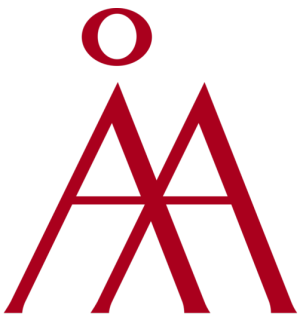

Åbo Akademi University

System Architecture of IoT

Assignment 2

Filipe Felício (2004623)

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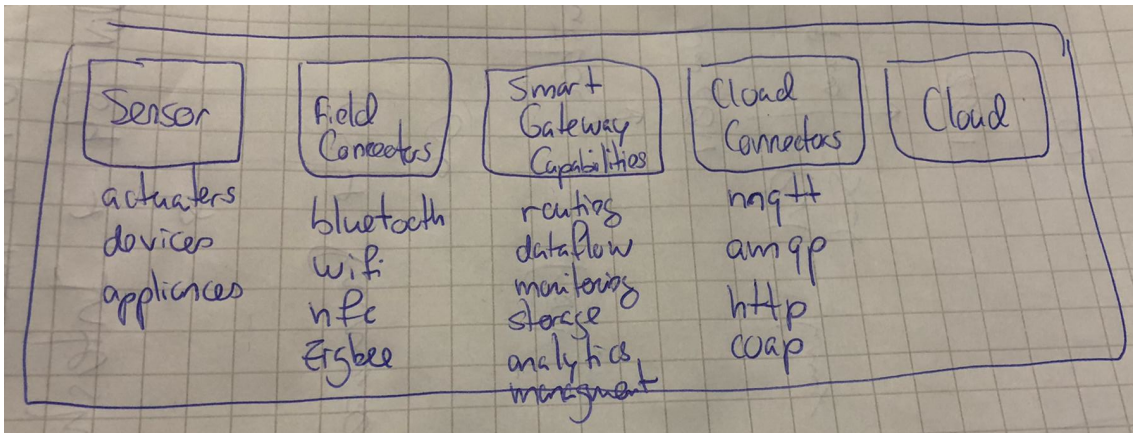
Contents

0.1 Using your own words, how would you define the what is the IoT?

Internet of Things is the concept that refers to the transformation of traditional physical objects into smart ones, allowing them to see, listen, think and execute tasks whilst making them "talk between themselves", using the sub-adjacent technologies, doing that interconnection through the internet and its protocols.

0.2 Please reproduce and complete on your answer sheet the following (IoT) architecture template with possibly missing components.



0.3 What are the two main families of IoT protocols on the application layer? Explain the main difference(s) between them (feel free to draw figures). For each family provide the name of at least one used protocol and a simple application example for it.

The two main families of IoT protocols on the application layer are:

- **Publish-Subscribe (Pub-Sub)** In a pub-sub architecture, a central source called a broker receives and distributes all data. Pub-sub clients can publish data to the broker or subscribe to get data from it—or both. Clients that publish data send it only when the data changes (report by exception, or RBE). Clients that subscribe to data automatically receive it from the broker/server, but again, only when it changes. The broker does not store data; it simply moves it from publishers to subscribers. When data comes in from a publisher, the broker promptly sends it off to any client subscribed to that data.
  - **Application:** Twitter is sort of a SMS-service meets discussion board. You can post short messages (up to 140 characters) that can be shared with a group of subscribers that are referred to as "followers". The main difference between twitter and other

messaging applications is that both SMS and Instant Messaging applications were designed primarily for one-on-one communications where Twitter was designed primarily for broadcast communications (publish/subscribe, or pub/sub)

