

# Analysis and Evaluation of Bluetooth Mesh

## Introduction

As we focus in this course in Next Generation Networks, our group would like to concentrate on a rising technology: Bluetooth Mesh Networking. The official Bluetooth webpage states:

"Bluetooth mesh networking enables many-to-many (m:m) device communications and is optimized for creating large-scale device networks. It is ideally suited for building automation, sensor network, asset tracking, and other IoT solutions that require tens, hundreds or thousands of devices to communicate with one another."

(<https://www.bluetooth.com/learn-about-bluetooth/bluetooth-technology/topology-options/le-mesh/mesh-faq/>)

Not only it is related to our NGN course but also represents a fundamental standard in the Internet of Things (IoT) world.

## Analysis

Our project aims at understanding how the Bluetooth standard works combined with a meshed use of the network. To do so we initially thought about using the existing Bluetooth Mesh standard from Bluetooth SIG. After finding out that most of the microcontroller in the market (including the Raspberry Pi) do not support this official technology, we decided to follow a different path: we will create our own Bluetooth mesh concept.

Our meshed network is a constellation of multiple devices that communicate with each other applying different topologies: unicast, multicast and broadcast should be made available. Therefore, we plan to introduce a routing table that allows nodes of the network (the devices) to choose autonomously where to send information without a central entity deciding the routes. There will be just one device keeping an eye on the whole network: the provisioner. In the next paragraph the proposal will go into more details.

This scenario will apply to a chat service, that we will implement using the Serial Port Profile (SPP) of the Bluetooth devices. This chat application will be created by our team and will feature only very basic chatting features. It will be used to showcase the Bluetooth mesh functionality.

## Scenario

As described in the previous paragraph we will have two main actors: the provisioner and the nodes. A node is a device that acts both as server and client. The server is the head of the node, providing routing information for the chat messages, while the client triggers the action of sending a message to the next node/s. The server needs to be implemented with a routing table to know exactly where and how to forward the message.

The provisioner on the other hand monitors the network and is responsible for adding or removing nodes from the topology. This entity needs to communicate with the single devices, updating the network map and forcing them to adjust their routing table according to the user's requirements. The provisioner-nodes and nodes-nodes communications should succeed with a suitable protocol. Our first thought regards Sockets.

Another important and technically complex aspect is the automation of the Bluetooth pairing and connection event once the network receives a new node. This part is not totally defined yet; we still need to determine an efficient way to perform it. In the initial development phases this step will be done manually. This means connection all the nodes together “by hand”.

The service running of this topology is a chat. We want to take advantage of the Bluetooth Serial Port Profile (SPP) that allows an already implemented way on how to send messages. To open the ports and get device information as well as to extract and read the content of the serial terminal, we rely on the Python library PySerial. Our additional goal is to create a simple application with very basic chatting capability.

## Workflow

Our initial intention is to study how Bluetooth Mesh works and how to establish a simple network. This will require a study period followed by tests with devices like smartphones, laptops, and Raspberries. We expect to close this part on 26<sup>th</sup> April.

Secondly, we will apply our new knowledge to implement the provisioner as well as the server/client setup for the nodes. This is the most complex and long part of our project since we have to build the concept from scratch. We plan to conclude it on 24<sup>th</sup> May.

Meanwhile or after depending on the effective timeline, we will automate the process of pairing and connecting the Bluetooth devices. For this we expect to finish on 7<sup>th</sup> June.

Finally, once the concepts show its first results, we will be able to perform a network analysis, showing how the hops between the devices work and the role of the provisioner. This will also be the time for implementing the chatting application for demonstration purposes. For this part we plan to finish 2 weeks before report submission.

## Tasks Division

Below we will describe a possible and meaningful scenario that involves the use of hardware autonomously at our own places.

- 1) Study and Analysis of Bluetooth Mesh - All together
- 2) Node Server/Client concept with routing table + Chat App - Theo
- 3) Provisioner + Automation of BL connection - Alessandro
- 4) Automation of BL connection + Network Analysis – Samuel

Notice that we will probably cooperate on the different tasks to help each other and learn as much as possible.