

## Chapter 1: BLE and the Internet of Things



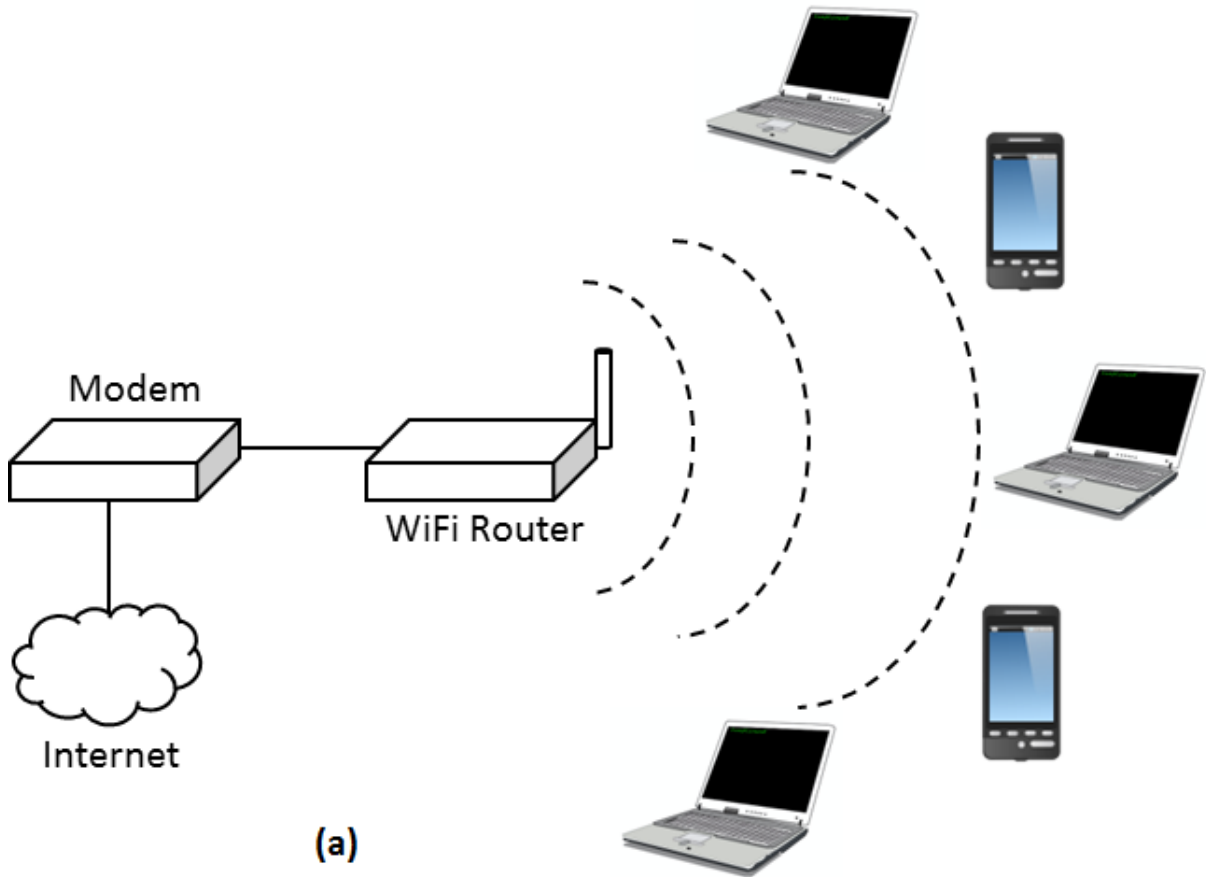


SAMSUNG

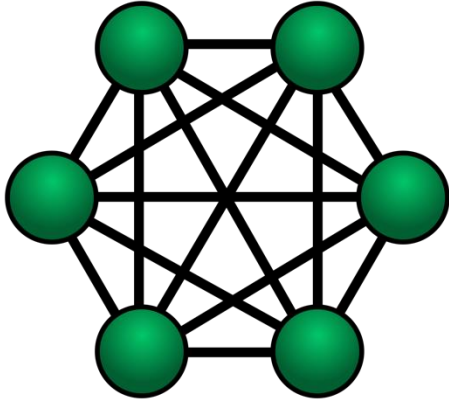












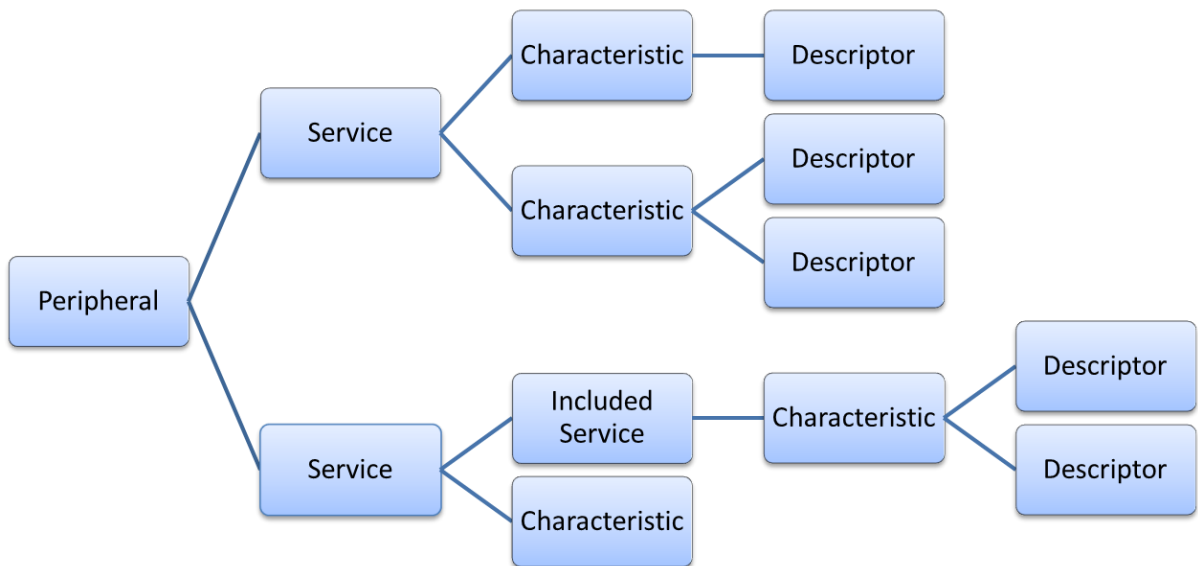
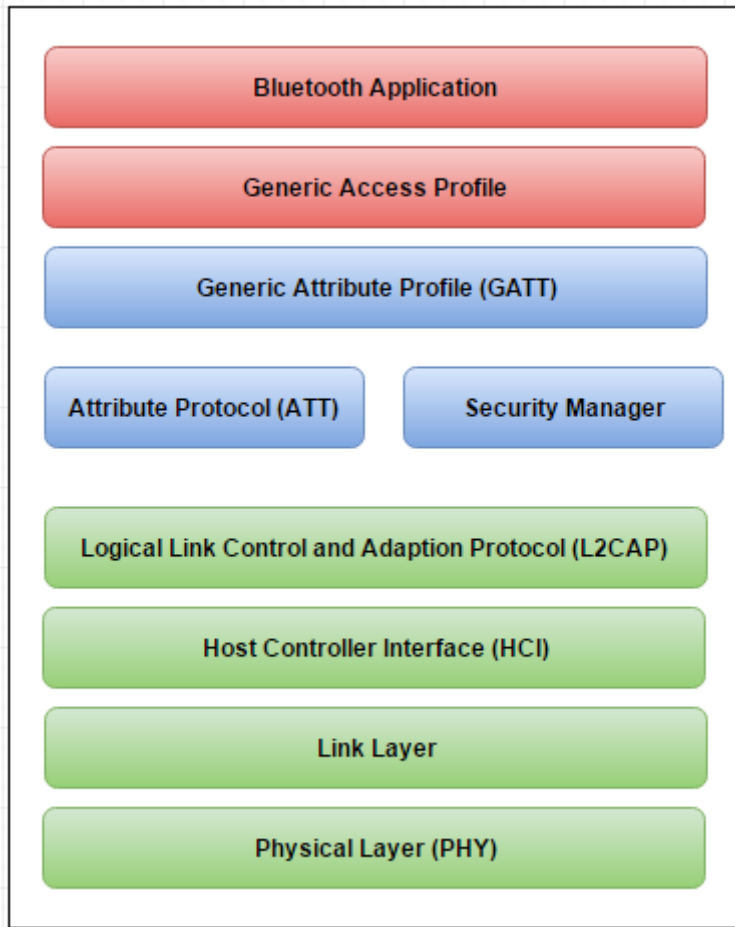
**ZigBee**<sup>®</sup>

Control your world



**Bluetooth**<sup>®</sup>

SPECIAL INTEREST GROUP

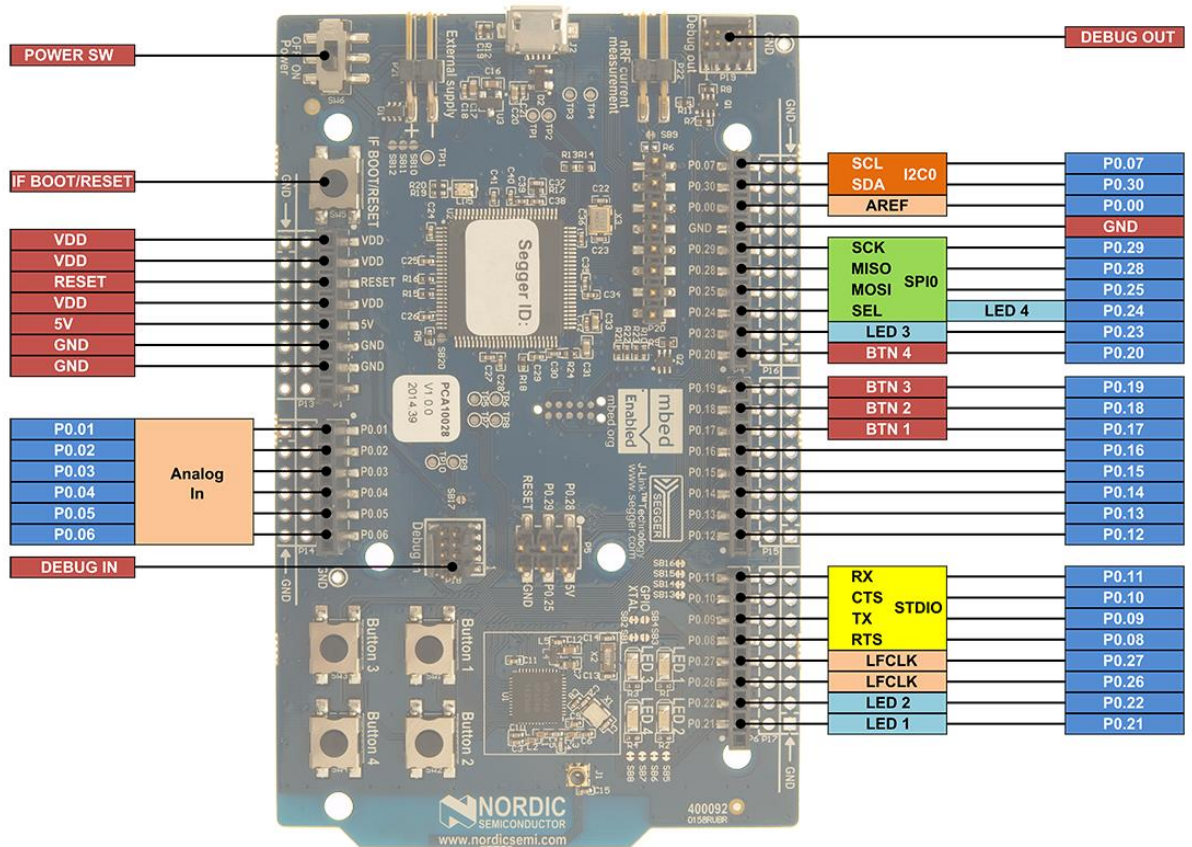
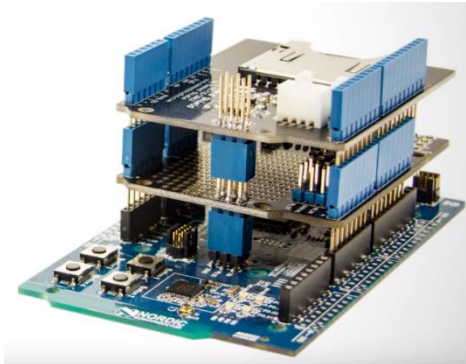


