Interoperability Provision of IoT Data Protocols on Top of Virtualized Infrastructure

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INTRODUCTION

Internet of Things (IoT) focuses on the interconnectivity amongst people, sensors, actuators and processes. This term aims on the connection of various devices in order to provide data analytics and automation (Haseeb et al, 2017). An important requirement of IoT is ubiquitous connectivity and in order to achieve it, applications are needed for supporting the various sets of devices that will be used, as well as, communication protocols (Buyya & Vahid Dastjerdi, 2016). For instance, the aforementioned devices can be e a smartwatch, a fitness band (Ranger, 2018), a television, a car and many more IoT related end user devices (Rouse, 2018). In addition, the IoT idea is also based on the concept of a digital home in which various daily devices (for example appliances) go online, are interconnected, and allow efficient data exchange among them.

Therefore, various sensing devices like Radio Frequency Identification Devices (RFID), scanners, GPS and so on are combined in order to form a wider network. The aim of that wider network is to have various devices connected and make possible the identification and management of them (Liu & Lu, 2012). Due to the variety of devices being connected together in order to allow data exchange, interoperability issues are encountered, which limit the applicability of IoT-related services due to the variety of IoT data protocols utilized by different sensors and data nodes. This article addresses the issues of IoT

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interoperability and possible solutions in relation to it. Through the agility brought by virtualization, which allows gateway functions to be deployed on demand in an agile manner, this chapter discusses the concept of interoperability provision over heterogeneous IoT data protocols.

More specifically, this chapter discusses the problem of interoperability in IoT domains by introducing the most popular IoT data protocols that are commonly used today. Then, a proposed solution is described based on the agility offered by virtualized infrastructures with SDN/NFV capabilities. The basic functionalities of these technologies are briefly presented and finally a proposed approach towards the deployment on-demand of date protocol GWs is described.

BACKGROUND

During 1980s and 1990s, there was the concept of making objects smart, by integrating to them processing and connectivity capabilities, but it was slowed down due to the low progress in technological advancements (Ranger, 2018). Additionally, in the book "When Things Start to Think", professor Neil Gershenfeld used the term "Things" which shows that there was an initial vision of Internet of Things (IoT) concept, back in 1999 (Rouse, 2018). The term IoT was coined by Kevin Ashton in a presentation regarding supply-chain management in 1999 (Kramp 2013). While he was part of the Auto-ID Center at MIT, he was involved in the Radio Frequency Identification Devices (RFID) applications extension in broader domains which is the basis of the Internet of Things (Buyya & Vahid Dastjerdi, 2016). Kevin Ashton with the term IoT wanted to describe a system that the real world is being connected using a ubiquitous network of sensors (Corcoran, 2016).

In order to fully understand the concept of IoT is better to consider the Internet,which is the basic infrastructure for interconnecting remote networking nodes, such as the IoT objects. The Internet origins are dated back to 1960s. TCP /IP was introduced in 1974 and by 1984 a thousand nodes were switched over to it for data transmission and as a networking protocol. In the 1990s and early 2000s, this connectivity trend continued, which gradually resulted in numerous connected terminals and devices. In present-day, people use smartphones in order to perform their daily tasks, mobile network allows for ubiquitous connectivity and the internet allows device connection from anywhere (Corcoran, 2016).

Nowadays, IoT applications have been found in different sectors, such as to systems which are industrial and closed-loop to commercial ones (Kolias, Stavrou, Voas, Bojanova & Kuhn, 2016). Examples of the devices are: cameras, lights, television, printers and so on. The number of devices which are currently connected to the internet is estimated to be around 5 billion and an increase is expected in 2020 to be around 25 billion. The future shows that IoT devices will be mainstream, increase technological advancements to areas such as healthcare by using monitoring wearables, to retail as well as transportation. There is a transition of the IoT devices and from monolithic boards are turning to modular devices so as to satisfy daily life's needs (Kolias, Stavrou, Voas, Bojanova & Kuhn, 2016).

IoT devices can use a variety of networks such as LAN, WAN, PAN or cellular networks. In addition, due to device restriction requirements such as battery, high autonomy and low cost, wireless technologies, such as RFID, Bluetooth, NFC are used (Díaz Zayas, García Pérez, Recio Pérez & Merino, 2017). RFID takes an important role in IoT. The RFID system includes back-end network applications and data acquisition. Devices as such even though they play an important role in IoT, still face various problems like standards compatibility. Moreover, besides RFID, wireless networks play an important role, allowing users to connect via various devices, creating the basis for the wider deployment of IoT systems (Liu & Lu, 2012).