

## Chapter 9

# Internet of Things and Internet of All Things

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### ABSTRACT

*Interaction between devices, systems, and services is provided in internet through a new concept: internet of everything (IoE). This new concept should present numerous opportunities for the creation of new devices and applications in the years that follow and can dramatically affect the day-to-day life of all of us. New possibilities of information access, transmission, analysis, and interaction are practically infinity. With so many benefits, it is expected to come with several challenges. System structure and architecture and information confidentiality, integrity, and availability are aspects that someone should keep in mind to design an IoE application. This chapter offers to the reader an overview of the evolution of devices connectivity until it reaches the IoE. Some IoE concepts and applications, together with some challenges, are presented.*

### INTRODUCTION

The Internet of Everything (IoE) represents a significant paradigm shift in Internet applications.

The evolution of the Internet can be briefly represented in five phases, as can be seen in Figure 1, according to Perera et al (2014). In an initial phase, this application was created to connect two computers, using a network interconnection protocol, the IP. In the next phase, the World Wide Web (WWW) was created, allowing the connection of a large number of computers. In a third phase, the Mobile Internet appears, connecting mobile devices to the Internet. In a fourth phase, Identities were connected on the

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Figure 1. Development of the Internet until the inclusion of the Internet of Things

Source: Batista adapted from Perera, 2017.



Internet through social networks. Finally, in the last phase, the Internet now includes objects that connect through the Internet, thus, forming the Internet of Things (IoT), as can be seen in Figure 1.

The expression “Internet of Things” was initially used by Kevin Ashton and, in 2001, the MIT Auto-ID center presented its vision of IoT (Perera, Zaslavsky, Christen, & Georgakopoulos, 2014). IoT was formally introduced by ITU (International Telecommunications Union), in Workshop Report (2005).

According to Chui (2010), Internet of Things is the network of physical objects or “things” embedded in electronic products, software, sensors and connectivity to enable objects to exchange data with the manufacturer, operator and / or other connected devices. Typically, IoT provides advanced device, systems and service connectivity, and goes beyond machine-to-machine (M2M) communication and covers a wide variety of protocols, domains and applications.

Esteves (2015) refers to Internet of Things (IoT) as the creation of a network of objects that have built-in technology, usually sensors and microprocessors, and that can interact with each other by sending or receiving information in an internal or external way. The Internet of Things connects people, processes, data and things to make connections more relevant and valuable than ever: converts information into action that creates new skills, richer experiences and unprecedented economic opportunities for businesses, individuals and countries.

Pessoa et al. (2016) have presented the concepts, applications, challenges and future trends of the Internet of Things (IoT) in their overview. The authors have reported good perspectives in the creation of solutions (products and services) that meet the “market needs” and / or needs of individuals. An example shown, is the concept established by Pandikumar et al. (2014), which states that the IoT architecture is a convergence of several technologies such as pervasive / ubiquitous computing, sensors / actuators, Information and Communication Technologies (ICT) and embedded systems, which gives the technology the necessary flexibility to adapt the real demands of the market.

The IoT paradigm has its own associated characteristics and concepts, and it also brings with it concepts from other areas of computing. IoT focuses on several technologies, such as: sensor hardware and firmware, WEB services, cloud, data modeling and storage, signal processing and information and telecommunications.

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