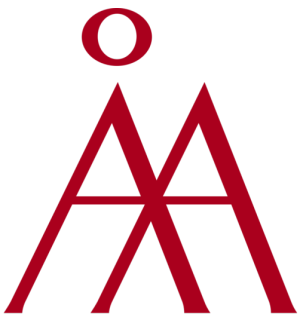

Åbo Akademi University

System Architecture of IoT

Assignment 1

Filipe Felício (2004623)

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Contents

0.1 Which application domain and technology are considered to be "the birth of IoT" ?

The term "Internet of Things" was first used at the Auto-ID Center at the Massachusetts Institute of Technology, in 1999, primarily for networked radio frequency identification (RFID) devices, by Kevin Ashton, who worked on a standard for tagging objects using RFID for logistics applications. RFID (Radio Frequency Identification) is primarily used to identify objects from a distance of a few meters[1].

0.2 When defining a reference IoT architecture, what are the main (high level) requirements to be considered? Provide a short description of the requirements.

Due to the existence of billions of different objects interconnected, it is necessary a consensual and flexible architecture.

After my research on the given papers and other relevant bibliography I have come across, it is noticeable that a universal accepted model still does not exist, meaning that the ever increasing number of proposed architectures has not yet converged to a single reference model[5].

Still we can find similarities between the different reference IoT architectures and some main requirements pop up, such as:

1) Connectivity and Communications, meaning the communication technologies used to connect heterogeneous objects together to deliver specific smart services[5];

2) Device Management, the ability to actively manage devices like remotely re-configuring Wi-Fi or network parameters, updating security credentials or software on a device, etc;

3) Data collection, Analysis, and Actuation, the process of gathering data from related objects within the network and sending it back to a Data Warehouse, Database, or Cloud, then analyzed it to take specific actions based on required services[5];

4) Scalability, which can be translated to the ability of supporting scaling from a small deployment to a very large number of devices;

5) Security, due to nature of this technologies and their connection to the Internet and the automation that produces machines behavior in the physical world, security is extremely important for an IoT architecture.

0.3 What are the main challenges when deploying an IoT application? Provide a short description of the challenges, and whenever possible a real-world example to illustrate your answers.

There are many deployment challenges associated with an IoT application, such as:

1) Efficient and Secure Communication: low power wireless networks that require little implementation effort are necessary, for which security is an important factor[3];

2) Suitable Hardware and Software: While the first one is widely available, it's questionable whether device-oriented, real-time networked OSs will ever exist for the different application

domains or whether the diversity of real-time OSs will continue[3];

3) Lack of Standardization: while there are claims about the need for common IoT standards, there are actually an overwhelming number of standards for IoT, emanating from mainstream standards development organizations (SDOs), mainly IETF, ITUT, IEEE, ETSI, ISO/IEC, and the International Society of Automation (ISA), as well as other state funded and international projects. Therefore, without unified effort, instead of converging toward common standards, this overwhelming number of proposals might contribute to further exacerbating the confusion about services and regulation[4];

4) Surrounding Legislation: due to its nature, IoT posses a challenge for governments worldwide to put into law protection to its citizens and when not properly done can make the development unfeasible (an abstraction that we can make about government intervention in any market). Legislators are faced with a type I/ type II mistake situation/problem where they want to optimize Security vs Privacy. An good example of this in an IoT application, was in 2020 when the Portuguese government launch an app called "STAYAWAY COVID", that used the users locations to alert each individual if he was in contact with another user that tested positive, and in the name of keeping people safe, try to make its download mandatory, with no regard for people's right for privacy. This type of technology enables dystopian novels like "1984" from George Orwell to stop being fiction.

0.4 Using your own words, define the notion of "Web of Things"? Provide possible examples.

Web of Things refers to the use/adaption of the many services, technologies and infrastructure of the World Wide Web that are already in place to accomplish the goal of making all smart objects/devices interconnect using, for instance, web protocols like HTTP, WebSocket, JSON, etc. This allows any device to connect regardless of what protocol(s) it uses to connect to the internet. One example is the Mozilla's WebThings Framework which is a collection of re-usable software components to help developers build their own web things which directly expose the Web Thing API. It includes implementations in a range of programming languages including Node.js, Python, Java, Rust and C++ (for Arduino)[6].

Bibliography

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[5] 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.

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