Chapter 4: Bluetooth Low Energy (BLE)

Time 3 Hours

At the end of this chapter you will understand …

**Most importantly, you will be able to use WICED to connect your IoT device to a Wi-Fi Network.**

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# BLE Introduction

With the addition of BLE in 2010, it has become very popular particularly in IoT devices such as smart watches, health monitors, beacons, etc. What these applications typically have in common is small batteries that are often not charged frequently. Therefore, low power is more critical than data transfer speed. Moreover, these types of devices don’t require a constant connection. Rather, they can connect somewhat infrequently to send a burst of data.

The scenario described above is ideal for BLE. In fact, the way low power is achieved in BLE is not by lowering the power of the radio (i.e. the range), but rather by having the radio turned off most of the time. That is, BLE connections can stay active while only turning on the radio for a small percentage of each connection interval (e.g. a few hundred microseconds). The connection interval can be varied depending on the application from 7.5 ms to 4 seconds to trade off power and performance.

The MCU is also put in sleep mode a large portion of the time to further reduce power.

PHY, channels, speeds, data rates, MTU, etc.

Advertising vs. connecting

Bluetooth 4.0, 4.1 (better throughput and power), 4.2 (data length extension – 27 bytes vs 251 bytes - and enhanced security/privacy 1.2 – FIPS compliant ECDH key exchange), 5.0 (2 Mbps), etc.

Bluetooth Smart, Smart Ready terminology

Stack/L2CAP, etc.

# GAP

GAP roles

# GATT

GATT database and GATT roles

# Profiles, Services, and Characteristics

Profiles (incl. standard profiles from BT SIG)

Profile: Collection of Services

Service: Collection of Characteristics

Characteristic: Collection of Attributes

# Security, Pairing and Bonding

Security and secure modes – including enhanced security and privacy from BT 4.2

Separate out pairing/bonding?

# CySmart

CySmart Android and iOS apps, CySmart PC app intro

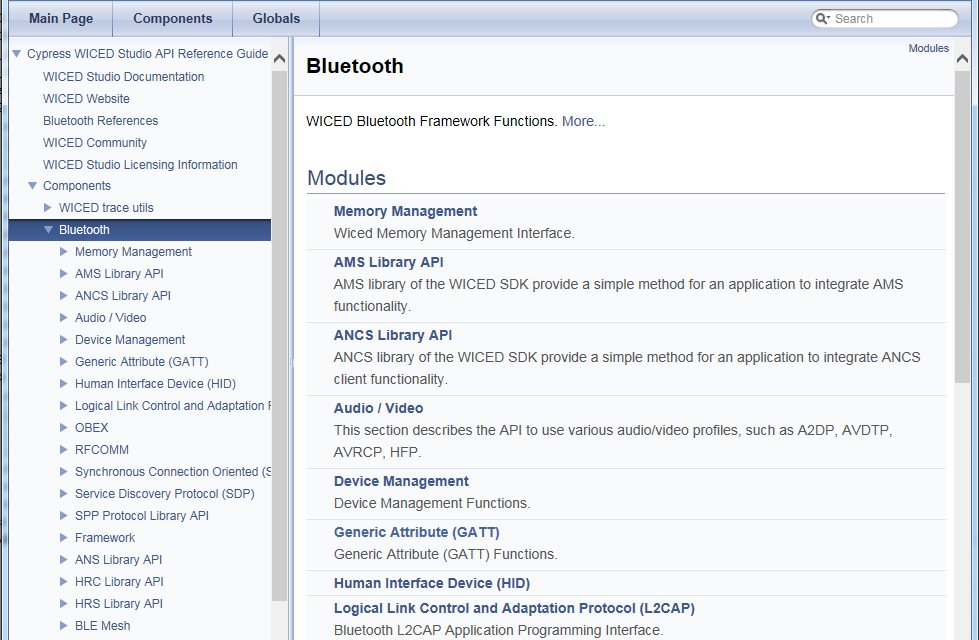
# Using BLE in WICED Studio

wiced\_bt\_cfg.c, GATT database definitions, callback functions, read/write functions

WICED Bluetooth Designer Wizard

# Documentation

The relevant documentation for Bluetooth functions are in the WICED SDK documentation under Components🡪Bluetooth.



# Advanced Topics

DTM – Direct Test Mode

HCI - Host Control Interface

OTA updates

Multi-role devices

Mesh

# Exercise(s)

* 1. Create a BLE Advertiser
  2. Connect using BLE
  3. Save BLE Bonding Information
  4. Add a Pairing Key
  5. (Advanced) Join a BLE Mesh Network ???

# Related Example “Apps”

|  |  |
| --- | --- |
| **App Name** | **Function** |
| snip.ble.eddystone |  |
| snip.ble.ibeacon |  |
| snip.ble.mybeacon |  |
| snip.ble.multi\_beakon |  |
| snip.ble.hrs |  |
| snip.ble.env\_sensing\_temp |  |
| semo.hello\_sensor |  |
|  |  |

# Recommended Reading