Lab2:
MQTT and LoPy WiFi

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Labs

⅓ Ready to use, tested examples

⅓ Exercise based on the examples

⅓ Your imagination → create new applications

Lab alert

The number of variables in the lab settings is huge (computer operating system, firewall, device firmware version, code version, network, etc)

Things will go wrong :-)

Be patient, we will solve all issues!

Found a bug? Let me know! Feedback is welcome.

Hands-on sessions

"Be excellent to each other", asking / helping is OK.

Google error messages to fix issues.

Coping blindly does not lead to new insight.

Reading other people's code helps a lot.

Check Pycom’s documentation.

Our Lab equipment

Pycom LoPy 4

PySense

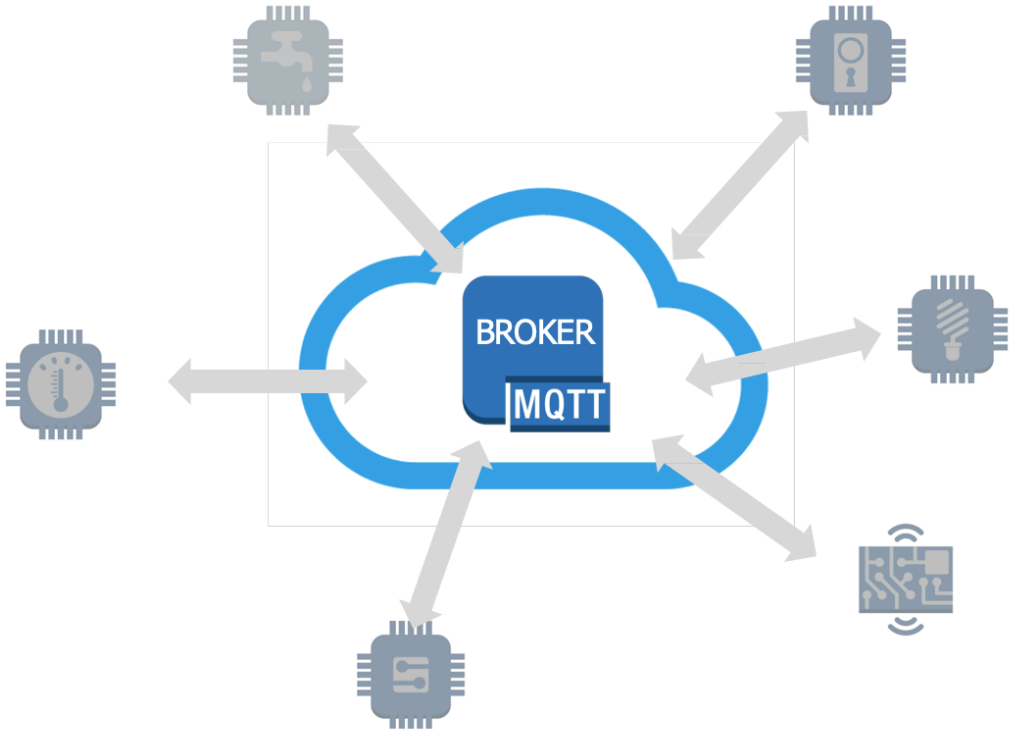
microUSB Cable

Laptop/Desktop

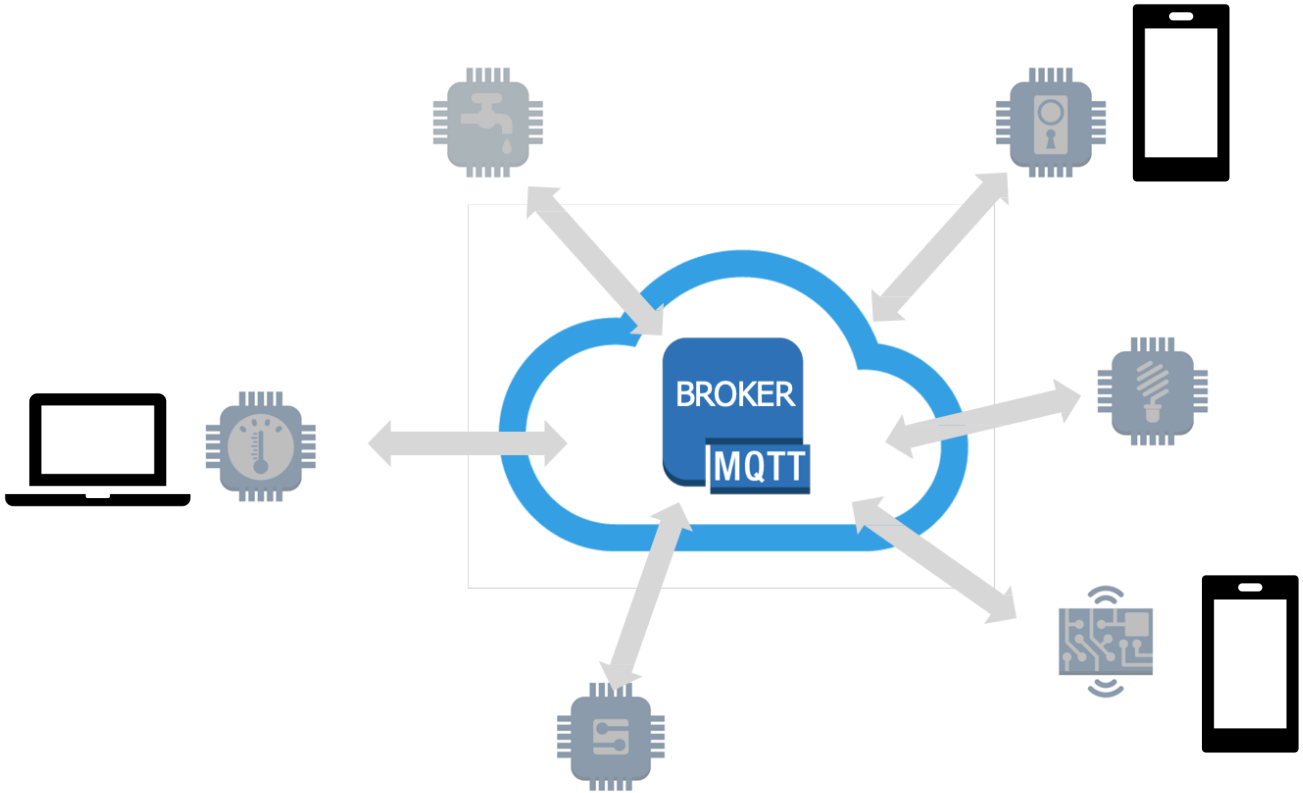
Smartphone

RPi

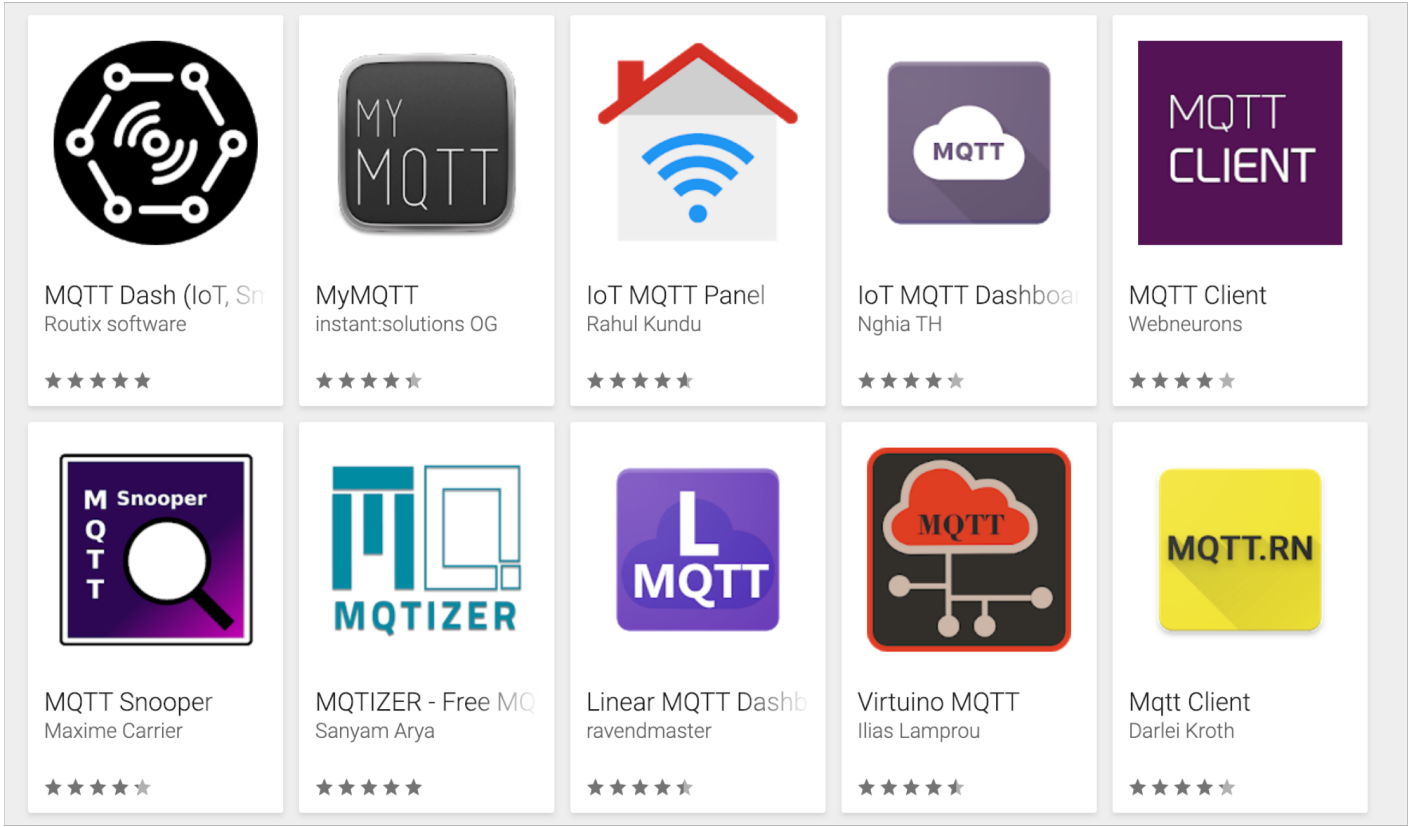
MQTT



MQTT



MQTT: Android



