folder “\BLE_Examples\BLE_Chat”. Support for IAR Embedded Workbench, Keil Microcontroller Development Kit, and Atollic TrueSTUDIO is available.

There are 4 project configurations:

- “Client”: Client role
- “Server”: Server role
- “Client throughput”: Client role for throughput test.
- “Server throughput”: Server role for throughput test.

The BLE Chat FW implementation has 2 roles:

- The Client connects to the “Chat” service as a Master.
- The Server exposes a Vendor Specific BLE Service named “Chat” and operates as a Slave. The 128-bit Universally Unique Identifier (UUID) value associated to the Chat Service is 0xD973F2E0-B19E-11E2-9E96-0800200C9A66.

The Chat Service contains 2 Vendor Specific Characteristics:

1) The TX Characteristic: the client can enable notifications on this characteristic. When the server has data to be sent, it will send notifications which contain the value of the TX Characteristic. The 128-bit UUID value associated with the TX Characteristic is 0xD973F2E1-B19E-11E2-9E96-0800200C9A66.

2) The RX Characteristic: it is a writable characteristic. When the client has data to be sent to the server, it writes a value into this characteristic. The 128-bit UUID value associated with the RX Characteristic is 0xD973F2E2-B19E-11E2-9E96-0800200C9A66.

The maximum length of the characteristic value is 20 bytes.

To set up the connection, 2 BlueNRG-MS devices (2 BlueNRG evaluation kits) are needed, one to implement the Master role and the other to implement the Slave role.

Once the connection is established, the 2 peers can start sending data on the link using these 2 characteristics.

When using the evaluation kits, data transfers are sent and received using a connection to the board through a terminal emulator on the PC, e.g. TeraTerm. Each evaluation kit will appear as a Virtual COM port to the PC. The terminal emulator is configured as follows: baud rate: 115200, stop bits: 1, parity: none, number of data bits per character: 8, and flow control: none.

Figure 1 below depicts the system set up.

Figure 1: BLE chat system setup



The “Client throughput” and the “Server throughput” project configurations allow the user to run a throughput test (the preprocessor defined symbol “THROUGHPUT_TEST” will be present in both project configurations).

The throughput test consists of the following steps:

- Program the Client on one BlueNRG-MS platform and reset it. The platform will appear as a virtual COM port to the PC. Open the COM port in a terminal emulator. Client will start 4 seconds after reset.
- Program the Server on a second BlueNRG-MS platform and reset it. The two platforms will try to establish a connection. As soon as they get connected, the slave will continuously send notifications of 20 bytes to the client.
- After every 500 packets received from the client, the current application throughput will be displayed on the Client terminal emulator.

Note: when working with BlueNRG-1, the STM32L1 on the STEVAL-IDB007V1 evaluation kit runs a USB to serial bridge firmware that allows a “pass-through” from the PC to the BlueNRG-1 directly. The firmware is provided in binary form within the BlueNRG-1 SDK. The BLE Chat application runs on the BlueNRG-1 device and is stored in Flash.

Support material

Related design support material
STEVAL-IDB005V1 and STEVAL-IDB006V1 – BlueNRG-MS Evaluation board
STEVAL-IDB007V1 – BlueNRG-1 Development kit / Evaluation board
Documentation
Datasheet DS10691, Upgradable Bluetooth® Low Energy network processor
Datasheet DS11481, Bluetooth® low energy wireless system-on-chip
Datasheet DS11045, SPBTLE-RF Very low power module for Bluetooth® Smart v4.1
User manual, UM1870, BlueNRG-MS development kits
User manual, UM2071, BlueNRG-1 development kit
User manual, UM2094, STEVAL-IDB007V1 evaluation board quick start guide
User manual, UM1865, BlueNRG-MS Bluetooth® LE stack application command interface (ACI)
Programming manual, PM0237, BlueNRG, BlueNRG-MS stacks programming guidelines

Revision history

Date	Version	Changes
22-Aug-2016	1	Initial release

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