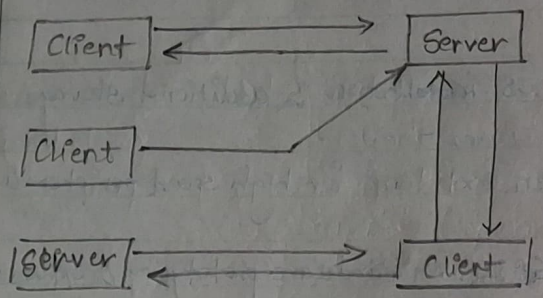
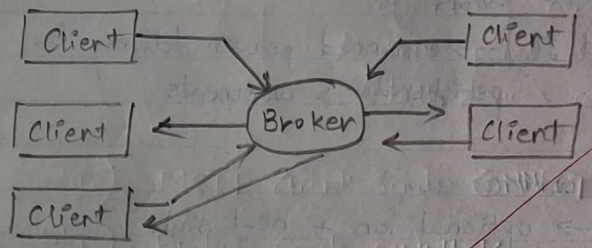
"CoAP Diagram"



"MQTT Diagram"



PRACTICAL - 2

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AIM: Basics of Network (CoAP, MQTT) and Cloud (ThingSpeaks).

Network: in IoT network is a system of connected sensors and smart devices that exchange data.

⇒ CoAP [Constrained Application Protocol]
- → its a web-transfer protocol allowing small, low-power devices to connect to IoT.
- → works best for low-bandwidth & low-availability constrained networks.
- → uses "client-server model" & is built over "UDP" (user datagram protocol)
- → used in M2M communication. (i.e., smart home devices, smart energies, building automation).

⇒ MQTT [Message Queuing Technology Transport]
- → used for light-weight communication.
- → uses "publish/subscribe" messaging protocol.
- → built over TCP → (To Transmission Control Protocol)
  - → providing reliable data transmission.
- → example: [client (device) publishes message to topics and other (devices) subscribes to those topics.]
  - → Temp. sensors publishes temp. data to topic (of fridge) & mobile application subscribes and get updated.

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Research and Explore Task:

=> How TCP works in MQTT?

Step 1) TCP connection Establishment (3-way Handshake)

i). SYN (synchronous)
↳ client sends SYN message to broker, initiating the connection.

ii). SYN-ACK (Synchronize-acknowledge)
↳ the broker responds with a SYN-ACK, acknowledging client-request & agreeing to the connection

iii). ACK (Acknowledge)
↳ client sends ACK message back to the broker, confirming the connection.

At this point TCP connection is fully established & both devices can start exchanging data.

Step 2). MQTT Client Sends CONNECT Message → client id, username, & password, keep-Alive interval, Clean Session flag

Step 3). Broker Sends CONNACK message → (success (0) or error) return code

Step 4). Client and Broker Exchange Data

Step 5). Quality of service (QoS) Handling → QoS 0 (At most once), QoS 1 (At least once), QoS 2 (Exactly once)

Step 6). Keep-Alive Mechanism

Step 7). Client or Broker Disconnects.

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↳ usage: smart home, industrial IoT.
for real-time data transfer.

=> ThingSpeak:
↳ is a IoT analytic platform. + API services
↳ used for lightweight purposes.
↳ storing data, analyzing data, visualizing data.
from IoT devices.

Key features

i). Data storage :→ allows device to store data to cloud storage
ii). Visualization :→ provides built-in tools → graphs, dashboards, etc.
iii). Integration : with MATLAB for advance analyzing & mach. ML)
iv). Real-time monitoring :→ display real-time data stream from devi

NOTE: MATLAB [MATrix LABoratory]
↳ modelling
↳ controller design
↳ to deploy control algorithm to embedded system that requires real-time tuning.

usage :→ agriculture, weather monitoring, predictive maintainance of application.

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Procedure example : 1) Devices sends data
↳ devices (ie, sensor, actuators, etc) sends data to ThingSpeak over HTTP or MQTT

2) Data Storage
↳ in channel the data gets stored (each channel is capable of storing different fields of data)

3) Data Analysis
↳ writes MATLAB scripts to analyze data.

4) Visualization
↳ data can now ~~be~~ is visualized on graphs & dashboards

example : weather station that collects temp. & humidity data.
Station send that data to ThingSpeak using API.
ThingSpeak stores data in channels.
Further we create graph to monitor temp. & humidity ~~trends~~ over time.

Conclusion : By performing research and exploring CoAP, MQTT and ThingSpeak we got the understanding how they work, there importance & real-world usage (it may be day-to-day usage, industrial, etc).

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