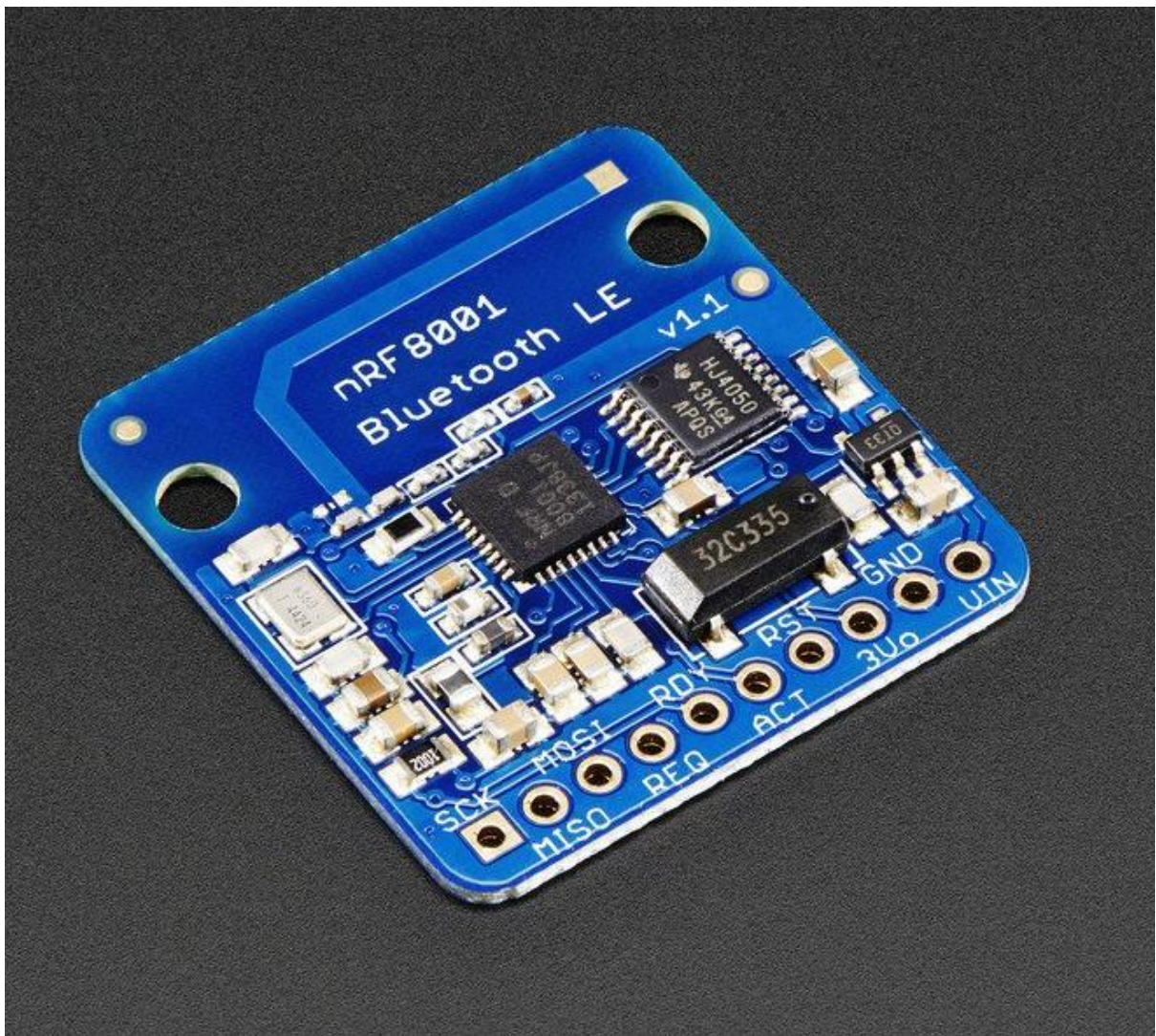


Overview	Properties	Security	Descriptors																														
<p><b>Name:</b> Heart Rate Measurement</p> <p><b>Description:</b> This characteristic is used to send a heart rate measurement.</p> <p><b>Type:</b> <a href="#">org.bluetooth.characteristic.heart_rate_measurement</a></p> <p><b>Requirement:</b> Mandatory</p>	<table border="1"> <thead> <tr> <th>Property</th> <th>Requirement</th> </tr> </thead> <tbody> <tr><td>Read</td><td>Excluded</td></tr> <tr><td>Write</td><td>Excluded</td></tr> <tr><td>WriteWithoutResponse</td><td>Excluded</td></tr> <tr><td>SignedWrite</td><td>Excluded</td></tr> <tr><td>Notify</td><td>Mandatory</td></tr> <tr><td>Indicate</td><td>Excluded</td></tr> <tr><td>WritableAuxiliaries</td><td>Excluded</td></tr> <tr><td>Broadcast</td><td>Excluded</td></tr> <tr><td>ExtendedProperties</td><td></td></tr> </tbody> </table>	Property	Requirement	Read	Excluded	Write	Excluded	WriteWithoutResponse	Excluded	SignedWrite	Excluded	Notify	Mandatory	Indicate	Excluded	WritableAuxiliaries	Excluded	Broadcast	Excluded	ExtendedProperties		None	<table border="1"> <thead> <tr> <th>Overview</th> <th>Permissions</th> </tr> </thead> <tbody> <tr> <td> <p><b>Name:</b> Client Characteristic Configuration</p> <p><b>Type:</b> <a href="#">org.bluetooth.descriptor.gatt.client_characteristic_configuration</a></p> <p><b>Requirement:</b> Mandatory</p> </td> <td> <table border="1"> <thead> <tr> <th>Permission</th> <th>Requirement</th> </tr> </thead> <tbody> <tr><td>Read</td><td>Mandatory</td></tr> <tr><td>Write</td><td>Mandatory</td></tr> </tbody> </table> </td> </tr> </tbody> </table>	Overview	Permissions	<p><b>Name:</b> Client Characteristic Configuration</p> <p><b>Type:</b> <a href="#">org.bluetooth.descriptor.gatt.client_characteristic_configuration</a></p> <p><b>Requirement:</b> Mandatory</p>	<table border="1"> <thead> <tr> <th>Permission</th> <th>Requirement</th> </tr> </thead> <tbody> <tr><td>Read</td><td>Mandatory</td></tr> <tr><td>Write</td><td>Mandatory</td></tr> </tbody> </table>	Permission	Requirement	Read	Mandatory	Write	Mandatory
Property	Requirement																																
Read	Excluded																																
Write	Excluded																																
WriteWithoutResponse	Excluded																																
SignedWrite	Excluded																																
Notify	Mandatory																																
Indicate	Excluded																																
WritableAuxiliaries	Excluded																																
Broadcast	Excluded																																
ExtendedProperties																																	
Overview	Permissions																																
<p><b>Name:</b> Client Characteristic Configuration</p> <p><b>Type:</b> <a href="#">org.bluetooth.descriptor.gatt.client_characteristic_configuration</a></p> <p><b>Requirement:</b> Mandatory</p>	<table border="1"> <thead> <tr> <th>Permission</th> <th>Requirement</th> </tr> </thead> <tbody> <tr><td>Read</td><td>Mandatory</td></tr> <tr><td>Write</td><td>Mandatory</td></tr> </tbody> </table>	Permission	Requirement	Read	Mandatory	Write	Mandatory																										
Permission	Requirement																																
Read	Mandatory																																
Write	Mandatory																																

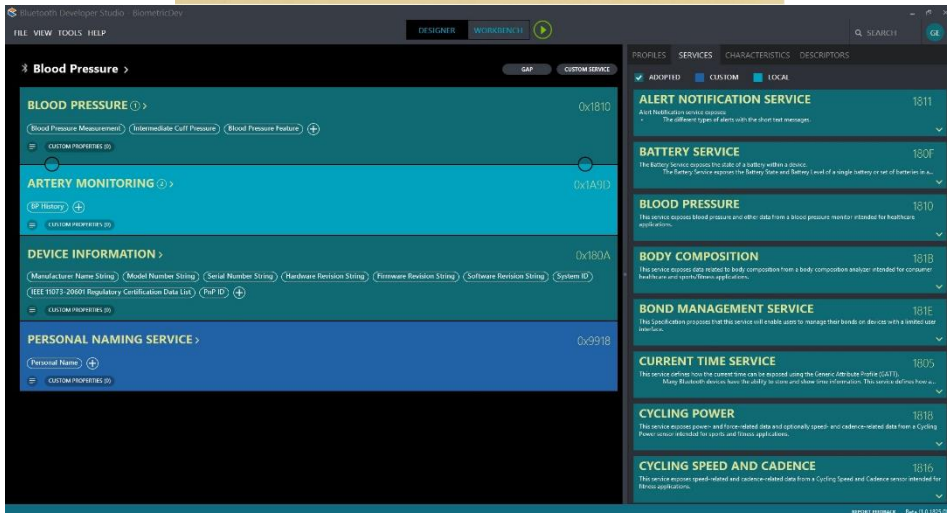
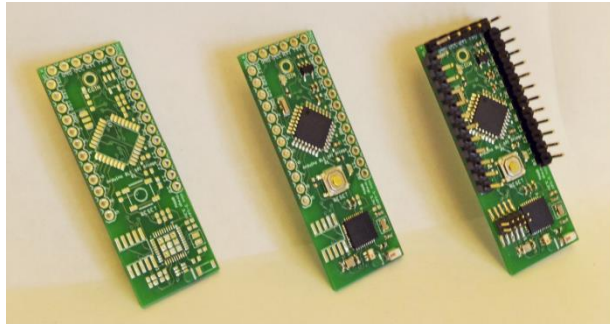


## Chapter 2: BLE Hardware, Software, and Debugging Tools









# nRF Connect

A NORDIC SEMICONDUCTOR PRODUCT

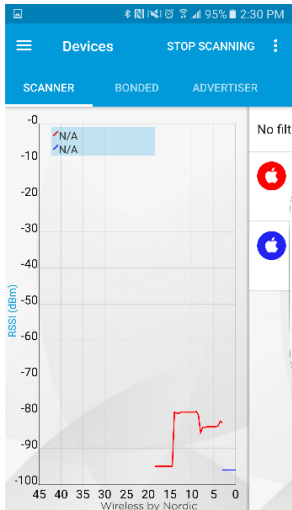
Devices SCAN

SCANNER BONDED ADVERTISER

No filter

- N/A  
A0:18:28:ED:C4:1F  
NOT BONDED  
RSSI: -90 dBm  
RTT: 183 ms
- N/A  
14:99:E2:1B:4A:13  
NOT BONDED  
RSSI: -99 dBm  
RTT: 9884 ms

Wireless by Nordic



Devices DISCONNECT

BONDED ADVERTISER MOTO 360 3LFJ

CONNECTED BONDED CLIENT SERVER

- Generic Attribute  
UUID: 0x1801  
PRIMARY SERVICE
- Generic Access  
UUID: 0x1800  
PRIMARY SERVICE
- Unknown Service  
UUID: 7bec25f9-9716-c0a6-e511-f30a00010000  
PRIMARY SERVICE
- Unknown Service  
UUID: 00010011-1a00-0080-0010-020000010000  
PRIMARY SERVICE
- Unknown Characteristic  
UUID: 0000101-0002-1000-8000-001a11000100  
Properties: INDICATE, READ  
Descriptors:  
Client Characteristic Configuration  
UUID: 0x2902

NORDIC SEMICONDUCTOR

Devices

- Configure GATT server
- Manage favorites
- nRF Logger
- Device information
- Settings
- Send feedback



nRF UART

Disconnect

[13:38:36] Connected to: UART

Device: UART - ready

Send

nRF UART

Connect

Select a device

UART E8:49:39:EF:85:25	Rssi: -86
One F9:6A:71:6A:5B:97	Rssi: -78
f96 FD:ED:82:65:A0:0E	Rssi: -89

Cancel

Device: <Select a device>

Send

nRF UART

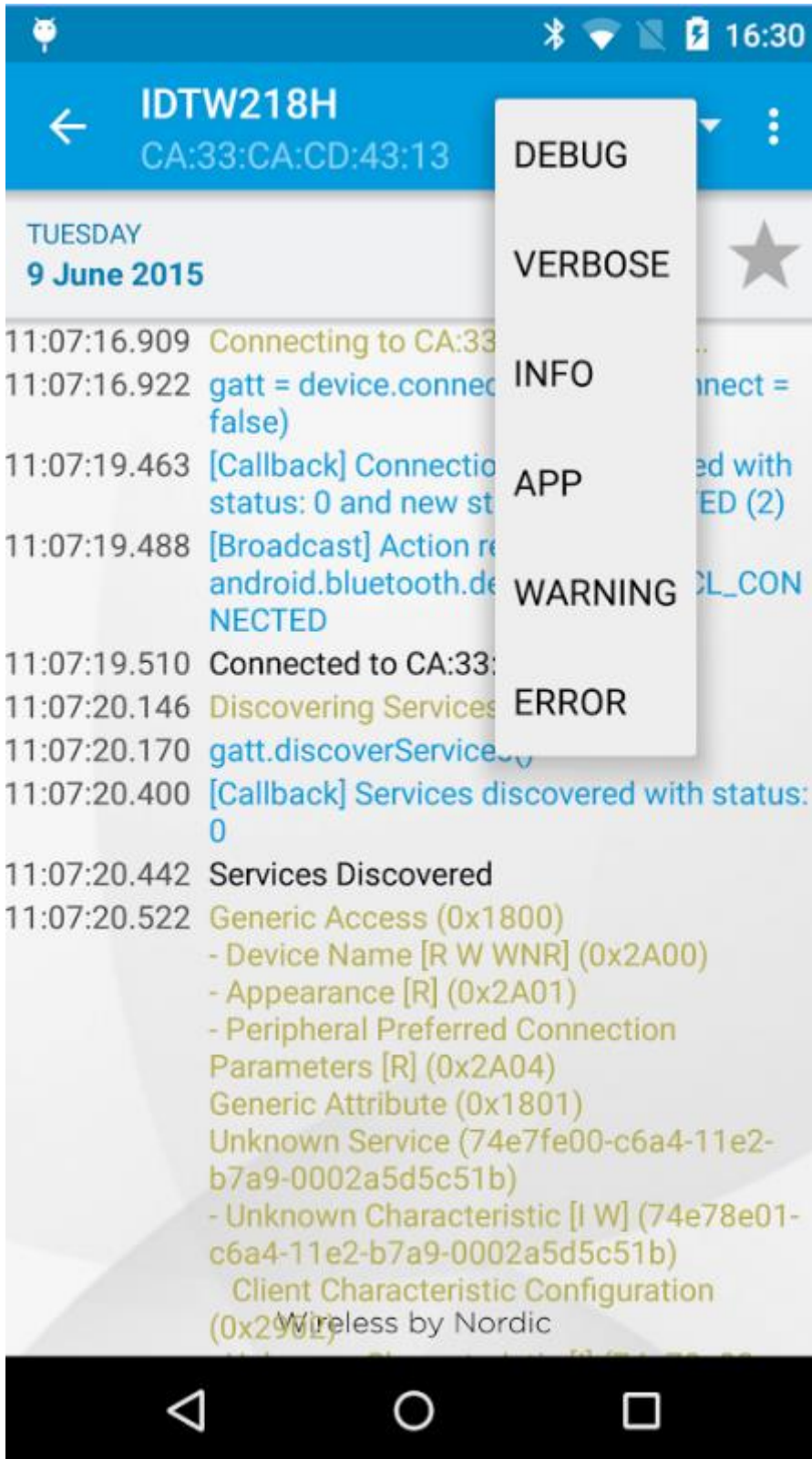
Disconnect

[3:55:36 PM] Connected to: UART  
[3:55:44 PM] TX: type in something  
[3:55:44 PM] RX: type in something  
[3:55:46 PM] TX: 你好  
[3:55:46 PM] RX: 你好

Device: UART - ready

Send

q w e r t y u i o p  
a s d f g h j k l  
z x c v b n m  
7123









16:50

# nRF Beacon for Eddystone



BEACONS

UPDATE



Namespace: nrf-nearby-1100  
Attachment: Welcome to Nordic Semiconductor



Wireless by Nordic





NodeCFG

00:1D:60:4E:61:0C

### Configure NodeCFG

Select an action

Connection Mode 

Action delay in seconds

10

Identification duration in seconds

20

Select a back up mode in case of action failure

Configuraton mode 

Edit default configuration

IDENTIFY

CANCEL

CONFIGURE



10:06



Registering Beacon

REGISTER BEACON

Location



Coordinates 51.495210, -0.143898

Expected stability

STABLE

Description

Station Entrance

Floor level

Properties

Name: model

Value: x-42

Attachments

Type: fabled-skein-95115/station-name

Data: Victoria Station



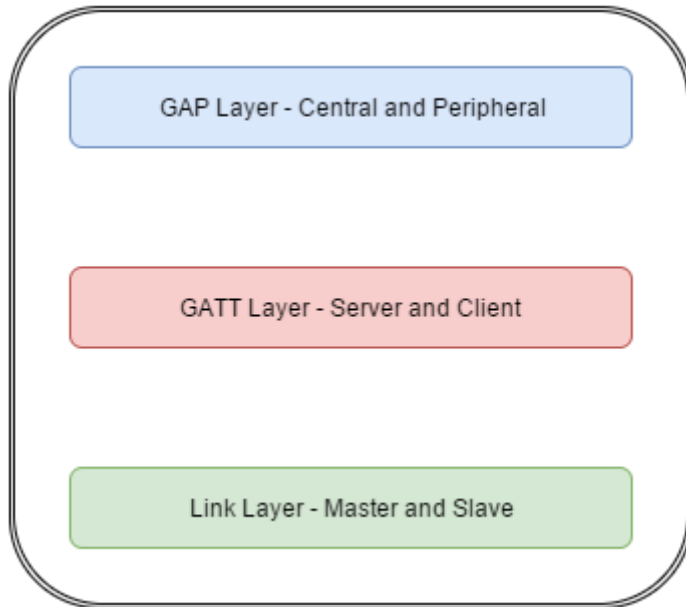
# Nearby Beacons



Searching for beacons



# Chapter 3: Building a BLE Central and Peripheral Communication System



**PLAYBULB COMET** CONNECT

FA:76:4B:0F:AC:E6  
NOT BONDED -82 dBm ↔ 62 ms

Type: BLE only  
Flags: GeneralDiscoverable, BrEdrNotSupported  
Complete list of 16-bit Service UUIDs: 0xFF07  
Appearance: [832] Generic Heart rate Sensor (Generic category)  
Tx Power Level: -2 dBm  
Manufacturer data (Bluetooth Core 4.1):  
Company: Reserved ID <0x494D> 0x504F57  
Complete Local Name: PLAYBULB COMET

CLONE RAW MORE

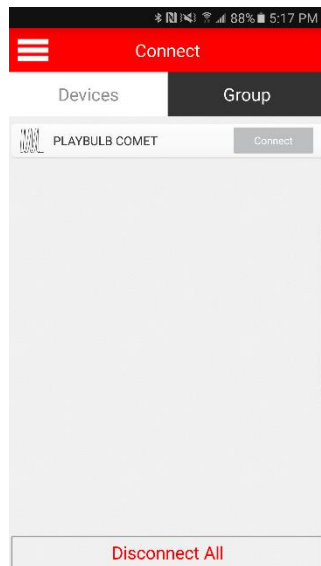
**Pair with your watch**

On your watch, swipe to see your watch code. Then tap this code when it appears in the list below.

