Department of Electronic & Telecommunication Engineering

University of Moratuwa

EN3250 Internet of Things

Individual Assignment

2020 Batch - Semester 5

26/10/2023

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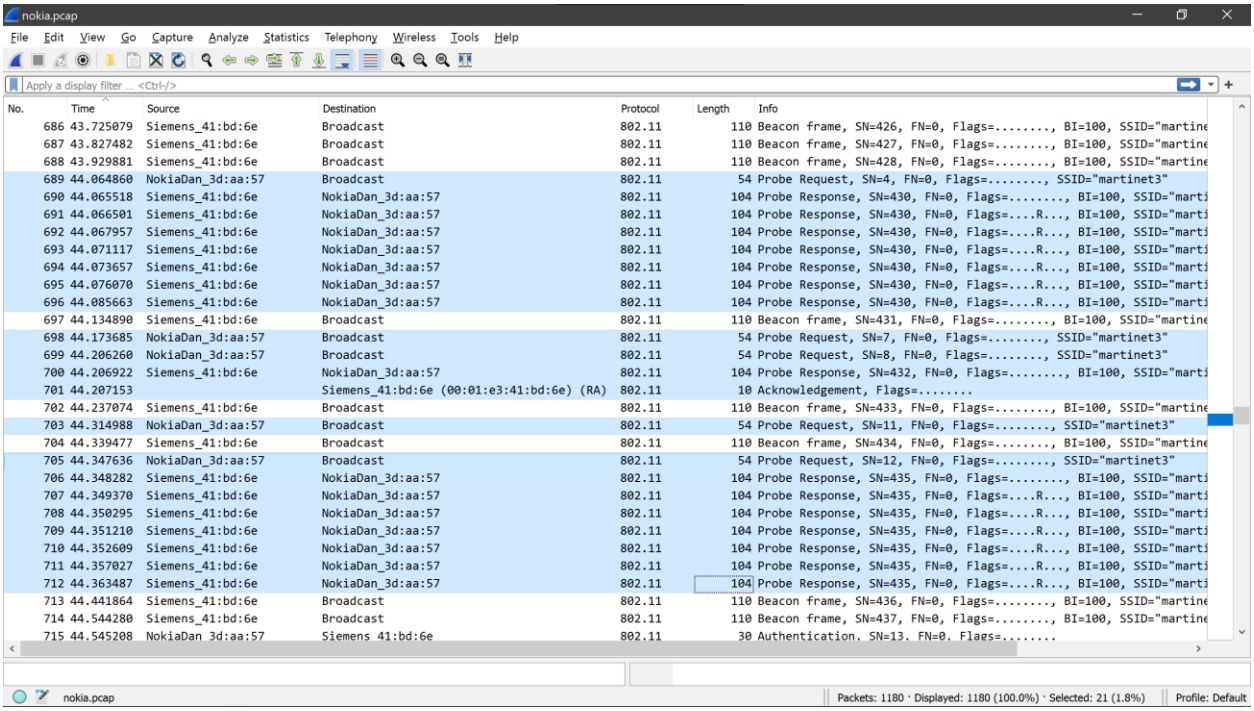
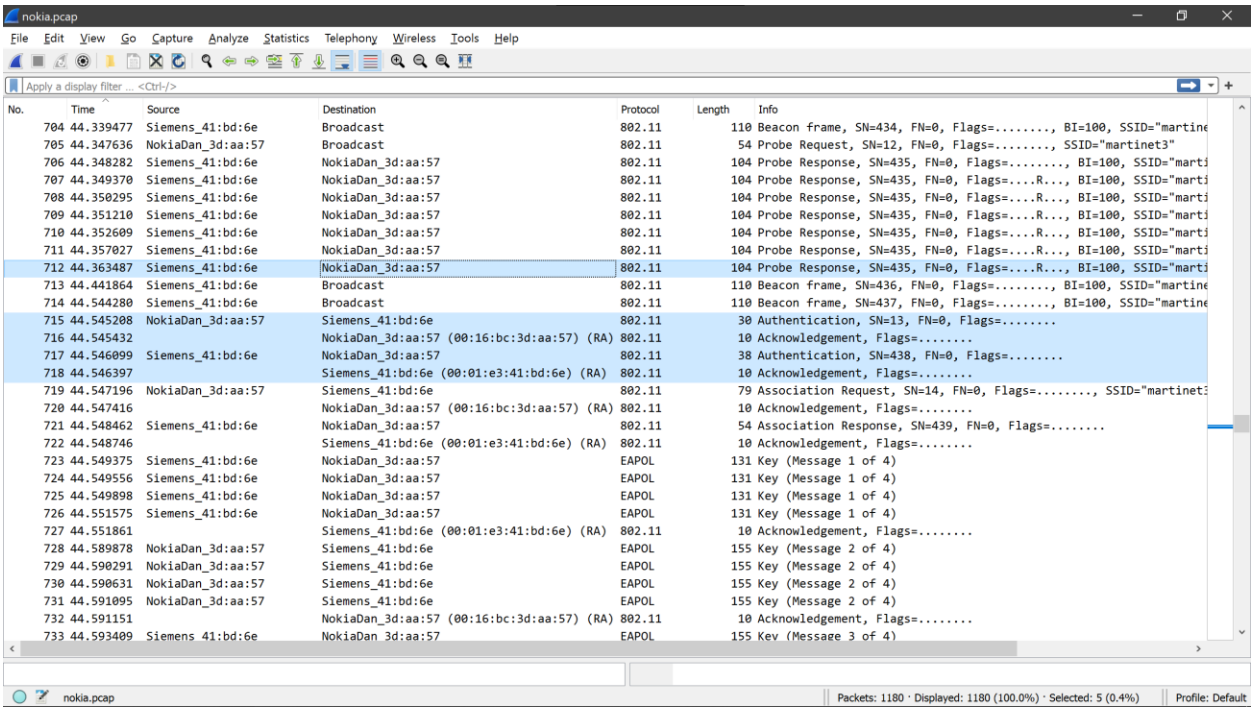
Problem 1

