Lab 4

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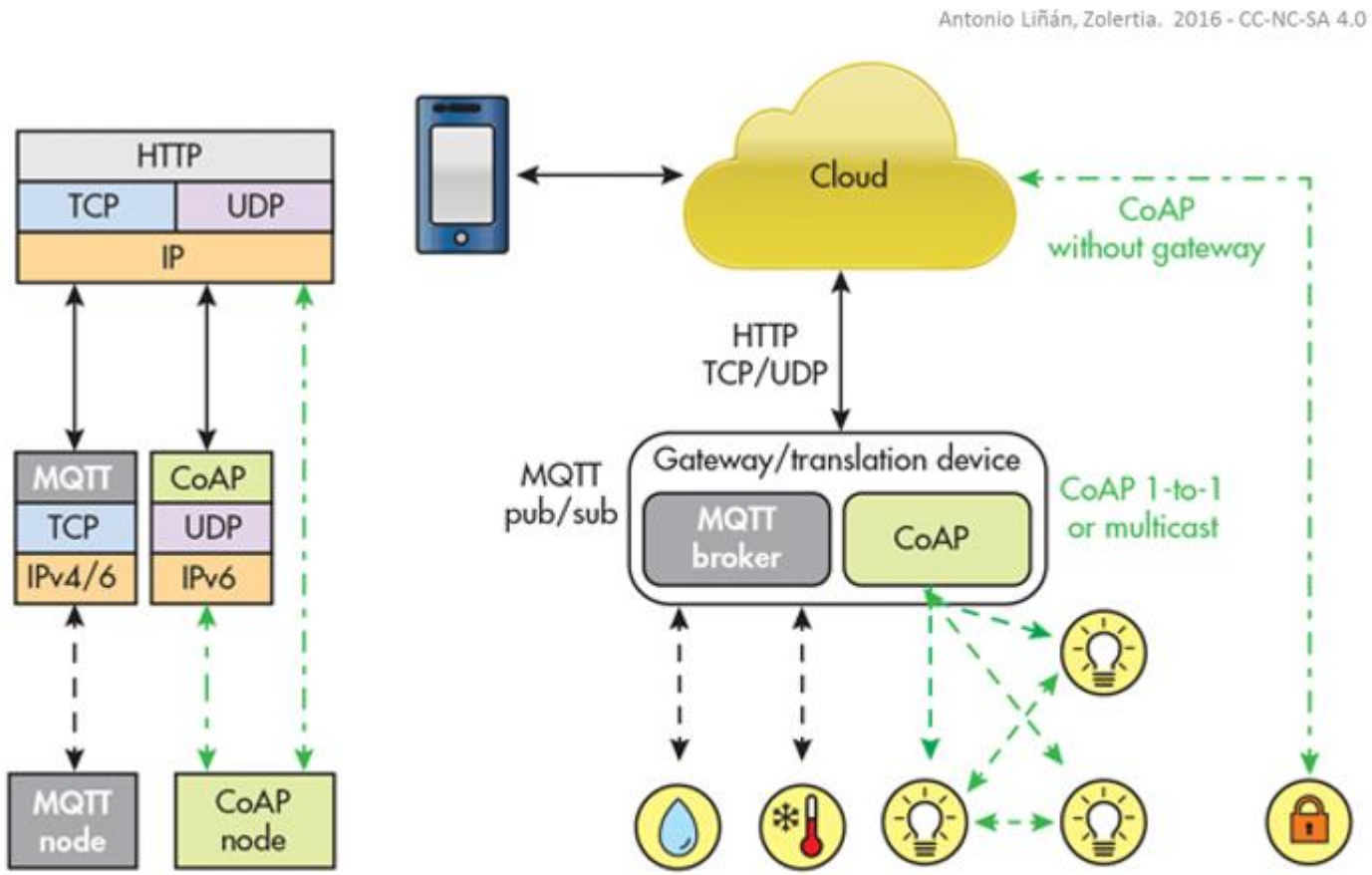
ÉCOLE D'INGÉNIEURS

REST, CoAP and MQTT



http://electronicdesign.com/iot/mqtt-and-coap-underlying-protocols-iot

Connecting to a cloud platform

UBIDOTS Platform

- You should subscribe to your **things.ubidots.com** platform
- Version Education https://ubidots.com/education/
- You can follow these two tutorials :

  https://www.youtube.com/watch?v=ynhJ4YhhQEM

  https://www.youtube.com/watch?v=p3DVe7TLvdI
- The objective is to demonstrate the basic functionality of Contiki's **Ubidots** library
  - How to use the library to POST to a **variable**
  - How to use the library to POST to a **collection**
  - How to receive (parts of) **the HTTP reply**