- MOTO 360 3LFJ
- PLAYBULB COMET

**Pairing with Moto 360 3LFJ**

Accept the prompts that appear on your phone to continue.



# ANDROID NOUGAT

```
@Override
public
    su
}
}
@Override
public
    su
}
};

BluetoothGatt
mBluetoothGatt.
    executeReliableWrite () boolean
    getConnectedDevices () List<BluetoothDevice>
    getConnectionState (BluetoothDevice device) int
    getDevice () BluetoothDevice
    getDevicesMatchingConnectionStates (int... List<BluetoothDevice>
    getService (UUID uuid) BluetoothGattService
    getServices () List<BluetoothGattService>
    readCharacteristic (BluetoothGattCharacteristic chara... boolean
    readDescriptor (BluetoothGattDescriptor descriptor) boolean
    readRemoteRssi () boolean
    requestConnectionPriority (int connectionPriority) boolean (ack);
mBluetoothGatt.
```

```

public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);

    BluetoothGatt gatt = BluetoothGattAdapter.getInstance(getApplicationContext());
    BluetoothGattCharacteristic charac... = BluetoothGattAdapter.getInstance(getApplicationContext()).getCharacteristic(UUID.fromString("00001101-0000-1000-8000-000000000000"));
    BluetoothGattService service = BluetoothGattAdapter.getInstance(getApplicationContext()).getService(UUID.fromString("00001101-0000-1000-8000-000000000000"));

    // Add characteristic
    gatt.addCharacteristic(charac...);

    // Add service
    gatt.addService(service);

    // Describe contents
    gatt.describeContents();

    // Get characteristic
    BluetoothGattCharacteristic charac... = gatt.getCharacteristic(UUID.fromString("00001101-0000-1000-8000-000000000000"));

    // Get characteristics
    List<BluetoothGattCharacteristic> characteristics = gatt.getCharacteristics();

    // Get included services
    List<BluetoothGattService> includedServices = gatt.getIncludedServices();

    // Get instance ID
    int instanceId = gatt.getInstanceId();

    // Get type
    int type = gatt.getType();

    // Get UUID
    UUID uuid = gatt.getUuid();

    // Write to parcel
    gatt.writeToParcel(parcel, 0);

    // Equals
    boolean equals = gatt.equals(obj);
}

```

```

super.onCreate(savedInstanceState);
}

BluetoothGatt mBluetoothGatt = BluetoothGattAdapter.getInstance(getApplicationContext());
BluetoothGattCharacteristic mCharacteristic = BluetoothGattAdapter.getInstance(getApplicationContext()).getCharacteristic(UUID.fromString("00001101-0000-1000-8000-000000000000"));
BluetoothGattService mService = BluetoothGattAdapter.getInstance(getApplicationContext()).getService(UUID.fromString("00001101-0000-1000-8000-000000000000"));
List<BluetoothGattCharacteristic> mCharacteristics = BluetoothGattAdapter.getInstance(getApplicationContext()).getCharacteristics();
List<BluetoothGattService> mIncludedServices = BluetoothGattAdapter.getInstance(getApplicationContext()).getIncludedServices();
int mInstanceId = BluetoothGattAdapter.getInstance(getApplicationContext()).getInstanceId();
int mType = BluetoothGattAdapter.getInstance(getApplicationContext()).getType();
UUID mUuid = BluetoothGattAdapter.getInstance(getApplicationContext()).getUuid();
Parcel mParcel = Parcel.obtain();
boolean mEquals = BluetoothGattAdapter.getInstance(getApplicationContext()).equals(obj);

// Add descriptor
mBluetoothGatt.addDescriptor(mBluetoothGattDescriptor);

// Describe contents
mBluetoothGatt.describeContents();

// Get descriptor
BluetoothGattDescriptor mDescriptor = mBluetoothGatt.getDescriptor(UUID.fromString("00001101-0000-1000-8000-000000000000"));

// Get descriptors
List<BluetoothGattDescriptor> mDescriptors = mBluetoothGatt.getDescriptors();

// Get float value
float mFloatValue = mBluetoothGatt.getFloatValue(BluetoothGattDescriptor.FORMAT_FLOAT_BE, 0);

// Get instance ID
int mInstanceId = mBluetoothGatt.getInstanceId();

// Get int value
int mIntValue = mBluetoothGatt.getIntValue(BluetoothGattDescriptor.FORMAT_INT16_BE, 0);

// Get permissions
int mPermissions = mBluetoothGatt.getPermissions();

// Get properties
int mProperties = mBluetoothGatt.getProperties();

// Get service
BluetoothGattService mService = mBluetoothGatt.getService(UUID.fromString("00001101-0000-1000-8000-000000000000"));

// Get string value
String mStringValue = mBluetoothGatt.getStringValue(BluetoothGattDescriptor.FORMAT_STRING_16, 0);

// Get UUID
UUID mUuid = mBluetoothGatt.getUuid();

// Get value
byte[] mValue = mBluetoothGatt.getValue();

// Get write type
int mWriteType = mBluetoothGatt.getWriteType();

// Set value
mBluetoothGatt.setValue(mValue);
mBluetoothGatt.setValue(1.5f, 1, BluetoothGattDescriptor.FORMAT_FLOAT_BE, 0);
mBluetoothGatt.setValue(1, BluetoothGattDescriptor.FORMAT_INT16_BE, 0);
mBluetoothGatt.setValue("Hello");

// Set write type
mBluetoothGatt.setWriteType(BluetoothGattDescriptor.WRITE_TYPE_DEFAULT);

// Write to parcel
mBluetoothGatt.writeToParcel(mParcel, 0);

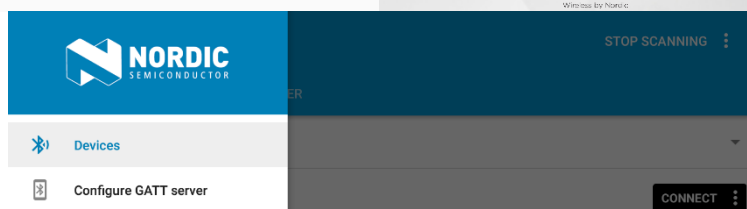
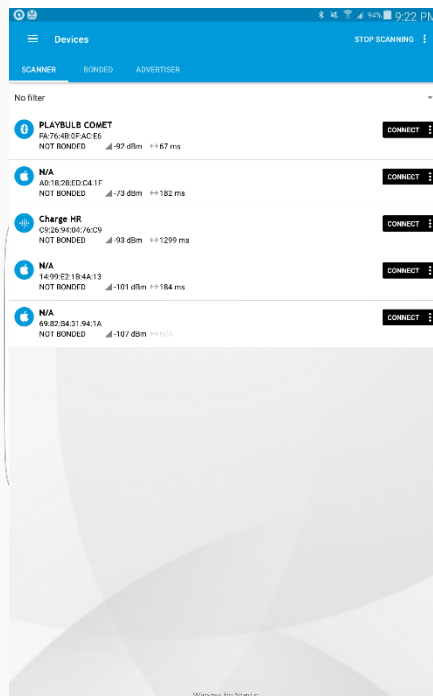
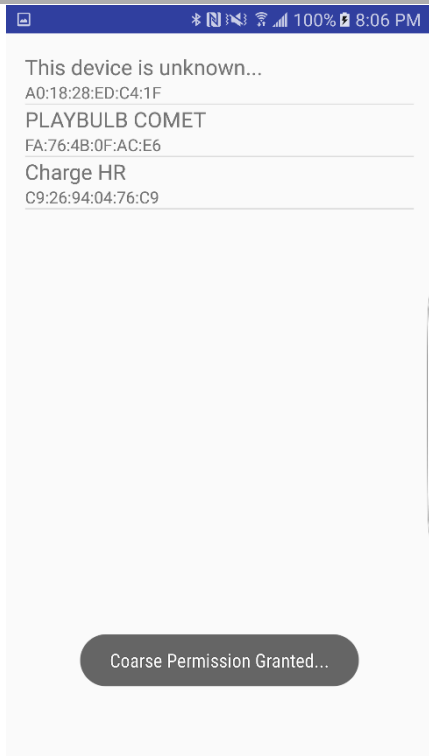
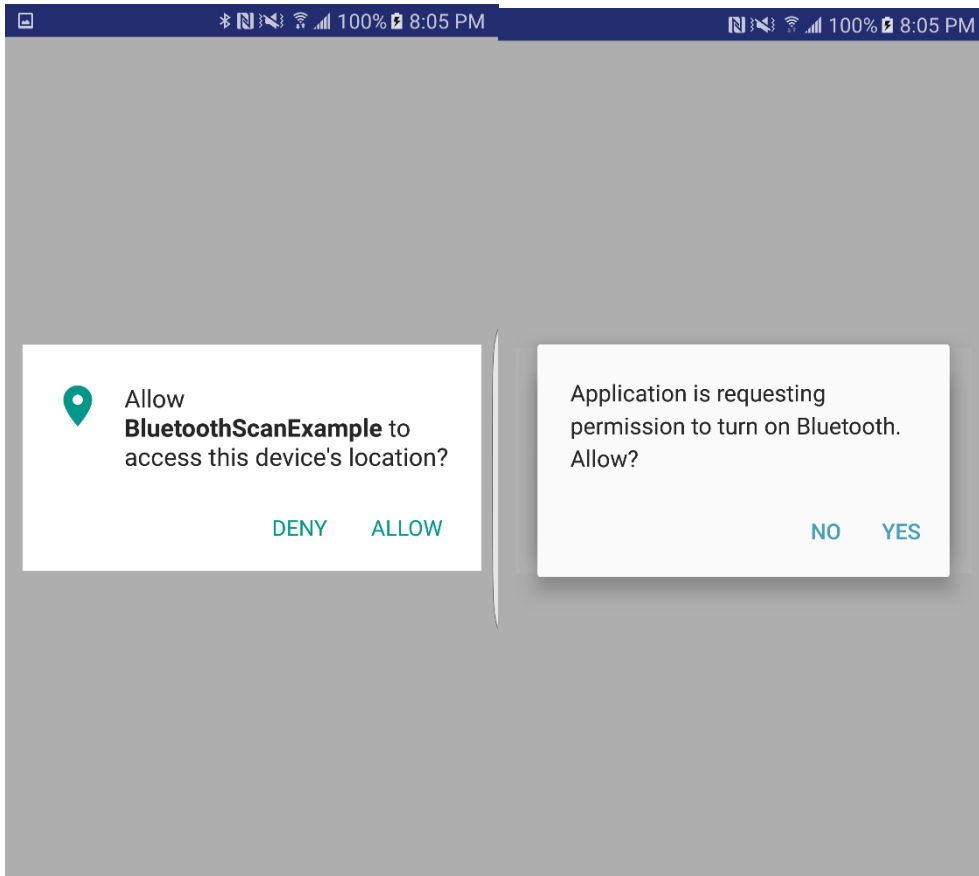
// Equals
boolean mEquals = mBluetoothGatt.equals(obj);
}

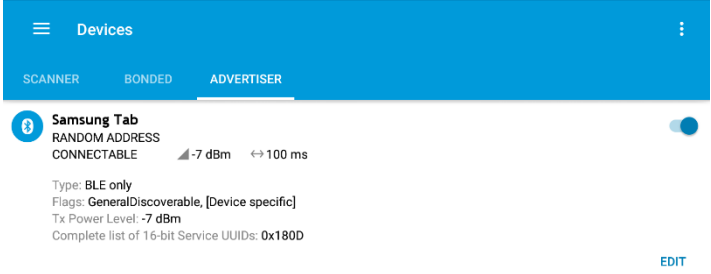
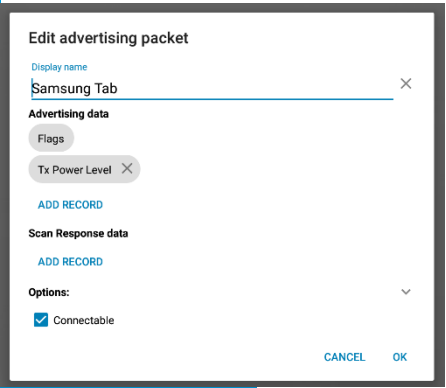
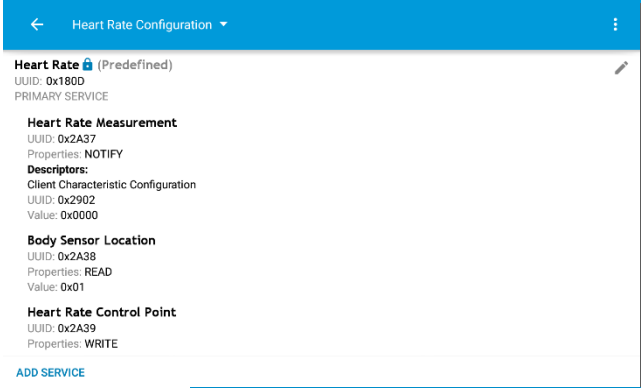
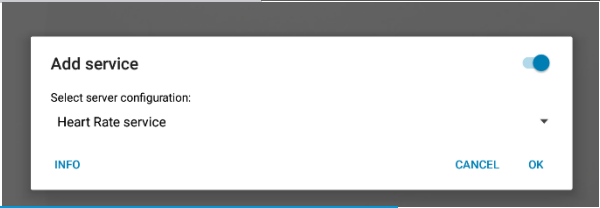
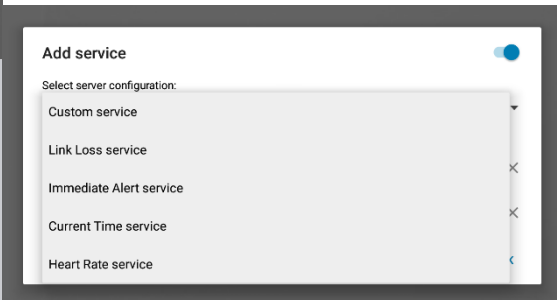
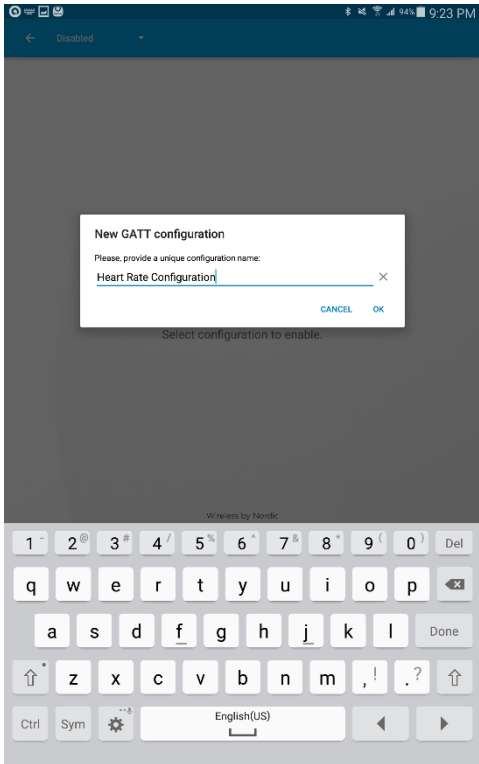
```

