

Project 1

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USE CASE :

Developing a decentralised peer to peer location sharing application for use in indoor venues to allow people to find their friends using **Bluetooth Low Energy** enabled smartphones and Bluetooth beacons for indoor positioning.

LOGICAL DIAGRAM :

HIGH LEVEL MESSAGING :

- **L2CAP** (Logical Link Control and Adaptation Protocol). This is responsible for multiplexing data between various higher layer protocols as well as segmentation and reassembly of data packets.
- **GAP** (Generic Access Protocol) . This profile defines the generic procedures related to device discovery and link management when connecting to Bluetooth devices. Protocol allows devices to scan for other devices with a particular service, i.e filtering out unwanted connections. GAP uses a Central/Peripheral relationship. Peripheral devices are small, low power devices (a BLE beacon), that can connect to a much more powerful central device (a smartphone or tablet).

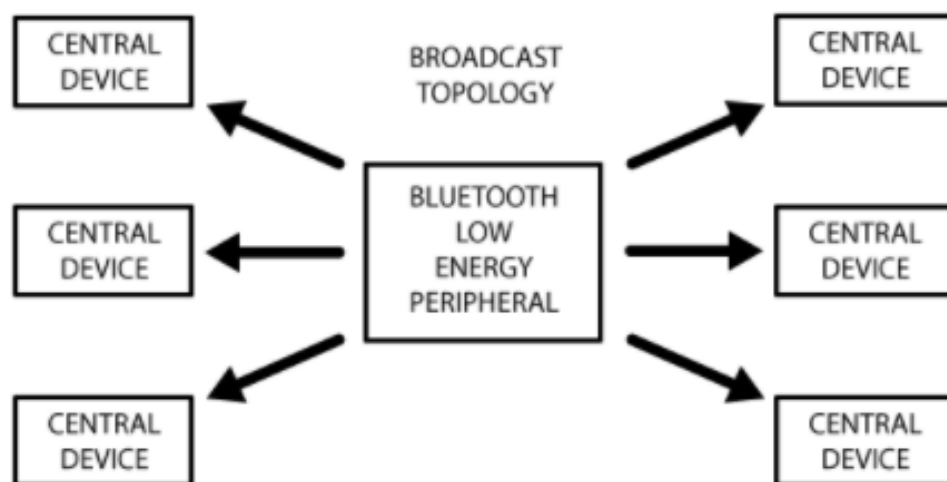


Fig. 1: GAP Broadcasting Topology (1)

- **GATT** (Generic Attribute Protocol). Provides profile and service discovery for Bluetooth low energy. The described procedures show how to use the ATT (Attribute Protocol) for service discovery as well as how to read and write attributes (data). Services and profiles are developed on top of GATT. GATT uses a Client/Server relationship. All transactions are started by the central device, the GATT Client, which receives response from the peripheral device, the GATT Server.

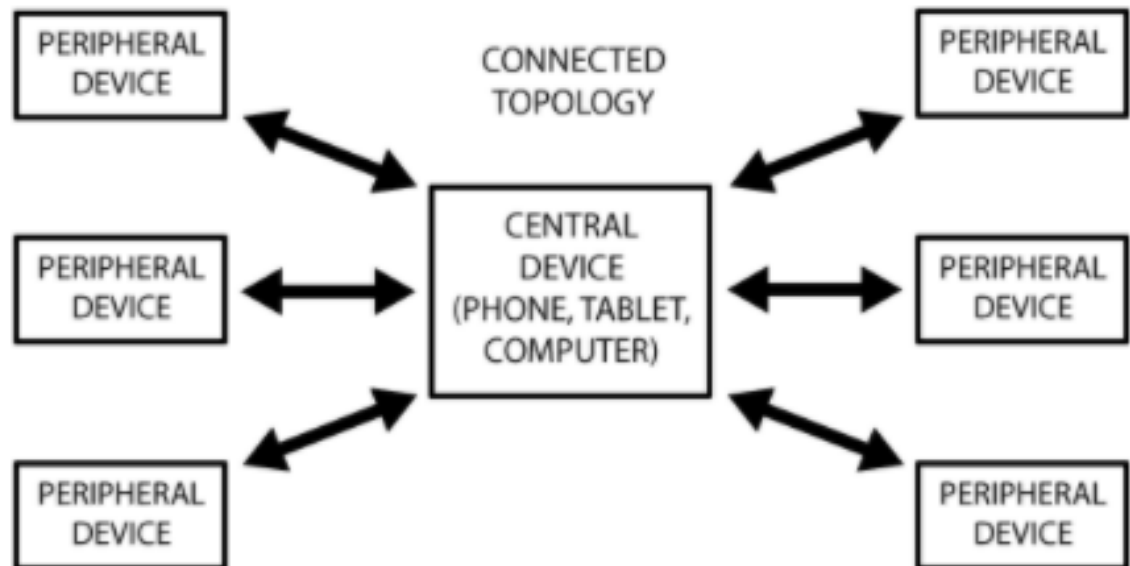


Fig. 2: GATT Connection topology (2)

- **6LoWPAN(Optional)** (IPv6 over Low power Wireless Personal Area Networks). An alternative to GATT is to use TCP/IP based communication with 6LoWPAN. 6LoWPAN compress's the IP messages sent over Bluetooth low energy to save on size requirements and power consumption.

PSEUDOCODE :

Server

- 1.Create socket (serverSocket) •
- 2.Bind socket to a specific port where clients can contact you

3.Register with the kernel your willingness to listen that on socket for client to contact the server.

4. Loop :

Accept new connection (connect_to_Socket)

Read Data Into connectSocket to Communicate with client

Close connect_to_Socket

End Loop

Client

1.Create socket

2. Loop

(Send Message To Well-known port of server)

3.Close Socket

NETWORKING MODEL : CLIENT to SERVER (Used for now, may change to peer to peer)

IMPLEMENTATION DETAILS :

Software Required:

Android Studio which is the primary code editor, Java Compiler, and debugging environment.

Android SDK.

We will code the app for BLE indoor tracking on android Studio using Bluetooth libraries, And enabling BLE permissions. Android Studio already has built in BLE functions for a wide range of attributes.

TESTING: Even though new phones and Laptops are BLE enabled , a specified environment is required to test the functioning of the system. Luckily there are a wide range of apps in android and IOS that mimic as BLE devices and track them thereof.

UNIQUE SELLING POINTS OF SYSTEM :

Bluetooth has two different methods of communication: Advertising and connection.

Advertising doesn't need the communicating devices to be paired which is best suited for applications where one device must continuously send its status to other devices.

Advertising packets can be broadcast from the devices to all of the beacons in the vicinity to achieve an accurate location reading, and all of the devices can broadcast information to each other via Bluetooth adhering to Bluetooth protocols.

BLE is used for applications that do not need to exchange large amounts of data, and can therefore run on battery power for years at a cheaper cost.

Thus initial input cost may be high, for hardware purposes. But the maintaining cost is very low.

REFERENCES:

1. <https://learn.adafruit.com/introduction-to-bluetooth-low-energy/gap>
2. <https://learn.adafruit.com/introduction-to-bluetooth-low-energy/gatt>