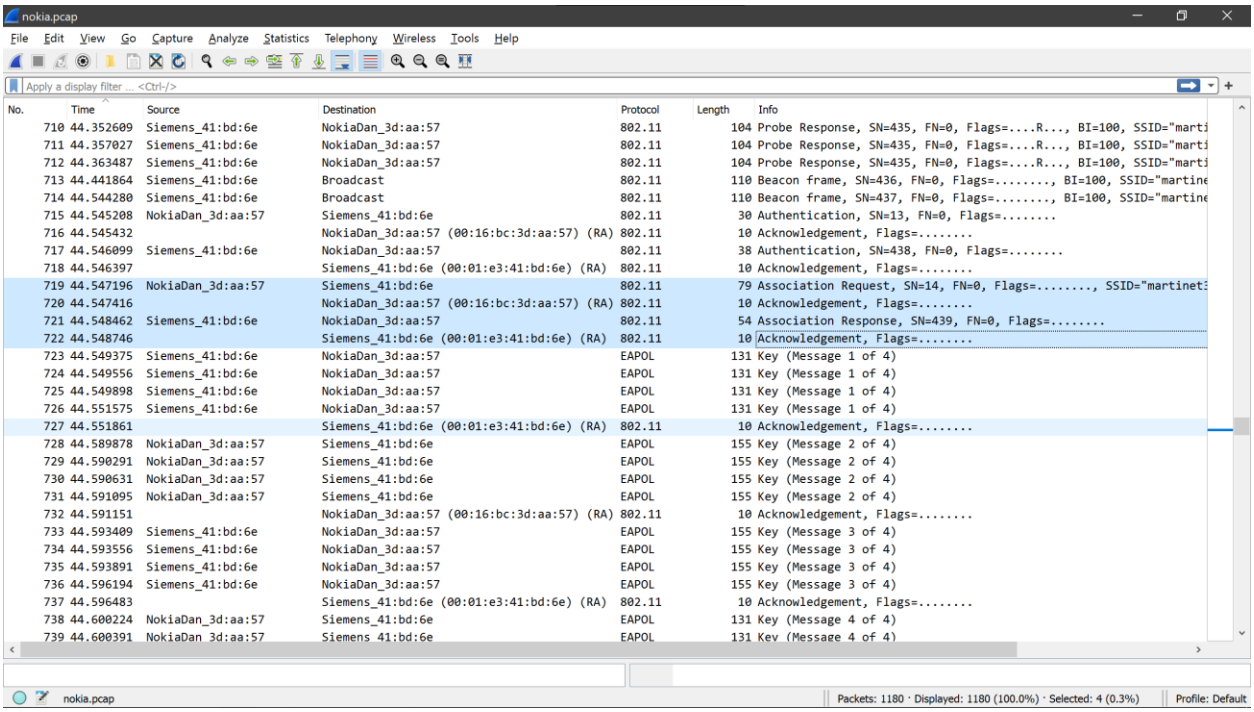
a) AP keeps transmitting beacons, and the Nokia mobile device(STA) uses Active scanning. STA instantiates probe requests. The AP responds to those probe requests with probe request responses. There are other devices as well, but we're focusing on these.
b) STA send multiple probe requests and AP send multiple probe request responses as well.



