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Internet of Things

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ABSTRACT

In this paper, we seek to highlight the concept of Internet of Things (IoT)in general, as well as reviewing the main challenges of the IoT environment by focusing on the recent research directions in this topic. Recently, IoT has emerged as a new technology that is used to express a modern wireless telecommunication network, and it can be defined as an intelligent and interoperability node interconnected in a dynamic global infrastructure network,also it seeks to implement the connectivity concept of anything from anywhere at anytime.Indeed, the IoT environment possesses a large spectrum of challenges has a broad impact on their performance, which can be divided into two categories, namely, i)General challenges: such as communication, heterogeneity, virtualization and security; and ii) Unique challenges: such as wireless sensor network (WSN), Radio Frequency Identification (RFID), and finally Quality of service (QoS) that is considered as a common factor between both general and special challenges. In addition, this paper highlights the main applications of the IoT.

1. INTRODUCTION

Today, we are living in the era of smart technologies which represents a "ubiquitous computing" or “web 0.3”. Internet of Things (IoT) has emerged strongly as a more prosperous area to express this kind of a new technology. It is not the first technology in this field, but also the cloud computing technology has been used to represent the ubiquitous computing world. In the seventh in the series of ITU Internet Reports originally it was launched in 1997 under the title “Challenges to the Network” , and it was first coined by Kevin Ashton in the RFID journal 1999 , In networked devices to propagate their information about physical world objects through the web. In recent years, the most of the IoT proposed architectures are used, web semantic to publish information through the social networks; for instance, the iPhone has innovated service is Nike + iPod to record information and published it on the social networks and the social network friends. Actually, the definition of IoT varies based on who you talk, but formally, it can be defined as a dynamic global network infrastructure with self-configuration and interoperable communication. Simply, IoT means the ability to make everything around us starting from (i.e. Machine Devices, Mobile phone and Cars) even (Cities and Roads) are expected to be connected to the Internet with an intelligent behaviour and taking into account the existence of the kind of autonomy and privacy. Meanwhile, the IoT environment contains a huge number of the different objects/things can be classified into two types namely; i) Things rechargeable batteries things: the most of them are mobiles (e.g. Laptop, tablets and mobile phone), and ii) Things are non-rechargeable things: these things are static from the mobility point of view. Generally, IoT includes three main demands are: the first, a shared understanding of the situation of its users and their applications. Secondly, software architecture and pervasive communication networks to cover and process contextual information, and lastly, the analytics tools in IoT that aims for autonomous and intelligent behaviour. Considerably, can be expressed the principle idea of IoT is promoting the communication between anything from anywhere at anytime through context-aware applications. Accordingly, IoT has relied on RFID and sensor network technologies in the implementations. For instance, IBM

company used IoT in Norwegian Sea oil platforms, by deploying sensors at seabed that are used to collect real information to make decision drill in the sea. On the other hand, the IoT environment like many networks suffering from the set of challenges which significantly affect their performance some of them are common and others, are special; the paper divides these challenges into
two categories, namely, i)Generalchallenges: which include common challenges between IoT and traditional network such as communication, heterogeneity, QoS, scalability, virtualization, data mining and security; and ii) Special challenges: such as RFID and WSN.

The main objective of this paper provides an overview about IoT, its definition, its architecture, and discusses the differences between IoT and the traditional Internet; then
highlighting the challenges of IoT and the recent research directions to solve them. Finally, the rest of this paper is summarized as follows: section II, introducing an overview about IoT concept, its history and its inception also discussing the differences between IoT and the traditional Internet; section III, focusing on the challenges and recent research directions to address them and section IV, reviewing a set of the most popular applications in IoT

2.Related Work

In this section, the paper seeks to offer a brief overview about IoT, its definition, its history and its inception also highlight the architecture design of IoT that is relied on three dimensions called “IoT infrastructure”; and the final part in this section discusses the similarities and differences between both IoT and traditional Internet.

