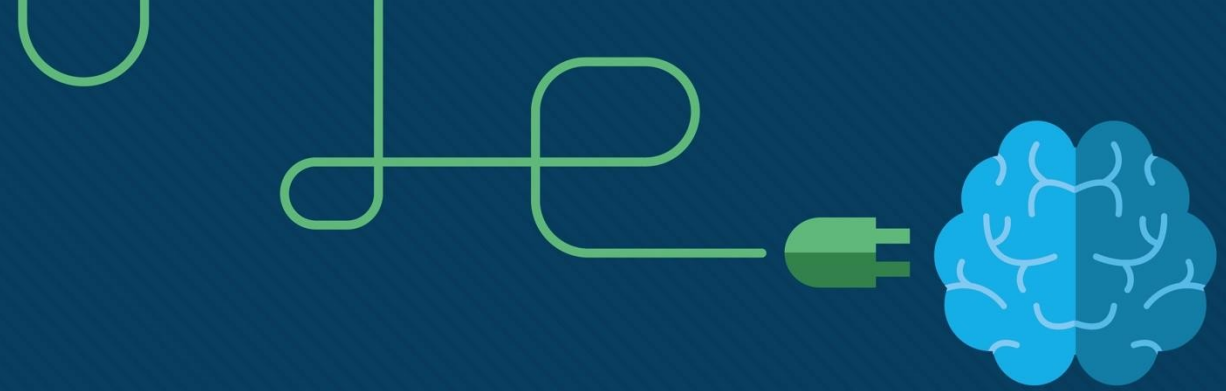

# IoT Protocols


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February 27, 2018

Source

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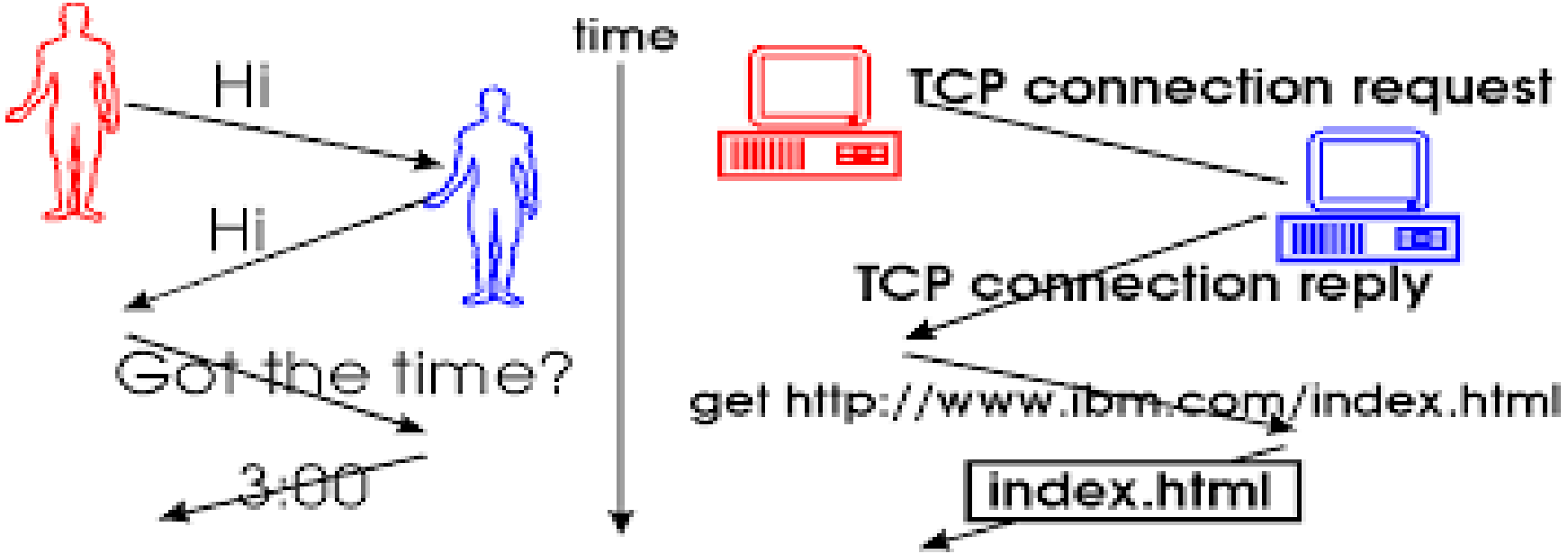
# What is Protocol



