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Design and implementation of a novel service management framework for IoT devices in cloud

Chinmaya Kumar Dehury, Prasan Kumar Sahoo*

Dept. of Computer Science and Information Engineering, Chang Gung University, Kwei-Shan, 33302, Taiwan(ROC)

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ABSTRACT

With advent of new technologies, we are surrounded by several tiny but powerful mobile devices through which we can communicate with the outside world to store and retrieve data from the Cloud. These devices are considered as smart objects as they can sense the medium, collect data, interact with nearby smart objects, and transmit data to the cloud for processing and storage through internet. Internet of Things (IoT) create an environment for smart home, health care and smart business decisions by transmitting data through internet. Cloud computing, on the other hand leverages the capability of IoT by providing computation and storage power to each smart object. Researches and developers combine the cloud computing environment with that of IoT to reduce the transmission and processing cost in the cloud and to provide better services for processing and storing the realtime data generated from those IoT devices. In this paper, a novel framework is designed for the Cloud to manage the realtime IoT data and scientific non-IoT data. In order to demonstrate the services in Cloud, real experimental result of implementing the Docker container for virtualization is introduced to provide Software as a Service (SaaS) in a hybrid cloud environment.

1. Introduction

Internet of Things (IoT) is the upcoming technology to convert an object into smart objects by connecting them to internet. This allows us to control any tangible object remotely. The term IoT coined (Epc symposium, 2003) for supply chain management and came to the attention when Auto-ID center launched their initial vision of the epic network for automatically identifying and tracing the flow of goods in supply-chains. According to an estimation made by Cisco, 50 billion devices will be connected to internet by 2020 forming a large dense IoT environment (Internet of things , iot). These IoT devices include intelligent oven, smart watch, smart air quality monitor, heart monitoring implants, rescue operation etc. Different sensors such as temperature sensor, gyro sensor, accelerometer, pressure sensor, and humidity sensors play an important role in establishing IoT environment. From above discussion, the basic definition of IoT can be derived as worldwide collaboration and formation of massive network among all physical entities or objects to reach common goals through unique addressing schemes by embedding RFID tags, sensors, actuators etc. As defined by the International Telecommunication Union (ITU) (Itu-t recommendation database, 2016), IoT is a global infrastructure for the information society, enabling advanced services by interconnecting physical and virtual things based on existing and evolving inter-operable information and communication technologies.

In Atzori et al. (2010), authors discuss three main visions of Internet of Things. The Semantic-oriented vision states that the increasing number of IoT devices increases the complexity in handling those devices. Huge amount of data are being generated in every instance of seconds, and the data exchange among IoT devices also increases exponentially. The semantic-oriented vision addresses the aforementioned issue, where the representations of huge data, storage, search, and organize information become cumbersome. The idea behind semantic-oriented vision is to propose new semantic technologies, which can exploit new solutions to handle such massive amount of data generated by IoT devices. The Internet-oriented vision states that distributing unique IP to each object to connect to the internet is difficult and inefficient as the number of IoT object increases. The existing internet protocol may not be able to handle billions of smart IoT objects. Hence, how to connect several objects to the internet and how to identify uniquely the data generated from those objects is the main concern in internet-oriented vision. Things-oriented vision mainly refers to the tracking of each object with specialized technology such as RFID tag. RFID tag is most popular technology in

* Corresponding author.
E-mail addresses: d0321009@stmail.cgu.edu.tw (C.K. Dehury), pksahoo@mail.cgu.edu.tw (P.K. Sahoo).

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