2.1.Definitions and History

In 1991, Mark Weiser has described the vision of the future
According to Atzori A.leraet al ,classified IoT to three paradigms namely, i) internet oriented (Middleware), ii) things oriented (Sensors), and iii) semantic oriented (Knowledge). In 1999 Neil Gershenfeld was speaking about similar things from the Massachusetts Institute of Technology, MIT Media Lab in his book “When Things
In 1999 Auto- ID labs and MIT sought to develop Electronic Product Code EPC, and use RFID to identify things on the network. In 2003-2004 the emergence of projects serving IoT idea such as Cooltown, Internet0, and the Disappearing Computer initiative, also IoT start to appear in book titles for the first time. RFID is deployed was published on a massive scale by the US Department of Defense. In 2005 IoT entered a new level when published its first report by International Telecommunication Union ITU. In 2008 a group of companies such as Cisco, Intel, SAP and over 50 other members of companies met to create IPSO Alliance, to promote the use of Internet protocol (IP) and to activate IoT concept. In 2008-2009 IoT was "Born" by Cisco Cisco Internet Business Solutions Group (IBSG) [8]. From the previous perspectives can be defined IoT as a set of smart things/objects such as home devices, mobile, laptop, etc., addressed by a unique addressing scheme and connected to the Internet through a unified framework this framework may be cloud computing.

2.2Architecture and Design

The best design of the architecture is a foundation stone to build a privileged IoT system; this architecture helped to address a lot of issues in the IoT environment such as scalability, routing, networking, etc. Typically, the IoT architecture approach based on three main dimensions are:
i) Information items: it includes all items connected to IoT environment may be sensing items, identifying items and control items;
ii)Independent network: which includes several features such as self-configuration, self-protection, self-adaptation, and self-optimization; and iii) Intelligent applications: which have intelligent behaviour over the Internet generally; the intelligent behaviour may be intelligent control, exchange data methods through network items, data processing, all the applications which are related
to the IoT can be classified according to these dimensions [9]. The intersection between these dimensions creates a new space named “infrastructure of IoT”, which provides support systems to serve the special things, which can provide various services such as goods identification, location identification and data protection. Fig 2 depicts the three dimensions of IoT and relationship between them. In this end, there are several approaches to build an architecture of IoT, the paper will focusing on two kinds namely, architecture called “EPC global network“

and another called “Unite and ubiquitous IoTs or U2IoTs”, to create an application on IoT, the architectural approach favoured which based on an open architecture the EPC global network. The system designed by AutoID center for conveying the dynamic information about objects/things to provide a history of the product movement for the authorized users, the RFID technology plays a key role to differentiate between these mobile objects, this system is
global network as a principle to design the architecture framework . The future architecture of IoT seeks to achieve connection between real-world, cyber-world and social world. Unite and ubiquitous IoTs or U2IoTs is considered as a different
world with the cyber world. The U2IoTs consists of a set of
heterogeneous systems, including unit of IoT to resemble human neural network that provides solutions to specific applications; U2IoTs includes the industrial IoT, local youth, national IoT, and global IoT whichintegration of multiple Unit IoTs with ubiquitous features, and it is similar to the social organization framework. The main characteristics of U2IoT model are cyber, physical, social co-existence, connectivity and interactivity, space-time
consistency and multi-identity status .

2.3Differences between IoT and
Traditional network

In the beginning, the IoT technology has broken a lot of the traditional ideas of network and started a new era of telecommunication technology. Can be considered IoT as an extension and expansion network based on the Internet; but it is different from either traditional network or the so- called Internet of people and WSN although considered as backbone to build any IoT block. The major equation to represent the IoT environment is "IoT environment= Internet + WSN", it is a common statement that uses to express the IoT environment. To analyze and judge the correctness of this statement, must be determined the similarities and differences between IoT, Internet, and WSN according to table 1. From the previous knowledge about the IoT environment can be judged on this view, it's a wrong; because there are two basic reasons for rejecting this view. First; IoT may not necessarily use IP in all cases for addressing things, because nature of IoT needs lightweight communication protocols, the complexity of the TCP/IP protocol is not suitable in particular, when works with the smart little things. Second, the IoT environment is mainly based on the connected
smart objects unlike traditional network. That’s what makes them move from only a mere extension of the Internet, also the behaviour of IoT depends on the creation of the interoperable systems, based on these arguments, can be corrected the previous statement.

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