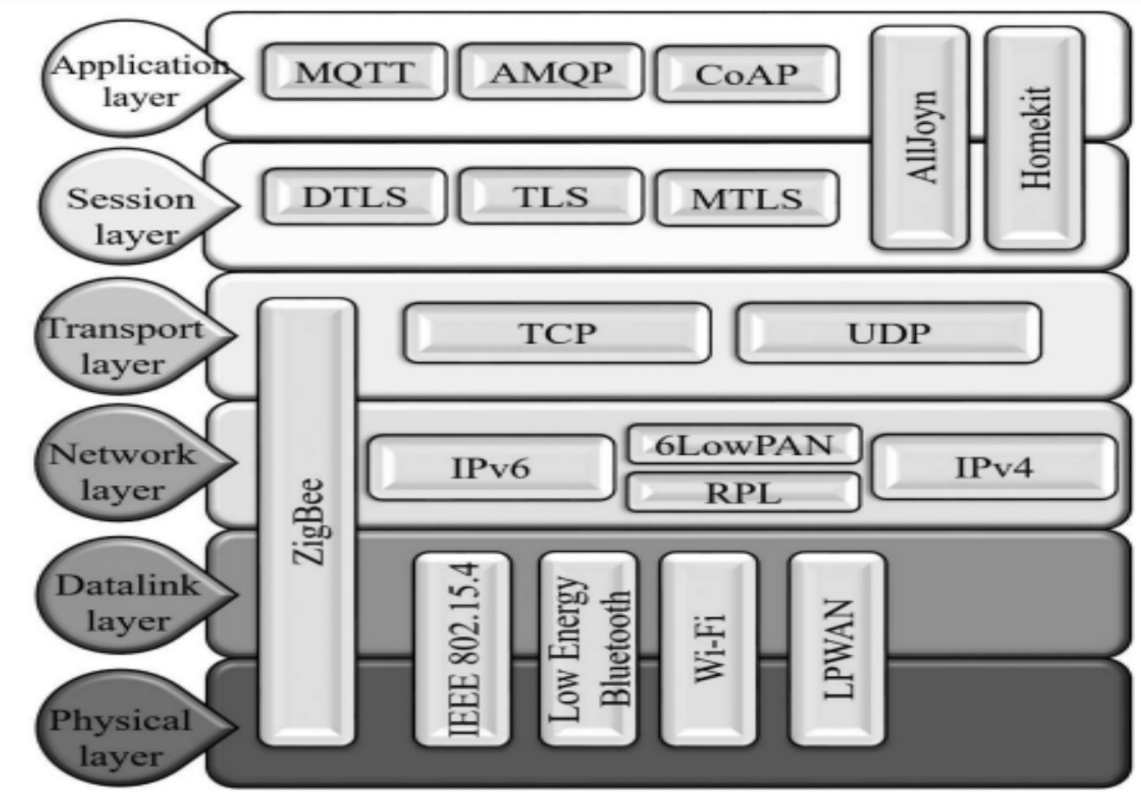
- Protocols are widely used in networks for

- How fast to send data?
- Discover paths to destinations.
- Replicate data.
- Encode data into transmitable format.

| | |
|---|---|
| Compute paths through networks | Routing protocols |
| Figure out how fast to send data | Transport protocols |
| Encrypting messages so others can't read them | Encryption protocols |
| Figure out who has an address | Address resolution protocols |
| Figure out what kinds of things the network can do | Service discovery protocols |