Android

- app
  - manifests
  - java
    - com.demo.bluetoothscanexample
      - MainActivity
      - com.demo.bluetoothscanexample (androidTest)
      - com.demo.bluetoothscanexample (test)
    - res
- Gradle Scripts
  - build.gradle (Project: BluetoothScanExample)
  - build.gradle (Module: app)
  - gradle-wrapper.properties (Gradle Version)
  - proguard-rules.pro (ProGuard Rules for app)
  - gradle.properties (Project Properties)
  - settings.gradle (Project Settings)
  - local.properties (SDK Location)









This device is unknown...

A0:18:28:ED:C4:1F

PLAYBULB COMET

FA:76:4B:0F:AC:E6

This device is unknown...

C0:E9:DE:07:AE:AE

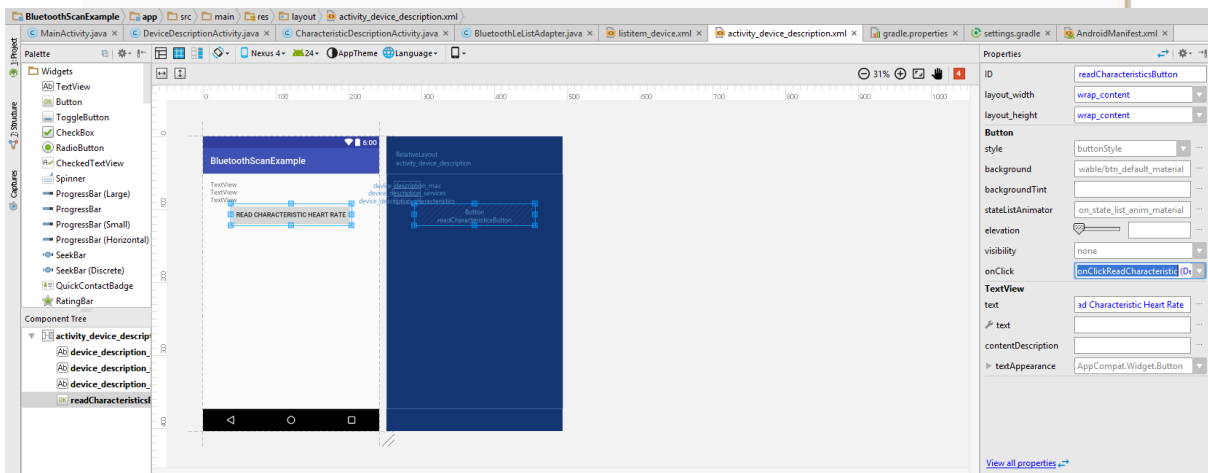
# BluetoothScanExample

C0:E9:DE:07:AE:AE

00001801-0000-1000-8000-00805f9b34fb

00001800-0000-1000-8000-00805f9b34fb

0000180d-0000-1000-8000-00805f9b34fb



# BluetoothScanExample

C0:E9:DE:07:AE:AE

00001801-0000-1000-8000-00805f9b34fb

00001800-0000-1000-8000-00805f9b34fb

0000180d-0000-1000-8000-00805f9b34fb

Reading Characteristics:

00002a37-0000-1000-8000-00805f9b34fb

00002a38-0000-1000-8000-00805f9b34fb

00002a39-0000-1000-8000-00805f9b34fb

READ CHARACTERISTIC HEART RATE

← Heart Rate Configuration ▾

**Heart Rate** ⓘ (Predefined)

UUID: 0x180D  
PRIMARY SERVICE

**Heart Rate Measurement**

UUID: 0x2A37  
Properties: NOTIFY

**Descriptors:**

**Client Characteristic Configuration**  
UUID: 0x2902  
Value: 0x0000

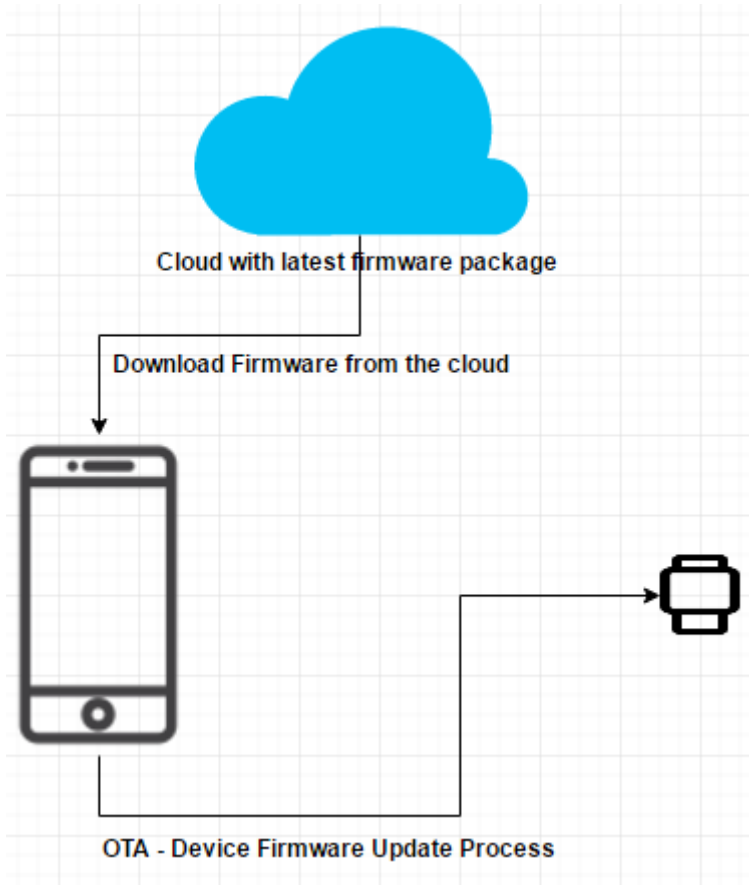
**Body Sensor Location**

UUID: 0x2A38  
Properties: READ  
Value: 0x01

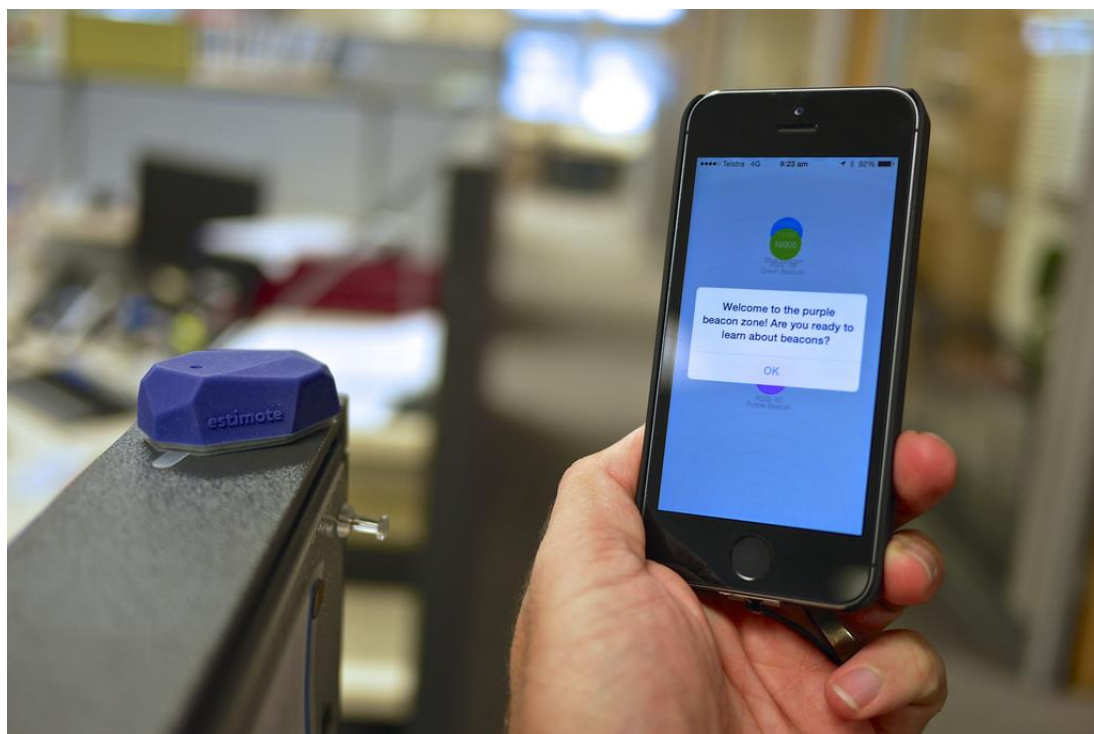
**Heart Rate Control Point**

UUID: 0x2A39  
Properties: WRITE

[ADD SERVICE](#)



## Chapter 4: Bluetooth Low Energy Beacons



Byte Offset 0 - Frame Type

Byte Offset 1 - Ranging Data (Tx Power)

Byte Offset 2 - NID[0] (10-byte Namespace)

Byte Offset 3 - NID[1]

Byte Offset 11 - NID[9]

Byte Offset 12 - BID[0] (6-byte instance)

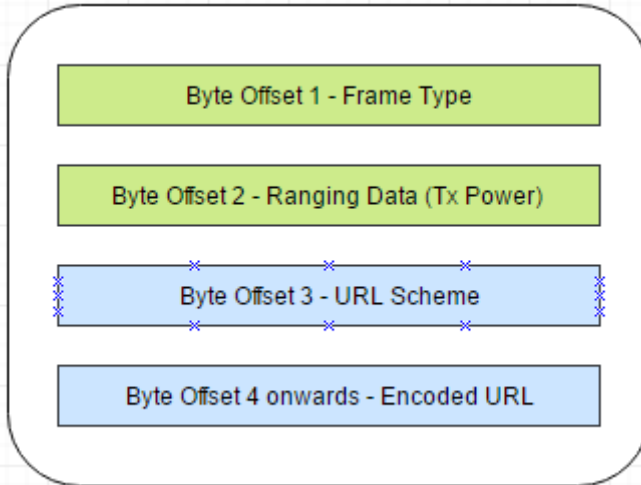
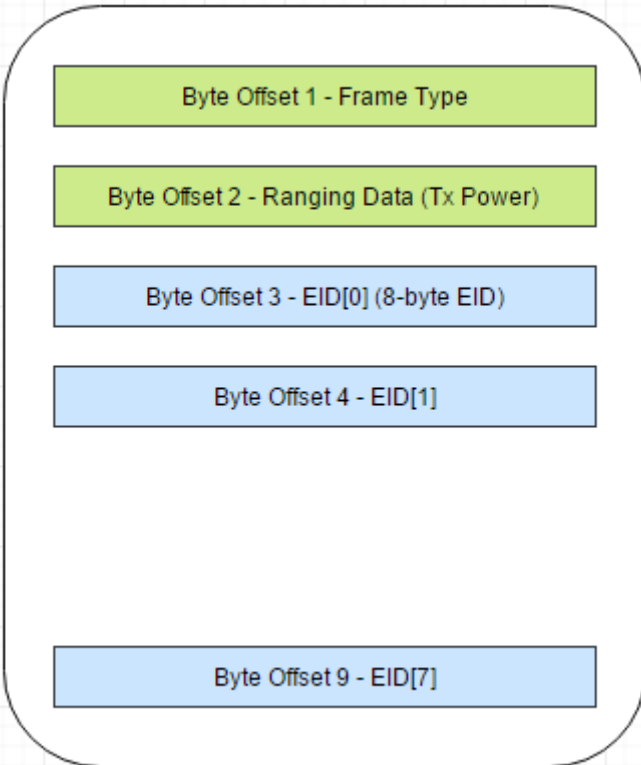
Byte Offset 13 - BID[1]

Byte Offset 17 - BID[5]

Byte Offset 18 - For future use




Byte Offset 19 - For future use







**estimote cloud** Beacons Logged in as usamaaftab80@gmail.com

<input type="checkbox"/>	 <b>Building Bluetooth</b> Identifier: 907a9c517f9e45e20320b8523a10d006 Packets: iBeacon (B9407F30-F5F8-466E-AFF9-25556B57FE6D:22317:982) • Estimote Telemetry Location: Unknown <input type="button" value="Settings"/>
<input type="checkbox"/>	 <b>Low Energy</b> Identifier: fd04aa567da62c9fb15f92251cfe821 Packets: iBeacon (B9407F30-F5F8-466E-AFF9-25556B57FE6D:8889:62400) • Estimote Telemetry Location: Unknown <input type="button" value="Settings"/>
<input type="checkbox"/>	 <b>Systems</b> Identifier: eb81a3e0e92afee99298416e1c5aba2d Packets: Eoystone URL (http://facebook.com) • Estimote Telemetry Location: Unknown <input type="button" value="Settings"/>

## Edit Settings



You can change beacons settings remotely. Set them here and they will be updated when you approach the beacons with the [Estimote iOS App](#), or an app with the Estimote iOS SDK integrated. [Learn more about remote beacon management.](#)

