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Bluetooth Low Energy - Workshop

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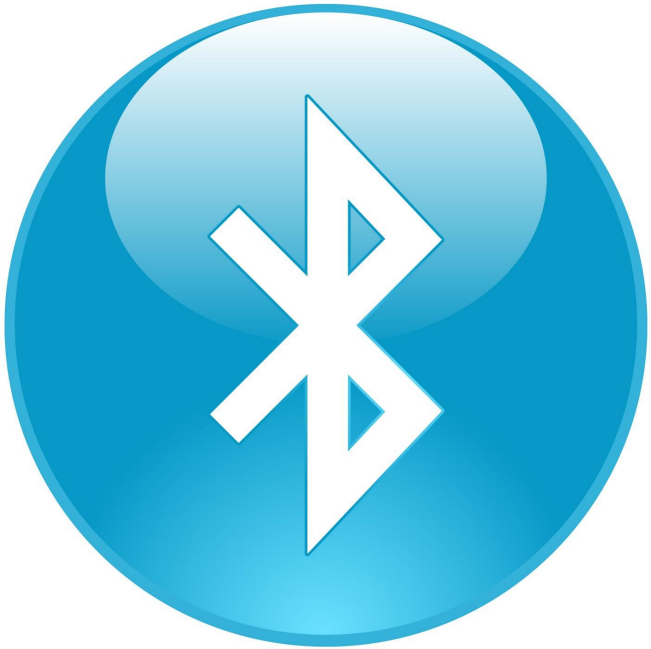
Agenda

1) Bluetooth
2) Bluetooth Low Energy
    - Beacons
    - Roles
    - Services
    - Characteristics
    - Descriptors / Attributes
3) Use cases
    - Location within a building.
    - Second factor authentication.
    - Physical authentication / authorization
    - Walk-away modality.
4) ¡Workshop!

Bluetooth

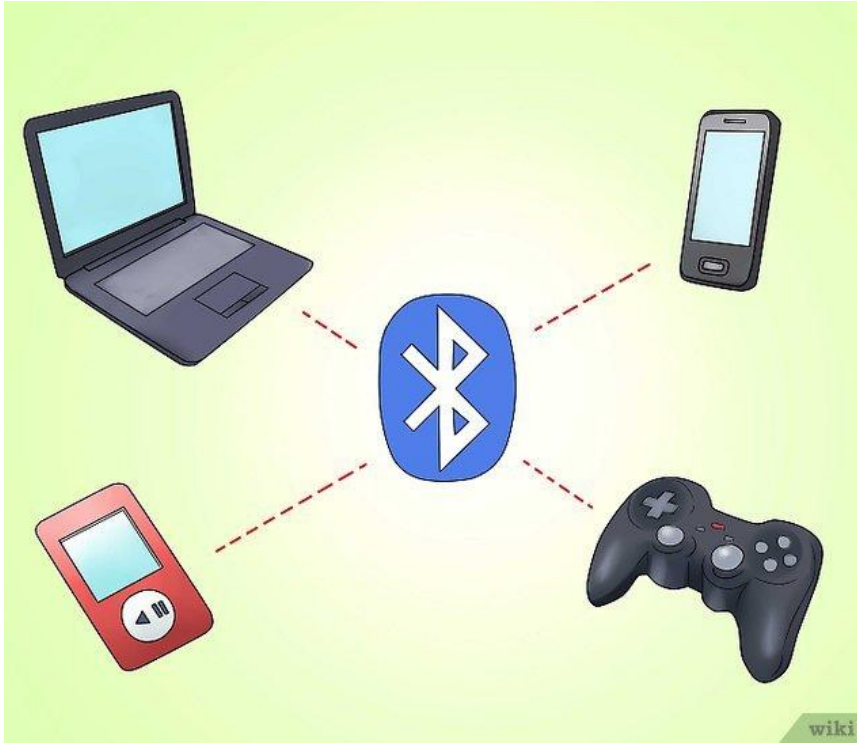
Bluetooth



What is Bluetooth?