- Protocols often organized into "stack or "'suite'"
  - Handles collection of activities associated wit particular environment
  - Examples: TCP/IP Internet, Bluetooth(IoT)

# OSI based IoT Protocols



# Application Layer: HTTP


- Hypertext Transfer Protocol (HTTP)
- For transmitting hypermedia documents, such as HTML.
- It was designed for communication between web browsers and web servers
- HTTP follows a classical client-server model
- HTTP is a stateless protocol.
- Stateless:meaning that the server does not keep any data (state) between two requests.
- Multiple Header: Multipurpose Internet Mail Extensions (MIME)
  - image/jpeg

# Application Layer:MQTT

- Message Queuing Telemetry Transport Protocol (MQTT)
  - It designed for lightweight machine-to-machine communication
  - Primarily used for low-bandwidth connections to remote locations.
  - It was introduced by IBM in 1999.
  - Example: MQTT based vehicle accident detection and alert system.

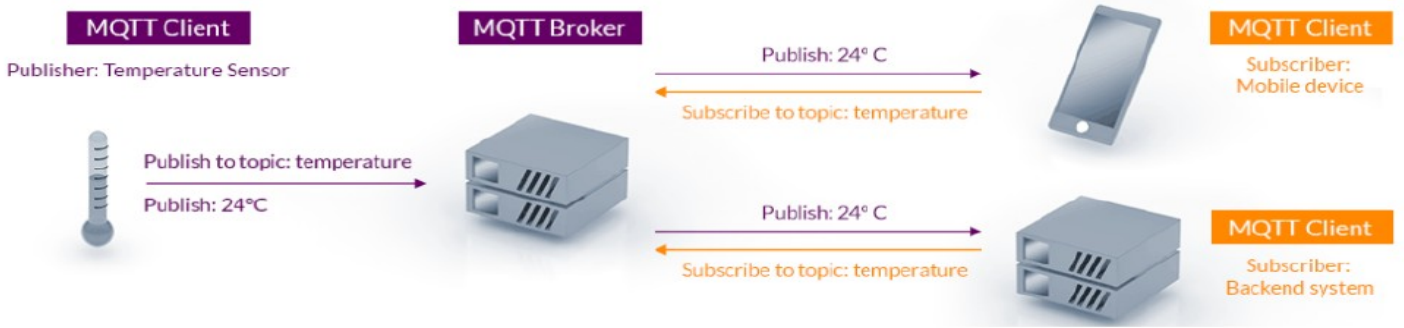



Figure: MQTT Architecture

- It uses a publisher-subscriber architecture.
- It consists of three main components:
  1. Publishers: The lightweight sensors that connect to the broker to send their data and go back to sleep whenever possible.,
  2. Subscribers: applications that are interested in a certain topic, or sensory data, so they connect to brokers to be informed whenever new data are received [1].
  3. Broker: classify sensory data in topics and send them to subscribers interested in the topics.

- MQTT (Message Queuing Telemetry Transport): MQTT is a lightweight publish/subscribe messaging protocol widely used in IoT applications. It is designed for efficient and reliable communication in constrained environments with limited bandwidth and high latency. MQTT uses a client/server model, where devices publish messages to topics and other devices subscribe to these topics to receive the messages. It operates on top of TCP/IP and supports asynchronous messaging, making it suitable for resource-constrained devices and low-power networks.

# Application Layer: CoAP

- Constrained Application Protocol (CoAP)