Connecting to a cloud platform

Example of an application with Ubidots

- Use **miredo** package to allow full ipv6 connectivity to your host

$ sudo apt-get install miredo

- You can test if your interface is configured with an ipv6 address

http://test-ipv6.com/

- If the IPv6 cannot be used in the school network so try to use your 3G, 4G networks

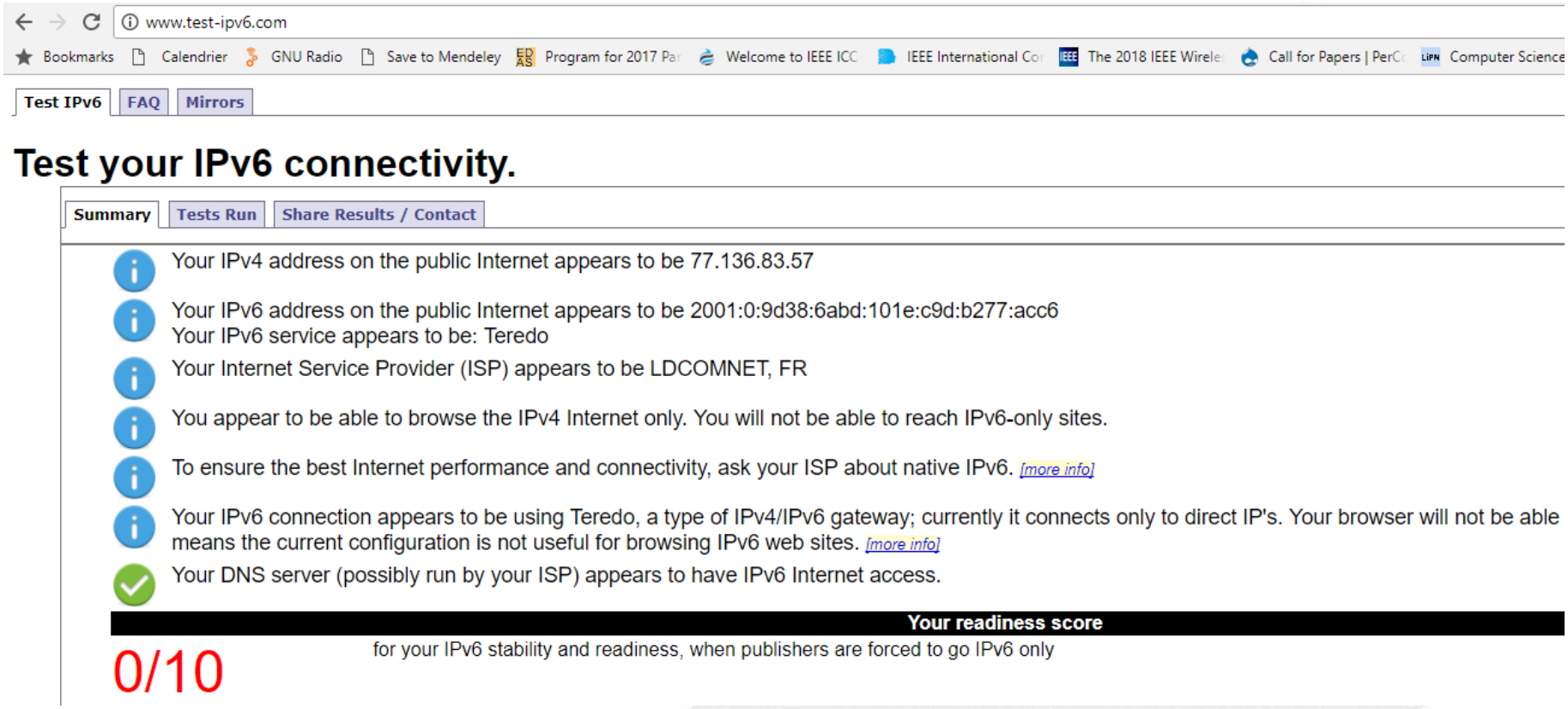
- Check if you can do ipv6 ping

$ ping6 ipv6.google.com

Connecting to a cloud platform

Example of an application with Ubidots

We can see the obtained local ipv6 address



Connecting to a cloud platform

Example of an application with Ubidots

➢ Ubidots uses TCP sockets to connect to the host **things.ubidots.com**. You can get the IPv6 address of **ubidots** platform from https://centralops.net/co/