- Wireless technology standard.
- It exchanges large amounts of data over a short range.
- It's meant to perform continuous data streaming.
- It also allows their users to create a PAN (Personal Area Network) to exchange information between devices.
- Its standard is IEEE 802.15.1

Bluetooth



Use cases

- Wireless headsets.
- Hands-free calling.
- File transfers.
- Music streaming (wireless speakers).
- Wireless keyboards.
- Wireless printers.
- Wireless joysticks.

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Bluetooth Low Energy

Bluetooth Low Energy

What is Bluetooth Low Energy?

- Wireless technology standard.
- Its power consumption is much lower than Bluetooth.
- It periodically exchanges small amounts of data.
- It’s meant to be used mostly on machine -to-machine (M2M) communication.

Bluetooth Low Energy

Use cases

- Geography-based targeted offers.
- Industrial monitoring sensors.
- Fibit-like devices.
- Blood pressure monitors.
- M2M communication.
- Multi-factor authentication.
- Indoor positioning.
- Home appliances.

Beacons

Beacons are specific advertising packets which we continuously broadcast in order to be found by another BLE module. They are built on top of the native BLE API.

We can think of it as a lighthouse, which send signals to boats (BLE devices) to take any action.

They’re mostly used to advertise sales offers by stores, indoor positioning, etcetera. When the phone finds these beacons, it can take an action like showing the user a notification to make it go inside the store and use it.

Roles

- **GAP Roles**
  - **Central device.**
  - **Peripheral device.**

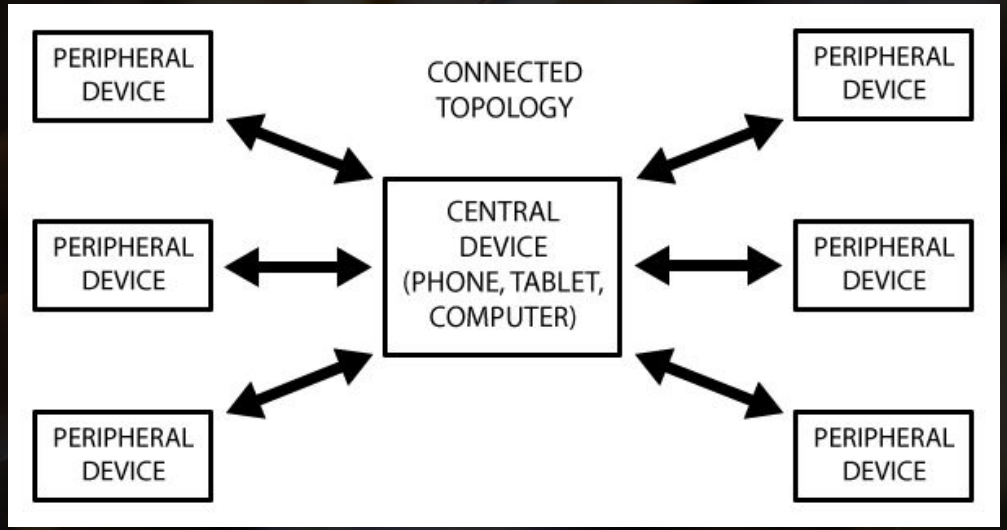
- **GATT Roles**
  - **GATT Client.**
  - **GATT Server.**

A Peripheral can advertise packets to let other devices know that it's there, but it is only a Central that can actually send a connection request to establish a connection.
When a link has been established, the Central is sometimes called a *Master*, while the Peripheral could be called a *Slave*.

Observer and Broadcaster are basically just non-connecting variants of the Central and Peripheral.

GATT (Generic Attribute Profile)

The Generic Attributes (GATT) define a hierarchical data structure that is exposed to connected Bluetooth Low Energy (LE) devices.



Services

GATT Services are collections of characteristics that act as a public interface offered by a BLE device to allow others to interact with it.

