UNIVERSITÉ CÔTE D'AZUR

POLYTECH NICE SOPHIA

# MQTT protocol
# Message Queuing Telemetry Transport

Fabrice MULLER

Fabrice.Muller@univ-cotedazur.fr

2023 - 2024

Copyright © F. Muller 2021

# Part 10 – Message Queuing Telemetry Transport

Lesson : 30mn

**Lab 1 : MQTT services**

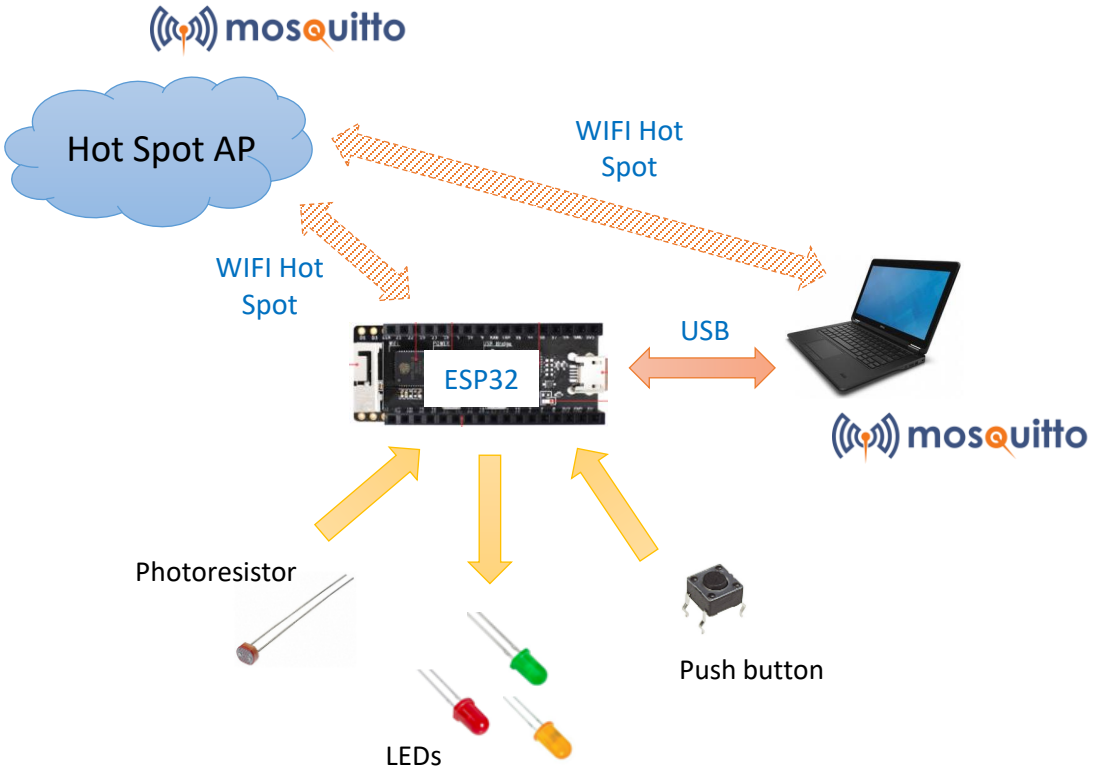
- MQTT with Mosquitto
- Mosquitto client services
- MQTT client services for ESP32

**Lab 2 : MQTT Bridge**

- Hierarchical MQTT Broker
- Configuration of a MQTT Bridge
- Application with ESP32 client

