A Framework based on Mobile Cloud Computing with Live Agent

Kay Thi Yar
University of Computer Studies, Yangon
julysong777@gmail.com

Abstract

Together with an explosive growth of the mobile applications and emerging of cloud computing concept, mobile cloud computing (MCC) has been introduced to be a potential technology for mobile services. MCC integrates the cloud computing into the mobile environment and overcomes obstacles related to the performance such as battery life, storage, and bandwidth; environment such as heterogeneity, scalability, and availability; security such as reliability and privacy. This paper gives definition, architecture, applications of MCC and features of live agent. Moreover, the issues which are likely to arise in MCC are discussed. Afterwards, the future research directions of MCC are depicted. In this paper, the approach of live agent is proposed in order to cope with two of these research directions. With the effectiveness of MCC and the ability of Live Agent, a framework is presented to fulfill the following five kinds of service such as providing research data, weather information, product information, healthcare suggestions and educational advice.

Keywords: Mobile cloud computing, cloud computing, mobile services, live agent.

1. Introduction

Mobile devices are increasingly becoming an essential part of human life as the most effective and convenient communication tools not bounded by time and place. Mobile users accumulate rich experience of various services from mobile applications, which run on the devices and/or on remote servers via wireless networks. The rapid progress of mobile computing (MC) becomes a powerful trend in the development of IT technology as well as commerce and industry fields [5]. However, the mobile devices are facing many challenges in their resources (e.g., battery life, storage, and bandwidth) and communications (e.g., mobility and security). The limited resources significantly impede the improvement of service qualities. Cloud computing (CC) has been widely recognized as the next generation's computing infrastructure. CC offers some advantages by allowing users to use infrastructure (e.g., servers, networks, and storages), platforms (e.g., middleware services and operating systems), and software (e.g., application programs) provided by cloud providers (e.g., Google, Amazon, and Salesforce) at low cost. As a result, mobile applications can be rapidly provisioned and released with the minimal management efforts or service provider's interactions. With the explosion of mobile applications and the support of CC for a variety of services for mobile users, mobile cloud computing (MCC) is introduced as an integration of cloud computing into the mobile environment. Mobile cloud computing brings new types of services and facilities for mobile users to take full advantages of cloud computing. Section I describes introduction of this paper. Section II provides a brief overview of MCC including definition, architecture, and its advantages. Section III discusses the use of MCC

in various applications. Section IV presents several issues that arise in MCC. Then, the future research directions will follow in section V. Afterwards, the proposed framework based on live agent is explained in Section VI. Finally, this paper is summarized and concluded in section VII.

2. Overview of Mobile Cloud Computing and Live Agent

The term "mobile cloud computing" which was introduced not long after the concept of "cloud computing" launched in mid-2007. It has been attracting the attentions of entrepreneurs as a profitable business option that reduces the development and running cost of mobile applications, of mobile users as a new technology to achieve rich experience of a variety of mobile services at low cost, and of researchers as a promising solution for green IT [6]. The Mobile Cloud Computing Forum defines MCC as follows: "Mobile Cloud Computing at its simplest refers to an infrastructure where both the data storage and the data processing happen outside of the mobile device. Mobile cloud applications move the computing power and data storage away from mobile phones and into the cloud, bringing applications and mobile computing to not just smart phone users but a much broader range of mobile subscribers [8]. Aepona describes MCC as a new paradigm for mobile applications whereby the data processing and storage are moved from the mobile device to powerful and centralized computing platforms located in clouds [2]. These centralized applications are then accessed over the wireless connection based on a thin native client or web browser on the mobile devices.

2.1. Architectures of Mobile Cloud Computing

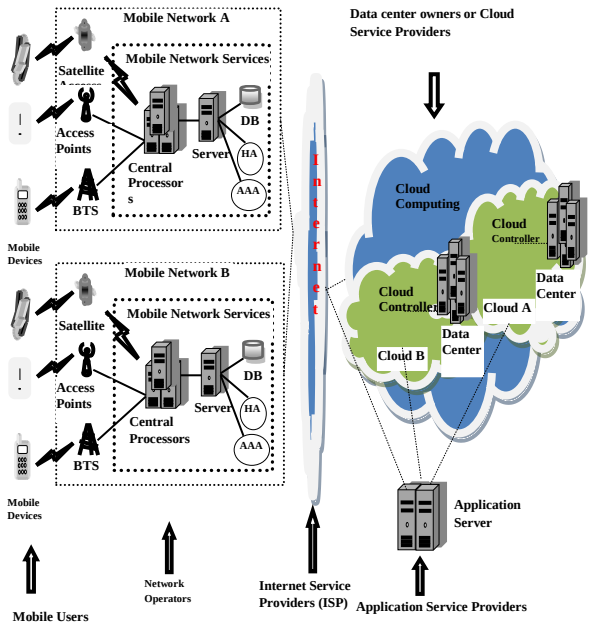

Figure 1. Architecture of Mobile Cloud Computing (MCC)