But at one point STA enters the Authentication phase. The interchange of information between the AP and the STA, where each side proves the knowledge of a given password.



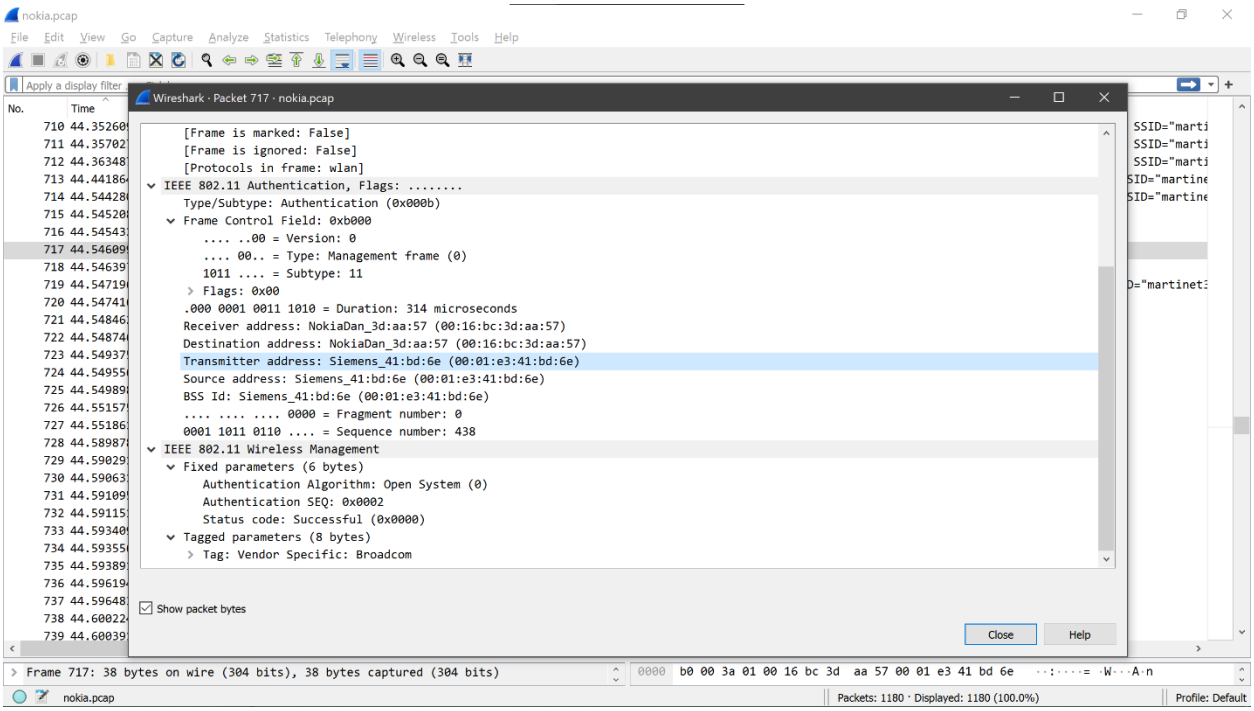
Then the device sends an association request frame to the AP.



