BLE Protocol in Study Watch, for App Development

The study watch uses s140 softdevice from Nordic SDK, which is a precompiled and linked binary image implementing Bluetooth 5 Low Energy protocol stack for nRF52 series of SoCs.

It has serial port emulation over BLE and includes the Nordic UART Service (NUS).

The 128-bit vendor-specific UUID of the Nordic UART Service is 6E400001-B5A3-F393-E0A9-E50E24DCCA9E (16-bit offset: 0x0001).

This service exposes two characteristics: one for transmitting and one for receiving (as seen from the peer).

- **RX Characteristic (UUID: 6E400002-B5A3-F393-E0A9-E50E24DCCA9E)**
  The peer can send data to the device by writing to the RX Characteristic of the service. ATT Write Request or ATT Write Command can be used.
- **TX Characteristic (UUID: 6E400003-B5A3-F393-E0A9-E50E24DCCA9E)**
  If the peer has enabled notifications for the TX Characteristic, the application can send data to the peer as notifications.

To improve the performance, throughput of the ble connection and characterize the stable data rate following parameters are used in **Study Watch** firmware:

- BLE GAP data length : 251
- BLE Tx and Rx PHY : BLE_GAP_PHY_2MBPS
- BLE Connection Interval: min 7.5ms, max 35ms
- BLE_COMMON_OPT_CONN_EVT_EXT option enabled, which is the parameter for enabling extended connection events
- Maximum MTU size: 244

High throughput mode in study watch:

The watch firmware enters the high throughput mode when sensor streaming is started and m2m2 SUB REQ command is given by the BLE Central device. The m2m2 packets are henceforth combined to a maximum of 4, before doing BLE Tx from Watch firmware side. Hence the BLE Central device needs to parse its BLE Rx packets, to extract m2m2 packets correctly. This was done to improve the BLE Dongle-Watch throughput. The mobile app may use M2M2_PM_SYS_BLE_SET_MAX_TX_PKT_COMB_CNT_REQ m2m2 command to lower the MAX_TX_PKT_COMB_CNT to 2 and restrict high throughput mode entry.

BLE Data rate seen with Watch & BLE Dongle combination is 8000 bytes/sec. BLE Data rate seen with iOS app is 1500 bytes/sec.

Reference:https://infocenter.nordicsemi.com/index.jsp?topic=%2Fcom.nordic.infocenter.sdk5.v15.2.0%2Fble_sdk_app_nus_eval.html&cp=7_5_1_4_1_2_24