IPv6 of ubidots server is: **2607:f0d0:2101:39::2**

Connecting to a cloud platform

Example of an application with Ubidots

- This application has been developed by **G. Oikonomou** (https://github.com/g-oikonomou/contiki/tree/ubidots-demo)

- The source code of the **/contiki/examples/ipv6/ubidots** is **ubidots-demo.c**
- Before compilation check if you have the folder in **/contiki/app/ubidots**

sudo make ubidots-demo.upload TARGET=zoul

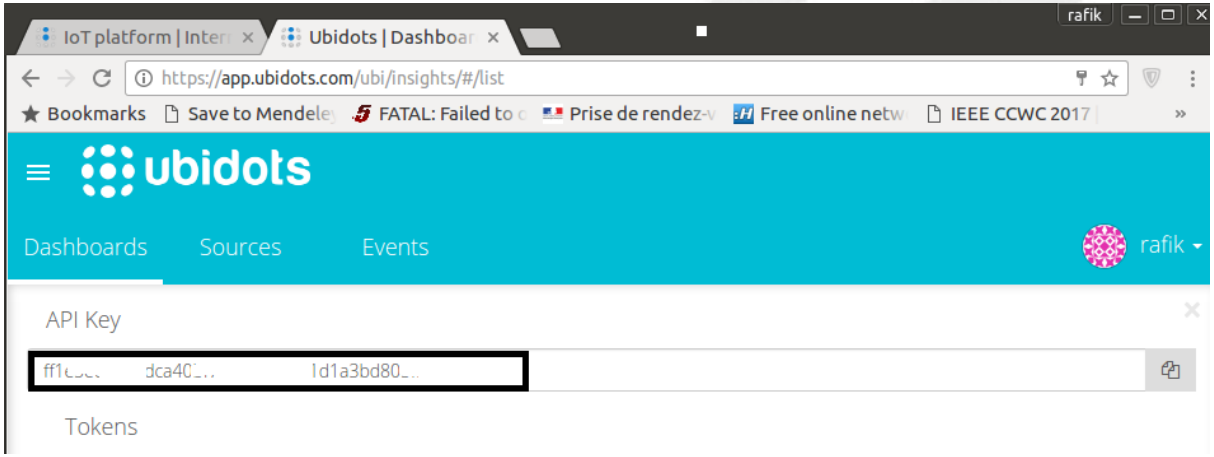
Check if you have the following instruction in your **project-conf.h**

#define UBIDOTS_CONF_REMOTE_HOST "2607:f0d0:2101:39::2"

IPv6 of ubidots server

The Ubidots demo posts every 30 seconds the zoul mote's **uptime** and **sequence number**, so we need to create these two variables at Ubidots.

Login or subscribe for an **ubidots** account. The most important information to keep confidential is the API Key.

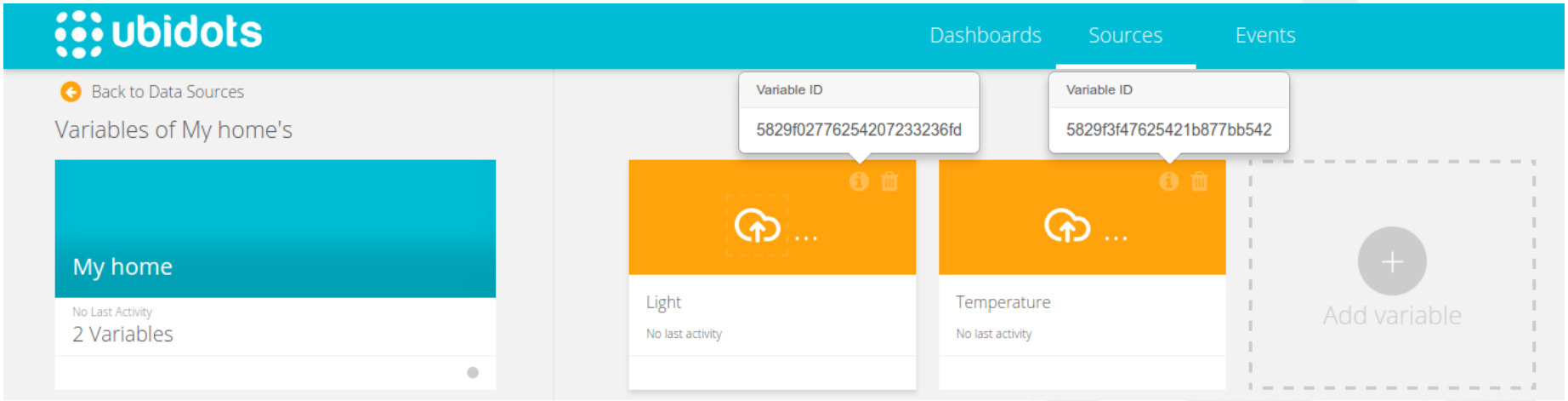


Connecting to a cloud platform

Example of an application with Ubidots

- Copy/Past the **API key** of your Ubidots API. It defines the value of the parameter