- **Service types:**
  - **Primary – Represents the primary functionality of the device.**
  - **Secondary – Represents an additional functionality of the device.**

Characteristics

Characteristics are defined attribute types that contain a single logical value. We could think of them as public variables exposed by the service that we could read/write values from/to.

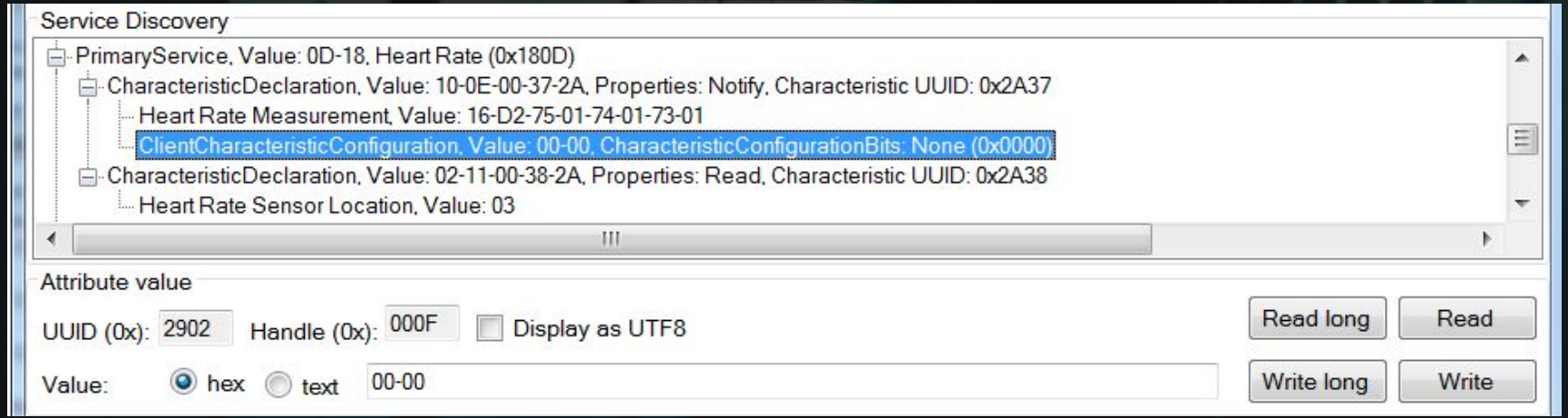
- **Permissions:**
  - **PERMISSION_WRITE**
  - **PERMISSION_READ**

- **Properties:**
  - **PROPERTY_READ**
  - **PROPERTY_WRITE**
  - **PROPERTY_NOTIFY**

Descriptors / Attributes

Descriptors are defined attributes that describe a characteristic value. with additional information.

Example:



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Use cases

Location within a building

Another use case for BLE beacons is to locate people inside a building. Our beacons can be broadcasting all over the place and we could use user's devices to detect them and act accordingly.

Usually, this means to provide location details, instructions to find a specific place, sales offers that are in nearby stores, etcetera.

Second-factor authentication

Using BLE, we can use our own mobile devices as second factor authentication tokens. As *Google Authenticator* does, we'll be able to enroll an additional token to our account to protect it further after we input our credentials.

Since BLE can be used as a hands-free technology, we won't even need to look at our phone. Instead, it will send our OTP (One-time password) right away to the workstation without any user interaction.

Physical authentication / authorization

Using BLE, we can use our own mobile devices as personal identifiers while we are inside a building. This way, an IoT device scanning for BLE devices will find ours, get our username from the device and then query an LDAP server to see whether we are a valid user AND we have permission to be there.

