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IoT Challenge #2

Packet Sniffing

Home Challenge #2

Part -1-

- Download the **challenge2.pcap** file here or from WeBeep
- Analyse the traffic with Wireshark or writing simple scripts (Python, C++)
- Answer the 7 questions (CQ1-CQ7)
  (IGNORE MALFORMED PACKETS)

Part -2-

- Solve the exercise in **pdf** (two questions EQ1, EQ2)

FILL THE FORM: form

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PART 1

Questions on the PCAP file

Challenge Questions (1-2)

CQ1) How many **different** Confirmable PUT requests obtained an unsuccessful response from the local CoAP server?

CQ2) How many CoAP **resources** in the **coap.me** public server received the same number of **unique** Confirmable and Non Confirmable GET requests?

Assuming a resource receives **X** *different* CONFIRMABLE requests and **Y** *different* NONCONFIRMABLE GET requests, how many resources have **X=Y,** with X>0?

Challenge Questions (3-4)

CQ3) How many **different** MQTT clients subscribe to the **public broker HiveMQ** using multi-level wildcards?

CQ4) How many **different** MQTT clients specify a **last Will Message** to be directed to a topic having as first level "university"?

Questions (5-7)

CQ5) How many MQTT subscribers **receive** a last will message derived from a subscription **without** a wildcard?

CQ6) How many MQTT **publish messages** directed to the **public broker mosquitto** are sent with the retain option and use QoS “At most once”?

CQ7) How many MQTT-SN messages on port 1885 are sent by the clients to a **broker in the local machine**?

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PART 2

Exercise

Part 2 - Exercise

A wireless IoT network consists of the following devices:

- A battery-powered, Wi-Fi-enabled **temperature sensor** that measures and transmits temperature data every 5 minutes.
- A battery-powered, Wi-Fi-enabled **valve** that receives temperature readings from the sensor and computes the average temperature every 30 minutes to decide whether to open or close.
- **A Raspberry Pi**, connected to the power grid, which only supports MQTT for communication.

The temperature sensor and valve can communicate using either **MQTT** or **CoAP**, with a specific pre-defined topic or resource. The topic/resource length is 10 bytes and the payload size is 8 bytes. However, since the Raspberry Pi only supports MQTT, any interaction between the Raspberry Pi and the battery-operated devices must use MQTT. The sensor and valve, however, can communicate directly using CoAP if desired.

Part 2 - Exercise

Consider the following message sizes (in bytes), which **already include** header and payload size for the COAP resource or MQTT topic used in the system:

COAP		MQTT	
GET Request	60 B	Subscribe	58 B
GET Response	55 B	Sub Ack	52 B
PUT Request	77 B	Publish	68 B
PUT Response	58 B	Pub Ack	51 B
Empty ACK	14 B	Connect	54 B
		Connect Ack	47 B
		Ping Req	52 B
		Ping Resp	48 B

Part 2 - Exercise

Assuming that:

1. Transmit and Receive cost per bit are
   E_{TX} = 50nJ/bit, E_{RX} = 58nJ/bit (nanojoule per bit)

2. The Wi-Fi network is ideal **(no losses)**

3. The processing cost on the valve to compute the average temperature every 30 minutes is **Ec = 2.4mJ (millijoule)**

4. The sensor and valve start in power-off state

Part 2 - Exercise

Exercise Question 1 (EQ1): Compute the total energy consumed by the two battery-powered devices **over a period of 24 hours** in both cases when using COAP **(a)** and MQTT **(b)**, using each in its **most efficient configuration energy-wise.**

Exercise Question 2 (EQ2): Propose **atleast one** solution for decreasing the energy consumption when passing using the Raspberry PI as a broker. **Give a rough estimate of the energy saving** that could be obtained with your solution: recompute the energy under your proposed configuration.

Motivate your answers in the **PDF**, and also report the numerical results in the **form** **(EQ1a, EQ1b, EQ2)**!!

Challenge deliverable

Deliver a ZIP file containing:

- A **PDF** named **Challenge.pdf** containing **motivated responses** with all filters used and comments of any additional code (if used). Specify your **names + person codes** in the pdf!
- A **PDF** named **Exercise.pdf** containing the solution of the Part 2 exercise. Specify your **names + person codes** in the pdf!
- **FILL this form with the numerical values of the responses (both parts)**

Organize clean reports! **Very bad reports will be penalized**

Upload the zip file on the **folder #2** on WeBeep "Consegne" folder

The ZIP should be named as follows:

2-teams: <leader_personcode>_<other_personcode>.zip

Single: <person_code>.zip

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PLEASE NOTE (Part 1)

1. Files without name and personcode or in a weird format won't be corrected (=0 points)

2. Always make clear and highlight your answer.
   The answer **should be clear and unique!**
   Example, answers like this:
   "If …… then the answer is 4, but if instead …… then answer is 5"
   Will get 0 points. **If you have doubts on questions ask before submitting**

3. Try to produce **small but effective answers**, write only useful things and if required upload images taken e.g. from wireshark. Final answers should be written as text. (not like, "see image for the answer")

For 2 people teams:

- Choose your team leader and name the file as:
  <leader_personcode>_<other_personcode>.zip

- **Only the teamleader** should upload the challenge in WeBeep
  Do note upload the same challenge more times!!!

- *Can I take the challenges with the other class students (different Prof.)*?
  YES, but **only the team leader** should upload the challenge in WeBeep

Delivery Deadline

- **FIRM** Deadline:

  April 6, 2025 h 23.59

- Max 2 people

Good Luck!