MQTT: iOS


Mqttt
Utilidades
ABRIR
MQTT
Tool

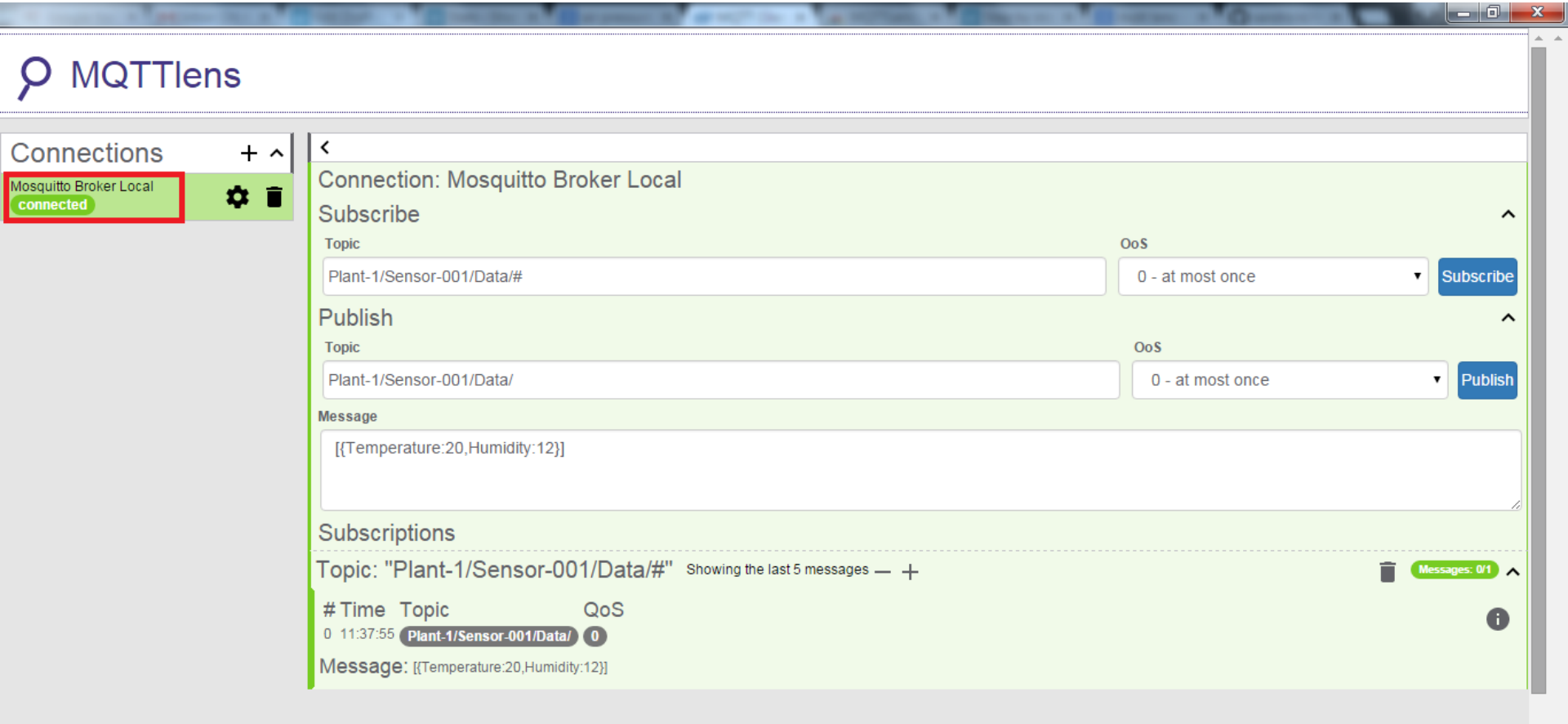

ICPDAS MQ...
Utilidades
ABRIR
MQTT
ICPDAS
UI View
Received Message
ICPDAS/Taichung/DL302/208/
ICPDAS/MQ1/WISE-7255/
DO0 - ON
DI0 - OFF

MQTT: browser

MQTT Lens: a Google Chrome application, which connects to a MQTT broker and is able to subscribe and publish to MQTT topics.

Google for MQTT Lens and install it in Chrome.

MQTT: Chrome browser



MQTT: brokers

https://iot.eclipse.org/getting-started/#sandboxes

Hostname: **iot.eclipse.org**

http://test.mosquitto.org/

Hostname: **test.mosquitto.org**

https://www.hivemq.com/mqtt-demo/

Hostname: **broker.hivemq.com**

MQTT: brokers

Ports: standard: 1883

encrypted: 8883

List of open brokers:

https://github.com/mqtt/mqtt.github.io/wiki/public_brokers

MQTT: exercise

Divide the class in two groups: one group will publish messages and the other will receive them.

You must first agree on:

1) The broker you will use

2) The topic you will use to publish/subscribe

MQTT: exercise

You can easily run your own MQTT gateway. On a RPi run:

sudo apt-get update

sudo apt-get install mosquitto mosquitto-clients

MQTT: exercise

To start and stop its execution use:

sudo /etc/init.d/mosquitto start/stop

Verbose mode:

sudo mosquitto –vudo /etc/init.d/mosquitto start/stop

MQTT: exercise

To check if the broker is running you can use the command:

```
sudo netstat -tanlp | grep 1883
```

Where "-tanlp" stands for: tcp, all, numeric, listening, program

MQTT: exercise

Your MQTT broker has to be on the same network as the devices that publish/subscribe!

WiFi

WiFi

In this example, we will use the LoPy to connect to a WiFi network, to sync to internal clock using NTP and to measure the WiFi signal level

The WiFi examples are in the Code/wifi directory

WiFi: WPA example

Open the example in the Code/wifi/WPA directory.

WPA is the authentication method used by most WiFi Access Points. It requires a password to connect to WiFi.

If your AP does not require a password, use the example in Code/wifi/Open.

WiFi WPA example, part 1

```
import machine

from network import WLAN
```

Import the python libraries needed

```
wlan = WLAN(mode=WLAN.STA)
```

Set the LoPy as a Station and not as an Access Point. We want to connect to an existing Access Point!

```
nets = wlan.scan()
```

Scan all the AP and put their names in the variable nets

WiFi WPA example, part 2

```
for net in nets:

    if net.ssid == 'MarconiLab':

     print('Network found!')

      wlan.connect(net.ssid, auth=(net.sec,
'marconi-lab'), timeout=5000)

    while not wlan.isconnected():

        machine.idle() # save power while
waiting

    print('WLAN connection succeeded!')

      break
```

For all the networks in nets, if the name is “MarconiLab” then write “Network found” and send the password.

