Internet of Things (IoT):
Network Protocols & Architectures

Speaker:

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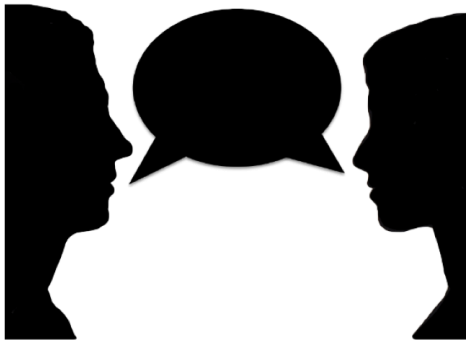
What is a Protocol

When **talking to another person** it's necessary to successfully communicate ideas with context and to know **who is speaking** and to **whom the information is being directed**.

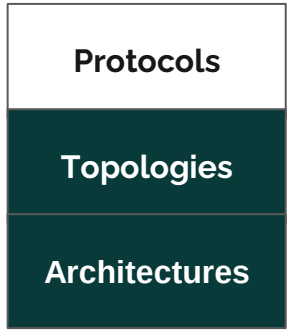


Computers don't have this flexibility, these conversations must take place with **encoded messages in specific and rigid formats** called **protocols.**

Network Protocols

Communication Protocols

- The **way devices communicates** through Protocols.
- These Protocols are the **rules for the exchange of data** between 2 or more devices in the network.



Network

- Internet is a **very large interconnection of devices**.
- Internet **works internally with layers** that perform **specific activities**.
- The idea es find the **optimal way to put the layers**.

Network Protocols

- These are the **Communication Protocols used in the interconnection of Network**.

Target of Network Protocols

- **Send and receive data** of any kind over a network.

- Identify **who is sending** and **what is the destination** of each message.

- Verify that the **message arrives successfully.**

- **Information Access Control** (Login, Encryption and decryption of information).

Protocols
Topologies
Architectures

IoT Protocols in TCP/IP Model

	TCP/IP Model	IoT Protocols
1	Network Access & Physical	WiFi, Ethernet, GSM, LTE
2	Internet	IPv4, IPv6, 6LoWPAN
3	Transport	UDP, TCP
4	Application	HTTPS, HTTP, MQTT, WS

It is commonly considered:

- **Internet and Transport layers** are taken by default.
- **The Network Access & Physical and Application layers** must be selected.

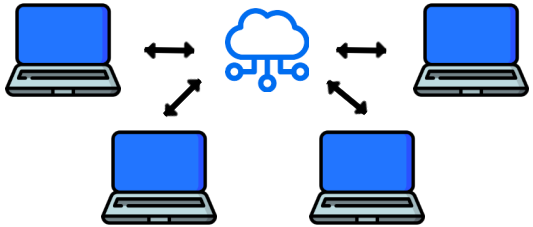
Network Topologies

It is the **way in which the devices are interconnected.**

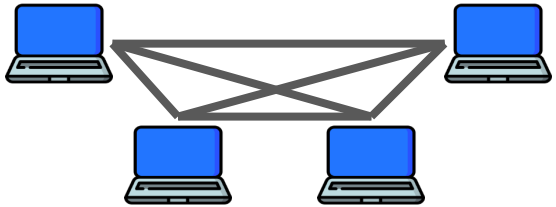
Some Ways of connection are:

- **Star**
- **Mesh**
- **Point to Point**
- **Etc...**

Star



Mesh



Point to Point

- Protocols
- **Topologies**
- Architectures

Network Architectures

This refers to **identifying which layers are used** and through **which protocol they communicate.**

Some architectures are:

- **Client/Server**
- **Publication/Subscription (Most Important)**
- **Distributed Communication**
- **Etc...**

