User Manual
TRAXENS BOX0022

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User Manual

TRAXENS
real data for logistics excellence

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1. Introduction

BLE is a protocol developed by Bluetooth SIG, the BLE stack contains two categories the Generic Access Profile (GAP) and the Generic Attribute Profile (GATT).

1.1 Generic Access Profile (GAP)

The GAP controls connections and advertising in Bluetooth and it makes the device visible and determines how two devices can interact with each other.

A device can join a BLE network by adopting these roles specified in GAP:

Broadcasting: These roles don't have to explicitly connect to one another to transfer data.

- Broadcaster: A device that broadcasts public advertising data packets, such as how long a button has been pressed.
- Observer: A devices that listens to the data in the advertising packets sent by the broadcaster. No connection happens between the broadcaster and observer.

Connecting: These roles must explicitly connect and handshake to transfer data. These roles are more commonly used than the broadcasting roles.

- Peripheral: A device that advertises its presence so central devices can establish a connection. After connecting, peripherals no longer broadcast data to other central devices and stay connected to the device that accepted connection request.
- Peripherals are low-power because they only have to send beacons periodically. Central devices are responsible for starting communication with peripherals.
- Bean is an example of a BLE peripheral.
- Central: A device that initiates a connection with a peripheral device by first listening to the advertising packets. A central device can connect to many other peripheral devices.
- When the central device wants to connect, it sends a request connection data packet to the peripheral device. If the peripheral device accepts the request from the central device, a connection is established.
- Your computer is an example of a BLE Central device when it connects to Bean.

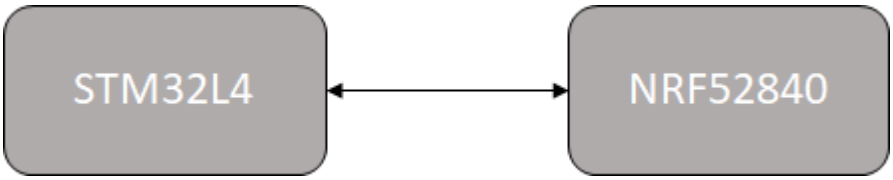
1.2 Generic Attribute Profile (GATT)

Similar to GAP, there are certain roles that interacting devices can adopt:

- Client: Typically sends a request to the GATT server. The client can read and/or write attributes found in the server.
- Server: One of the main roles of the server is to store attributes. Once the client makes a request, the server must make the attributes available.

1.3 Hardware context

The BLE chip is the NRF52840 developed by Nordic Semiconductor. In our case, the NRF52 is only used as Bluetooth low energy component and it's driven by an STM32L4.