**Lab 3 : MQTT Application**

- Publish sensor information
- Subscribed to sensor




Copyright © F. Muller 2021

# What is MQTT?

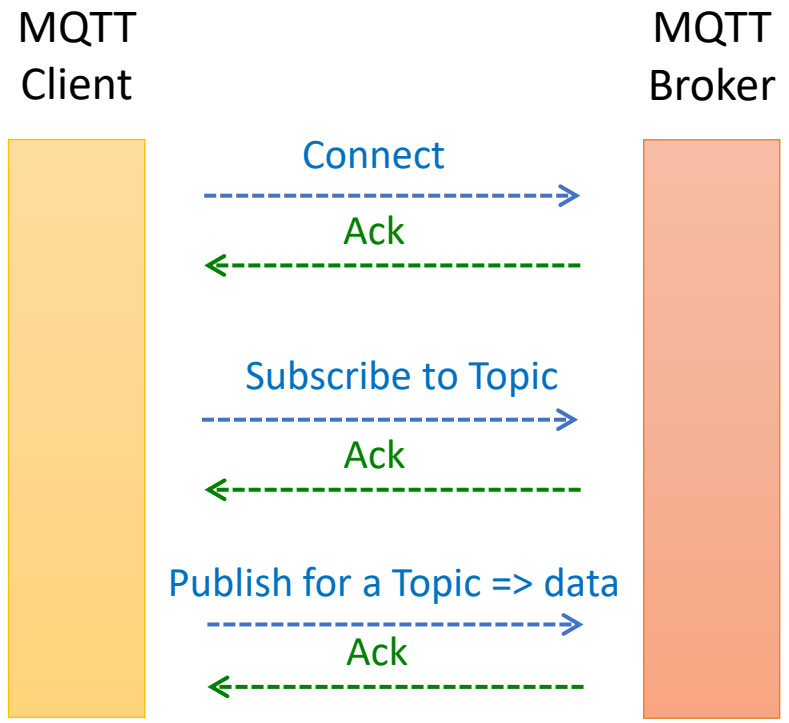
- Lightweight publish/subscribe messaging protocol designed for M2M telemetry in low bandwidth environments
- One of the main protocols for IoT deployments
- Designed for TCP/IP networks (Application layer)
- Versions
  - MQTT v3.1.0
  - MQTT v3.1.1 – In Common Use
  - MQTT v5 – Currently Limited use

Practical MQTT with Steve, http://www.steves-internet-guide.com/

Copyright © F. Muller 2021

# MQTT packet (1)

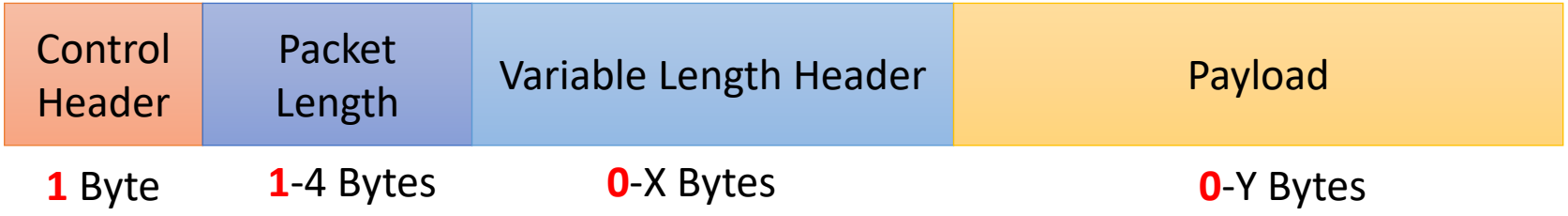
- Binary based protocol
- Use a command & command ack format
- Message
  - Topic names
  - Client ID
  - Username and password
- Payload
  - Excluding MQTT protocol information
  - Binary data
  - The content and format is application specific




Copyright © F. Muller 2021

# MQTT packet (2)

- MQTT packet / Message format
  - 2-byte fixed header
  - Variable-header (optional)
    - Size depends on the message type
  - Payload (optional)
    - User Data to be sent




Copyright © F. Muller 2021

# MQTT Topics

- Topics
  - polytech/templier1/roomE133/temperature

Temperature in room E133 in templier1 at Polytech

- Wildcards
  - Single Level: +
    - polytech/templier1/+/temperature

Temperature in all rooms in templier1 at Polytech

  - Multi Level: #
    - polytech/templier1/#

All sensors in all rooms in templier1 at Polytech

- Topics beginning with $
  - Reserved for internal statistics of the MQTT broker.

