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A DISTRIBUTED MOBILE CLOUD COMPUTING ARCHITECTURE FOR THE MULTIMEDIA SERVICES OF CELLULAR (MOBILE) PHONE

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Abstract: Mobile cloud computing (MCC) is emerging as a new paradigm for supporting a broad range of multimedia services of cellular phone (mobile). MCC alleviates the burden of storage and computation on mobile devices. Mobile Cloud Computing (MCC) has revolutionized the way in which mobile subscribers across the globe leverage services on the go. The mobile devices have evolved from mere devices that enabled voice calls only a few years back to smart devices that enable the user to access value added services anytime, anywhere. MCC integrates cloud computing into the mobile environment and overcomes obstacles related to performance (e.g. battery life, storage, and bandwidth), environment (e.g. heterogeneity, scalability, availability) and security (e.g. reliability and privacy). In this article, we describe the design requirements and architecture for MCC. The novelty in this architecture is an integrated cloudlet and base station subsystem that can meet application-level quality of service requirements and allow mobile resource provisioning close to the user. We also propose a connection handoff mechanism among cloudlets and discuss related resource management challenges for MCC.

Keywords: Cloud Computing, Mobile Cloud Computing, Challenges in MCC, Research Areas in MCC

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INTRODUCTION

WHAT IS MCC?

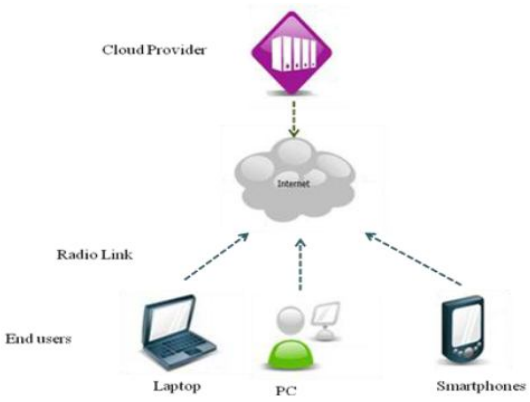

Figure 1:- Mobile Cloud Computing

Delivering cloud services in a mobile environment brings numerous challenges and problems. Mobile devices cannot handle complicated applications due to their innate characters. Also, it is impossible that a mobile device is always online, the offline solution of the device need be considered as well. The absence of standards, security and privacy, elastic mobile applications requirement may obstruct the development of Mobile Cloud Computing. In order to understand the challenges and provide further scope for research, an understanding of this novel approach is essential.

WHAT IS MCC Architecture?

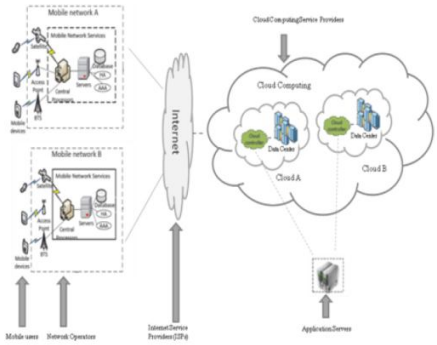

Figure 2:- Mobile Cloud Computing Architecture

The mobile devices are connected to the mobile networks through base stations that establish and control the connections (air interface) and functional interfaces between the networks and mobile devices. Mobile users' request and information are transmitted to the central

processors that are connected to the servers providing mobile network services. Here, services like AAA (Authentication, Authorization and Accounting) can be provided to the users based on Home Agent (HA) and subscribers data stored in databases. The subscribers' requests are then delivered to a cloud through the Internet. Cloud controllers present in the Cloud, process the requests to provide the mobile users with the corresponding cloud services. These services are developed based on the concepts of utility computing, virtualization and service-oriented architecture. The details of cloud computing will be different in different contexts. The major function of a cloud computing system is storing data on the cloud and using technology on the client to access that data. Some authors mentioned that Cloud Computing is not entirely a new concept. Cloud Computing has manifested itself as a descendent of several other computing areas such as Service-oriented Architecture, grid and distributed computing, and virtualization and inherits their advancements and limitations. They introduced Cloud Computing as a new paradigm in the sense that it presented a superior advantage over the existing under-utilized resources at the data centers. Several business models rapidly evolved to harness this technology by providing software applications, programming platforms, data-storage, computing infrastructure and hardware as services. Cloud is also introduced as a type of parallel and distributed system consisting of a collection of interconnected and virtualized computers that offer computing resources from service providers to customers meeting their agreed SLA (Service Level Agreement).

WHAT IS DISTRIBUTED CLOUD COMPUTING Architecture?

The rapid increase in the use of multimedia services and applications on mobile devices has led IT companies to evolve their technologies to cope with the multimedia requirements.

Cloud computing, which is a new

Content-centric paradigm can fulfill these requirements by providing data and computing resources on demand. It allows

Users to access infrastructure, platforms, and software at low cost. For example, Amazon provides its users personal storage spaces with Simple Storage Services (S3) and ability to perform extensive computation on the data using Elastic Compute Cloud (EC2). Likewise, Google's App Engine allows users to develop and deploy their applications on Google's platform.

On the user's side, the demand for mobile services is rapidly growing. It is expected that the number of mobile users will exceed 800 million by 2015. However, mobile devices have several limitations, such as short battery life, and limited storage and computation power. To address these limitations, mobile cloud computing (MCC) is presented as an integration of cloud

computing and mobile technology. MCC is defined as the infrastructure where both data storage and processing are offloaded from mobile devices to the cloud, bringing mobile applications a much broader range of users. MCC overcomes the limitations of mobile devices by moving the data processing and storage to the powerful platforms located in the cloud.

