Chapter 9

Sensor Cloud: A Cloud-Based Sensor Network Data Gathering and Processing Platform

Seyed Amin Hosseini Seno
Ferdowsi University of Mashhad, Iran

Fatemeh Banaie
Ferdowsi University of Mashhad, Iran

ABSTRACT

With the advancement of wireless sensor networks (WSN) and the increasing use of sensors in various industrial, environmental and commercial fields, it is difficult to store and process the volume of generated data on local platforms. Cloud computing provides scalable resources to perform analysis of online as well as offline data streams generated by sensor networks. This can help to overcome the weakness of WSN in combining and analyzing heterogeneous and large numbers of sensory data. This chapter presents a comprehensive survey on state-of-the-art results in the context of cloud–enabled large-scale sensor networks. The chapter also discusses the objectives, architecture and design issues of the generic sensor-cloud platform.

INTRODUCTION

The global sensor market represents an increasing use of wireless sensors in a wide variety of applications, including process automation, monitoring service, health and vehicular networking. The growth of this market is expected to reach more than $190 billion at the compounded annual growth rate of 11% by 2021. These global sensor networks provide remote sensing application, which is known as Internet of Thing (IoT). However, traditional WSNs are domain specific and task-oriented,
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which lead to inefficient and redundant deployments of sensor nodes (Khan et al., 2016). Moreover, the limitations of WSNs (Mao et al., 2012; Tu & Blum, 2009) in the terms of battery life, processing and storage capacity would probably impact the service performance, and converges towards designing better data and communication management system for WSN (Madria et al., 2014).

Connecting the large scale WSN to the cloud platform can provide meaningful information to the users by processing and analyzing the vast amount of collected data from multiple locations. This idea helps to alleviate the limitations of sensor nodes using the extensive cloud resources. The resulting sensor-cloud platform enables a new kind of services and applications that are the hart of next-generation smart environment.

Sensor-cloud Infrastructure (SCI) refers to the advent of cloud computing (Buyya et al., 2009) for a new generation of ubiquitous monitoring and effective control of the on-field distributed WSNs. It is a new dimension of cloud computing for the efficient management of sensor network resources (Alamri et al. 2013). SCI provides services in the form of virtual network slices of the shared infrastructure, which lead to the convenient and on-demand access to a shared pool of resources by virtualizing the physical sensors on a cloud platform. Likewise, virtualization allows users to use sensors without worrying about their locations and specifications (Yuriyama & Kushida, 2010). As shown in Figure 1, sensor-cloud architecture is composed of three layers:

- **Physical sensors layer** that performs sensing and forwards the sensed data to the sensor-cloud.
- **Sensor-cloud Infrastructure** that provides SaaS by virtualizing physical sensors as virtual sensors.
- **Applications layer** that uses the sensed information provisioned by sensor-cloud service provider (SCSP) to serve on-demand requests of End-users.

Such an integration brings mutual benefits to both WSN and cloud computing. For WSNs, it can provide sensing data to multiple applications at the same type, instead of the application specific model. In addition, it takes the advantages of the powerful processing and the storage abilities of cloud computing for sensing data. For cloud computing, it will enrich the existing cloud platform with a new service paradigm, named as Sensing-as-a-Service (SaaS). This service enables the cloud platform to provide physical sensors as a service to the End-users, rather than a typical hardware (Zeng et al. 2013). This chapter presents a comprehensive survey on state-of-the-art results in the context of cloud –enabled large-scale sensor networks. The survey helps new researchers entering the domain of sensor-cloud by providing a comprehensive survey on recent developments.
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