  UBIDOTS_CONF_AUTH_TOKEN in **project-conf.h**



- Copy the **Variables IDs** which correspond to

#define UBIDOTS_DEMO_CONF_UPTIME “ "

#define UBIDOTS_DEMO_CONF_SEQUENCE “ ”

Of course, you add these variables in your **project-conf.h**

Connecting to a cloud platform

Example of an application with Ubidots

- Check if your **Makefile** looks like the following screenshot:

(root) > home > etudiant > contiki > examples > ipv6 > ubidots > Makefile >

```
DEFINES+=PROJECT_CONF_H=\"project-conf.h\"
CONTIKI_PROJECT = ubidots-demo

APPS = ubidots


ifdef UBIDOTS_WITH_AUTH_TOKEN
  DEFINES+=UBIDOTS_CONF_AUTH_TOKEN=\"$(UBIDOTS_WITH_AUTH_TOKEN)\"
endif

all: $(CONTIKI_PROJECT)

CONTIKI_WITH_IPV6 = 1

CONTIKI = ../../..

include $(CONTIKI)/Makefile.include
```

- Compile the project

Connecting to a cloud platform

Example of an application with Ubidots

- Compile and program a Border Router device as shown in the previous Labs.
- Verify the Border Router is online by making a ping6 request to it.
- Browse the Border Router's web service and also ping6 the **ubidots-demo** node

```
Ubidots client: HTTP Reply 200
HTTP Status: 200
Ubidots client: New header: <Server: nginx>
Ubidots client: New header: <Date: Fri, 13 Mar 2015 09:35:08 GMT>
Ubidots client: New header: <Content-Type: application/json>
Ubidots client: New header: <Transfer-Encoding: chunked>
Ubidots client: New header: <Connection: keep-alive>
Ubidots client: New header: <Vary: Accept-Encoding>
Ubidots client: Client wants header 'Vary'
H: 'Vary: Accept-Encoding'
Ubidots client: New header: <Vary: Accept>
Ubidots client: Client wants header 'Vary'
H: 'Vary: Accept'
Ubidots client: New header: <Allow: GET, POST, HEAD, OPTIONS>
Ubidots client: Chunk, len 22: <[{"status_code": 201}]> (counter = 22)
Ubidots client: Chunk, len 0: <(End of Reply)> (Payload Length 22 bytes)
P: '[{"status_code": 201}]'
```

Connecting to a cloud platform

Example of an application with Ubidots

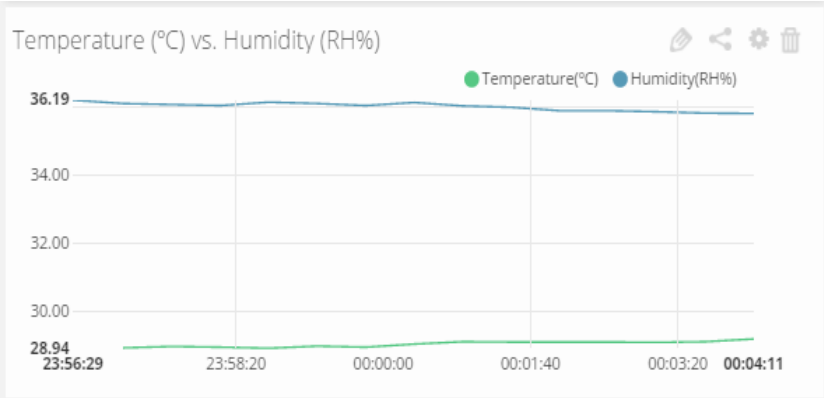
- After fixing the missing in your source code, you should obtain the following information after pushing the **reset button**.