### • Device

Beacon Health Check

Connection

iBeacon

Eddystone-UID

Eddystone-URL

Eddystone-TLM

Eddystone-EID

Estimote Telemetry

Estimote Location

Here & Now

Name

Building Bluetooth

Geo Location

Tags

Smart Power Saving

On

Motion Detection

Off

Motion Only Broadcasting

Off

Motion Only Broadcasting Delay (0 to 300 000 ms)

0

Flip to Sleep

Off

Dark to Sleep

Off

Eddystone Configuration Service

Off

Automatic Firmware Update

Off

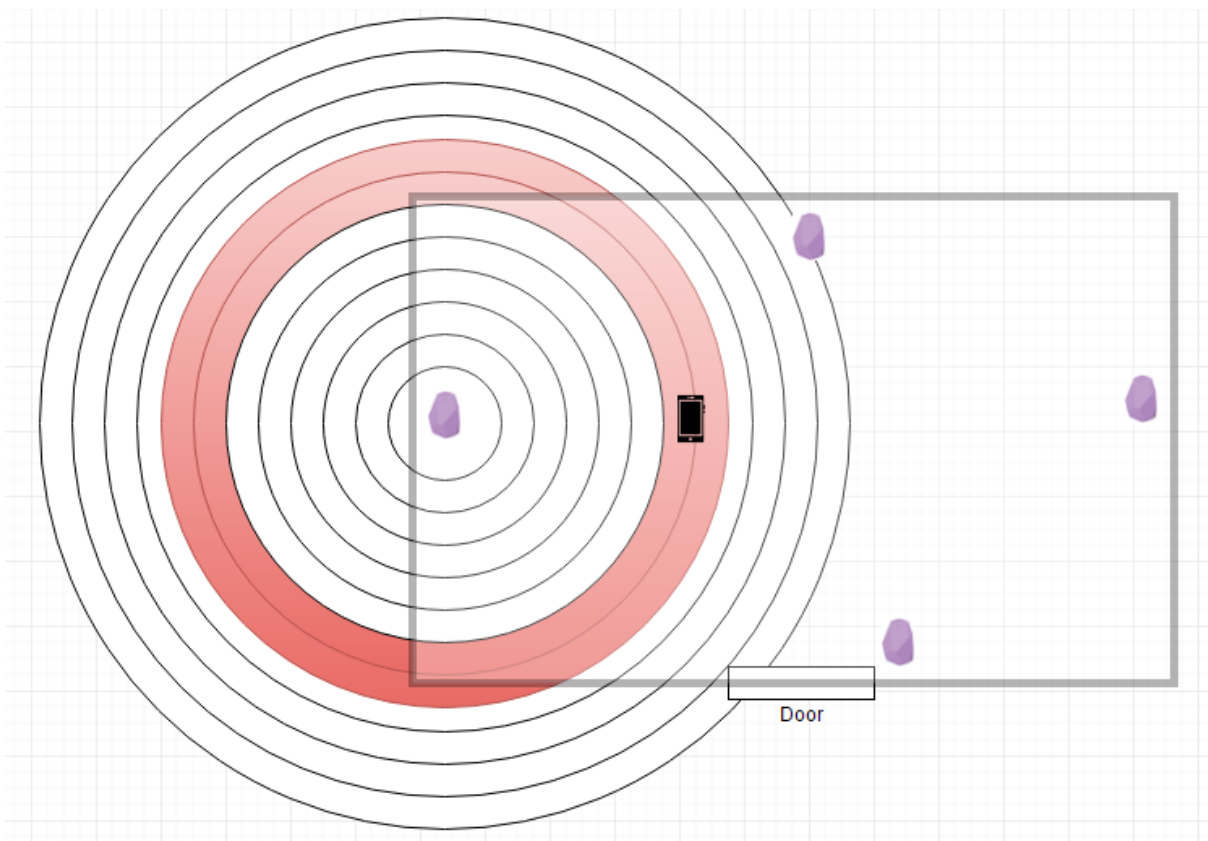
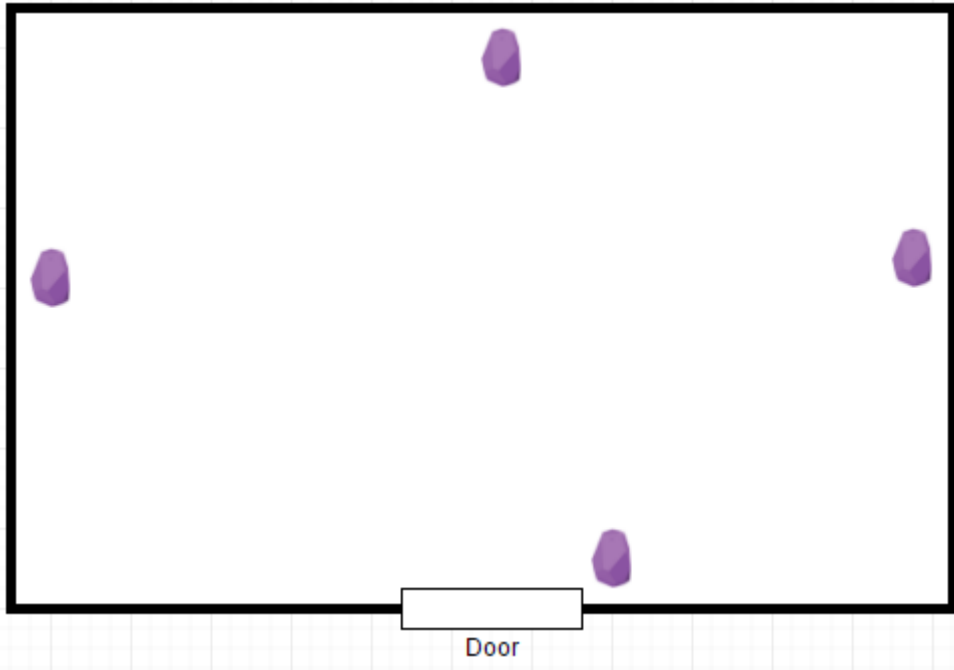
Delete Pending Settings

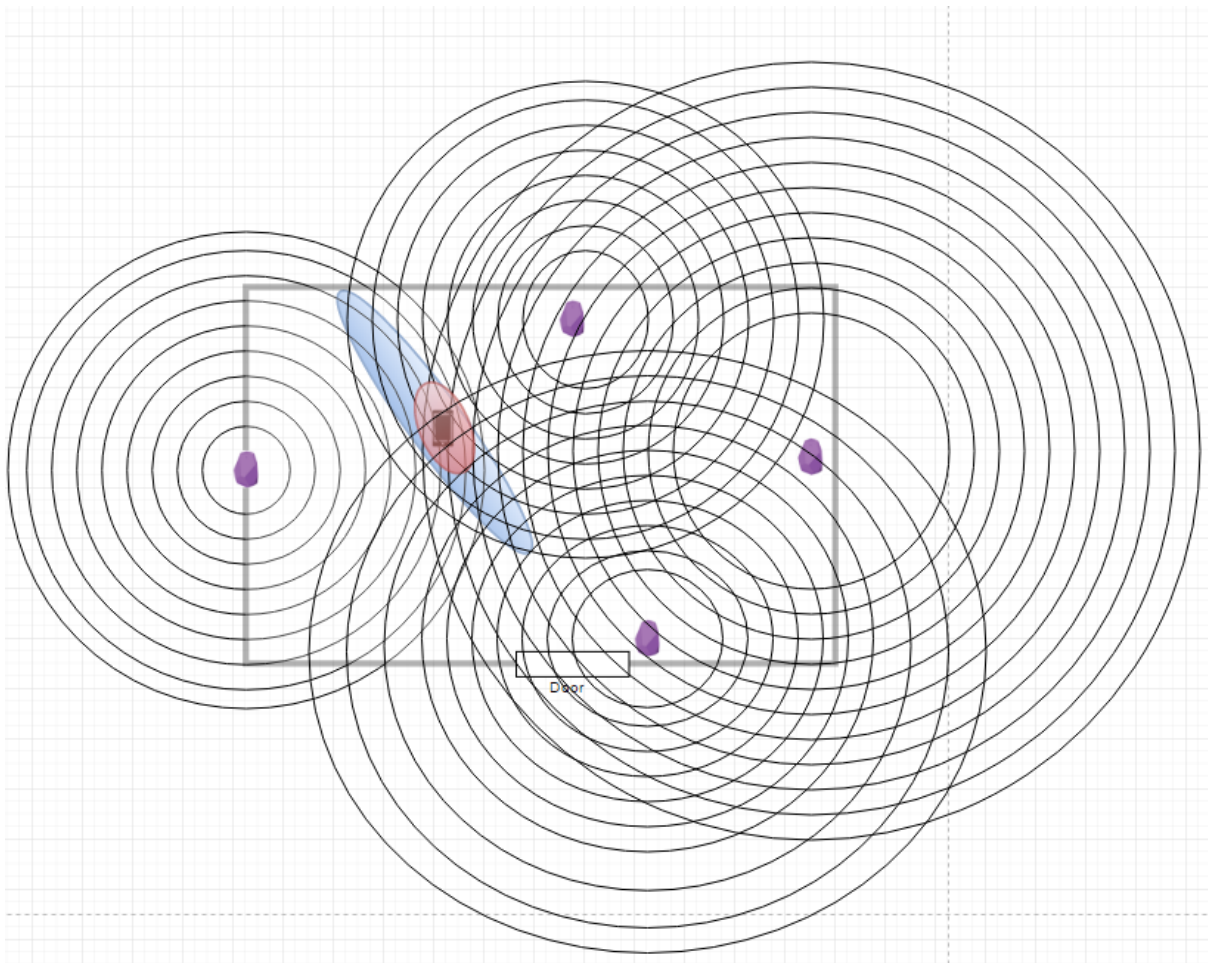
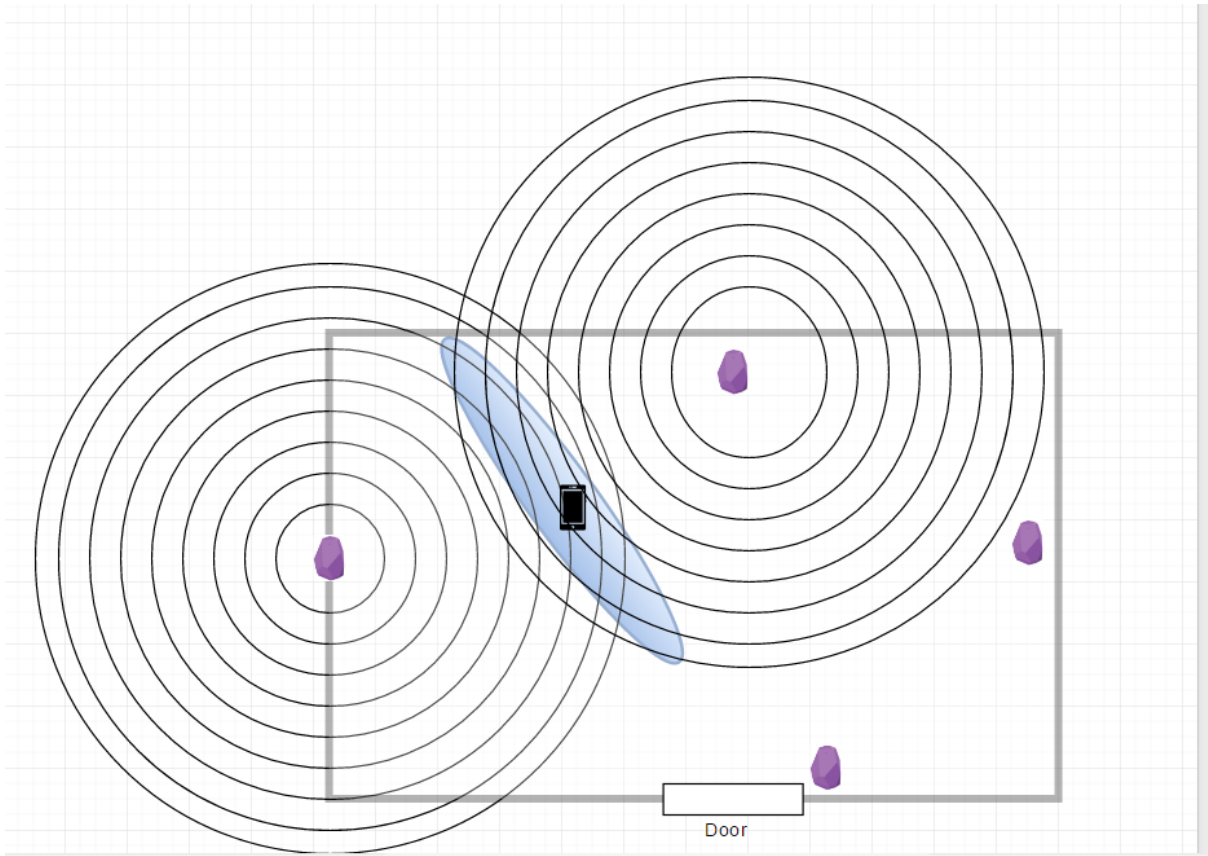
Cancel