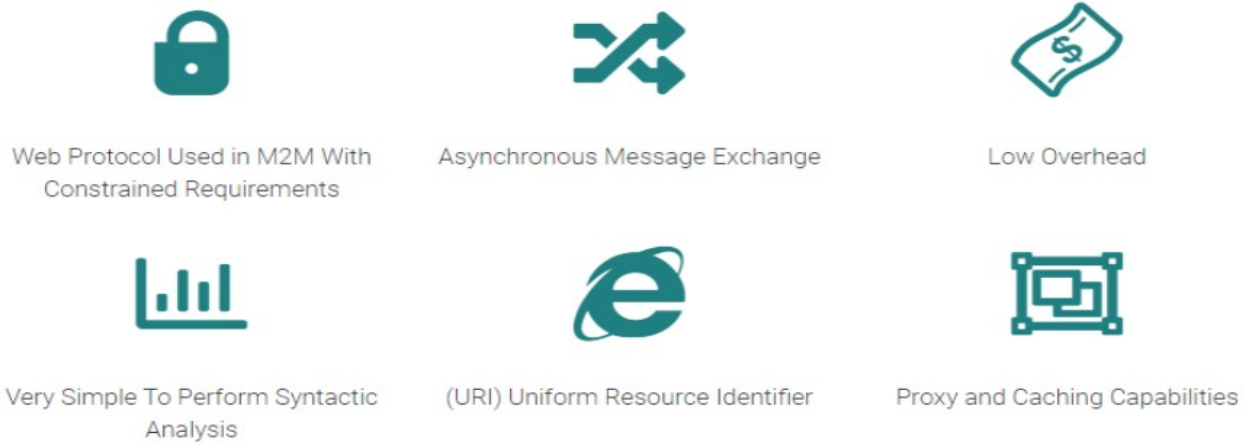



Figure: CoAP features

# Application Layer: CoAP (contd.)

- A constrained-bandwidth and constrained-network protocol designed for devices with limited capacity to connect in machine-to-machine communication.
- **Request Response Model**
- GET, PUT, DELETE, etc.
- It is also a document-transfer protocol that runs over UDP.
- Representational State Transfer (REST) is the standard interface between HTTP client and servers.
- It is designed by IETF Constrained RESTful Environment (Core) working group to provide lightweight RESTful (HTTP) interface.

# Application Layer: CoAP (contd.)

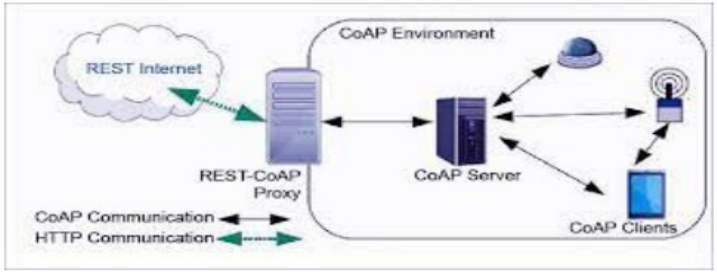



Figure: HTTP and CoAP

- CoAP architecture is divided into two main sublayers:messaging and request/response.
- The messaging sublayer is responsible for reliability and duplication of messages
- request/response sublayer is responsible for communication.
- CoAP has four messaging modes:
- confirmable,

# ISA 100 HAP : ISA-100.11a Human-Machine Interface Access Point

ISA 100 HAP is a wireless protocol specifically designed for industrial automation and control systems. It provides reliable and secure communication between industrial devices, such as sensors, actuators, and controllers. ISA 100 HAP operates in the 2.4 GHz frequency band and supports both point-to-point and mesh networking topologies. It offers low latency, high reliability, and robustness, making it suitable for demanding industrial environments.