The objective of this article is to address the challenges of mobile services in terms of data management and networking, and develop an architecture that can lead to the design of MCC. In particular, our focus is on the retrieval and communication of pre or chestrated multimedia data, which imposes several resource management challenges on designing an MCC architecture. The main technical challenges are highlighted as follows,

• **Heterogeneous networks and QoS requirements:** Multimedia services may span multiple heterogeneous network protocols, such as second generation (2G), 3G, and Long Term Evolution (LTE), with different quality of service (QoS) requirements. Dynamic resource allocation protocols are needed to meet these.

• **Heterogeneous multimedia data:** Distributed mobile services such as video over IP, multimedia streaming, and photo sharing can consist of various types of data including video, audio, and images. Such data may have different delivery requirements that need to be synchronized to provide coherent information to mobile users. The proposed architecture entails multiple layers of functionality and addresses the QoS requirements and resource management challenges in terms of end-to-end delay, jitter, buffering, and bandwidth. A novel feature of this architecture is the integrated subsystem of cloudlet and base station, which provides a “close-to-the-user” proxy system functionality that ensures seamless delivery of data that meets QoS requirements. This functionality is achieved by dynamic allocation of resources, including buffers and radio frequency (RF) channels, synchronization of multiple streams, and seamless handoff of streams among base stations. In this article, we first present a cloud architecture for MMC and its components.

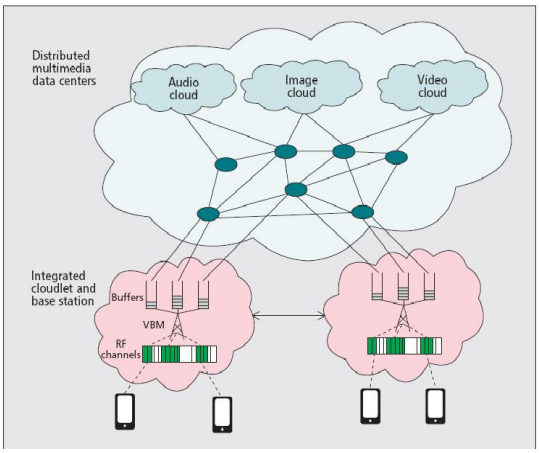

Figure 3:- Distributed Cloud Architecture for multimedia Services

In the above figure 3, we perceive a distributed multimedia cloud architecture for mobile users that consists of distributed multimedia data centers, and integrated cloudlet and base station. The proposed MCC supports this environment. It can be noted that MCC architecture has two major components; a set of distributed multimedia data centers and an integrated cloudlet and base station subsystem.

We assume that the data centers act as repositories for multimedia information. A multimedia data center in the cloud retrieves the requested data from the database and communicates it to the cloudlet over the Internet. The cloudlet then transmits the multimedia information to mobile users on the RF channels. The MCC architecture overcomes the high latency that results from the direct communication between a large number of mobile users and multimedia data centers. The cloudlet ensures QoS to mobile users by managing the interface between the Internet and the mobile network. It coordinates with allocation of RF resources through its local base station.

RESULT & DISCUSSION

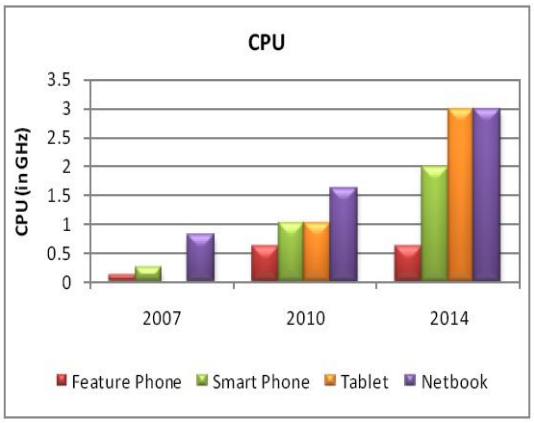

Figure 4(a):- Performance comparison of mobile and fixed devices

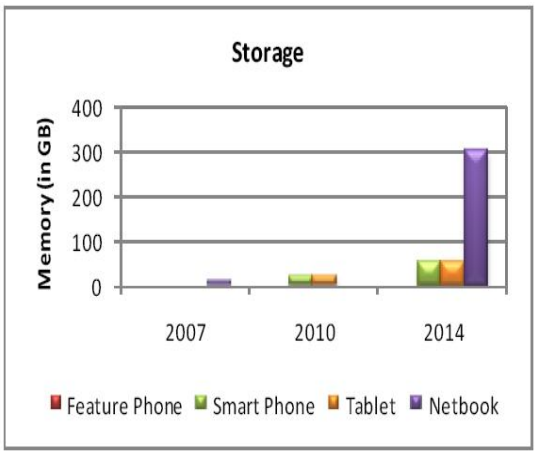

Figure 4(b):- Performance comparison of mobile and fixed devices

CONCLUSION

Mobile Cloud Computing, as a development and extension of Cloud Computing and Mobile Computing, is the most emerging and well accepted technology with fast growth. The combination of cloud computing, wireless communication infrastructure, portable computing devices, location-based services, mobile Web etc has laid the foundation for the novel computing model. In this paper we have given an overview of Mobile Cloud Computing that includes architecture, benefits, key challenges, present research and open issues.

In this article, we have proposed a novel mobile cloud computing architecture for supporting mobile multimedia applications and services in mobile networks. The key part of this architecture is the integrated cloudlet and base station subsystem

that provides a "close-to-the-user" proxy functionality and performs dynamic allocation of resources. In addition, we have presented a functional layered architecture that includes a set of functions and protocols to support multimedia applications and services. We have also presented the connection handoff mechanism among cloudlets and its related challenges. In addition, we have discussed prospective challenges in managing resources including buffer and RF channels.

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