Protocols

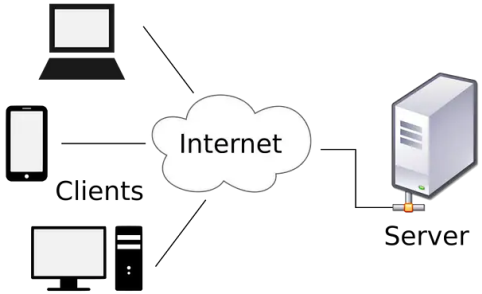
Topologies

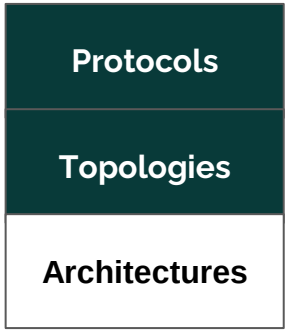
Architectures

Client/Server Architecture

Used for WebSockets and HTTP Protocols

- **Clients make requests to the server to distribute the work among the clients.**
- They are Robust Devices and use a **lot of processing power and energy consumption**.
- **They are effective but not efficient or Light**.





Pub/Sub Architecture

This architecture is used by the most important and popular IoT protocol called MQTT.

Message Queing Telemetry Transport

Send Data	→	Publish
Receive Data	→	Subscribe
Cloud	→	Broker

Protocols

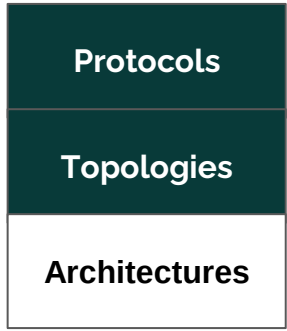
Topologies

Architectures

MQTT Relevance

Origins

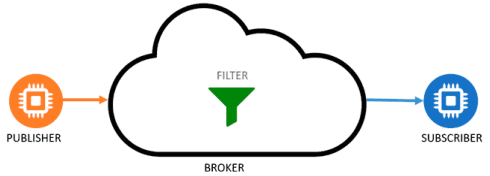
It was created by Andy Stanford-Clark of **IBM** and Arlen Nipper of **EuroTech** in **1999** as a mechanism to connect devices in the oil industry from sensors. **In 2010 it was released.**



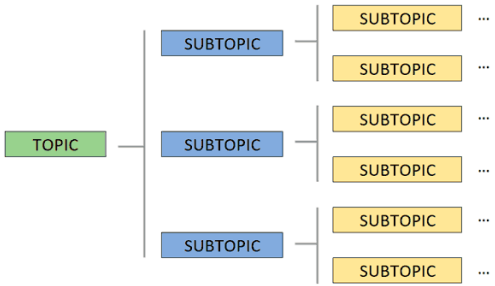
Advantages

- **Connections** are kept open and **reused.**
- It is a **simple and lightweight** protocol, usable in **low-power devices** and requiring **minimal bandwidth.**
- It is a robust form of communication that provides **security and trust.**