The AP subsequently reply with an association response frame that will allow the STA to join the network or be excluded. Then the STA is included, the AP releases an association ID to the client and add it to the list of connected clients. At this point, data can be exchanged with the AP and vice versa. All data frames will be followed by an acknowledgment.

c) SSID: Siemens_41:bd:6e
BSSID: 00:01:e3:41:bd:6e

The pair (BSSID, SSID) found by any device at a particular location is called the “fingerprint” of that location.
This is unique to a given physical location, and hence a useful feature for localization.



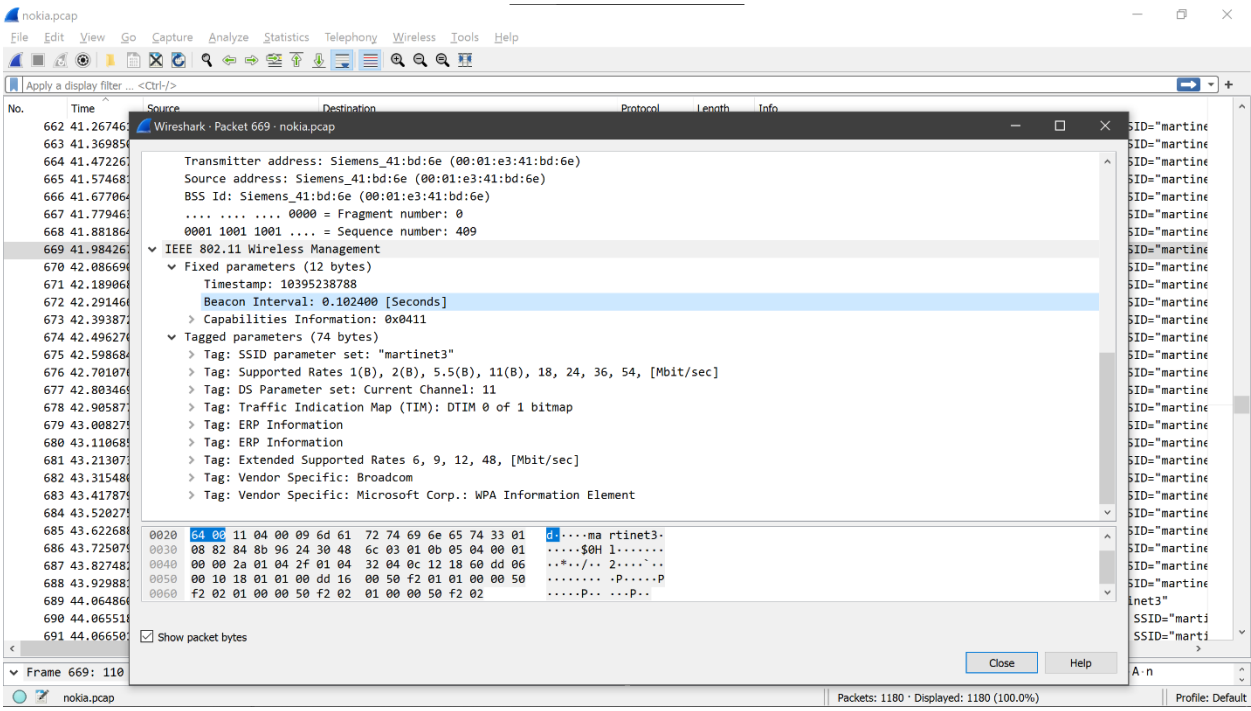
d) Passive scanning:

1. uses beacons and probe requests.
2. After a channel is selected, the device performing the scan will receive beacons and probe requests from nearby STAs.
3. An access point may transmit a beacon, and if the STA receives the transmission, it may progress to join the network.

