Project Report: Challenge 1 - IOT

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1. **Difference between MID = 53533 and MID = 42804**
   a. In the packet with MID = 53533 represents a CONFIRMABLE message, it means that it needs to be acknowledged because it needs to be reliable. On the other hand the packet with MID = 42804 is a NON-CONFIRMABLE message, it means it does not require acknowledgement. In fact, by looking at the packets, the confirmable message receives an ack while the non confirmable message doesn't.
   b. The MID = 53533 is a GET message, while MID = 42804 is a DELETE message.
   c. The confirmable message's length is 61 while non confirmable is 60, this may be due to the confirmable bit.

2. **Response to message N. 2428**
   a. The response to the message N = 2428 is the message with N = 2429. In particular the response to a specific request is identified by the fact that they have the same token number. In fact, in order to retrieve the response message, the token of message N.2428 has been searched and N.2429 was found. The response says that the delete operation is confirmed.

3. **How many replies to requests of type confirmable having the result code "Content" are received by the client "localhost"?**
   a. Answer: **8** replies
   b. FILTER: ip.dst == 127.0.0.1 && coap.type == 2 && coap.code == 69
   c. It is important to say that the ACK are in response only to confirmable requests. Therefore all the ACK messages (coap.type==2) with localhost as destination (ip.dst == 127.0.0.1) and of type Content (coap.code == 69) are the result of the analysis.

4. **How many GET excluding OBSERVE requests, directed to non existing resources.**
   a. Answer: **6**
   b. coap.token==***token*** && !coap.opt.observe && coap.code==GET, where **token** is the token of the not found responses (FILTER:coap.code==132). This is because token of the not found response is the same of the request,

5. **How many messages contain the topic…?**
   a. Answer: **0**
   b. FILTER1: mqtt.passwd=="admin", this way, all the clients with password admin were found. Each client is identified by its IP address and TCP port. The IP.src was always 127.0.0.1 in this case.
   c. FILTER2: ip.src==127.0.0.1 && tcp.port==**port** && mqtt.msgtype == 3, where **port** identifies the clients found with the previous FILTER1. Also messages of type publish are filtered.

    d. In the end the answer is zero, because the + wildcard is one level, while all the resources found had one level more w.r.t the position of the plus. If it was # wildcard then we would have found some results.

6. **How many clients are connected to the public broker mosquitto?**
    a. Answer: **9**
    b. FILTER: "mqtt && !_ws.malformed && mqtt.willmsg && ip.dst == 5.196.95.208", searched all the packets with mosquitto as a destination.
    c. We used the fact that mosquitto IP is **5.196.95.208**
    d. Even if packets come from the same IP, they have different ports, so are considered as different clients.

7. **How many didn't receive PUBREL answers?**
    a. Answer: **94**
    b. FILTER1: mqtt.msgtype==6, this way we searched the PUBREL answers. There are no PUBREL answers, so 0 PUBREL.
    c. FILTER2: mqtt.msgtype==3 && mqtt.qos==2 && !_ws.malformed, this way are found all the packets with QoS2 that are publish messages
    d. In the end, since there were no PUBREL, all the messages found with FILTER2 didn't receive the PUBREL. So 94 is exactly the number of packets resulting from FILTER2.

8. **Average length of Total Will length**
    a. Answer,avg = **37.77** (11, 32, 32, 32, 32, 36, 36, 36, 36, 36, 36, 36, 44, 44, 44, 44, 44, 44, 44, 44, 44, 44).
    b. FILTER: mqtt.clientid == "" && mqtt.conflag.willflag == 1 && !_ws.malformed

9. **How many ACKS for clients …**
    a. Answer: **5**, 1 connect, 3 subscribe, 1 publish acks.
    b. FILTER1: mqtt.clientid=="6M5H8y3HJD5h4EEscWknTD", found packets with that client ID, from this step we understand what is IP and Port of that client.
    c. FILTER2:ip.dst==10.0.2.15 && tcp.port==46295 && mqtt, where IP and port were retrieved at the previous step.

10. **What is the average MQTT length….**
    a. Answer: **63.59**, length may differ due to optional fields in the messages (e.g. username, password, lastWillTopic)
    b. FILTER: mqtt.ver==3 && mqtt.msgtype==1