MQTT Relevance

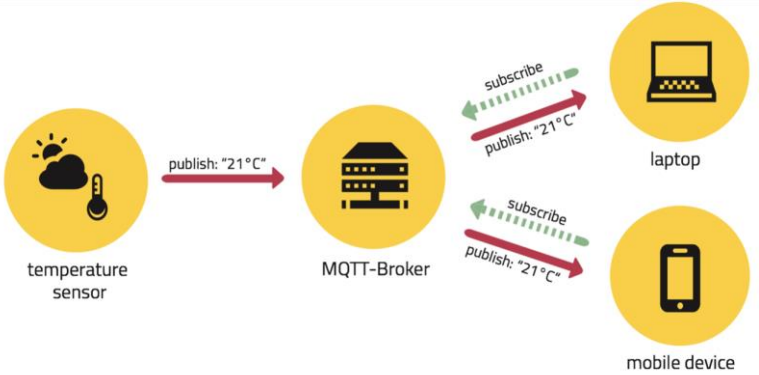


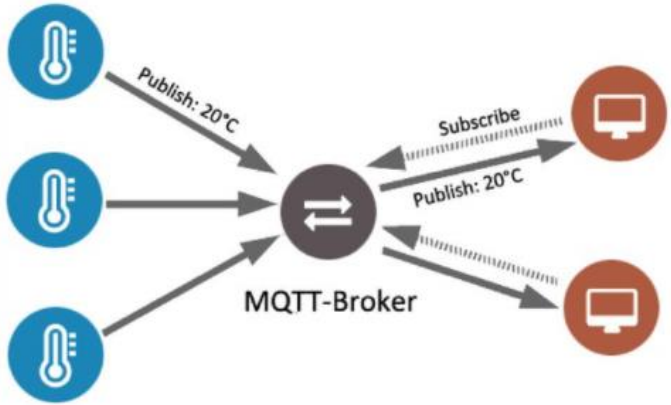
- It works with a **broker** that **filters the information by TOPICS.**
- It does **not confuse the information** and there **is no need to separate it**.
- **Clients can subscribe to one or more Topic.**
- **Clients Publish** Data into a **unique Topic**. **All Topics are Valid**, for example: Casa/Salon/Persiana
  Casa/Salon/Temperatura
  Casa/Salon/Persiana



- **Topic Format**: It has **one or more separate levels** with a **/**

MQTT Relevance



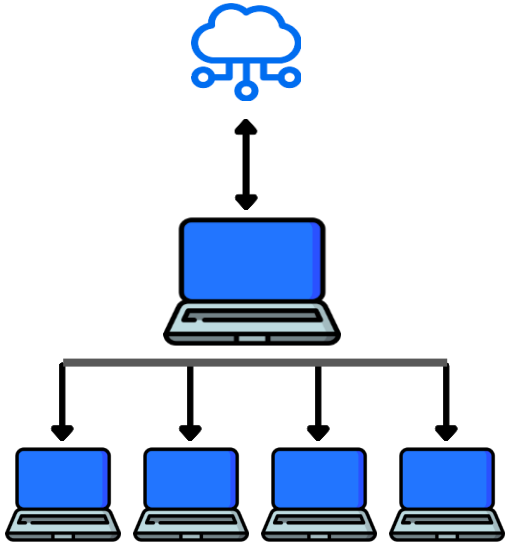


Distributed Communication Architecture

It is a **parallel computing model**, with a **large number of devices** organized in **clusters** to perform a **common task**.

Multiple Topologies are used in clusters.

Cluster = Group.

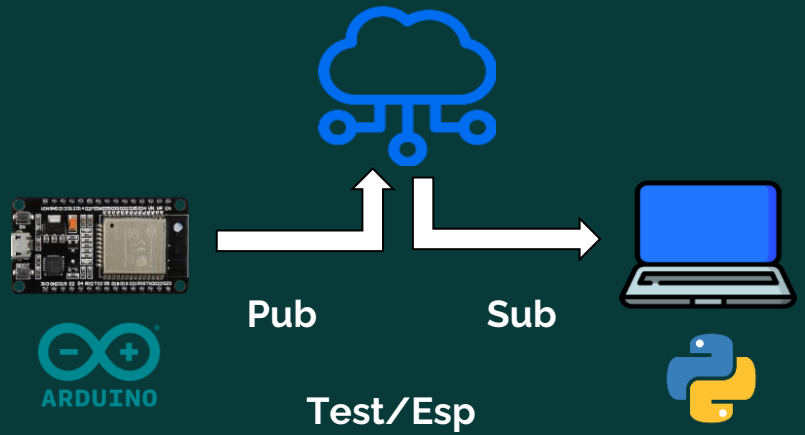


Tree Network Topology

- Protocols
- Topologies
- Architectures

Example 1

Connect to a public Broker (test.mosquitto.org) using the MQTT Protocol, publish some data to a Topic (Test/Esp) in the Broker with Arduino (Esp32) and Subscribe those data to the Broker of the same Topic using Python.