If you are not connected, go to idle mode.

If you are connected, then write “WLAN connection succeeded”

WiFi: NTP

Network Time Protocol (NTP) is a protocol used to synchronize computer clock times in a network.

NTP servers, of which there are thousands around the world, have access to highly precise atomic clocks and GPS clocks.

NTP uses Coordinated Universal Time (UTC) to synchronize computer clock times.

WiFi: NTP example

Open the example in Code/wifi/NTP directory.

The example code connects to a WiFi Access Point using WPA and then contacts a NTP server to sync the internal clock.

If the NTP protocol is blocked at your University, then use the code in the Code/wifi/Sync-no-NTP folder.

WiFi: Sync-no-NTP example

Some networks block the access to NTP. Check with your system administrator to make sure that the NTP port (number 123) is open for you.

If the NTP protocol is blocked at your University, then use the code in the Code/wifi/Sync-no-NTP folder.

We use a time web server to sync the clock.

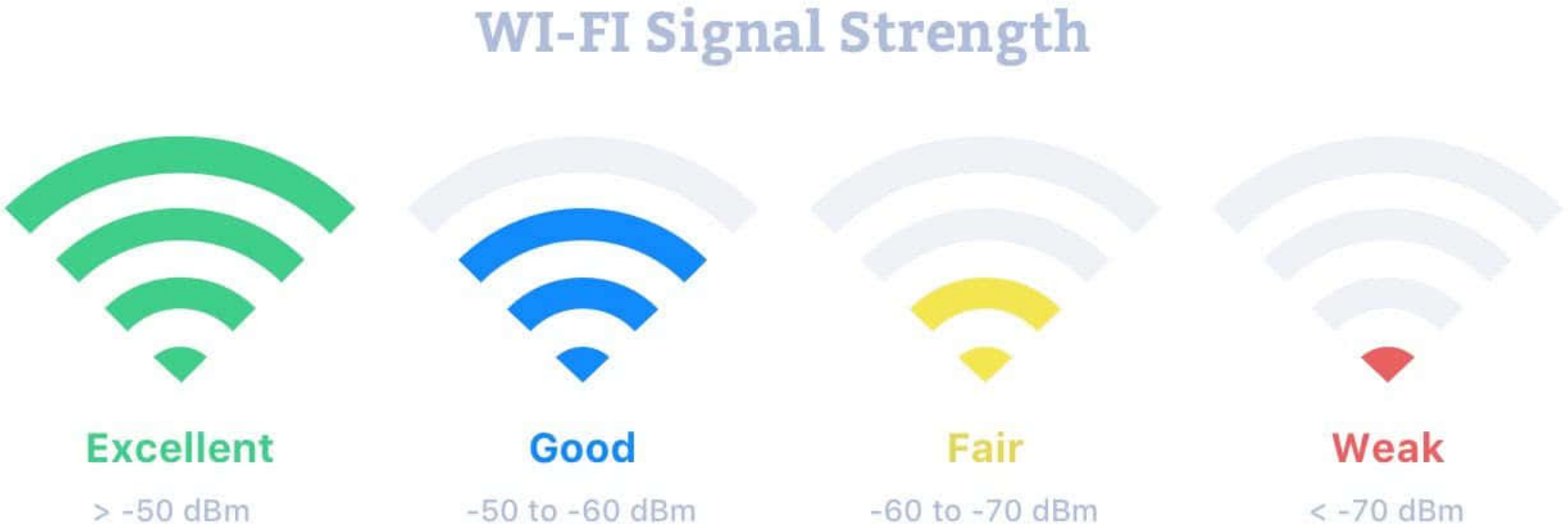
WiFi: RSSI

RSSI (Received Signal Strength Indication) is a general term used by any radio-based technology to indicate the strength of a received signal.

The received signal level is a negative value when expressed in dBm, and higher values show a stronger signal.

For example, -65 is s stronger signal level than -90.

WiFi: RSSI



Credit: https://www.netspotapp.com/what-is-rssi-level.html

WiFi: RSSI example

Open the example in Code/wifi/RSSI directory.