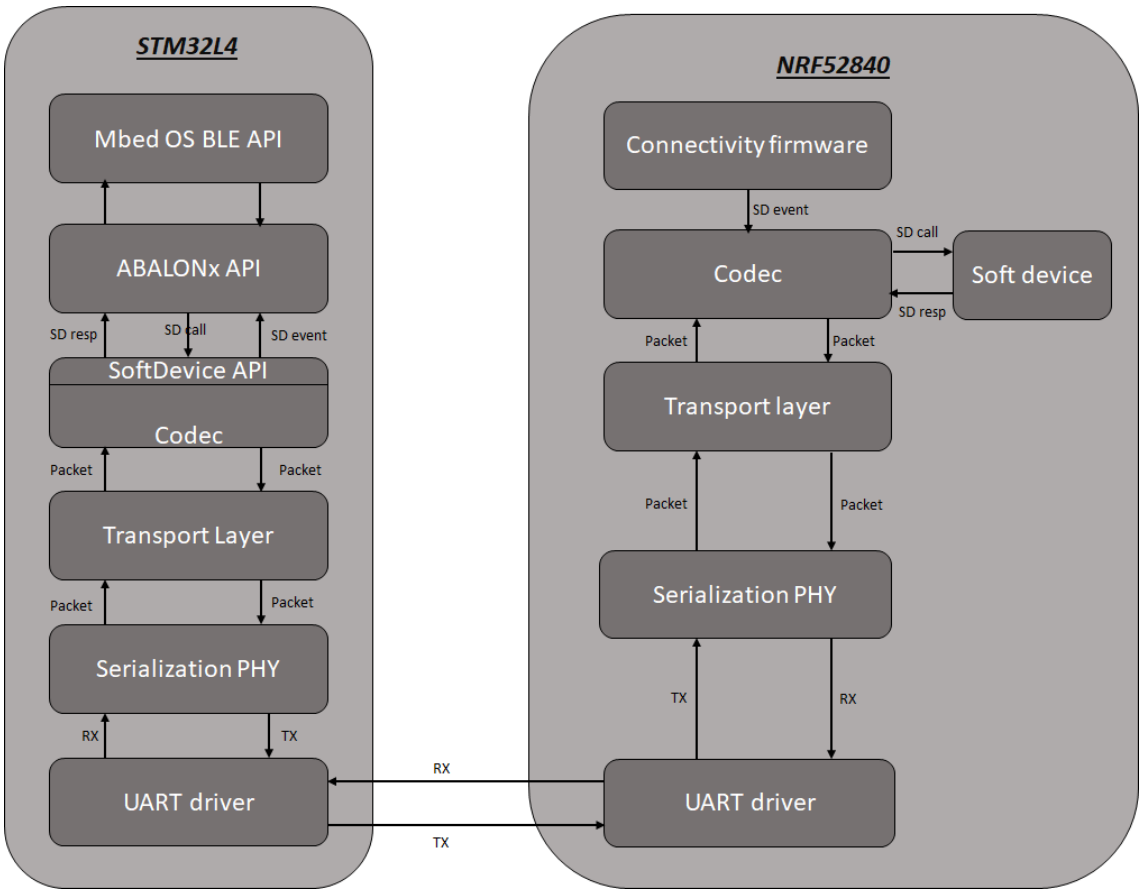
The Bluetooth application is set in the STM32L4 chip and allow the setup of the NRF52. For this Nordic give a serialization librairies which must be ported in our project.

2 Serialization Architecture

The STM32 runs a serialzed application to communicate with an external bluetooth chip, the soft device which contains the stack bluetooh is only flashed in the NRF52840 and in the stm32 is replaced by a codec that implements the SoftDevice API.

All function calls to the codec are serialized and transmitted to the NRF52 using the transport layer drivers.The NRF52 decodes the serialized commands from the *STM32* and executes the corresponding function in the SoftDevice.

Any event from the SoftDevice is encoded by the codec and transmitted to the *STM32* using the transport layer. In the *STM32*, the event is decoded and passed to the application.



3 Nordic delivery integration

To integrate the BLE Nordic delivery in the STM32 project, the steps are:

- Download the nRF5 SDK v15.0.0
  https://www.nordicsemi.com/eng/Products/Bluetooth-low-energy/nRF5-SDK
- Import all files from
  <InstallFolder>\components\serialization\application\codecs\ble\middelware
- Import all files
  from ***<InstallFolder>\components\serialization\application\codecs\ble\serializers***
- Import ble_advdata.c ,ble_conn_params.c and
  ble_conn_state.c from ***<InstallFolder>\components\ble_common***

4 Legal notice

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

NOTE: The grantee is not responsible for any changes or modifications not expressly approved by the party responsible for compliance. Such modifications could void the user's authority to operate the equipment.

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:
(1) This device may not cause interference, and
(2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :
(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Warning:

FCC and ISED Radio-frequency Exposure Statement

Warning: this equipment generates and radiates radio-frequency energy. In order to comply with the FCC and ISED radio-frequency radiation exposure guidelines for uncontrolled environment, this equipment has to be installed and operated while maintaining a minimum body to antenna distance of 20cm.

Users are not permitted to make changes or modify the system in any way.