Chapter 8
Examining IoT's Applications Using Cloud Services

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ABSTRACT

Cloud IoT has evolved from the convergence of Cloud computing with Internet of Things (IoT). The networked devices in the IoT world grow exponentially in the distributed computing paradigm and thus require the power of the Cloud to access and share computing and storage for these devices. Cloud offers scalable on-demand services to the IoT devices for effective communication and knowledge sharing. It alleviates the computational load of IoT, which makes the devices smarter. This chapter explores the different IoT services offered by the Cloud as well as application domains that are benefited by the Cloud IoT. The challenges on offloading the IoT computation into the Cloud are also discussed.

1. INTRODUCTION

Cloud computing and Internet of Things (IoT) are inseparable in today's computing paradigm. Both of them complement each other by leveraging its services. The number of devices used in day-to-day life of the human as well as industries is growing rapidly since many services are automated. Cloud empowers communication among these devices seamlessly on demand basis. The characteristics of cloud such as scalability, on-demand, and pay per use will greatly help the development of IoT. The devices in

IoT network becomes "smarter, smaller and cheaper" by using the cloud services. In IoT, 'things' refer to any object on face of the earth, whether it is a communicating device or a non-communicating dumb object (Parwekar, 2011). Fig.1 illustrates the convergence of IoT using cloud services. Various applications and users get benefited by this merging. The three technologies such as cloud computing (Internet centric), IoT (Device centric) and Big data (Data centric) are tied together in the evolution of pervasive and ubiquitous model. Earlier in the Web 1.0 & Web 2.0 developments, Human-to-Human communication was well established in the form of web pages and social networking. Later in the Web 3.0 era, devices are communicating each other for sharing the data. Not only the data, knowledge and experience gained by the devices can also be shared to avoid duplication in learning process.

For example, cloud robotics is the emerging field which uses the cloud based IoT techniques. Here, robots act as thin-client in which the computation and storage are simply offloaded into cloud. Google car is another example for convergence of cloud and IoT, which uses the Google map services from the cloud. It receives the accurate street view images, 3D sensors and traffic patterns information on the move.

The true potential of cloud can be realized by applying IoT devices in different applications. Cost of IoT devices will be cheaper by leverage the cloud services on rental basis. As the wireless network devices are equipped with 4G/5G/GPRS/LTE technologies, service access from the cloud is not a big concern. Cloud services are provisioned primarily in the form of Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). But in IoT, SAaaS (Sensing and Actuation as a Service) can also be provided by using the cloud.

Currently IoT paradigm interconnects 9 billion sensor devices and future growth is predicted to scale-up 24 billion devices in the year 2020. The data generated from

Figure 1. Convergence of cloud with Internet of Things
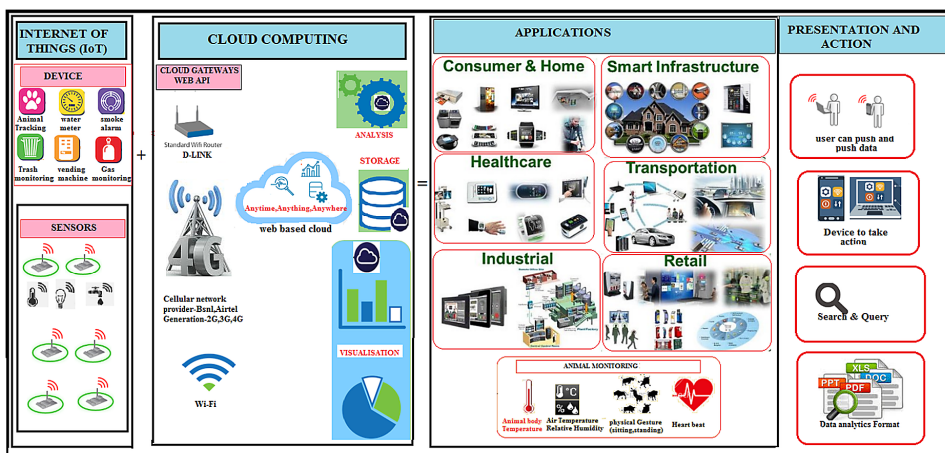
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