

INTERNET OF THINGS: AN INTRODUCTION

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Abstract

The Internet is an evolving entity. It started as the “Internet of Computers.” Research studies have forecast an explosive growth in the number of “things” or devices that will be connected to the Internet. The resulting network is called the “Internet of Things” (IoT). This paper provides a simple introduction to the IoT, its application and potential benefits to the society.

Key Words: *Bluetooth, Internet of Computers, Internet of Things, Optical tags, Radio-frequency identification, Wireless sensor network.*

1. INTRODUCTION

Through several technological advances, the modern society is heading towards an “always connected” paradigm. “If you’ve watched any live television lately, you’ve seen commercials for security systems that you can control from your phone, thermostats that learn from your behaviors, and cars that tell you where they are packed. The Internet and mobile devices have made these technologies possible [1].

Most of the devices we use today support communication technology. Such devices include cell phones, sensors, smart grid, and laptops. The devices can interact among themselves through the Internet. Such a paradigm is called the “Internet of Things” (IoT) or “Internet of Object,” where the devices are referred to as the things. It is the Internet of relating to things.

The term, Internet of things, was first coined by Kevin Ashton, a British entrepreneur in 1999. He meant to represent the concept of computers and machines with sensors, which are connected to the Internet to report status and accept control commands [2]. The goal of IoT is to integrate and automate everything from home appliances to plants on factory

floors. Experts predict that the IoT will consist of about 50 billion objects by 2020. Analyst IDC reckons that the global IoT market will exceed \$7 trillion by 2020 [3].

IoT is the next step in the evolution of the Internet since it takes into consideration all devices connected to it. It allows all types of elements (sensors, actuators, personal electronic devices, laptops, tablets, digital cameras, smart phones, alarm systems, home appliances, or industrial machines, etc.) to autonomously interact with each other.

2. PROPERTIES AND APPLICATIONS

The IoT may be more appropriately referred to as the Internet of relating to things. Integration of every device with the Internet necessitates that devices use an IP address as a unique identifier. To some extent, the future of IoT will be limited without the support of IPv6.

There are four main technologies that enable IoT [4-6]:

- (1) Radio-frequency identification (RFID) and near-field communication: This technology offers a way to bridge the gap between physical objects and the virtual world. It enables the design of microchips for wireless communication that can identify anything they are attached to automatically just as an electronic barcode. A basic RFID system consists of an RFID reader and RFID tag.
- (2) Optical tags and quick response codes: This is used for low cost tagging.
- (3) Bluetooth low energy (BLE): Newly released smart phones have BLE hardware in them.
- (4) Wireless sensor network: Sensors are important in IoT. They are usually connected as wireless sensor networks to monitor physical properties in specific environments. IoT may be regarded as a things-connected network, where things are wirelessly connected via smart sensors. These sensors collaborate with each other to provide information of their physical surroundings.

IoT is the convergence of the Internet with RFID, sensor and smart objects. IoT has potential for societal as well as economic impact. Potential applications are the major force driving the future of the IoT. Some see IoT as a vehicle for economic growth. IoT may be regarded as consisting of three visions as shown in Figure 1. [8].

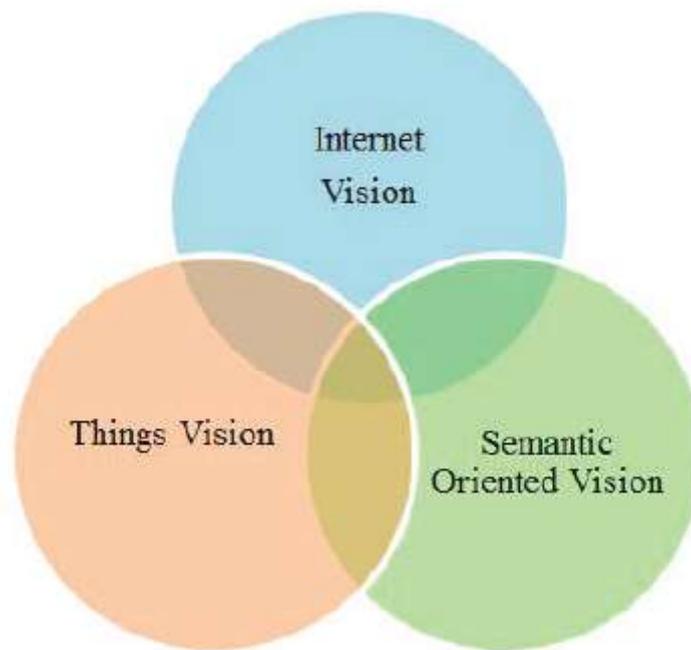


Figure1. Three main visions of the Internet of Things

3. CHALLENGES FACING IoT

IoT is the biggest promise of the technology today, but a number of challenges need to be overcome in order for IoT to achieve its objective. Some scholars and social observers doubt whether the promises of the ubiquitous computing revolutions would come true. There are four major challenges IoT faces [7]. The first is security. People's concern is that the IoT is being developed rapidly without due consideration of the profound security challenges involved. In a world where all things are connected, individual's right to privacy needs to be protected. Principles of informed consent, data confidentiality and security must be safeguarded.

The second challenge is deployment of IPv6. The supply of IPv4 addresses was exhausted in February 2014. The deployment of IPv6 will cover this IP address shortage and make network management less complex.

The third challenge is sensor energy. Providing power to sensors for a prolonged period of time is key to IoT being deployed successfully.

The fourth challenge is standardization. Another challenge is the battle over protocols and standards. Standardization of technologies involved is important. IEEE and the Internet of Things Global Standards Initiative are attempting to develop IoT standards. Standards on IoT have attracted a lot of attention in many countries.

4. CONCLUSION

The Internet has changed everything. Its principal goal, back in 1973, was to enable computers to communicate with each other. Its usage is multifaceted and is expanding on a daily basis. The Internet of Things is a worldwide network of physical objects using the Internet as a communication network. It is the next stage of information revolution because it deals with inter-connectivity of everything. It is becoming what people on the street can relate to.

When smart things everywhere are connected, we will be able to do more. The evolution of IoT is shown in Figure 2, reference [6]. IoT has brought magic and science fiction to fruition. It is a vision which is currently under progress. IoT is growing rapidly. It has the potential to drive integrated solutions that can make a difference. The IoT is here to stay.

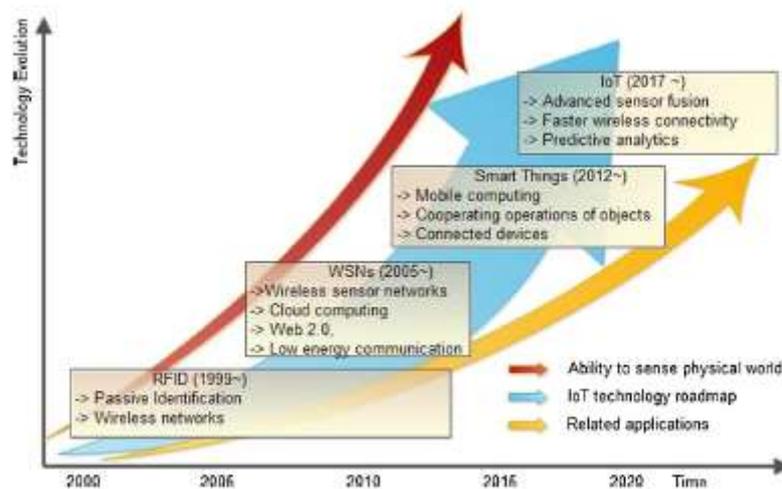


Figure2. Evolution of IoT.

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