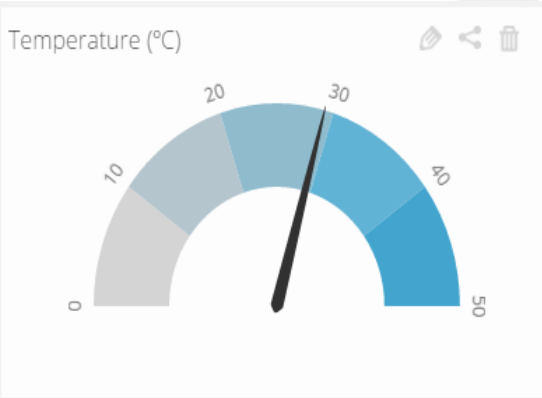
```
rafik@rafik-Precision-7510:~/enseignement/OCRES/contiki/examples/ipv6/ubidots$ s
udo make login PORT=/dev/ttyUSB1
using saved target 'zoul'
../../../tools/sky/serialdump-linux -b115200 /dev/ttyUSB1
connecting to /dev/ttyUSB1 (115200) [OK]
Contiki-2.6-4018-gcdf76cb
Zolertia RE-Mote revision B platform
CC2538: ID: 0xb964, rev.: PG2.0, Flash: 512 KiB, SRAM: 32 KiB, AES/SHA: 1, ECC/R
SA: 1
System clock: 16000000 Hz
I/O clock: 16000000 Hz
Reset cause: External reset
Rime configured with address 00:12:4b:00:06:0d:b3:ef
 Net: sicslowpan
 MAC: CSMA
 RDC: ContikiMAC
Ubidots client: STATE_ERROR_NO_NET
Server IPv6 addresses: [fd00:0000:0000:0000:0212:4b00:060d:b3ef]
[fe80:0000:0000:0000:0212:4b00:060d:b3ef]
Ubidots client: STATE_ERROR_NO_NET
Ubidots client: STATE_STARTING
Ubidots client: Checking 2607:f0d0:2101:39::2
Ubidots client: 'Host: [2607:f0d0:2101:39::2]' (remaining 42)
Ubidots client: STATE_TCP_CONNECT (1)
Ubidots client: Connect 2607:f0d0:2101:39::2 port 80
```

Connecting to a cloud platform

Example of an application with Ubidots

- If you are able to exchange real-world data with your network, you should obtain these curves.





- If you have problems to obtain such results see the following WIKI, Section **Hands on: connecting to a real world IoT platform (HTTP-based)**

https://github.com/marcozennaro/IPv6-WSN-book/blob/master/5.asc#hands-on-connecting-to-a-real-world-iot-platform-http-based

Connecting to a cloud platform

- It is possible to use python middleware to push/pull data to/from could platform:

```python
import time
import requests
import math
import random
import json

TOKEN = "A1E-qp6nRZ0dBrLxhRXTb58PZPeHumsBoZ"  # Put your TOKEN here
DEVICE_LABEL = "machine"  # Put your device label here
VARIABLE_LABEL_1 = "temperature"  # Put your first variable label here
VARIABLE_LABEL_2 = "humidity"  # Put your second variable label here
VARIABLE_LABEL_3 = "position"  # Put your second variable label here

def build_payload(variable_1, variable_2, variable_3):
    # Creates two random values for sending data
    value_1 = random.randint(-10, 50)
    value_2 = random.randint(0, 85)

    # Creates a random gps coordinates
    lat = random.randrange(34, 36, 1) + \
        random.randrange(1, 1000, 1) / 1000.0
    lng = random.randrange(-83, -87, -1) + \
        random.randrange(1, 1000, 1) / 1000.0
    payload = {variable_1: value_1,
               variable_2: value_2,
               variable_3: {"value": 1, "context": {"lat": lat, "lng": lng}}}

    return payload

def post_request(payload):
    # Creates the headers for the HTTP requests
    url = "http://things.ubidots.com"
    url = "{}/api/v1.6/devices/{}".format(url, DEVICE_LABEL)
    headers = {"X-Auth-Token": TOKEN, "Content-Type": "application/json"}

```

```python
def post_request(payload):
    # Creates the headers for the HTTP requests
    url = "http://things.ubidots.com"
    url = "{}/api/v1.6/devices/{}".format(url, DEVICE_LABEL)
    headers = {"X-Auth-Token": TOKEN, "Content-Type": "application/json"}
    # Makes the HTTP requests
    status = 400
    attempts = 0
    while status >= 400 and attempts <= 5:
        req = requests.post(url=url, headers=headers, data=json.dumps(payload))
        status = req.status_code
        attempts += 1
        time.sleep(1)
    # Processes results
    if status >= 400:
        print("[ERROR] Could not send data after 5 attempts, please check \
            your token credentials and internet connection")
        return False

    print("[INFO] request made properly, your device is updated")
    return True

def main():
    payload = build_payload(
        VARIABLE_LABEL_1, VARIABLE_LABEL_2, VARIABLE_LABEL_3)

    print("[INFO] Attemping to send data")
    post_request(payload)
    print("[INFO] finished")

if __name__ == '__main__':
    while (True):
        main()
        time.sleep(1)
```

The End…

Thank you so much