클라우드 컴퓨팅에서 Handheld Devices 기반의 M2M 및 IoT 온라인 쇼핑 서비스 프레임워크

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Framework of Online Shopping Service based on M2M and IoT for Handheld Devices in Cloud Computing

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Abstract

We develop Framework architecture of Online Shopping Services based on M2M and IoT for Handheld Devices in Cloud Computing. MapReduce model will be used as a method to simplify large scale data processing when user search for purchasing products online which provide efficient, and fast respond time. Therefore, providing user with a enhanced Quality of Experience (QoE) as well as Quality of Service (QoS) when purchasing/searching products Online from big data.

1. Introduction

Currently, Cloud Computing provides a diversity of services for variety of users anywhere anytime in the world. Furthermore, cloud computing capabilities enable developer to integrate and develop new services for electronic devices (e.g. handheld devices, home appliances, Smartphone, vending machine, etc). The fast development of smart devices such as smart phone and the advances of broadband internet enable users to access the internet for variety of purposes (e.g. shopping, educational, learning, surfing, social network applications, socializing, etc) and view them in rich contents. A cording to Cisco IBSG, it is predicted that by the year of 2015 the number of devices connected to internet will reach 25 billion and by the year of 2020, 50 billion devices will be connected to internet [1].

As a result more devices will be connected to internet and more services will be developed for meeting user QoS as well as QoE. Users can access and control other devices (e.g. PC, Smart TV, Tablets, etc) that they own anytime anywhere and retrieve data as well. This concept is known as Machine to Machine (M2M) and in the case of internet of things (IoT) user can access devices through Internet as well as communication with each other. IoT enable objects to be linked to each other in real world with virtual world, therefore enabling every time in the world connectivity for anything and for everyone [2]. These objects can be any device, products, etc which have barcode or RFID tags. Users can purchase products using barcode or RFID which provide flexibility for users to receive products through delivery service or by physically visit the shop, present their barcode and receive the product. However, products availability is not guarantee all the time because it might be sold out or not in stock yet which will lead to a poor QoS and QoE. Furthermore, an efficient searching method is needed to search for products in the internet or in vending machine specially when there are about 5.4 million vending machines in Japan according to Japanese vending machine association [3,4]. Searching information regarding a desired product from a vending machine big data server will required more time to do so.

In this paper, we introduce a framework of Online Shopping Service based on M2M and IoT for Handheld Devices in Cloud Computing. Our service will 1) enable users to access the internet, purchase variety of product (e.g. cloth, items, soft drinks, pizza, etc) through shopping sites, generate barcode/RFID, and allocate a nearby vending machine to users to obtain their product, 2) provide users with fast tool to search the internet, and 3) provide QoS and QoE for online shoppers. The reminder of this paper is organized as follow; in section 2 we describe related work. Scenario and System architecture are mention in section 3 and 4. In section 5 describe process of MapReduce Dataflow and in section 6 we draw the conclusion. In section 7 we provide future work.

2. Related work

1.1. Internet of Things (IoT)

It describes a view where all object are connected to internet and becoming part of it. These objects are identified uniquely and can be accessed through the any

network. User can identify objects position, and their status [5,6]. In Internet of Things opinion, the definition of things is very huge and includes diversity of physical elements such as personal objects which we carry them with us every place we go to (e.g. Smartphones, Tablets, digital camera, PCs, etc). In addition it includes elements in environments (e.g. at home, transportation vehicle, at work, etc). Other objects (things) can be made with barcode or RFID tags that are connected to gateway devices [7]. IoT consider as a technological revolution that depict the future of communication and computing where its development needs the support from some innovational technologies. RFID consider as a primary technology that is needed to enable IoT [7].

1.2. Machine to Machine (M2M)

In January 2009, the ETSI M2M Standardization started with the establishing of ETSI technical committee (TC) M2M [8]. The standard defines required elements and function which its purpose is to provide end-to-end connectivity. The communication of M2M can be used to allow a large diversity of automated complex operations such as remote control, monitoring and sensing. Communication of M2M can be brings low cost and power, and short distance wireless communication protocol (e.g. WiFi, Bluetooth, ZigBee, etc) [8].