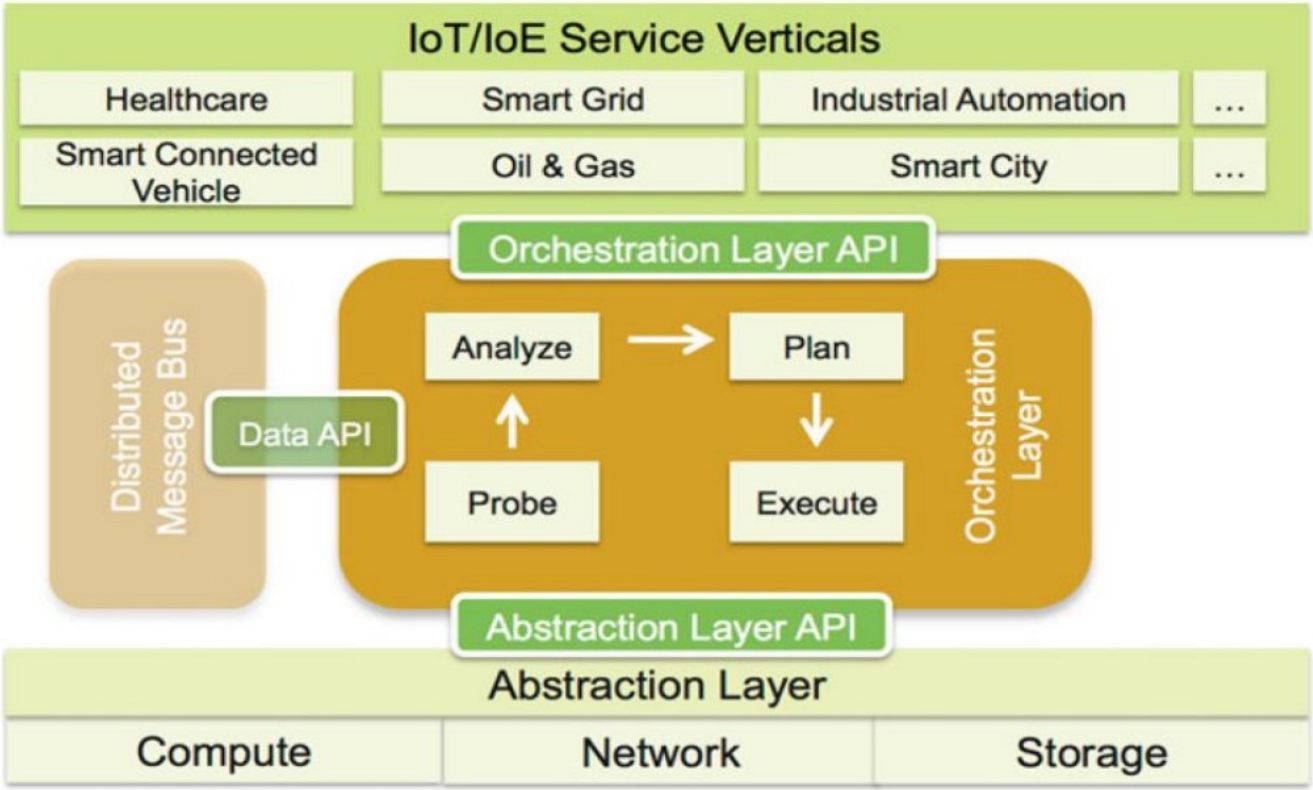
- CoAP (Constrained Application Protocol): CoAP is a specialized web transfer protocol designed for IoT devices with limited resources, such as low-power sensors and actuators. It is a lightweight protocol that enables devices to communicate with each other and with web servers using a RESTful architecture. CoAP is built on top of UDP, making it efficient for constrained networks. It supports request/response interactions and allows for resource discovery, observation, and event notifications.


- Fog computing is making use of decentralized servers in between network core and network edge for data processing and to serve the immediate requirements of the end systems.
- Fog computing is non-trivial extension of Cloud computing paradigm to the edge of the network.

## Edge Server

- Edge servers in fog computing architectures often act as intermediaries between IoT devices and the cloud. They collect, preprocess, and filter data generated by the IoT devices, performing initial analytics and making localized decisions. This localized processing reduces the need to transmit all data to the cloud, resulting in more efficient use of network bandwidth and reduced cloud infrastructure costs.

# Fog Software Architecture




- Fog nodes are heterogeneous in nature and deployed in variety of environments including core, edge, access networks and endpoints
- Fog architecture should facilitate seamless resource management across diverse set of platforms

# CEP Task

- **Must done:**
  - Sensor Architecture
  - Data Architecture
- **Install Ubuntu Core Operating System on RaspberryPi**
  - Make IoT Architecture
  - Start working on software Architecture