From the concept of MCC, the general architecture of MCC can be shown in Figure 1. In Figure 1, mobile devices are connected to the mobile networks via base stations (e.g., base transceiver station (BTS), access point, satellite) that establish and control the connections and functional interfaces between the networks and mobile devices. Mobile users' requests and information are transmitted to the central processors that are connected to servers providing mobile network services. Here, mobile network operators can provide services to mobile users as AAA (for authentication, authorization, and accounting) based on the home agent (HA) and subscribers' data stored in databases. After that, the subscribers' requests are delivered to a cloud through the Internet. In the cloud, cloud controllers process the requests to provide

mobile users with the corresponding cloud services. These services are developed with the concepts of utility computing, virtualization, and service-oriented architecture (e.g., web, application, and database servers). The details of cloud architecture could be different in different contexts. For example, four-layer architecture is explained in [3] to compare cloud computing with grid computing. An architecture for creating market-oriented clouds is presented and an architecture for web delivered business services is proposed. In this paper, we focus on a layered architecture of cloud computing as shown in Figure 2. This architecture is commonly used to demonstrate the effectiveness of the cloud computing model in terms of meeting the user's requirements [7].

Software as a Service (Microsoft's Live mesh)
Platform as a Service (Google App engine, Microsoft Azure)
Infrastructure as a Service (Amazon EC2, S3)

Figure 2. Service-oriented cloud computing architecture

Generally, a cloud computing is a large-scale distributed network system implemented based on a number of servers in data centers. The cloud services are generally classified based on a layer concept such as Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).

2.2. Advantages of Mobile Cloud Computing

Cloud computing is known to be a promising solution for mobile computing due to many reasons such as mobility, communication, and portability. In the following, how the cloud can be used to overcome obstacles in mobile computing is described and advantages of MCC are pointed out.

1. Extending battery lifetime: Battery is one of the main concerns for mobile devices. Several solutions have been proposed to enhance the CPU performance, to manage the disk and screen in an intelligent manner to reduce power consumption [1].

2. Improving data storage capacity and processing power: Storage capacity is also a constraint for mobile devices. MCC is developed to enable mobile users to store or access the large data on the cloud through wireless networks [9].

3. Improving reliability: Storing data or running applications on clouds is an effective way to improve the reliability since the data and application are stored and backed up on a number of computers [4].

2.3. Live Agent

Live Agent provides a secure, proven and scalable virtual contact centre to help the customer break free from the constraints of traditional contact centre models [11]. It combines the latest platform technology and applications with a flexible, well-distributed network of highly qualified agents. As a result, the customers can acquire many advantages such as lower costs, increased revenue, happiness and perfection. Live Agent is fully integrated with the Service Cloud, so there's nothing to install or set up and live agents will be chatting in any time. Live Agent is help desk and live chat software integrated into one powerful platform. It is real-time help desk optimized for efficiency and high performance. The role of Live Agent - Chat is to talk to the visitors and convert them into customers and then increase customer satisfaction. It can be used for live chat and real-time visitor monitoring. Live Agent - Helpdesk

can be used to manage company email communication, mail accounts, feedback and contact form requests, all in one place. Live Agent is simple and easy way to track, respond and solve the customer's issues and the best way to support the customers [10].

3. Applications of Mobile Cloud Computing

Mobile applications gain increasing share in a global mobile market. Various mobile applications have taken the advantages of MCC. In this section, some typical MCC applications are introduced.

1. Mobile Commerce

Mobile commerce (m-commerce) is a business model for commerce using mobile devices.

2. Mobile Learning

Mobile learning (m-learning) is designed based on electronic learning (e-learning) and mobility.

3. Mobile Healthcare

The purpose of applying MCC in medical applications is to minimize the limitations of traditional medical treatment.

4. Mobile Gaming

Mobile game (m-game) is a potential market generating revenues for service providers.

5. Other Practical Applications

A cloud becomes the most effective tool when mobile users require searching services such as keyword-based searching, voice-based searching, tag-based searching and popular social networks as Twitter and Facebook.

4. Issues of Mobile Cloud Computing

As discussed in the previous section, MCC has many advantages for mobile users and service providers. However, because of the integration of two different fields, i.e., cloud computing and mobile networks, MCC has to face many technical challenges. This section lists several research issues in MCC, which are related to the mobile communication and cloud computing.

A. Issues in Mobile Communication Side
- **1.** Low Bandwidth
- **2.** Availability
- **3.** Heterogeneity

B. Issues in Computing Side
- **1.** Computing Offloading
- **2.** Security
- **3.** Enhancing the Efficiency of Data Access
- **4.** Context-aware mobile cloud services.

5. Open Issues and Future Research Directions

This section presents several open issues and possible research directions in the development of MCC.

1. Low Bandwidth

Although many researchers propose the optimal and efficient way of bandwidth allocation, the bandwidth limitation is still a big concern. Therefore, 4G network and Femtocell are emerging as promising technologies

2. Network Access Management

An efficient network access management not only improves link performance for mobile users but also optimizes bandwidth usage.