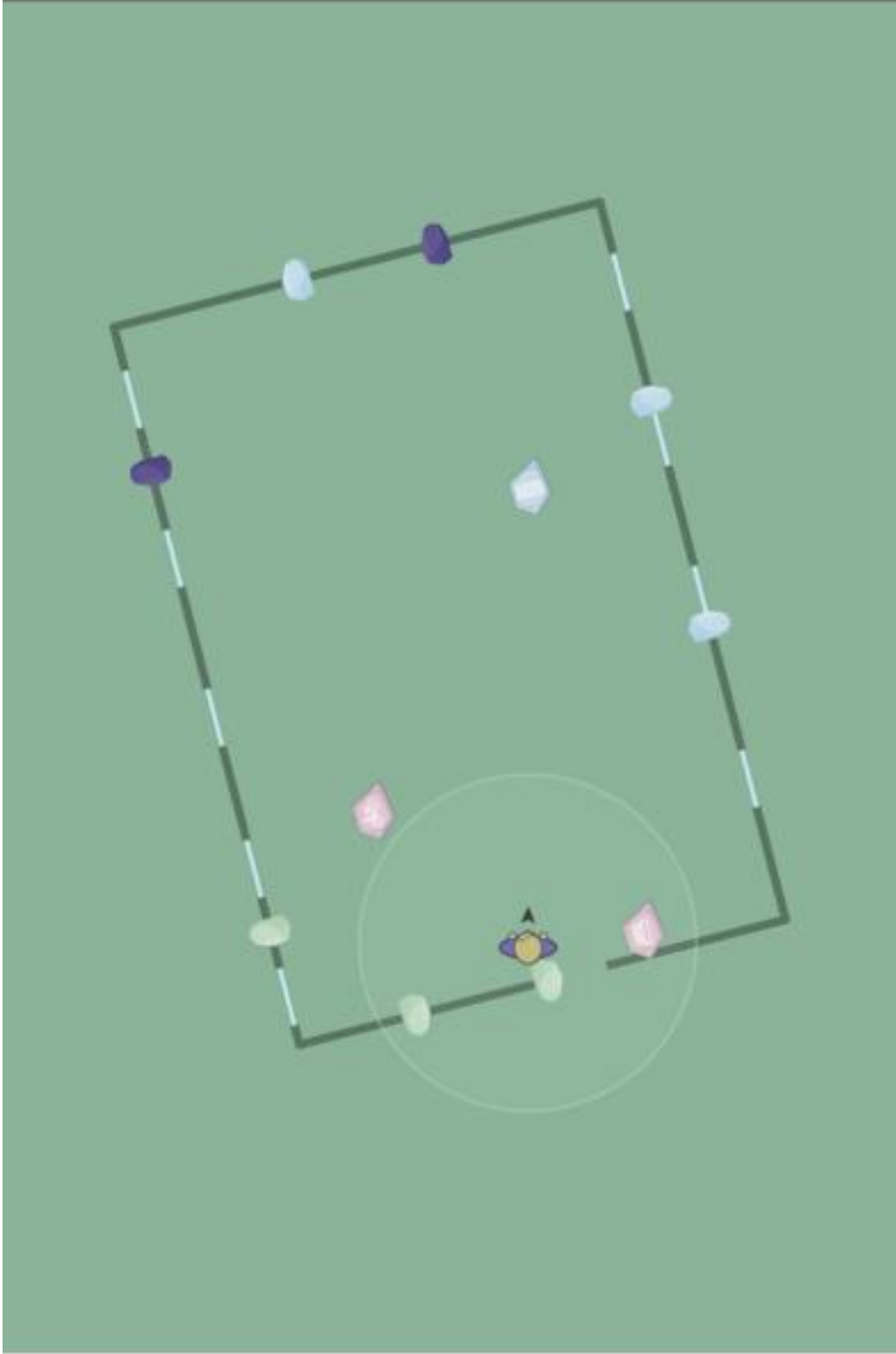
Save Changes

## Chapter 5: BLE Indoor Navigation Using Estimote Beacons









x:1.20 y:6.31  $\alpha:104^\circ$  >



```

[Usamas-MacBook-Pro:BLESystemsIndoor usamaaftab$ echo -e 'target "BLESystemsIndoor" do\npod "EstimateIndoorSDK"\nend'>Podfile
[Usamas-MacBook-Pro:BLESystemsIndoor usamaaftab$ pod install
Setting up CocoaPods master repo
$ /usr/bin/git clone https://github.com/CocoaPods/Specs.git master --progress
Cloning into 'master'...
remote: Counting objects: 1058358, done.
remote: Compressing objects: 100% (29/29), done.
Receiving objects: 80% (852651/1058358), 230.76 MiB | 1.31 MiB/s

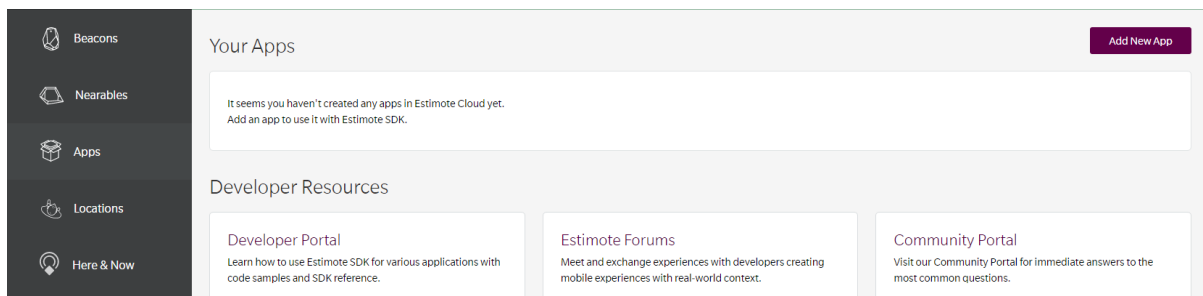
```

```

[Usamas-MacBook-Pro:BLESystemsIndoor usamaaftab$ echo -e 'target "BLESystemsIndoor" do\npod "EstimateIndoorSDK"\nend'>Podfile
[Usamas-MacBook-Pro:BLESystemsIndoor usamaaftab$ pod install
Setting up CocoaPods master repo
$ /usr/bin/git clone https://github.com/CocoaPods/Specs.git master --progress
Cloning into 'master'...
remote: Counting objects: 1058358, done.
remote: Compressing objects: 100% (29/29), done.
remote: Total 1058358 (delta 6), reused 2 (delta 2), pack-reused 1058325
Receiving objects: 100% (1058358/1058358), 372.91 MiB | 1.43 MiB/s, done.
Resolving deltas: 100% (491002/491002), done.
Checking connectivity... done.
Checking out files: 100% (134425/134425), done.
Setup completed
Analyzing dependencies
Downloading dependencies
Installing EstimateIndoorSDK (2.3.2)
Installing EstimateSDK (4.13.1)
Generating Pods project
Integrating client project

[!] Please close any current Xcode sessions and use `BLESystemsIndoor.xcworkspace` for this project from now on.
Sending stats
Pod installation complete! There is 1 dependency from the Podfile and 2 total pods installed.
Usamas-MacBook-Pro:BLESystemsIndoor usamaaftab$

```



## Your Own App



Get App ID & Token

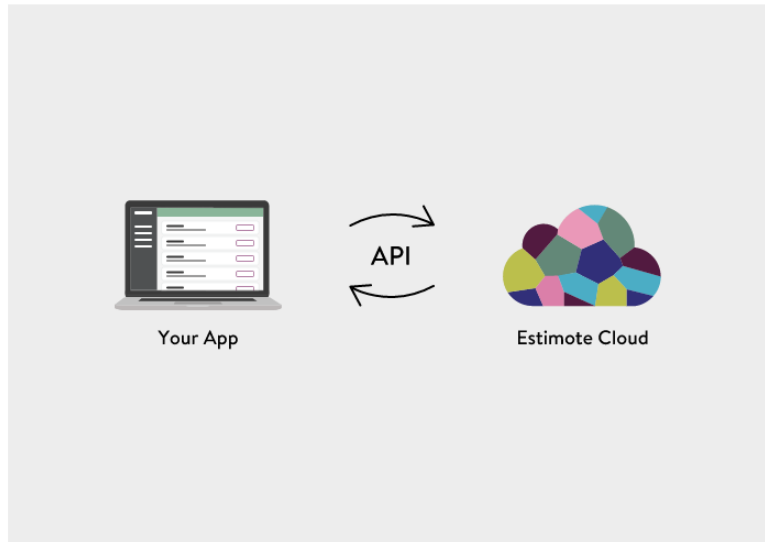
### Get Estimote Cloud credentials to integrate with your own app

Pick this if you wish to integrate your own app with Estimote Cloud, use a language we don't yet have templates for, or use our web API.

Beacons required: 0



(0 x Dev Kit)



Go Back

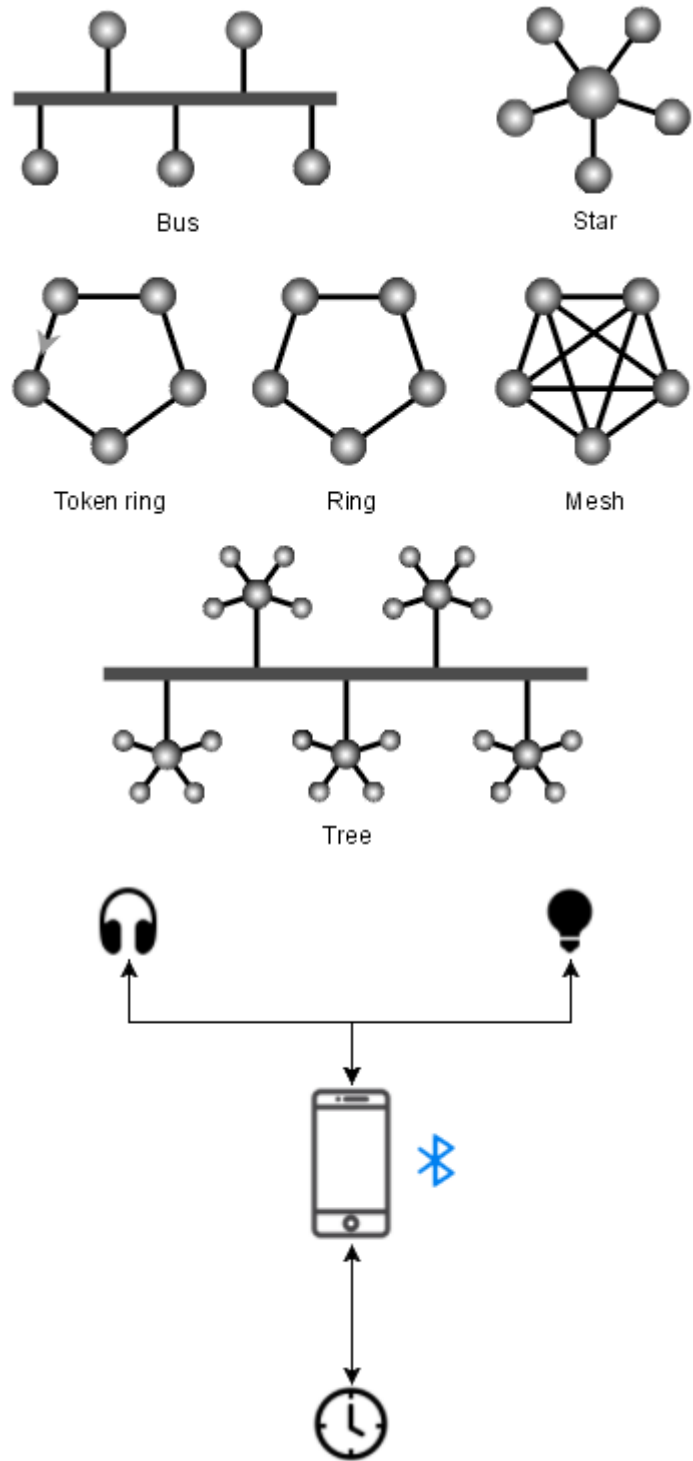
Get App ID & Token

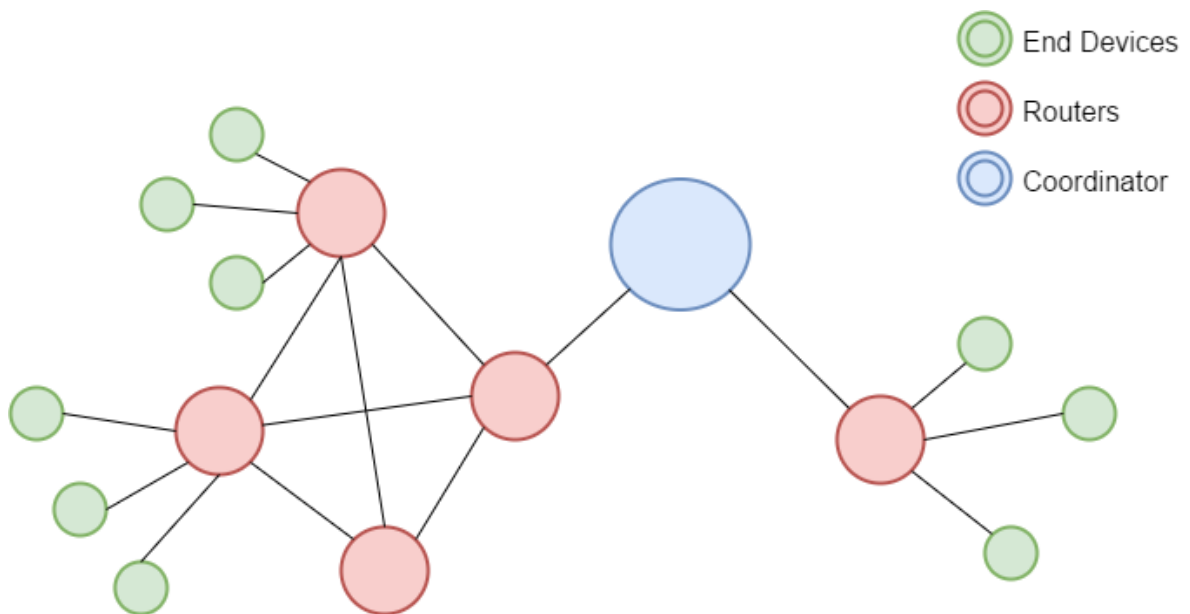
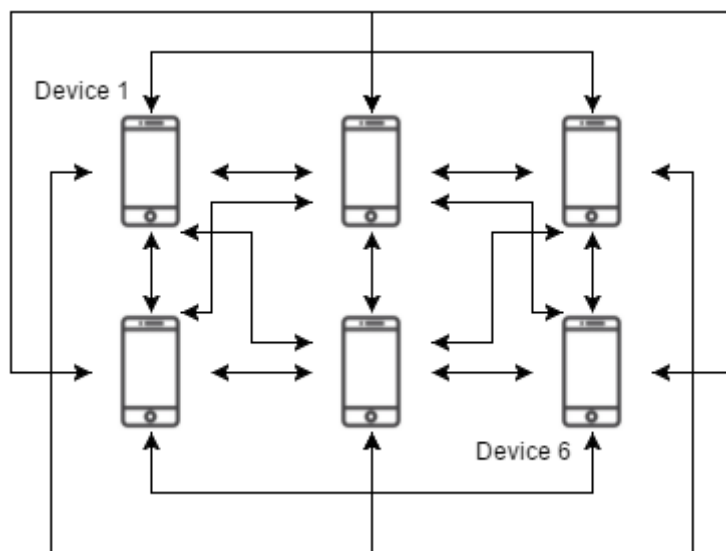
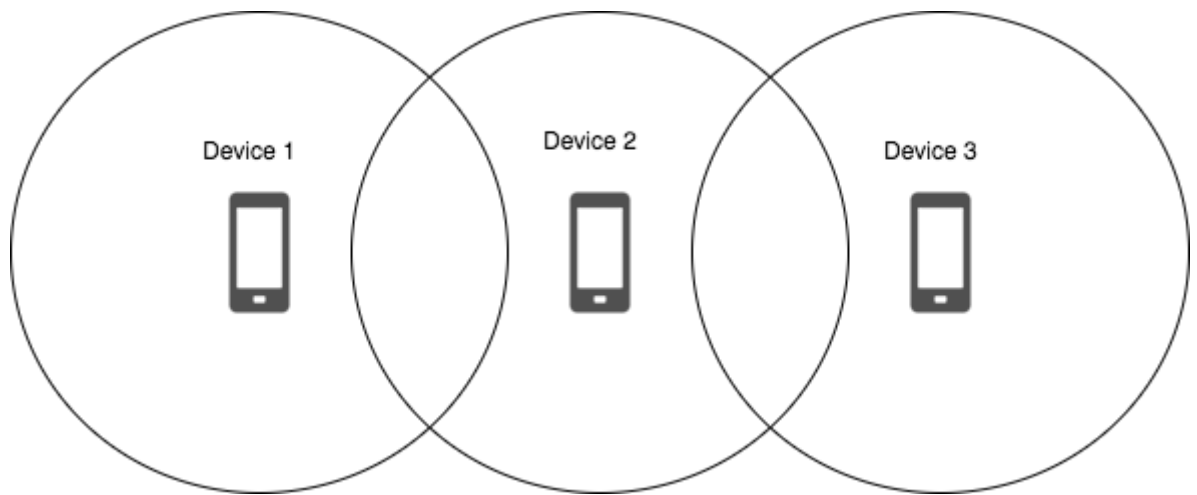
Your access credentials to Estimote Cloud API:

