



# Esp Tracking System

ETSPolito

Politecnico di Torino

## Project developed by

- Damiano Franzò
- Davide Gallotti
- Federico Gianni
- Carlo Maria Negri

## Scope of the project

The scope of the project is to analyze mobile devices in several rooms of a building through the `PROBE_REQUEST` messages sent.

The messages are captured by some micro-controllers placed within the rooms in fixed points.

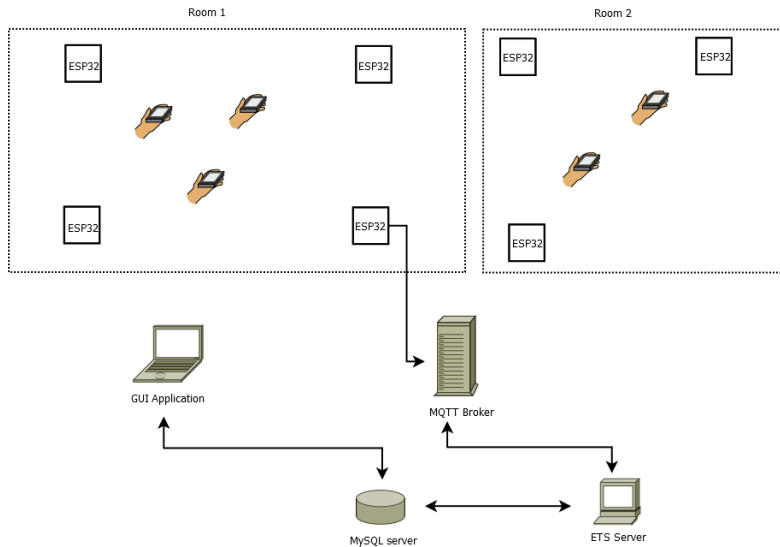
The application developed performs analysis in term of frequency, tracking and hidden MAC detection

# High level view

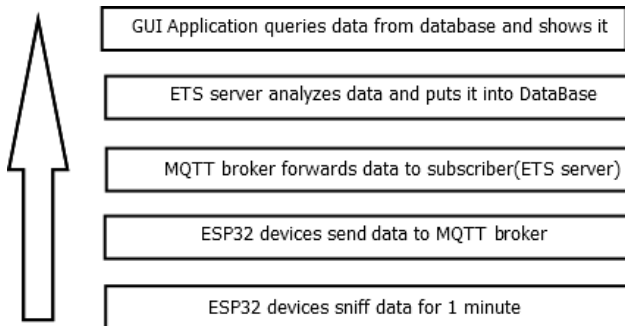
## Main components of the project

- ESP32 Wifi Sniffer
- ETS Server
- GUI application

## Sketch



# Data flow



# ESP32



## Firmware development

- Configuration file
- Partition table configuration (File system)
- Synchronize time-stamp
- Two main tasks: Sniffing Task (One minute sniffing) and MQTT task

# MQTT Broker



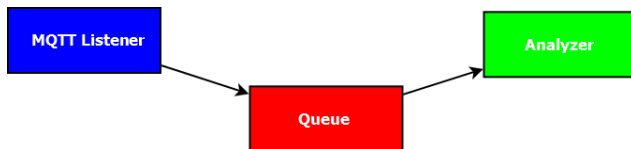
## Reasons for the choice

- Enable communication between ESP32 Devices and ETS server
- Simple usage
- Scalability



# ETS Server

## Producer and Consumer pattern



### Characteristics

- Developed in Python 3
- Suited for scalability
- Used libraries: pandas, paho-MQTT
- Concurrency control
- Testability through MQTT Fake Publisher

# MySQL Server



## Reasons for the choice

- Open-source
- Good results even with a lot of data

# Database

#	HASH	MAC	TID	ROOMID	X	Y	ST	HTCI
591	d82...	58:40:4e:7a:e7:0d	1544116712	1	2.5600	1...	37...	062d
592	cd7...	3c:83:b5:01:02:b9	1544116436	1	2.3653	0...	37...	
593	df33...	00:24:54:f3:89:64	1544114903	1	0.0112	1...	37...	4e01
594	5d0...	3c:83:b5:01:02:b9	1544116443	1	2.4187	0...	37...	
595	c2b...	78:4f:43:87:1e:47	1544116700	1	2.7107	2...	37...	062d
596	8ad...	3c:83:b5:01:02:b9	1544116449	1	2.3653	0...	37...	
597	ff8f3...	3c:83:b5:01:02:b9	1544114913	1	2.3107	0...	37...	
598	9c1...	3c:83:b5:01:02:b9	1544114919	1	2.3467	0...	37...	