Copyright © F. Muller 2021

# MQTT client

- Publish
  - A client is free to publish on any topic it chooses
  - Can only publish messages to a single topic (no group)
  - There are **no reserved topics**
- Quality of Service for publish/subscribe
- 3 levels of QoS
  - Level 0 – Default and doesn't guarantee message delivery
  - Level 1 – Guarantees message delivery but could get duplicates
  - Level 2 -Guarantees message delivery with no duplicates
- Retained message
  - No subscriber = Discarded message when a message is published
  - Retained message flag to keep the last message
  - Only one message is retained per topic

Copyright © F. Muller 2021

# MQTT Broker/Server

- Eclipse Mosquitto (mosquitto.org)
  - Open-source message broker
  - Use a publish/subscribe model
  - Suitable for IoT messaging (low power sensors or mobile devices)
  - Support MQTT protocol versions 5.0, 3.1.1 and 3.1

Subscribe to the Topic : polytech/templier1/roomE133/temperature

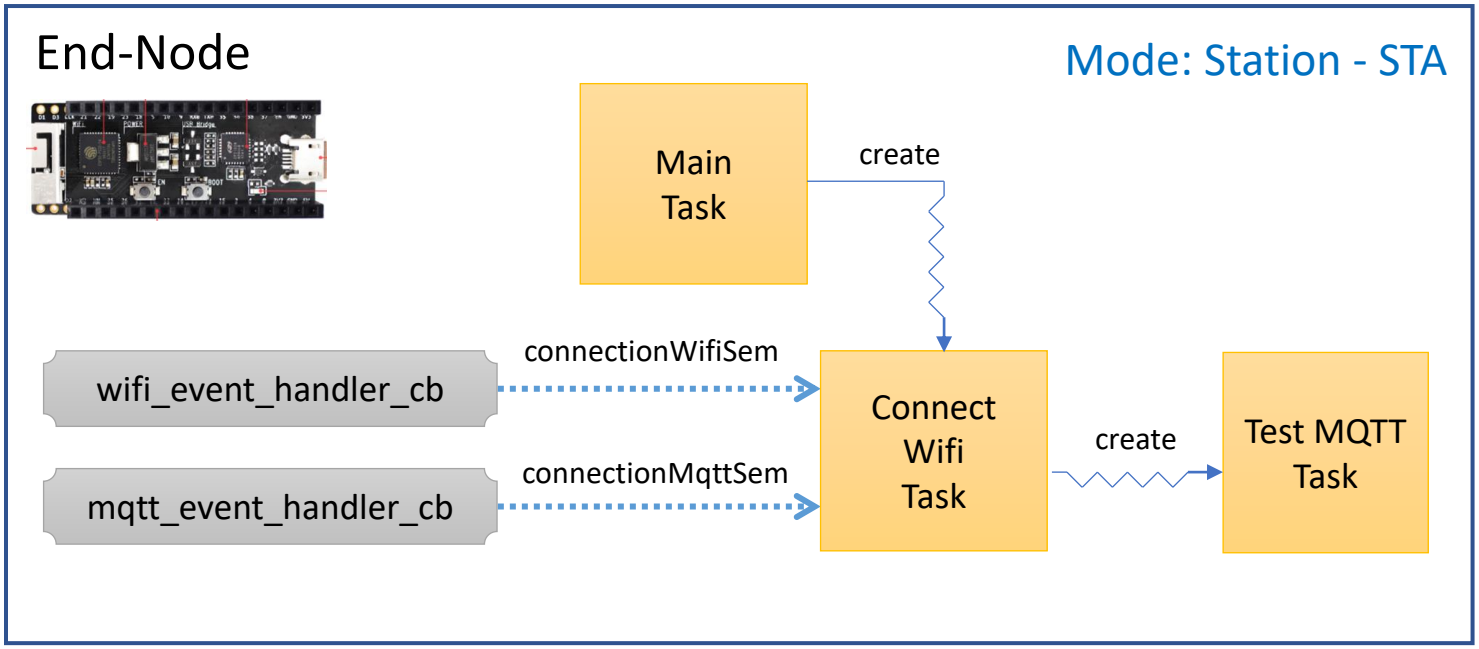
```
mosquitto_sub -h localhost -t "polytech/templier1/roomE133/temperature"
```

Publish for the Topic : polytech/templier1/roomE133/temperature

```
mosquitto_pub -h localhost -t "polytech/templier1/roomE133/temperature" -m 22.5
```