App ID: **blesystemsindoor-2hj**

App Token: **789cd5d8ad58fe3771a1de1d033a3cd2**

# Chapter 6: Bluetooth Mesh Technology

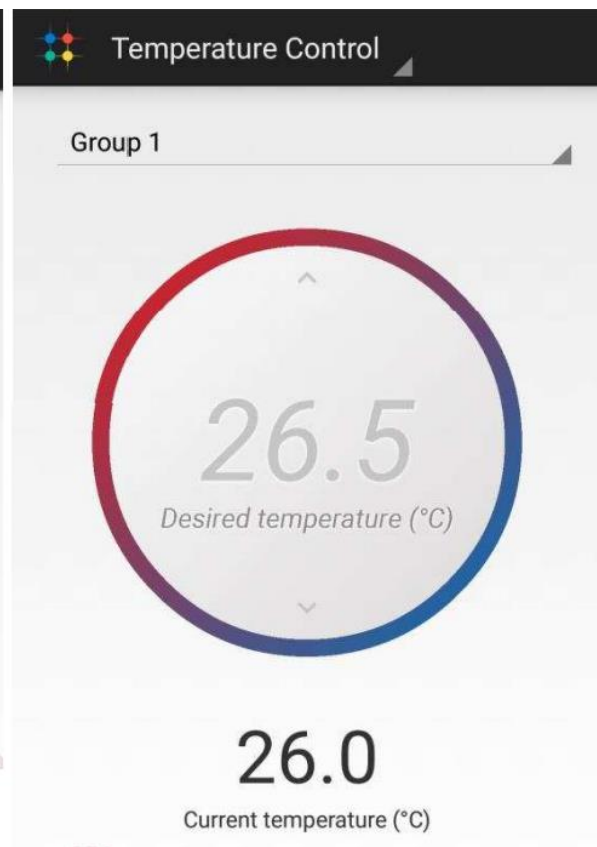
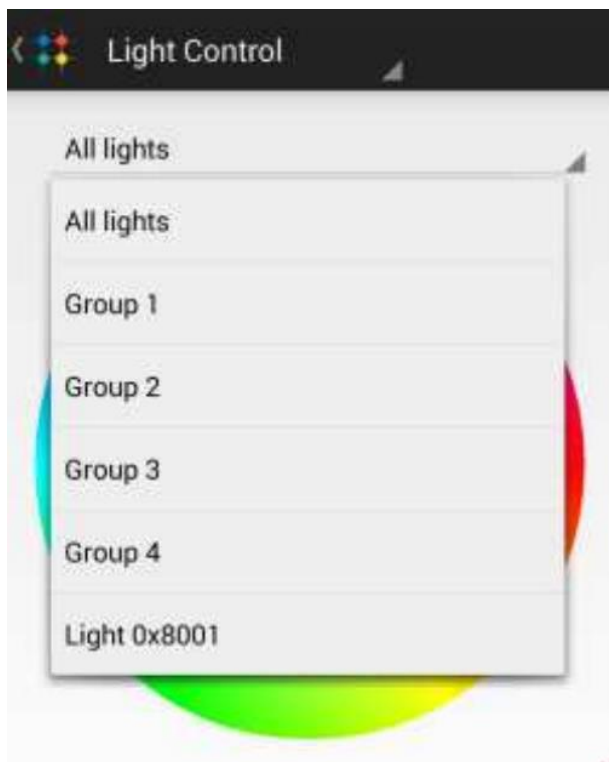
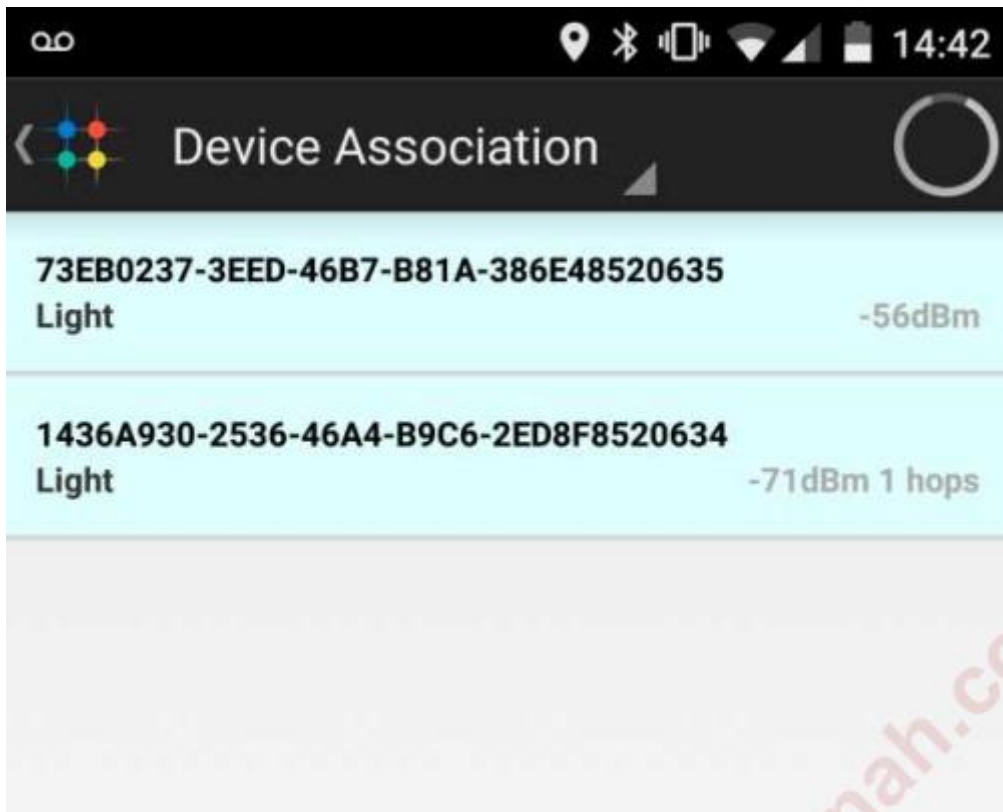




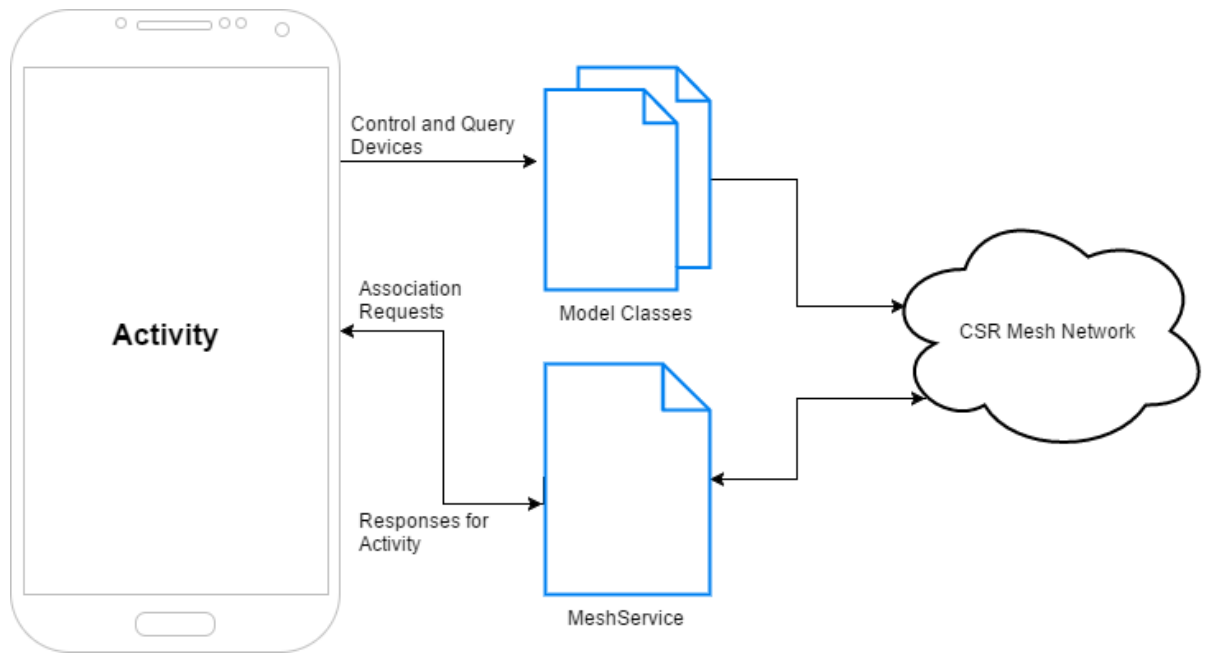




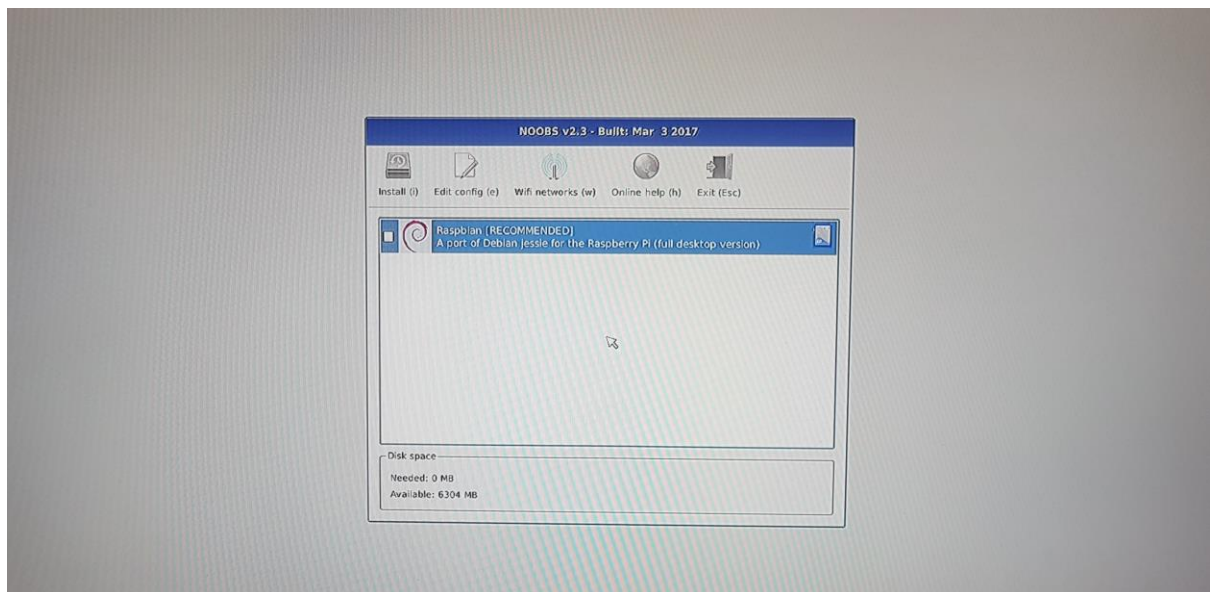
Connecting...

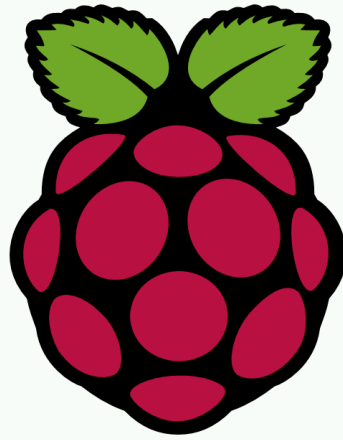






# Chapter 7: Implementing a Bluetooth Gateway Using the Raspberry Pi 3





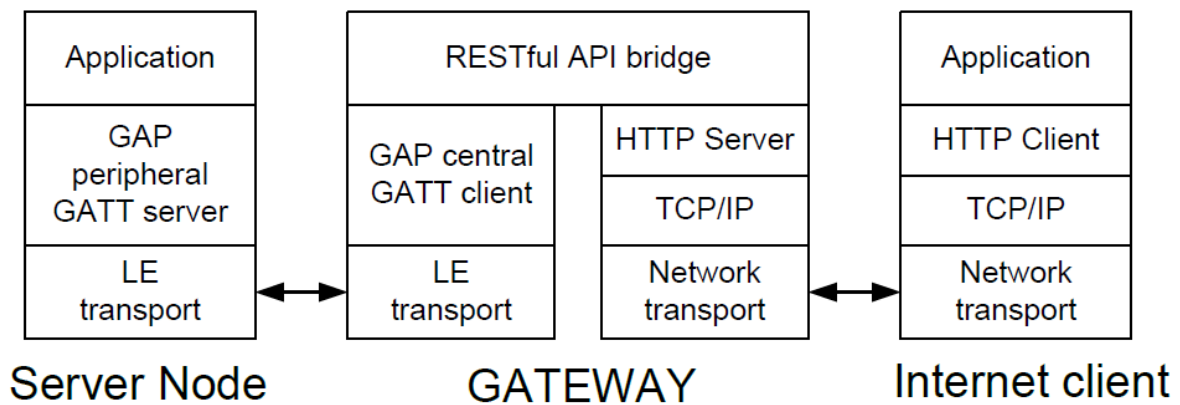
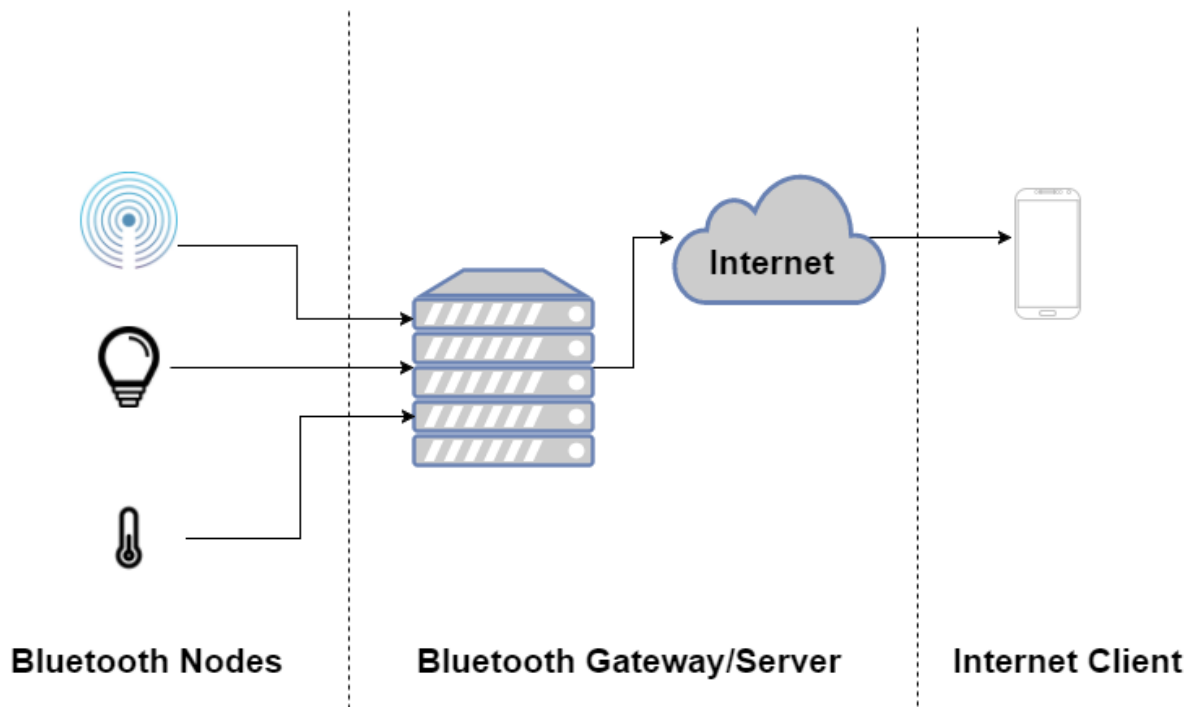
```
pi@raspberrypi: ~/BluetoothGateway/gateway
File Edit Tabs Help
pi@raspberrypi:~ $ cd BluetoothGateway
pi@raspberrypi:~/BluetoothGateway $ cd gateway
pi@raspberrypi:~/BluetoothGateway/gateway $ sudo npm start

> newsmartgw@1.0.13 start /home/pi/BluetoothGateway/gateway
> node server.js

Auto scan
Scan started
Scan complete
scanStopped function
█
```