## Reason

- simple structure

# Hidden devices

- ▼ IEEE 802.11 wireless LAN
  - ▶ Fixed parameters (12 bytes)
  - ▼ Tagged parameters (248 bytes)
    - ▶ Tag: SSID parameter set: Vodafone5GHz-WhiteHat
    - ▶ Tag: Supported Rates 6(B), 9, 12(B), 18, 24(B), 36, 48, 54, [Mbit/sec]
    - ▶ Tag: Traffic Indication Map (TIM): DTIM 0 of 0 bitmap
    - ▶ Tag: Country Information: Country Code IT, Environment Any
    - ▶ Tag: Power Constraint: 6
    - ▶ Tag: TPC Report Transmit Power: 13, Link Margin: 0
    - ▶ Tag: RSN Information
    - ▼ Tag: HT Capabilities (802.11n D1.10)
      - Tag Number: HT Capabilities (802.11n D1.10) (45)
      - Tag length: 26

## HT Capabilities

- Why?

# GUI Application



## ESP Tracking System



View Graph



View Rooms



View Mac Frequency



Configuration



Progetto Programmazione di Sistema 2018

## Characteristics

- Python QT
- User friendly



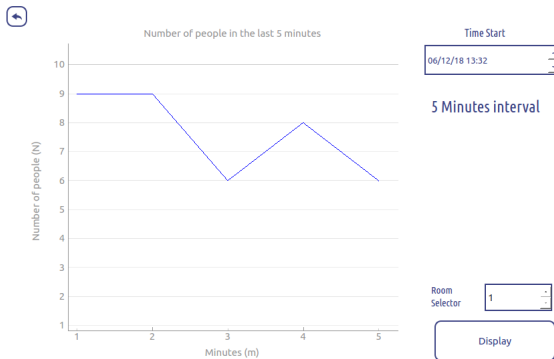
## Advantages

- Customizable with CSS
- Custom Widget to draw the room
- Existing widget for graph or plot
- Cross-Platform (Window, Linux, MacOS)

## HOW THE APPLICATION WORKS

Smart Guide for Dumb User

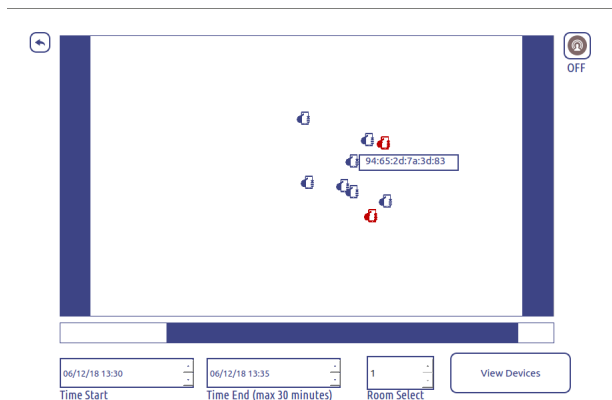
# View Graph



In this section is possible have a graphic plot about the number of devices in a selected room in the last 5 minutes from a selectable starting time.



# Room View



A simple live view of a room in which is possible to select a device and see its mac address. It's also possible select a longer time lapse to see an animation about the movement of all devices.

# Mac Frequency

The screenshot displays a web-based interface for monitoring MAC addresses. On the left, a panel titled "List of Mac Address" contains a list of ten entries, each with a number and a MAC address. The first entry is highlighted in light blue. To the right, an "Info about" panel shows details for the selected MAC address, including its frequency and a list of intervals. Below these panels are input fields for "Time Start", "Time End", and "Room Selector", along with a "Search" button.

**List of Mac Address**  
Select one to info

- #1 10:30:47:51:75:fb
- #2 3c:83:b5:01:02:b9
- #3 6c:71:d9:22:96:f9
- #4 88:b1:11:5a:8d:77
- #5 da:a1:19:01:93:fd
- #6 da:a1:19:d7:5a:10
- #7 da:a1:19:bd:6a:8c
- #8 da:a1:19:bb:4b:66
- #9 da:a1:19:81:1a:c1
- #10 da:a1:19:6d:c8:b4

**Info about**

Mac Address: 10:30:47:51:75:fb  
 Frequency: 2 time(s) (discretizzate in 120 minuti)

-Intervals-  
 il 06 dicembre 2018

Time Start: 02/12/18 00:00  
 Time End: 06/12/18 19:00  
 Room Selector: 1

Search

In a selected interval is possible view a rank of all devices. For check information about the time it's needed click on the mac-address in the left-side.

# Git



## Divide et Impera

- Firmware on Esp
- Broker and Analyzer
- Database Structure
- Graphic User Interface

Repository at: <https://bitbucket.org/esp32polito/>

# Why Git?

- Backup of the project
- Good co-operative ambient
- Rollback to older version
- Branches to test and add new features
- Documentation

# Thanks for attention!