Copyright © F. Muller 2021

# Lab1 – MQTT services




Raspberry Pi Foundation

*Raspberry PI board*

WiFi

(1) IoT Gateway

(2) MQTT Broker

Ethernet

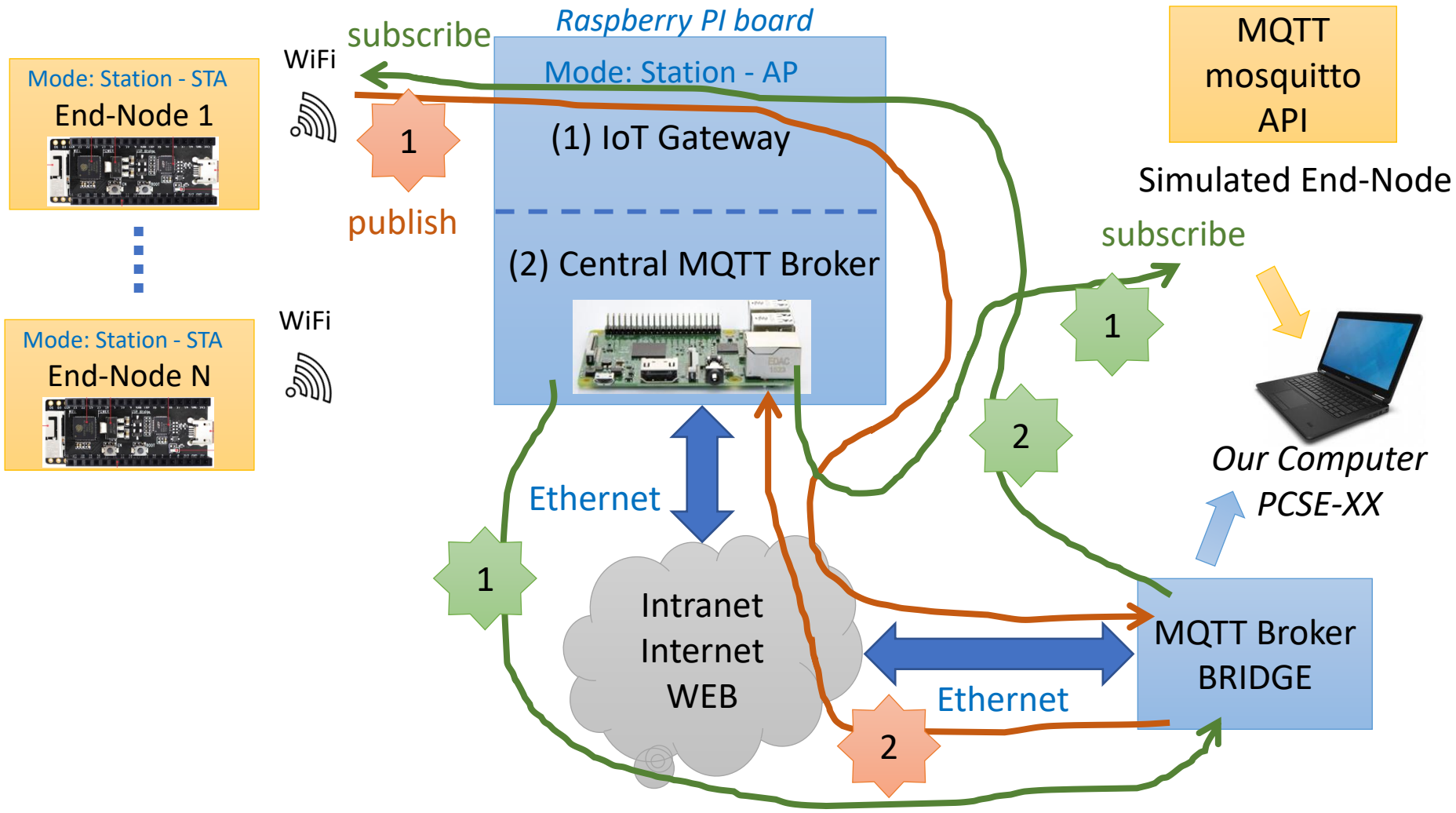
Intranet
Internet
WEB

*Our Computer*
*PCSE-XX*

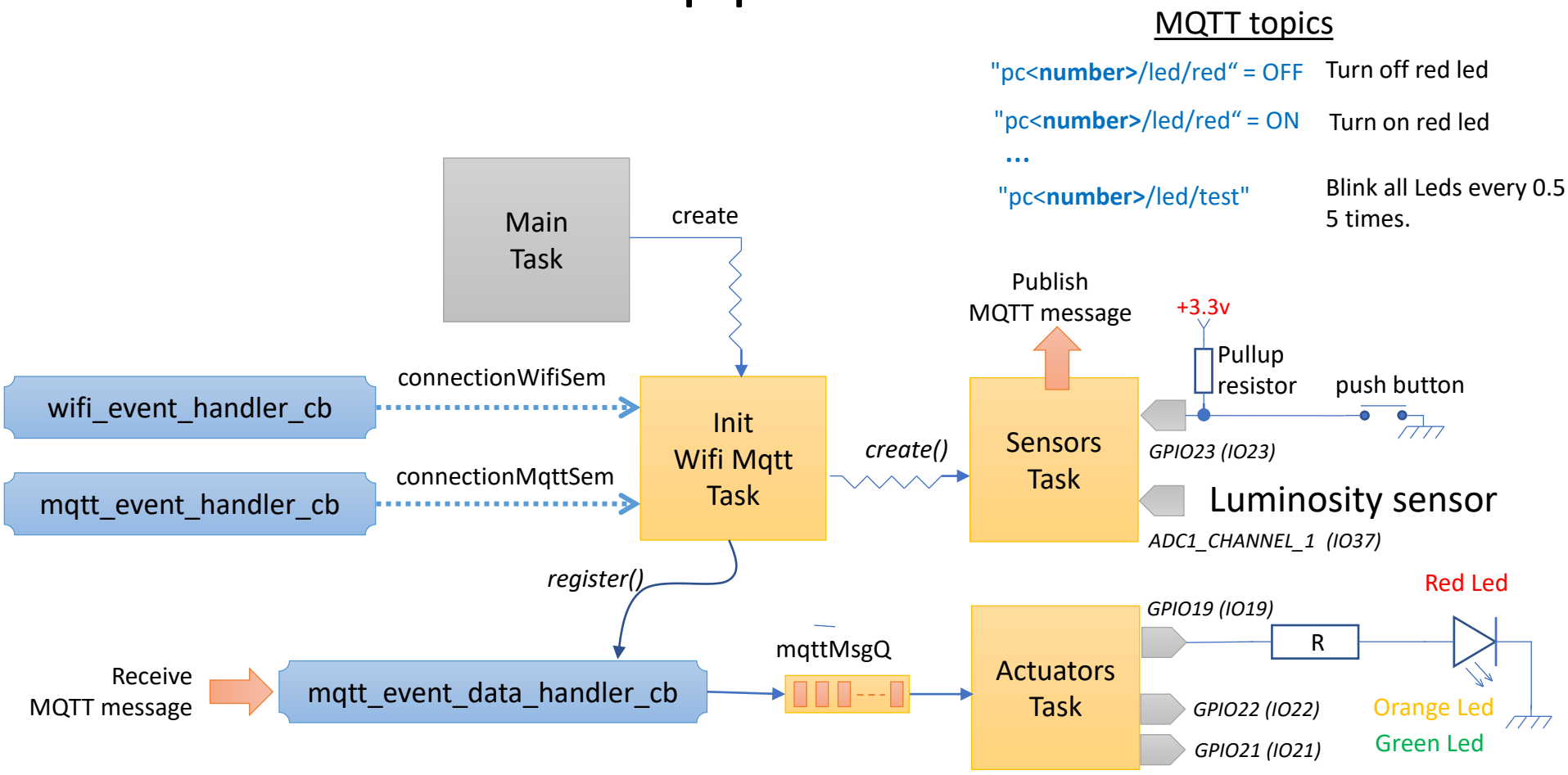
Ethernet

Copyright © F. Muller 2021

# Lab2 – MQTT Bridge



# Lab3 – MQTT Application




Copyright © F. Muller 2021

# References

- Practical MQTT with Steve, http://www.steves-internet-guide.com/
- Eclipse Mosquitto, https://mosquitto.org/