– **Protocol:** XMPP, MQTT, AMQP

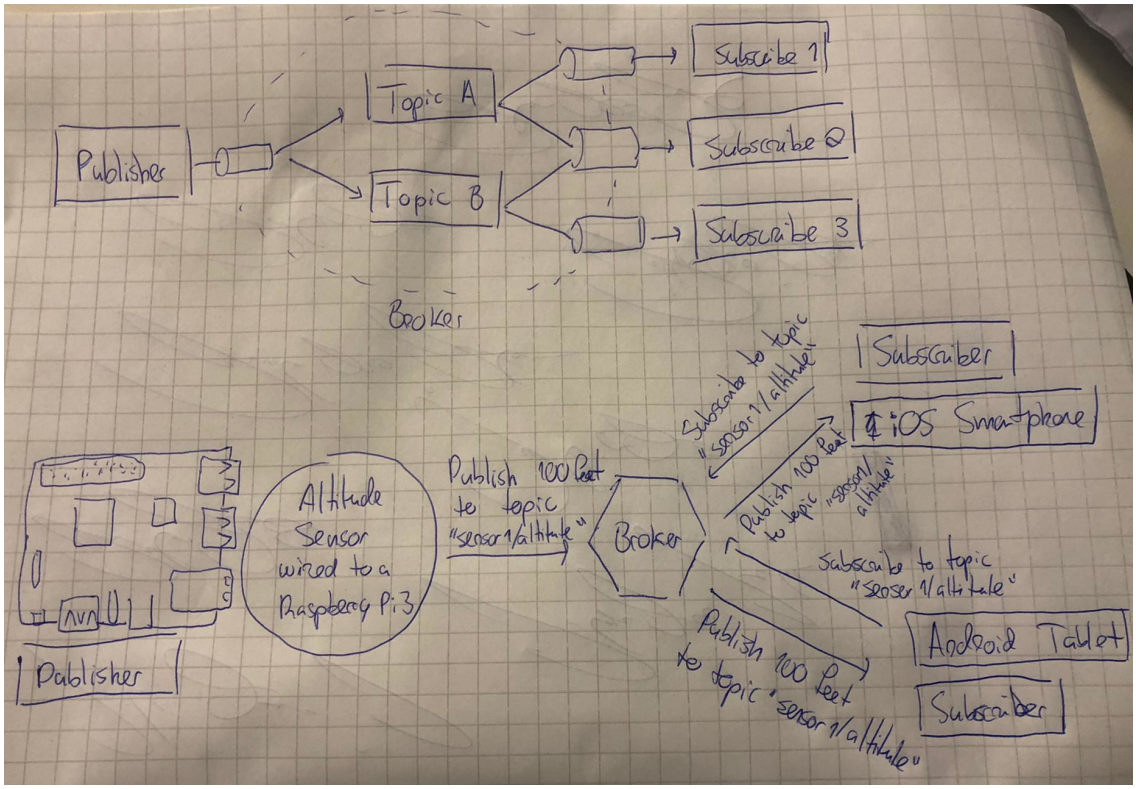


Figure 1: Pub-Sub Architecture in a theorical and a pratical example

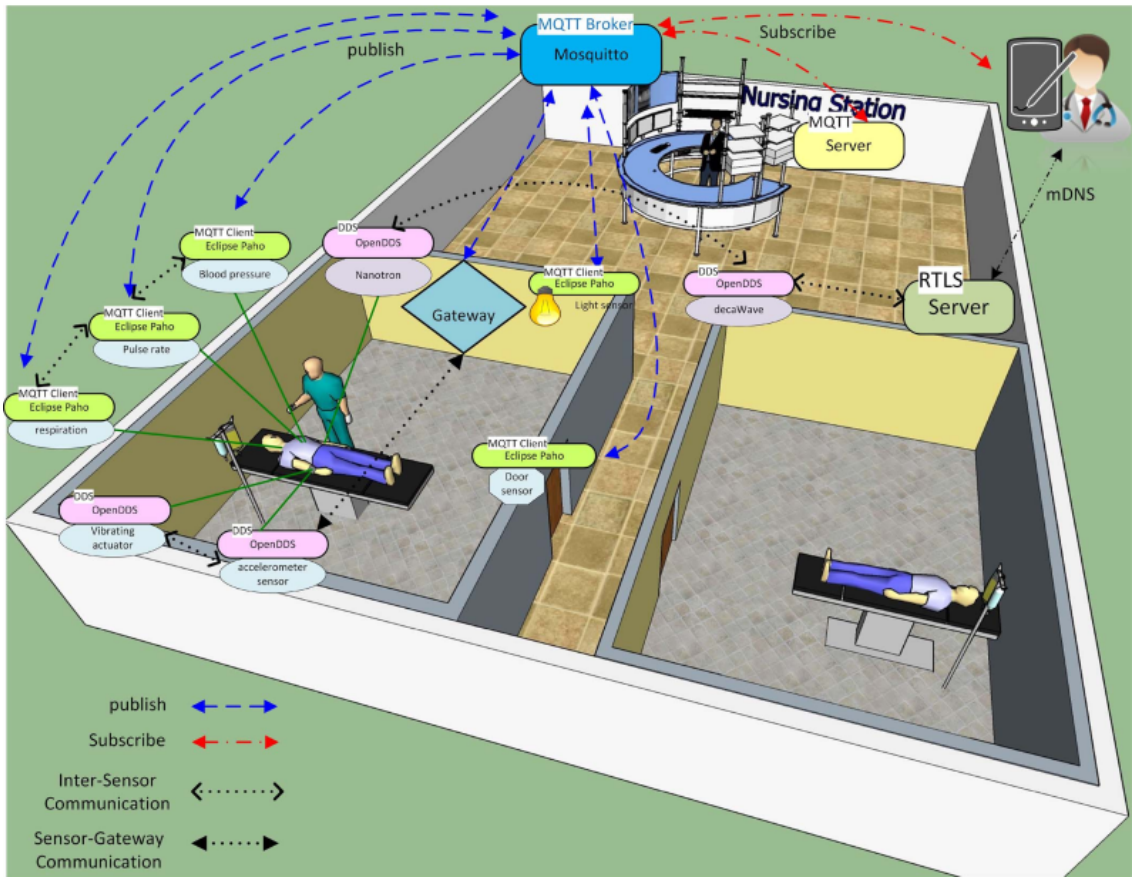


Figure 2: IoT Architecture in a Nursing Scenario using pub-sub

- **Request-Response (Client-Server)** In the request-response model, a client computer or software requests data or services, and a server computer or software responds to the request by providing the data or service.
  - **Application:** When watching a YouTube video on a smartphone, the web browser or YouTube app is the client, requesting the video over the internet to YouTube's web server, that once it receives the request, responds by serving the video page to the client, along with the other millions of video pages going to other millions of clients worldwide.
  - **Protocol:** CoAP, HTTP, WebRTC

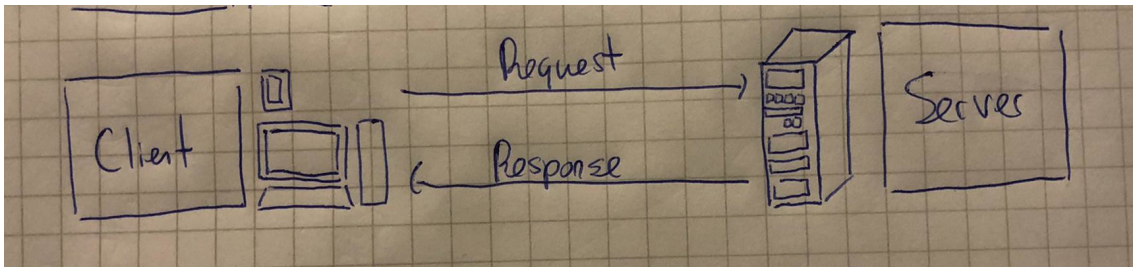


Figure 3: Client-Server Architecture

0.4 What are the main characteristics of Low Power Wide Area Networks (LPWANs)?

The main characteristics of a **Low Power Wide Area Networks** are:

- **Low power consumption**
- **Low Cost**
- **Regulated Transmission of data**
- **Good Geographical range**

0.5 What are the common sources of energy for energy harvesting system? For each one, list the associated advantages and disadvantages. Which source(s) has/have high power density?

The most common sources of energy for a energy harvesting system are:

- **Thermal energy**
  - **Pros:** Cheap and Renewal/Clean source of energy
  - **Cons:** Power-inefficient and can not be used bellow 0^{o}C
- **Light energy**
  - **Pros:** Abundant, Easy harvest and Affordable
  - **Cons:** Inefficient
- **RF energy**
  - **Pros:** Re-usability of radio frequency
  - **Cons:** Power-inefficient
- **Kinetic energy**
  - **Pros:** Usability in smaller areas
  - **Cons:** Expensive

The source of energy that has the best power density is **Light energy**.

Bibliography

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[2] Ala Al-Fuqaha, Mohsen Guizani, Mehdi Mohammadi,Mohammed Aledhari, Moussa Ayyash,"Internet of Things: A Survey on Enabling Technologies, Protocols, and Applications" in IEEE communication surveys and tutorials, vol.17, no.4, pp. 2347–2351, 2015.