4. This mode of scanning uses less power.

e)

1. By opening a captured beacon sent:



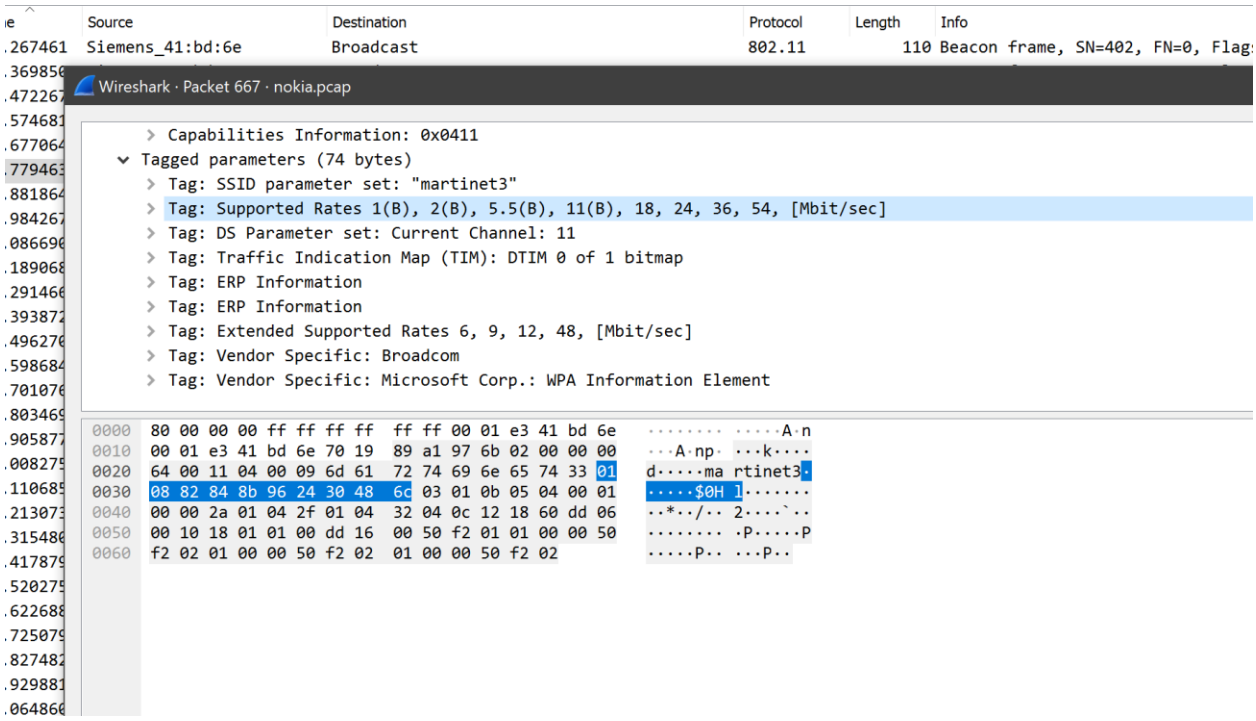
2. By checking the time interval between the beacon transmissions.

665	41.574681	Siemens_41:bd:6e	Broadcast
666	41.677064	Siemens_41:bd:6e	Broadcast
667	41.779463	Siemens_41:bd:6e	Broadcast
668	41.881864	Siemens_41:bd:6e	Broadcast
669	41.984267	Siemens_41:bd:6e	Broadcast
670	42.086690	Siemens_41:bd:6e	Broadcast
671	42.189068	Siemens_41:bd:6e	Broadcast
672	42.291466	Siemens_41:bd:6e	Broadcast
673	42.393872	Siemens_41:bd:6e	Broadcast
674	42.496270	Siemens 41:bd:6e	Broadcast

Calculation

41.881864 - 41.779463 = 0.10240100000000 s

f)


