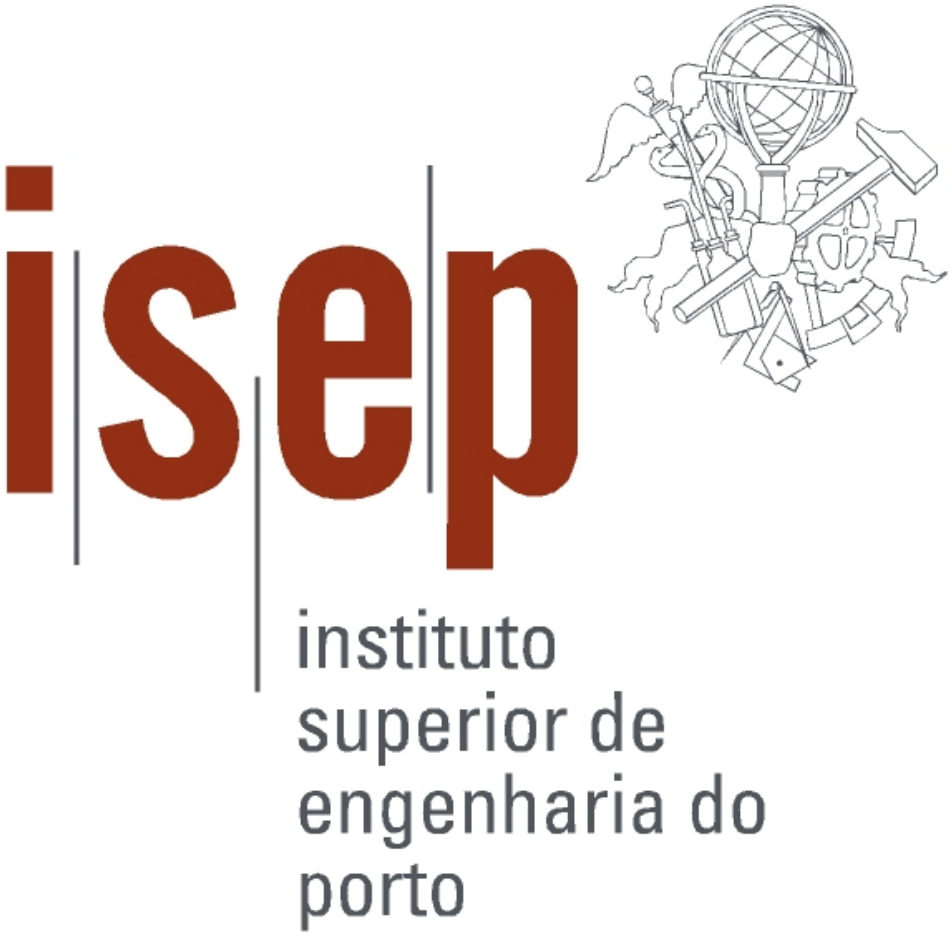
Assignment 4

Report



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List of Acronyms and Definitions

MQTT Message Queuing Telemetry Transport

CoAP Constrained Application Protocol

QoS Quality of Service

TLS Transport Layer Security

IoT Tnternet of Things

M2M Machine-to-Machine

DTLS Datagram Transport Layer Security

SRTP Secure Real-time Transport Protocol

DDS Data Distribution Service

1 Communication Protocol Comparison

In the last classes we learned and explored Message Queuing Telemetry Transport (MQTT), Constrained Application Protocol (CoAP) and Data Distribution Service (DDS). These three different protocols have its own strengths and weaknesses and are mainly used in the field of the Tnternet of Things (IoT) and Machine-to-Machine (M2M) communications.

Here is a brief explanation:

- MQTT: Publish-subscribe messaging protocol that is designed for low-bandwidth networks. Uses Transport Layer Security (TLS) for encryption. It uses a broker to route messages between publishers and subscribers. Standardized by the IETF.
- CoAP: Request-response protocol that supports caching, multicast and observe features. Uses Datagram Transport Layer Security (DTLS) for encryption. It has a client-server architecture and it is designed for low-power wireless networks. Standardized by the IETF.
- DDS: Data-centric publish-subscribe messaging protocol that supports the exchange of large amounts of data between different devices. Supports multiple security mechanisms, including TLS, DTLS and SRTP. It is designed for real-time systems. Standardized by the Object Management Group.

All three protocols are lightweight and efficient in terms of bandwidth and power consumption, they use asynchronous messaging with different levels of QoS, in all three of them it is easy to add or remove devices maintaining the architecture and are platform-independent protocols which can be used in various operating systems and hardware.

Comparing them in terms of architecture, MQTT and DDS use publish-subscribe architecture, where the publisher sends data to a broker, which routes the data to all interested subscribers. While CoAP uses a client-server architecture in which the client sends a request to a server, which sends a response back.

When it comes to network requirements and message size, MQTT and CoAP are designed to be implemented in networks with limited bandwidth and have a limit on the message size, typically around 256 bytes. DDS, on the other hand, can handle large amounts of data making it suitable for high-bandwidth networks.

Even thought all three protocols support security features such as authentication and encryption, DDS provides more advanced security features such as access control, data encryption and secure discovery.

MQTT and CoAP support different levels of Quality of Service (QoS) for message delivery (three levels in MQTT and four in CoAP). In contrast, DDS supports configurable QoS levels based on the importance of the data.

It is important to notice that DDS is a middleware protocol, while MQTT and CoAP are application layer protocols. Meaning that DDS can provide more advanced features such as content-based filtering, data caching, and distributed coordination.

Each of the studied protocol can be used in a variety of different applications depending on the specific requirements and use case.

MQTT protocol gives the functionality to remote control and monitor the system:

- Smart Home automation: Connecting various smart home devices.
- Industrial Automation: Connecting industrial devices such as sensors, PLCs and HMIs.

- Remote sensing: Connecting central servers to remote sensors like weather stations and environmental monitoring devices.

Likewise, CoAP can also give the functionality to remote control and monitor the system:

- Smart city applications: Connecting various smart city devices such as streetlights, parking sensors and waste management systems.
- Healthcare monitoring: Connecting central servers to wearable devices such as fitness trackers and medical monitors.
- Building automation: Connecting various building automation systems such as lighting, HVAC and security systems.

DDS should be used is applications where it is important to have real-time decision making, coordination, situational awareness and monitoring:

- Autonomous Vehicles: Connecting various systems in an autonomous vehicle such as sensors, actuators and control systems.
- Aerospace and Defense: Connecting various systems in an aerospace or defense application like radar systems, communication systems and control systems.
- Medical equipment: Connecting various medical equipment, for example patient monitors, ventilators and infusion pumps.