The example code scans all available APs and shows their name (ssid) and RSSI reading.

```
while True:
    for net in nets:
    print(net.ssid, net.rssi)
```

WiFi: Exercises

1) Move in the lab and check the RSSI values. How far can you go while still receiving a specific APs?

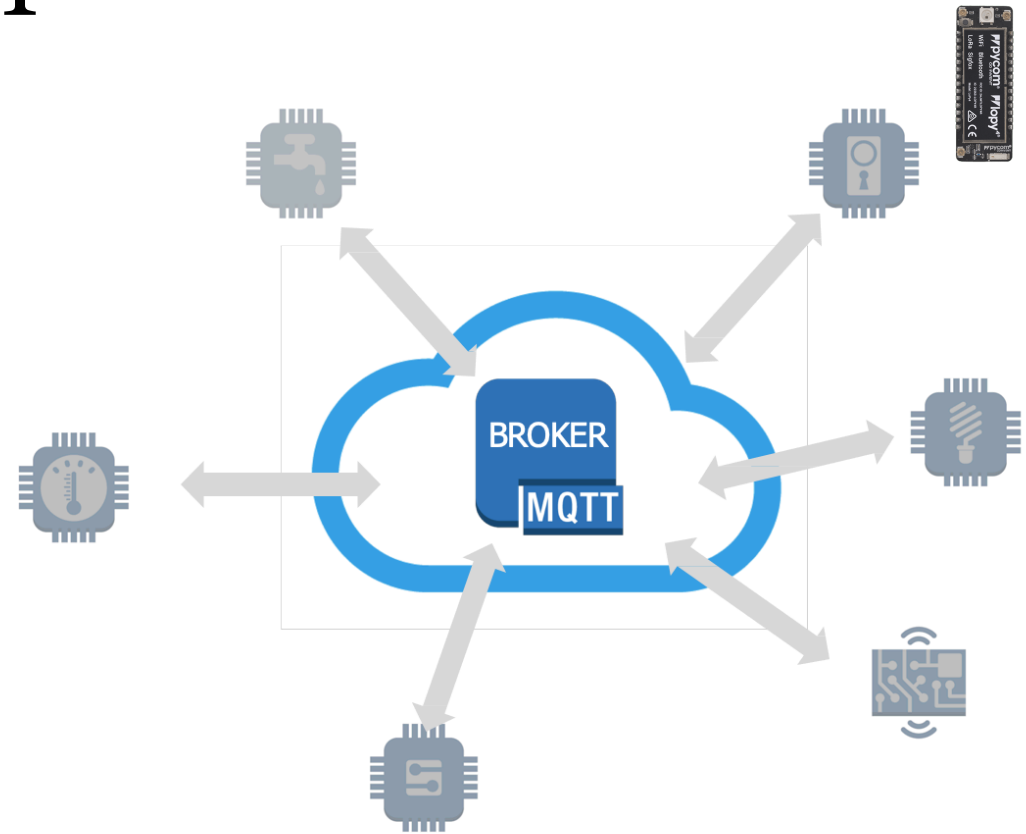
2) Without moving the LoPy, plot the RSSI values over time. How much does the RSSI fluctuate?

3) Save the RSSI value and the time in a log file in the flash memory.

4) Use the LED to show the RSSI signal level.

MQTT via WiFi with LoPy

MQTT



WiFi MQTT Publisher example

Open the example in Code/MQTT/publisher directory.

The example code connects to a WiFi Access Point using WPA, connects to an MQTT broker, created some random data and sends data using a specific topic.

WiFi MQTT Publisher: Exercises

1) Can you receive the data using a subscriber on your phone/browser?

2) Publish using MQTT the values of temperature and humidity of the PySense. Can you receive them?

WiFi MQTT Subscriber example

Open the example in Code/MQTT/subscriber directory.

The example code connects to a WiFi Access Point using WPA, connects to an MQTT broker and waits for messages on a specific topic.

WiFi MQTT: Final Exercise

Divide the class in two groups: the first group publishes temperature and humidity values and the second group changes the LED color according to the temperature value (eg red if temp>30, green if temp<30).

Summary

We learned how to publish and subscribe to MQTT messages using a smartphone or a PC.

We learned how to use WiFi capabilities of the LoPy to connect to an AP, sync the internal clock and read RSSI values.

We sent and received MQTT messages using LoPys.

Feedback?

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