1.3. MapReduce

It is a parallel programming model which was developed by Google Company to be used with programming tool such as Java, C++, etc to process number of data cluster [9]. MapReduce used by Google and other software which can be classified into cloud computing for the purpose of searching. It consists of Map and reduce. The Map function takes in key/value pair and generates the result as an intermediate list of key/value pairs [11]. MapReduce was used widely in query in large scale data cluster (e.g. Big data, etc) such as Google's query application. More description of MapReduce process is explained in details in [9, 10]. It is a well know model for parallel data computing in high performance cluster computing environment.

3. Scenario

In this section we consider two scenarios which can be applied to other scenarios as illustrated in Fig 1. First scenario, we are assuming that the user is connecting to the internet through handheld devices (e.g. smart phone, Tablets, etc) to purchase product (e.g. cloths, chose, Pizza, etc) from online shopping website (e.g. Gmarket, Amazon, Pizza etc). The user brows website, select products, process payment and finally selects delivery method (e.g. mail, direct retrieval of produce from store or vending machine). We assume that user select to receive product by allocating a nearby vending machine to get the products. After payment process is completed, user receives generated barcode or RFID. Message will be sending to vending machine to reserve the products until user arrive and receive it. Note that we want the user to select retrieving product from nearby vending machine when the shopping website do not have the user purchased product. As a result, provides another alternative effective method for user satisfaction

Second scenario, we assume that the user connect to online pizza shopping website to purchase pizza when a pizza store is closed or delivery time is finished. Here the user only can purchase from nearby vending machine. The user will select the desired pizza and process the payment. Then the user will grant access to communicate with Vending machine. The Vending Machine Location Server will allocate the user current location by communicating with user device and estimate the time that is required to make the pizza where user can receive the pizza when he/she arrived at vending machine location. For example, the user location is 30min away from vending machine and making pizza required 20mins. When user passes 10min, the a message will be send to vending machine from cloud or user devices to start preparing the pizza so when the user arrive, the pizza will be hot and ready to serve.

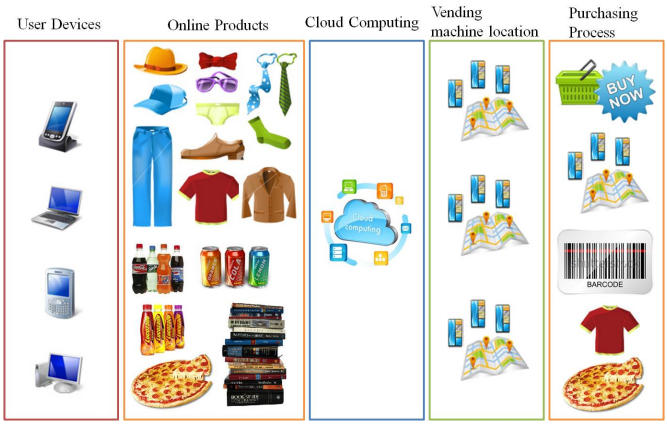

Fig 1.Scenario

4. System Architecture

Figure 2 illustrate System Architecture of our proposed framework of Online Shopping Service based on M2M and IoT for Handheld Devices in Cloud Computing. The component of Cloud computing Side consist of Mobile Device Server, Products Server, Bar code Server, M2M Server, Vending Machine Location Server, and User devices User End side. The terminologies used to describe the system architecture are illustrated in Table 1.

Table 1. System Architecture Components and Roles

Product Server	Responsible of Storing Information about variety of Products such as Name, identification, price, etc.
Mobile Device Server	Responsible of Storing information about handheld devices such, id, type, connection, etc
M2M Server	Responsible of providing a protocol for device to communicate between each other.
VM Location Server	Responsible of keeping and allocating vending machine location information.
Barcode Server	Responsible of generating products barcode/RFID for purchased products.
User Devices	Responsible of accessing the Internet.

