Problem Solving with the Internet of Things and Python

Unit 4 - BLE Connectivity

Lab 6

Intro to BLE

What is BLE?

You were introduced to BLE back in Unit 1.

"Bluetooth is a low-power, short-range radio technology that can connect and share data between electronic devices."

from- https://www.popsci.com/reviews/how-does-bluetooth-work/

Intro to BLE

Who controls the BLE standards?

The Bluetooth Special Interest Group or Bluetooth SIG was formed in 1998.
This is a non-profit organization that does not make any Bluetooth devices but is comprised of members from many different companies that help define the Bluetooth standards and the future.

The groups most influential members are:

- Ericsson (founding member)
- Intel (founding member)
- Nokia (founding member)
- Toshiba (founding member)
- Microsoft (member since 1999)
- Lenovo (member since 2005)
- Apple (member since 2015)

Let's go to the source…

Bluetooth SIG

Once we get there, remember, we are interested in Bluetooth LE not Bluetooth Classic.

Just the facts

Frequency Band- 2.4GHz ISM Band (2.402 – 2.480 GHz Utilized)

Channels - 40 channels with 2 MHz spacing
(3 advertising channels/37 data channels)

Channel Usage - Frequency-Hopping Spread Spectrum (FHSS)

Data Rate - 125 Kb/s to a max of 2 Mb/s

Range - depends on power of transmitter but figure 10m or less for low power IoT devices

Connection Types - Point to Point, Mesh, Broadcast only

BLE connection modes

Setting up a BLE Connection

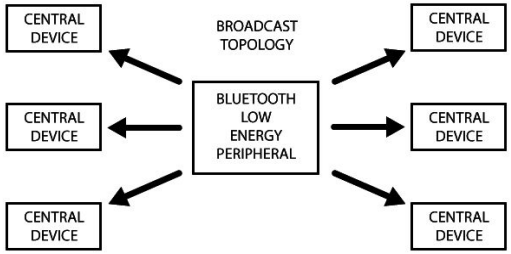
All BLE connections use a central / peripheral model. One end of the connection is the peripheral and the other end is the central.

Peripheral devices - advertise

"Hey, I am here. I can do these things and I am ready to connect…"

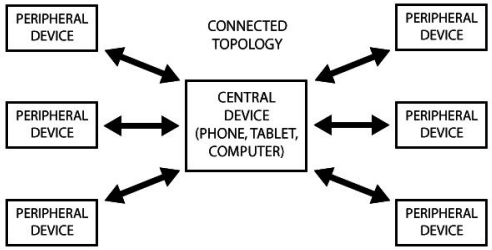
Central devices - Listen for available devices and connect to the ones they are interested in

BLE connection - Broadcast only



Source: https://learn.adafruit.com/alltheiot-transports/bluetooth-btle

BLE connection - Point to point



Source: https://learn.adafruit.com/alltheiot-transports/bluetooth-btle

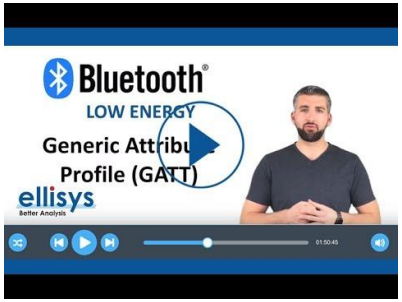
What is BLE Advertising?

NOTE: You should skip from about 3:10 until 5:10 of the video.

Deeper into BLE connections

NOTE: Watch until 3:15 mark, then skip remainder.

Even deeper into BLE connections



So many names!

central or peripheral?

master or slave ?

client or server ?

Central or Peripheral

PRIOR TO CONNECTION

The peripheral is the advertising device.

The central is the device listening to peripheral devices or that decides to connect to a peripheral device

Master or Slave

AFTER A CONNECTION IS ESTABLISHED

The peripheral becomes the slave device.

The central becomes the master device.

Client or Server

The client makes requests for data or sends commands.
This is typically the more powerful device, like a computer or cellphone.

The server sends data and responded to requests.
This is typically the IoT device!

Final look

Central → Master → Client
Typically the more powerful computing device.

Peripheral → Slave → Server
Typically the IoT device.

Lab 6

Lab 6 will introduce you to using BLE communication with the Adafruit Feather. Thankfully, we can import some useful libraries which will allow us to ignore many of the details (abstraction) about using BLE and just USE it to solve problems.

More resources

https://learn.adafruit.com/alltheiot-transports/bluetooth-btle

https://www.popsci.com/reviews/how-does-bluetooth-work/

Complete BLE video series