Chapter 1
Internet of Things:
Architecture, Protocols, and Interoperability as a Major Challenge

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ABSTRACT

This chapter covers an introduction to internet of things (IoT), various architectures proposed by the researchers, IoT protocols, and interoperability as a major challenge. Millions of devices will be connected to internet in a few years. The major problems in accomplishing the vision of IoT is the incompatibility of devices and standard protocols to support heterogeneity. Interoperability in IoT has been a major problem with the constant increase in various kinds of sensors and manufacturers and lack of a common platform or protocol to all such sensors to share data among each other. As we traverse from physical layer to the higher layers in the IoT stack, each layer has interoperability challenges that have to be addressed uniquely such as network layer interoperability, messaging protocol interoperability, data format interoperability, and semantic interoperability.

INTRODUCTION

Information technology has profound impact on human's daily life. The internet era has erased the geographical borders and exchange of information is instantly processed, unlike traditional ways which required days or months for larger distance. The internet which is used for interconnecting end users has evolved to a stage which connects the physical objects that communicate with each other and with humans, offering a service. 'Internet-of-Things' (IoT) is used as an umbrella keyword which covers various aspects of spatially distributed devices with embedded identification, sensing and actuation capabilities.

'Internet of Things' evolved in 1980's with coffee vending machine, and the original term is coined by Kevin Ashton, the Executive Director of Auto-ID Labs in MIT in 1999. The concept of 'Internet of Things' first became very popular through the Auto-ID centre in 2003 and in related market analysts publications (S. Madakam et al., 2015). IoT enables different style of living and interacting with the

content and services available around us. This is the need of large corporations that benefit them to become more efficient, flexible, reduce errors in order to maintain accuracy. The technological evolution and the internet revolution has made academicians, industrialists and researchers to think about how to connect everything on the planet by transforming the real world objects into smart virtual objects through intelligence, the type of wireless communications to be built into devices, and the need of the internet infrastructure to support constrained devices.

IoT has two words: "Internet" and "Things". *Internet* is interconnection of communication networks that use standard internet protocol(TCP/IP). *Things* are real objects in this physical world. These real objects can be equipped with identifying, sensing, networking and processing capabilities that will allow these objects to communicate with one another which are of similar capabilities to accomplish some objective. *Internet of Things* allows people and things to be connected at *Anytime*, from *Anyplace* and with *Anything* and *Anyone* which implies addressing elements such as convergence, content collections, computing, communication and connectivity. Machine-to-Machine(M2M) solutions which is a subset of IoT suffice the needs of industries which requires minimal direct human intervention to deliver the services using wireless network technology.

The communication industry had seen tremendous growth in the last two decades and IoT is a paradigm shift in Information Technology. IoT is maturing and becoming the most hyped concept in IT world by overcoming the barriers such as size and cost of wireless communication, addressing issue to billions of devices connecting to the internet, power constrained devices etc. As the technology evolves the electronic industries/companies have started building Wi-Fi and cellular wireless connectivity into a wide range of devices. The challenge of addressing to the growing number of physical objects connected to the internet is solved by introducing IPv6 which allows us to assign a communication address to billions of devices. The battery technology has advanced tremendously by using solar recharging concept incorporated into numerous devices. That's how IoT aims at unifying everything in our world under a common infrastructure by giving us control of things around us.

Figure 1. Characteristics of IoT
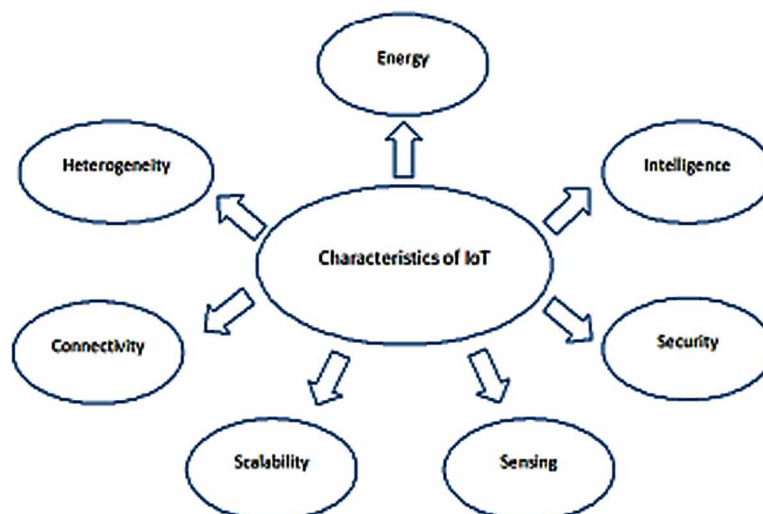
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