When a user for example wants to purchase pizza online, he/she will do the following steps:

Step 1: The user will register/log in to online pizza website and select the desired pizza and beverages.
Step 2: When user complete all payment process, barcode server will generate unique barcode for the user. VM Location server will obtain user information (e.g. id, user location through GPS/through user registration in cloud) from Mobile device server.
Step 3: Vending Machine/cloud computing will estimate the distance between user and a nearby vending machine. Then it will send request communicate with vending machine through M2M server.
Step 4: Assuming that vending machine has a smart technology that allow it to start as soon as the user departure.
Step 5: When user arrive at vending machine, the user scan their barcode and receive the pizza on time.

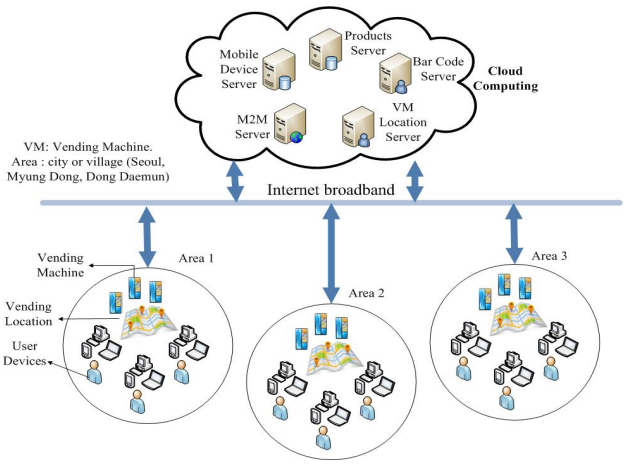

Fig.2 System Architecture

5. MapReduce Dataflow

In Fig 3, we introduce a conventional model of MapReduce which we use to search for desired information in a large scale of data (e.g. Big data). It consists of two steps: Map and Reduce. The run time system generates concurrent instances of map task which divide and process the entered data. Map tasks are copied to the reduce tasks where it reduce the middle results and produce the final result (Output). All the above data is stored as key/value pairs for efficient data indexing and partitioning [12]. When user surf the internet looking for product or any items, after the completion of selecting desired product, paying required payment, a request will be send to MapReduce to search products among 5.4 million vending machine (e.g. in case of being in Japan., etc). After receiving the required content, the information will be send to users. MapReduce will efficiently reduce the computation and provide fast results [12].

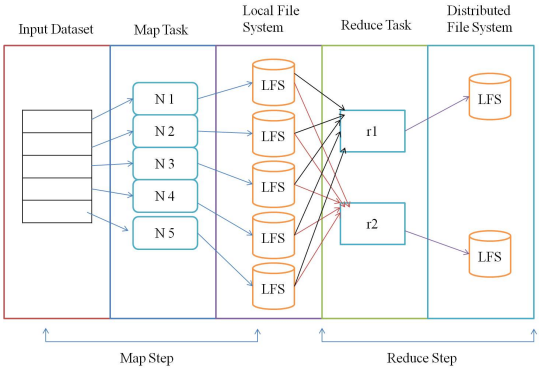

Fig 3.MapReduce Dataflow

6. Conclusion

In this paper we provide a Framework of Online Shopping Service based on M2M and IoT for Handheld Devices in Cloud Computing. We introduce our scenario and system architecture. We used M2M concept allowing device to talk to each other and obtain needed information using IoT concept. For searching a large scale of data and obtain necessary information, we used conventional MapReduce process. Our system will enable users to find a new method of searching online products as well as searching product in a nearby store or vending machine that has user's desired products. Finally providing user with a new way to enjoy online shopping as well as provide QoS and QoE for online shopper.

7. Future works

For future work we plan to implement the system and test it under a number of different well known MapReduce algorithms to get more test result to enhance performance of our system and provide satisfaction for online shoppers. We also plan to implement and test the efficient of our system in finding and processing large scale of data when more than one task are presented in the same time.

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