Source
Destination
Protocol
Length
Info
Siemens_41:bd:6e
Broadcast
802.11
110 Beacon frame, SN=402, FN=0, Flag
Wireshark · Packet 667 · nokia.pcap
Capabilities Information: 0x0411
Tagged parameters (74 bytes)
Tag: SSID parameter set: "martinet3"
Tag: Supported Rates 1(B), 2(B), 5.5(B), 11(B), 18, 24, 36, 54, [Mbit/sec]
Tag: DS Parameter set: Current Channel: 11
Tag: Traffic Indication Map (TIM): DTIM 0 of 1 bitmap
Tag: ERP Information
Tag: ERP Information
Tag: Extended Supported Rates 6, 9, 12, 48, [Mbit/sec]
Tag: Vendor Specific: Broadcom
Tag: Vendor Specific: Microsoft Corp.: WPA Information Element
0000 80 00 00 00 ff ff ff ff ff ff 00 01 e3 41 bd 6e
0010 00 01 e3 41 bd 6e 70 19 89 a1 97 6b 02 00 00 00
0020 64 00 11 04 00 09 6d 61 72 74 69 6e 65 74 33 01
0030 08 82 84 8b 96 24 30 48 6c 03 01 0b 05 04 00 01
0040 00 00 2a 01 04 2f 01 04 32 04 0c 12 18 60 dd 06
0050 00 10 18 01 01 00 dd 16 00 50 f2 01 01 00 00 50
0060 f2 02 01 00 00 50 f2 02 01 00 00 50 f2 02

Problem 2

a) For example,
Skip Time Resource:
This resource could be identified as /.well-known/skip-time. The skipping rope could expose the time duration of the skip in milliseconds through this resource. The endpoint could be something like,
coap://<skipping_rope_IP>/.well-known/skip-time.

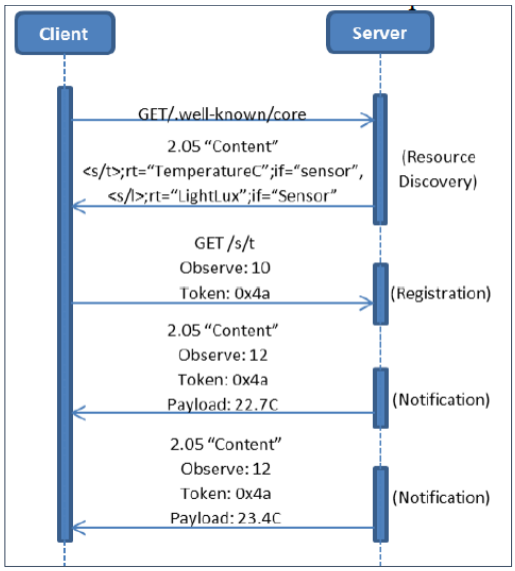
Total Skip Number Resource:
This resource could be identified as /.well-known/total-skip-number. For instance, the skipping rope could expose the total count of skips through this resource. The endpoint could be something like,
coap://<skipping_rope_IP>/.well-known/total-skip-number.

Calories Burned Resource:
This resource could be identified as /.well-known/calories-burned. It could provide the number of calories burned during the skipping session. The endpoint could be something like,
coap://<skipping_rope_IP>/.well-known/calories-burned.

Tangles Resource:
This resource could be identified as /.well-known/tangles. It could indicate the number of times the rope has tangled during the session. The endpoint could be something like,
coap://<skipping_rope_IP>/.well-known/tangles.

Battery Level Resource:
This resource could be identified as /.well-known/battery-level. It could reveal the current battery level of the skipping rope. The endpoint could be something like,
coap://<skipping_rope_IP>/.well-known/battery-level.

b)



c) Advantages of using CoAP:

- Lightweight Protocol
- RESTful Interaction
- Efficiency in Small Data Transfers
- Less Complex Implementation

Disadvantages of using CoAP:

- Limited QoS Support
- Scalability Issues
- Limited Broker Functionality.
- Security Concerns

Problem 3

a)
- Machine usage
- Power usage
- Worker presence
- Machine Idle times/ efficiency
- Inventory updates/ Water tanks

b) Consider the Machine usage and Power usage
   - Monitoring the power usage allows to avoid any failures, plant shutdown etc.
   - Machine usage monitoring will allow to optimize the production line, reducing unwanted power consumption, produce more output etc.

c) The main challenge it that the production line must not stop while digitalization. The experts at TeeJay Lanka PLC showed that, they implemented the IOT devices parallel to the production line

d) _

e) The main factors would be the ROI.