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DEPARTAMENTO DE ELECTRÓNICA, TELECOMUNICAÇÕES E INFORMÁTICA
MESTRADO EM ENG. DE COMPUTADORES E TELEMÁTICA
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REDES E SISTEMAS AUTÓNOMOS

AUTONOMOUS NETWORKS AND SYSTEMS

PRACTICAL GUIDE 2 – B.A.T.M.A.N.

Objectives

- Set up B.A.T.M.A.N. ad-hoc network
- Validate the multi-hop ad-hoc network with simple tests
- Observe the status of the network
- Try new topologies of the ad-hoc network to force different paths
- Analyse metrics of the network

Duration

2 weeks

1st week

Introduction

The Better Approach to Mobile Ad-hoc Networking (B.A.T.M.A.N.) is a protocol for multi-hop mobile ad hoc networks. The official documentation is available [here](#).

In this practical guide, we will learn how to deploy a Wi-Fi ad-hoc network with support for multi-hop. Supporting more than one hop means the network will behave like a mesh network, where the nodes can reach other nodes that are directly or indirectly connected, if they are part of the same batman group and Wi-Fi channel.

Environment

The setup we will be mounting for the experience uses [Nvidia Jetson Nano 2GB Dev Kits](#), and there is one available for each group of 2 students:



Nvidia Jetson Nano 2GB Dev Kit

Each Jetson is identified with a sticker, example “UW 306”. For this example, the **id** of the device is 6.

Every Jetson is already flashed with the official Nvidia image (Ubuntu-based) and it has already some pre-configuration (the batman binary is installed).

In terms of networking and authentication, the board is configured with the following:

- Hostname: jetson-**id**
- Ethernet interface: 192.168.3.**id** (it also accepts DHCP)
- SSH login
 - Username: jetson
 - Password: rsa2023

An USB Wi-Fi Adapter, based on the Atheros AR9271 chipset, will be used extend Jetson with Wi-Fi capabilities. The important thing about this adapter is that the chipset allows the configuration of the Wi-Fi interface in IBSS mode which is required for the configuration of ad-hoc networks.



USB Wi-Fi Adapter with Atheros AR9271 chipset

1. Connecting your PC to the Jetson board

1.1. Configure your PC with an IP in the same LAN of the Jetson Ethernet interface (192.168.3.0/24) and connect an Ethernet cable between your PC and Jetson.

Example: 192.168.3.1/24 (no gateway needed)

1.2. Use ssh to connect to the Jetson board, using the IP and authentication described in the previous page. In Windows use Putty or ssh through WSL. In Linux use ssh directly.

2. Configure the Wi-Fi interface in preparation for the batman network.

2.1. Change the Wi-Fi interface mode to IBSS

(check the Wi-Fi interface name (`ip a`), and use it to replace with the right name in the following commands)

```
$ sudo ip link set wlanX down
```

```
$ sudo iw wlanX set type ibss
```

```
# sudo ifconfig wlanX mtu 1500
```

- 2.2. Select the right Wi-Fi channel. The 4 groups in the front of the room use channel **1**, and the 4 groups at the back use channel **11**:

```
$ sudo iwconfig wlanX channel Y
```

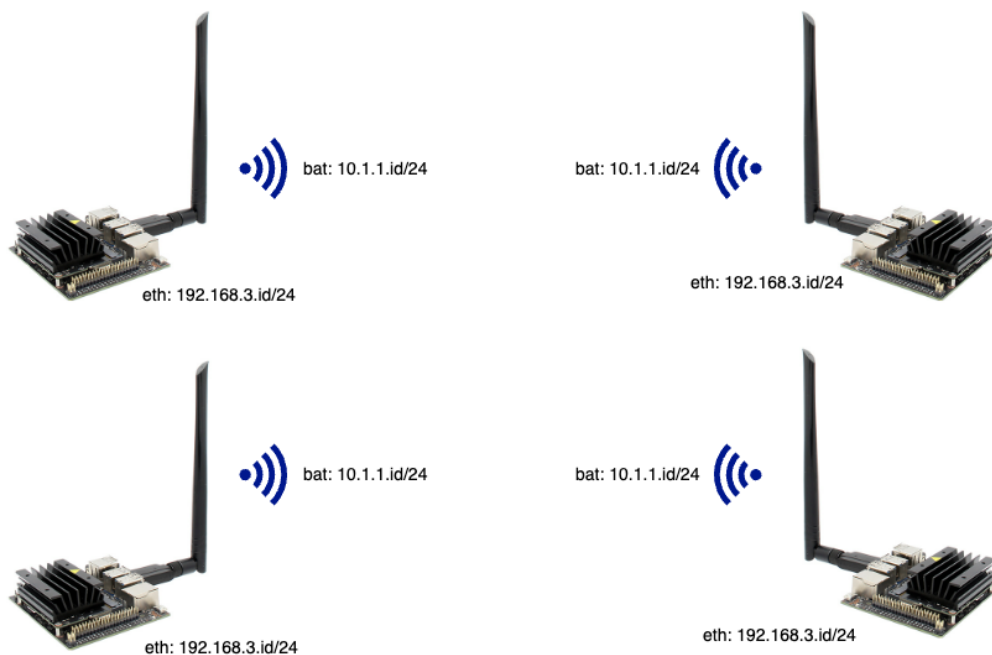
```
$ sudo ip link set wlanX up
```

- 2.3. Confirm if the Wi-Fi interface is in the correct mode, with the following command:

```
$ sudo iw dev
```

3. First batman network configuration

- 3.1. In the classroom, we will form 2 networks, each with 4 groups together. Each batman network will look like the following scheme:



- 3.2. Find out (**search online**) what is the frequency (f0) in MHz for the Wi-Fi channel selected in the configuration of exercise **2.2**.
- 3.3. Then, choose a name for your batman network (together with the other 3 groups).

- 3.4. On your Jetson, run the following command, according to the frequency and the chosen ad-hoc network name:

```
$ sudo iw wlanX ibss join network_name f0
```

- 3.5. Finalize the batman configuration with the following:

```
$ sudo modprobe batman-adv
```

```
$ sudo batctl if add wlanX
```

```
$ sudo ip link set up dev wlanX
```

```
$ sudo ip link set up dev bat0
```

```
$ sudo ifconfig bat0 10.1.1.id/24
```

(Configure the IP for the batman LAN, according to the **id** of your board)

4. Testing the batman network for the first time

- 4.1. Together with the colleagues from the other groups, test the wireless connection to their Jetsons, using the ping command. Validate that you can reach every node of the ad-hoc network.

```
$ ping 10.1.1.id
```

Important note: For every time you boot the Jetson board, you need to setup batman again. However, there are ways to put the configuration automatic at the boot.