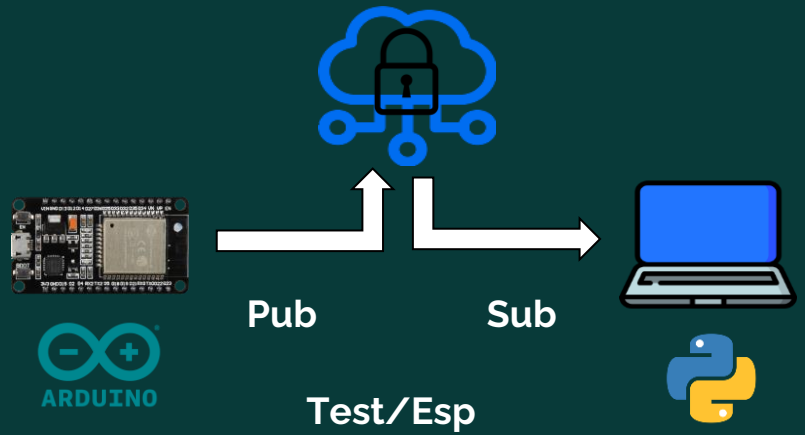
Protocol:
MQTT

Architecture:
Pub/Sub

Topic:
Test/Esp

Example 2

Connect to a public Broker (test.mosquitto.org) using the MQTT Protocol, publish some data to a Topic (Test/Esp) in the Broker with Arduino (Esp32) and Subscribe those data to the Broker of the same Topic using Python. In All cases use Authentication.



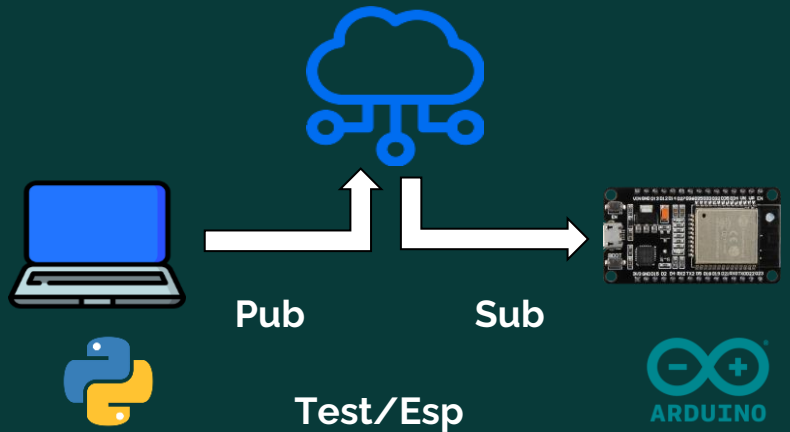
Protocol:
MQTT

Architecture:
Pub/Sub

Topic:
Test/Esp

Example 3

Connect to a public Broker (test.mosquitto.org) using the MQTT Protocol, publish some data to a Topic (Test/Esp) in the Broker with Python and Subscribe those data to the Broker of the same Topic using Arduino (Esp32).



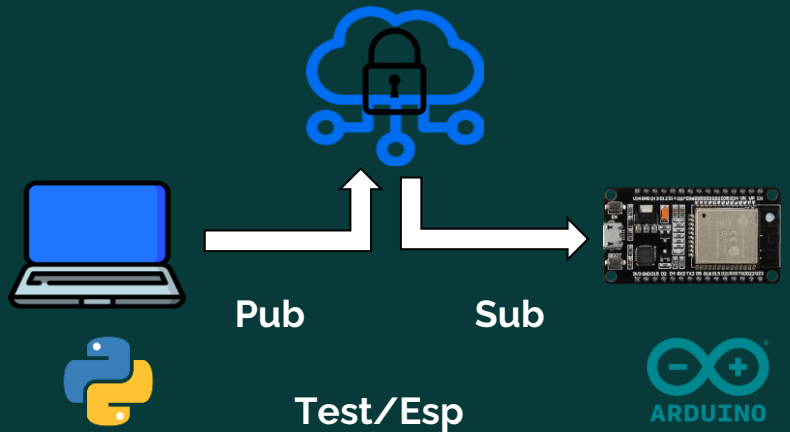
Protocol:
MQTT

Architecture:
Pub/Sub

Topic:
Test/Esp

Example 4

Connect to a public Broker (test.mosquitto.org) using the MQTT Protocol, publish some data to a Topic (Test/Esp) in the Broker with Python and Subscribe those data to the Broker of the same Topic using Arduino (Esp32). In All cases use Authentication.



Protocol:
MQTT

Architecture:
Pub/Sub

Topic:
Test/Esp

References

- **Gerber, A. & Romeo, J.** (2020, Enero). Connecting all Things in the Internet of Things. IBM. **https://developer.ibm.com/articles/iot-lp101-connectivity-network-protocols/**
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Thanks!!!