

MIDDLEWARE

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Topic Description

Middleware is software that acts as a bridge between the operating system, the database, and applications, especially in networks. This concept is crucial for communication between different systems and devices, particularly in the Internet of Things (IoT) domain. The course on Middleware explores this topic through two main technologies: MQTT and oneM2M.

MQTT (Message Queuing Telemetry Transport) is a lightweight protocol primarily used for communication between devices in IoT contexts. It operates on a publish/subscribe model, where a client publishes a message to a "topic," and another client subscribes to that topic to receive the messages. It is particularly suitable for environments with limited bandwidth, which is often the case in IoT applications.

oneM2M is an international standard aimed at establishing a common service layer for communication between devices in the IoT. It allows various devices and applications to be integrated and connected to the Internet in a standardized way.

Implementation

During this module, we had the opportunity to work on laboratory sessions where we put into practice the concepts of MQTT and oneM2M.

1. **The first two laboratories focused on MQTT.** In these exercises, we created a simple application to publish and subscribe to a topic. The application consisted of a button and a light controlled via an ESP32, using a Mosquitto server as the MQTT broker. Using the Arduino IDE, we wrote code allowing the devices to communicate with each other, utilizing the pubsubclient library developed by Nick O'Leary. We collaborated with another group to define a common topic, enabling us to turn the light on and off with our button and vice versa.
2. **The third laboratory was dedicated to oneM2M.** After an introduction to the protocol and queries via a Jupyter Notebook, we simulated the previous application, but this time with oneM2M standards, particularly with an ACME server. Using the capabilities of Jupyter Notebook, we created four threads to simulate a complete system: one for the

broker, one for the button, one for the light, and one for the ACME server. This work helped us better understand the integration of oneM2M in real-world scenarios.

3. **The final laboratory was about deployment with NodeRed.** Unfortunately, due to delays in the previous laboratories, we did not have enough time to progress sufficiently on this part.

Analysis

In conclusion, Machine to Machine (M2M) communication is a fascinating topic. It is at the core of many IoT applications as it ensures smooth and effective communication between devices. The MQTT protocol was very well explained, and I now feel comfortable with its operation, which is a real asset for IoT projects. However, I found the course on oneM2M to be relatively short and superficial, leaving me with an incomplete understanding of this technology.

Given that I want to focus more on web and software development, I believe that Middleware technologies are not essential for my future projects. However, having a solid understanding of the different technologies used in the industry is always beneficial, as it enriches the overall understanding of systems and their interactions.

Skill Matrix: Middleware

Protocols and communication	Expected	estimated
Know how to situate the main standards for the Internet of Things	4	<u>4</u>
Deploy an architecture compliant to an IoT standard and implement a sensor network	4	<u>3</u>
Deploy and configure an IoT architecture using OM2M	4	<u>3</u>
Interact with the different resources of the architecture using REST services	4	<u>4</u>
Integrate a new technology into the deployed architecture	4	<u>3</u>