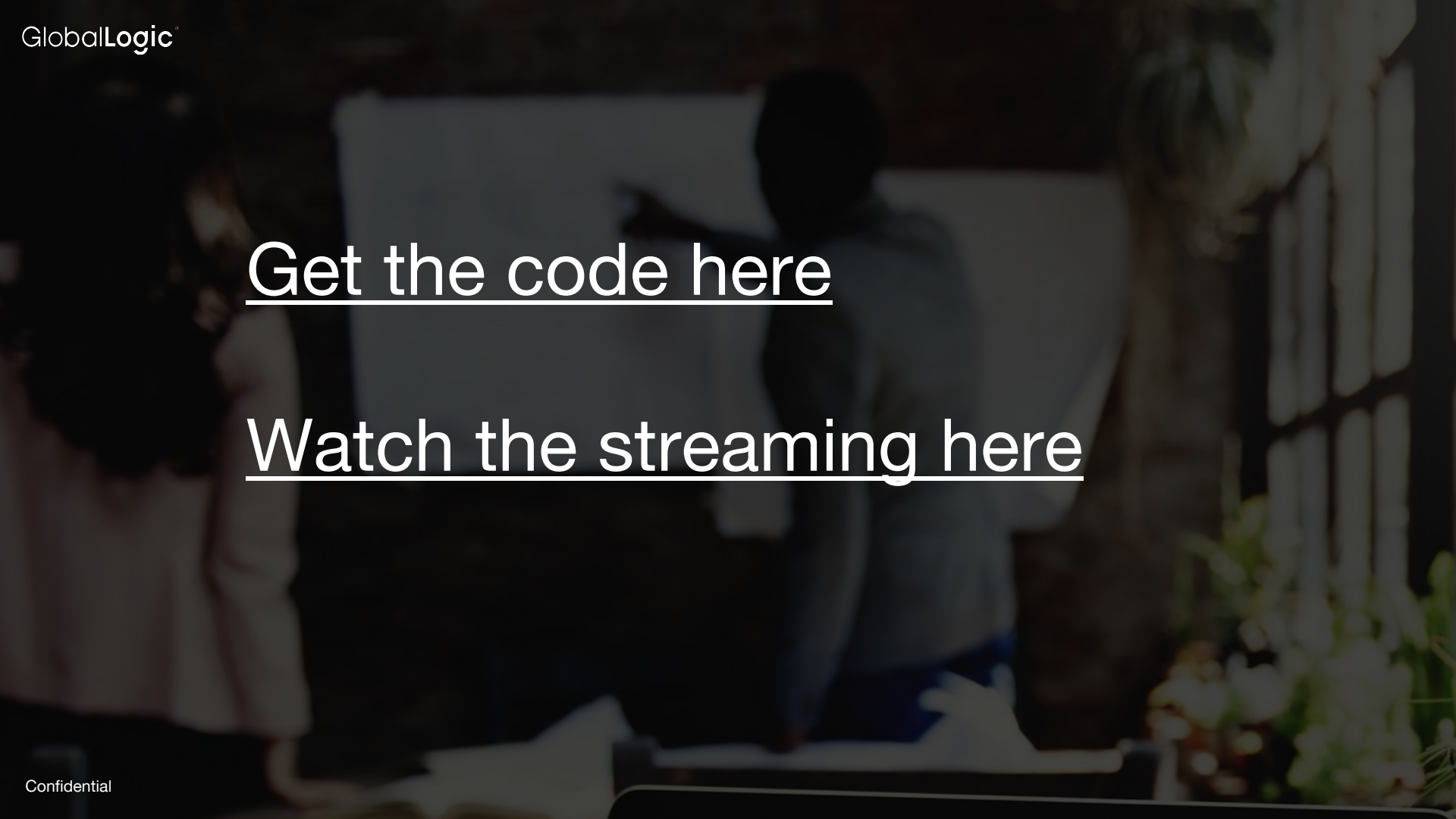
This could be a good improvement for badges, NFC tags and RFID cards.

Walk-away modality

This use case allows us to keep a BLE device in our pocket advertising a certain kind of beacon. Our workstation will periodically look for this beacon and if it goes away as we walk away from our computer, the latter will realize that we are not working on it anymore and lock the screen automatically.

This provides a smarter level of corporate security since most employees usually leave their laptops unlocked and unattended.

Workshop



Get the code here

Watch the streaming here

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Thank you

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