Internet of Things (IoT) System Architecture and Technologies

Research Paper Summary

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A theoretical model of Internet of Things (IoT) eco-system architecture and technologies.

0.1 INTRODUCTION

In 2008, 'things' connected to the internet were more in number than people and by 2022 these internet connected things will has already reached 80 billion. Expanding control over things has been a major intent for humans ever since the advent of fire. In this paper we provide a theoretical reference model that can be used by operators and network designers to determine the proper setup for IoT inter-communication. An Internet of Things is a digital overlay of information over the physical world. Objects and locations become part of the Internet in two ways. One is that they are connected to the Internet over wired and wireless networks. Alternatively, embedding sensors and transmitters into objects enables them to be addressed by Internet pro-tocols and sense and react to their environments.

0.2 BACKGROUND

0.2.1 Historical Background

- In this section, we define the IoT communication and exploring its Eco-system including the function of the key components and elements.
- The concept of enabling devices with the ability to com-municate with each other, without human interaction, has been a subject of experimentation many times throughout the decades.
- Radio frequency identification, or RFID, may be a crucial and first technology for IoT. The roots of RFID technolo-gy can be traced back to World War II
- Advances in radar and radio frequency (RF) communications sys-tems continued through the 1950s and 1960s.

0.2.2 IoT Defination

The Internet of Things (IoT) is a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things. The scope of IoT is not limited to just connecting things (device, appliances, and machines) to the Internet, IoT allows these things to communicate and exchange data.

0.2.3 IoT Ecosystem

The IoT ecosystem has five horizontal layers that are essential elements which is common to all IoT use-cases, regardless of vertical segment
1. Sensors or controllers (embedded in connected devices, the "things" in the Internet of Things)
2. A gateway device to aggregate and transmit data back and forth via the data network.
3. A communications network to send data.
4. Software for analyzing and translating data.
5. The end application service.

0.3 IOT TECHNOLOGIES

IoT is not a single technology. It is a combination of sensors, devices, networks, and software that unlock valuable, actionable data from the Inter-net of Things.

There are a range of technologies that enable IoT connec-tivity, each with benefits and restrictions that are explored below.
With the exception of cellular, virtually all major technologies are designed for using unlicensed Industrial, Scientific and Medical (ISM) band radio frequencies.

0.3.1 Cellular

The 3GPP family of cellular networks technologies is the leading platform for wireless communication worldwide. What started out as a single global standard for mobile telephony has evolved into a broad range of 2G, 3G and 4G network technologies that operate across an ever-expanding range of frequency-bands. The legacy 2G standards like General Packet Radio Ser-vices (GPRS), the current 3G/4G High Speed Packet Ac-cess (HSPA) , Long-Term Evolution (LTE) and the Emerging 4G-MTC (Machine Type Communication) are used to connect IoT devices. 3GPP Release 13 introduced a number of Machine Type Communication (MTC) enhancements to the LTE standard. LTE CAT-1 is optimized for reduced data rates and in-cludes a power saving feature that can support battery life-times of up to 10 years.

0.3.2 Lower-Power Wide Area Networks (LPWAN)

Long Range Radio (LoRa)

LoRa is a wide-area network intended for wireless, low-cost, battery op-erated devices in regional, national or global networks. LoRa provides bi-directional communication between end-devices and enterprises via a gateway. The LoRa Alliance is an open, non-profit association of industry leaders that believe the IoT era is now.

SigFox

SigFox is a French company that deploys LPWAN using ISM band frequencies for low-energy objects. In open space the connection range is over 40 kilometers. The standby time for two AA batter-ies in SigFox connected devices is 10 years or more. The SigFox network is best suited to M2M use cases that do not require large amounts of data being communicated.

0.3.3 Wireless Personal Area Networks (WPAN)

Bluetooth is the most famous of WPAN family and con-sidered a short-range connectivity solution. It operates on the license-free, global 2.4 GHz to 2.485 GHz ISM fre-quency band. It is also able to 'hop' between frequencies to reduce interruptions in connection from other wireless technologies sharing the same ISM spectrum. Due to it being a low bandwidth connection, it is not suitable for transferring large amounts of data; it is best suited to link-ing sensors and small electronic devices.

0.4 CONCLUSION

The Internet of Things is weaving a new worldwide web of interconnected objects. In the paper the author has presented the IoT technology stack that consists of multiple layers, including device hard-ware, connectivity, data management, applications and analytics; illustrating a reference model for IoT communi-cation, system architecture and main used wide area net-works based on Cellular, WPAN or LPWA technologies. Finally, The IoT describe the common applications that could be implemented by providers to generate new reve-nue stream, enhance agility to reach new levels of achievement by accelerating digital business transfor-mation through efficiency, new business and improved customer experience