3. Quality of Service

In MCC, mobile users need to access to servers located in a cloud when requesting services and resources in the cloud. The mobile users may face some problems that cause delays when users want to communicate with the cloud, so QoS is reduced significantly. Two new research directions are Clone Cloud and Cloudlets that are expected to reduce the network delay.

4. Pricing

Using services in MCC involves with both mobile service provider (MSP) and cloud service

provider (CSP). However, MSPs and CSPs have different services management, customers management, methods of payment and prices. Therefore, this will lead to many issues, i.e., how to set price, how the price will be divided among different entities, and how the customers pay.

5. Standard Interface

The current interface between mobile users and cloud are mostly based on the web interfaces. Web interface is not specifically designed for mobile devices. In the future, HTML5 is expected as a promising technique to address this issue.

6. Service Convergence

In some cases, a single cloud is not enough to meet mobile user's demands. Therefore, the new scheme is needed in which the mobile users can utilize multiple clouds in a unified fashion. One of the potential solution of this issue is the sky computing, which is a computing model where resources from multiple clouds providers are leveraged to create a large scale distributed infrastructure. To offer a service to mobile user in a unified way, the service integration called convergence would need to be explored.

6. Proposed Framework

With the increasing growth of using internet, internet marketing, running successfully business and searching useful information for users' specific needs are becoming a challenging task. In today's competitive online environment, users require real-time communications and expect prompt responses to their queries. Today's internet users tend to be more demanding and when visiting any website they imagine getting responsive and real-time assistance. Therefore, the features of live agent are combined with the ability of MCC to provide users' requested service completely and effectively in only one place and to increase user satisfactions dramatically without users' effort. With the help of cloud computing technology and the capability of live agent, the proposed framework is intended to implement the mobile applications for providing the following five kinds of service.

- Providing useful data for research candidates
- Providing weather information for specific regions and daily weather conditions
- Providing information for users' desired products
- Providing guidelines and suggestions for health care and given symptoms
- Providing advice for students who passed matriculation exam to choose suitable fields.

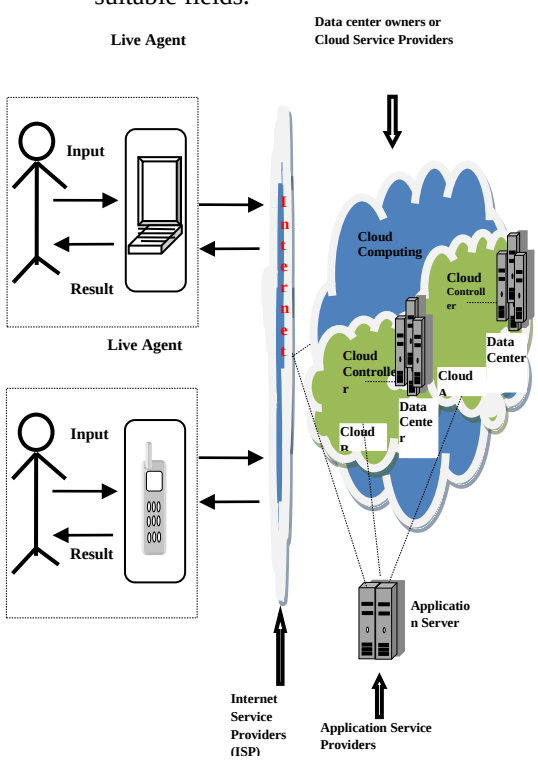

Figure 3. Architecture of Proposed System

For the above services, users need not to search related data for their specific needs because live agent provides necessary data on behalf of users. Consequently, the live agent will perform asking

information from the user and searching for the specified information from the cloud as shown in Figure 3. In order to accomplish these processes by the live agent, all the relevant data have to be stored in many servers on the cloud. After receiving searched keywords from the user, live agent searches the data related to the given keywords on the cloud severs. And then, live agent returns the result to the user. This result includes the information of the requested service and the charges of this service from various types of cloud. In other words, the live agent of this proposed system will effectively and efficiently provide the user to search for desired information, choose desired types of cloud and pay charges for their chosen cloud types in only one place. Two of future research directions such as pricing and service convergence known as mobile sky computing can be covered by using live agent. Accordingly, the proposed framework is a multi-purpose and cost-effective way to provide an excellent customer service around-the-clock and is suitable for small businesses as well as large corporations.

7. Conclusion

Mobile cloud computing is one of mobile technology trends in the future since it combines the advantages of both mobile computing and cloud computing, thereby providing optimal services for mobile users. According to a recent study by ABI Research, a New York-based firm, more than 240 million businesses will use cloud services through mobile devices by 2015. The applications supported by mobile cloud computing and issues have been discussed. Moreover, the future research directions have been outlined. Regarding with the issue of energy savings, the mobile cloud computing, which reduces the usage of electrical power, obviously leads to green computing. Finally, a framework based live agent has been proposed to work out two future research issues such as pricing and service convergence. With the effectiveness of Live Agent, the proposed system will offer a complete set of useful features; including a real-time information retrieval process, various reporting options, multi-chat sessions, multi-customer support operations, etc., along with advanced customization.

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