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Network Communication and Network Programming

• Part 1 – Open-Ended Questions:

1. What are the main differences between HTTP, MQTT, and CoAP?

- **HTTP** → Request/response over TCP, heavy but universal → best for web & APIs.
- **MQTT** → Pub/sub over TCP, ultra-lightweight → best for IoT messaging via broker.
- **CoAP** → Request/response (with observe) over UDP, lightweight → best for constrained IoT devices.

2. Which protocol would you choose for:

- Sending temperature data every second → MQTT
- Controlling a smart bulb (on/off) → CoAP
- Uploading a large file → HTTP

3. Explain QoS levels (0, 1, 2) in MQTT and give one use case for each.

- QoS 0 – *At most once*
 - Message sent **once**, no acknowledgment, no retry.
 - Fastest, least reliable.
 - **Use case:** Sending temperature data every second (losing one reading doesn't matter).
- QoS 1 – *At least once*
 - Message delivered **one or more times** (possible duplicates).
 - Publisher retries until acknowledgment is received.
 - **Use case:** Sending a smart bulb "ON/OFF" command (better to repeat than to miss).
- QoS 2 – *Exactly once*
 - Message delivered **once and only once** with a 4-step handshake.
 - Most reliable, but slowest and heaviest.
 - **Use case:** Sending billing data or financial transactions where duplication is unacceptable.

4. Why does CoAP use UDP instead of TCP?

- CoAP uses UDP because it is lighter and faster than TCP.
- It avoids the extra steps of making a TCP connection, saving time and power.
- It can also send one message to many devices at once (multicast).

5. Why is HTTP still widely used even though MQTT and CoAP are lighter for IoT?

- HTTP is still widely used because it is **universal and well-supported** on all devices. It works easily with the **web, browsers, and REST APIs**, making integration simple. Many developers and systems already know HTTP, so it's the **default choice** despite being heavier.
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You can find part 2 on the repo → [🌐 GitHub - Ahmed-Khaled-Abdelmaksod/SIC_intern](#)