## Devices

Name	Address	RSSI	Services	State
PLAYBULB COMET	fa:76:4b:0f:ac:e6	-68	ff07	Not Connected
<UNKNOWN>	a0:18:28:ed:c4:1f	-83	No advertised services	Not Connected
<UNKNOWN>	47:d4:38:6d:2c:d8	-93	No advertised services	Not Connected
<UNKNOWN>	c2:f4:d1:d5:b0:2b	-95	fe9a	Not Connected
<UNKNOWN>	c6:f8:d5:d9:b4:2f	-80	fe9a	Not Connected
<UNKNOWN>	ef:91:6c:d3:55:12	-92	fe9a	Not Connected
<UNKNOWN>	68:64:4b:36:be:3c	-77	No advertised services	Not Connected
<UNKNOWN>	ca:a7:5c:9a:e8:5b	-95	fe9a	Not Connected



## Devices

Name	Address	RSSI	Services	State
PLAYBULB COMET	fa:76:4b:0f:ac:e6	-68	ff07	Not Connected
<UNKNOWN>	a0:18:28:ed:c4:1f	-83	No advertised services	Not Connected
<UNKNOWN>	47:d4:38:6d:2c:d8	-93	No advertised services	Not Connected
<UNKNOWN>	c2:f4:d1:d5:b0:2b	-95	fe9a	Not Connected
<UNKNOWN>	c6:f8:d5:d9:b4:2f	-80	fe9a	Not Connected
<UNKNOWN>	ef:91:6c:d3:55:12	-92	fe9a	Not Connected
<UNKNOWN>	68:64:4b:36:be:3c	-77	No advertised services	Not Connected
<UNKNOWN>	ca:a7:5c:9a:e8:5b	-95	fe9a	Not Connected

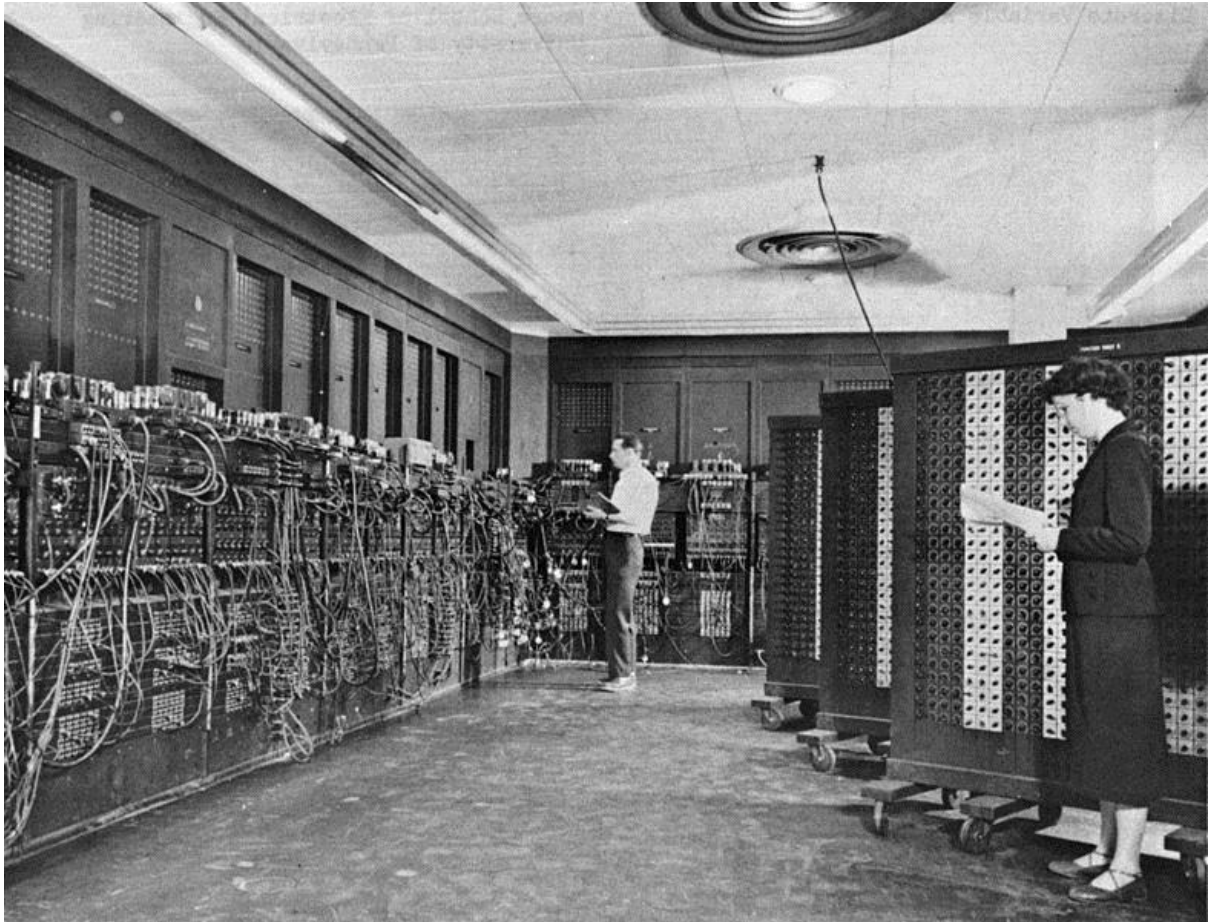
Name	Status	Type	Initiator	Size	Time	Waterfall	1.00 s	
192.168.1.111	200	docum...	Other	1.4 KB	121 ms			
style.css	200	stylesh...	(index)	1.2 KB	127 ms			
jquery.js	200	script	(index)	32.9 KB	126 ms			
bootstrap.min.css	200	stylesh...	(index)	(from ...	7 ms			
bootstrap.min.js	200	script	(index)	(from ...	8 ms			
page.js	200	script	(index)	(from ...	9 ms			
require.js	200	script	(index)	6.7 KB	98 ms			
main.js	200	script	(index)	578 B	190 ms			
bootstrap.min.css	200	stylesh...	(index)	(from ...	3 ms			
app.js	200	script	require.js:34	773 B	88 ms			
homePage.js	200	script	require.js:34	1.4 KB	240 ms			
devicePage.js	200	script	require.js:34	4.2 KB	187 ms			
systemPage.js	200	script	require.js:34	768 B	264 ms			
notificationsPage.js	200	script	require.js:34	1.2 KB	212 ms			
ractive.min.js	200	script	require.js:34	53.6 KB	345 ms			
rv.js	200	script	require.js:34	3.7 KB	229 ms			
jquery.js	200	script	require.js:34	32.9 KB	291 ms			
dataHelper.js	200	script	require.js:34	1.5 KB	230 ms			
deviceDetail.html	200	xhr	rv.js:147	2.9 KB	78 ms			
notificationsPage.html	200	xhr	rv.js:147	912 B	127 ms			
deviceList.html	200	xhr	rv.js:147	1.0 KB	99 ms			
systemPage.html	200	xhr	rv.js:147	674 B	142 ms			
events	200	events...	Other	251 B	221 ms			
devices	200	xhr	jquery.js:5	1.0 KB	299 ms			

```

▼ {title: "Devices",...}
  ▼ nodes: [{self: {href: "http://localhost:8001/gap/nodes/fa:76:4b:0f:ac:e6"}, handle: "fa764b0face6",...},...]
    ▼ 0: {self: {href: "http://localhost:8001/gap/nodes/fa:76:4b:0f:ac:e6"}, handle: "fa764b0face6",...}
      ► AD: [{ADType: "<type1>", ADValue: " <value1>"}]
        address: "fa:76:4b:0f:ac:e6"
      ▼ advertisement: {localName: "PLAYBULB COMET", txPowerLevel: -2,...}
        localName: "PLAYBULB COMET"
        ► manufacturerData: {type: "Buffer", data: [77, 73, 80, 79, 87]}
          serviceData: []
          ► serviceUuids: ["ff07"]
            txPowerLevel: -2
        ▼ bdaddrs: [{bdaddr: "fa:76:4b:0f:ac:e6", bdaddrType: "public"}]
          ► 0: {bdaddr: "fa:76:4b:0f:ac:e6", bdaddrType: "public"}
            connectionState: false
            handle: "fa764b0face6"
            rssi: -68
          ► self: {href: "http://localhost:8001/gap/nodes/fa:76:4b:0f:ac:e6"}
            service: []
        ► 1: {self: {href: "http://localhost:8001/gap/nodes/a0:18:28:ed:c4:1f"}, handle: "a01828edc41f",...}
        ► 2: {self: {href: "http://localhost:8001/gap/nodes/ca:a7:5c:9a:e8:5b"}, handle: "caa75c9ae85b",...}
        ► 3: {self: {href: "http://localhost:8001/gap/nodes/c7:a4:59:97:e5:58"}, handle: "c7a45997e558",...}
        ► 4: {self: {href: "http://localhost:8001/gap/nodes/c6:f8:d5:d9:b4:2f"}, handle: "c6f8d5d9b42f",...}
        ► 5: {self: {href: "http://localhost:8001/gap/nodes/ef:91:6c:d3:55:12"}, handle: "ef916cd35512",...}
        ► 6: {self: {href: "http://localhost:8001/gap/nodes/c9:26:94:04:76:c9"}, handle: "c926940476c9",...}
        ► 7: {self: {href: "http://localhost:8001/gap/nodes/14:99:e2:1a:9e:ea"}, handle: "1499e21a9eea",...}
      title: "Devices"
  
```

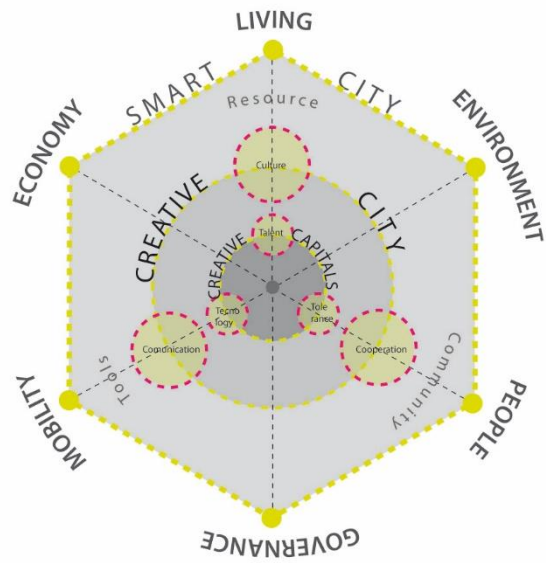
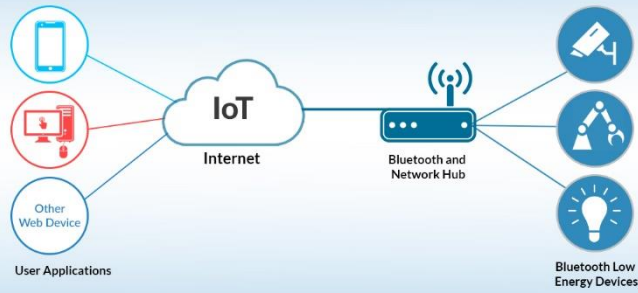


## Chapter 8: The Future of Bluetooth Low Energy





# Bluetooth role in the future of IoT



Amre El-Hoiydi Phonak Communications AG	Angel Polo Broadcom	Anthony Viscardi Texas Instruments
Bjarne Klemmensen Oticon A/S	Brian A. Redding Qualcomm Technologies, Inc.	Burch Seymour Continental Automotive
Chris Deck ON Semiconductor	Clive D.W. Feather Samsung Electronics Co., Ltd.	David Engelen-Lopes Nordic Semiconductor ASA
Dishant Srivastava CSR	Edward Harrison Anritsu	Eivind Sjøgren Olsen Nordic Semiconductor ASA
Florian Lefeuvre Texas Instruments	Harish Balasubramaniam Intel	Huanchun Ye Broadcom
James Wang MediaTek	Jean-Philippe Lambert RivieraWaves	Jeff Solum Starkey Hearing Technologies
Joel Linsky Qualcomm Technologies, Inc.	Johan Hedberg Intel	Jonathan Tanner Qualcomm Technologies, Inc.
Josselin de la Broise Marvell	KC Chou MediaTek	Knut Odman Broadcom
L.C. Ko MediaTek	Laurence Richardson Qualcomm Technologies, Inc.	Marcel Holtmann Intel
Mayank Batra Qualcomm Technologies, Inc.	Michael Knudsen Samsung Electronics Co., Ltd.	Michael Ungstrup Widex A/S
Niclas Granqvist Polar	Phil Corbishley Nordic Semiconductor ASA	Phil Hough Anritsu
Raja Banerjea CSR	Rasmus Abildgren Samsung Electronics Co., Ltd.	RaviKiran Gopalan Qualcomm Atheros
Robert Hulvey Broadcom	Robin Heydon Qualcomm Technologies, Inc.	Sam Geeraerts NXP
Sandipan Kundu CSR	Shawn Ding Broadcom	Steven Hall Broadcom
Thomas Varghese Mindtree	Till Schmalmack Phonak Communications AG	Tim Wei IVT Wireless
Tomás Motos López Texas Instruments	Yi-Ling Chao Marvell	