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Research on Mobile Cloud Computing: Review, Application and Orientations

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Abstract - *This paper review current research effort work proceeding mobile Computing. Firstly we discuss about the mobile cloud computing, mobile computing, and cloud computing. After that discuss server challenges for the design of mobile cloud computing service. Second a model has been proposed to analyze related work. Third we inspection recent model cloud computing Architecture, application and future uses. Mobile Cloud Computing(MCC) which is combination of both mobile computing and cloud computing. Their main method involves creating virtual clones of smartphone execution environments on non-mobile computers and pushing task execution to these virtual devices.*

Key Words: **Mobile Computing, Cloud Computing, Virtualization, Mobility, plateform services**

1. INTRODUCTION

Mobile Cloud Computing(MCC) is the combination of cloud computing, mobile computing and wireless network to bring rich computational resources to mobile users, network operators as well as cloud computing provider. Its simplest refers to an infrastructure where both the data storage and data processing happen outside of the mobile device. Mobile cloud applications move the computing power and data storage away from the mobile devices and into powerful and centralized computing platforms located in the cloud, which are then accessed over the wireless connection based on a thin native client. In recent years, applications targeted at mobile devices have started becoming abundant with applications in various categories such as entertainment, health, games, business, social networking, travel and news. The concept of offloading data and computation in cloud computing, is used to address the inherent problems in mobile computing by using resource providers other than the mobile device itself to host the execution of mobile applications. Such an infrastructure where data storage and processing could happen outside the mobile device could be termed a 'mobile cloud'. According to the top ten strategic technology trends for 2012 [1] provided by Gartner (a famous global analytical and consulting company), cloud computing has been on the top of the list, which means cloud computing will have an increased impact on the enterprise and most organizations in 2012. MCC aims to augment computing capabilities of mobile devices, conserve local resources - especially battery, extend storage capacity, and enhance data safety to enrich the computing experience of mobile users. The goal of this paper is to discuss in detail the current research that addresses these issues. On one hand, to ensure that mobile devices adequately make best use of advantages of cloud computing to improve and extend their functions.

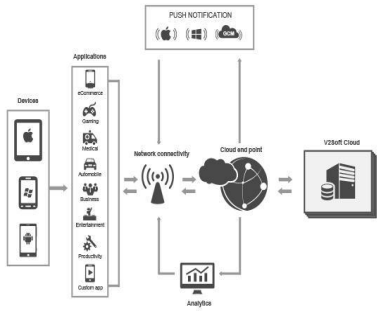

Fig. Mobile Cloud Computing

1.1 OVERVIEW OF MOBILE CLOUD COMPUTING

As a development and extension of Cloud Computing and Mobile Computing, Mobile Cloud Computing, as a new phrase, has been devised since 2009

1.1.1 Mobile Computing- Mobile Computing is a technology that allows transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link. Mobile computing involves mobile communication, mobile hardware, and mobile software. Communication issues include ad hoc network and infrastructure networks as well as communication properties, protocols, data formats and concrete technologies. Hardware includes mobile device or device components. Mobile software deals with the characteristics and requirements of mobile applications.

1.1.2 The features of mobile computing are as follows

a. **Mobility**: A device/person that moves between different geographical locations, networks and communication devices.
b. **Low reliability:** due to signals is susceptible to interference and snooping, a mobile computing network system has to be considered from terminals, networks, database platforms, as well as applications development to address the security issue.
c. **Mobile elements rely on a finite energy source**: While battery technology will undoubtedly improve over time, the need to be sensitive to power consumption will not diminish. Concern for power consumption must span many levels of hardware and software to be fully effective.
d. **Diversity of network conditions**: normally the networks using by mobile nodes are not unique, such networks can be a wired network with high-bandwidth, or a wireless Wide Area Network (WWAN) with low bandwidth or even in status of disconnected
e. **Autonomy**: A cloud system is an autonomic system, which automatically configures and allocates the resources of hardware, software and storage to clients-on-demand, and the management is transparent to end users.
f. **Usability and extensibility**: cloud computing provides a safe mode to store user's data while users do not worry about the issues such as software updating, leak patching, virus attacks and data loss.

1.2 Cloud Computing- Cloud computing has been designed for enterprises. The public cloud computing infrastructure that exists today may not be the perfect architecture to support mobile computing. Amazon is the biggest cloud in the cloud computing. Amazon has released its new "cloud-accelerated" Web browser Silk. Silk a "split browser" whose software resides both on Kindle Fire and EC2.In the era of PC, many users found that the PCs they bought 2 years ago cannot keep pace with the development of software nowadays; they need a higher speed CPU, a larger capacity hard disk, and a higher performance Operation System (OS). That is the magic of "Moores Law" which urges user upgrading their PCs constantly, but never ever overtaken the development of techniques. Thus, a term called "Cloud Computing" burst upon our lives. Cloud computing has become a well-known expression since 2007. The cloud computing system is the development of parallel processing, distributed and grid computing on the Internet, which provides various QoS guaranteed services such as hardware, infrastructure, platform, software and storage to different Internet applications and users.

1.2.1 Framework: cloud computing systems actually can be considered as a collection of different services, thus the framework of cloud computing is divided into three layers,

which are infrastructure layer, platform layer, and application layer.

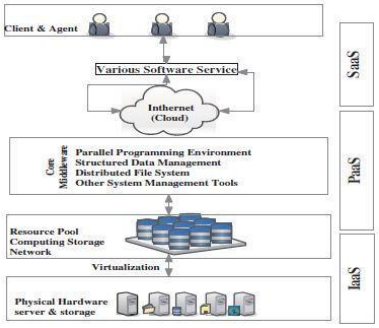

Fig.2: The Framework of cloud computing

1.2.2 Infrastructure as a service: Moving down the stack, we get to the fundamental building blocks for cloud services. IaaS is comprised of highly automated and scalable compute resources, complemented by cloud storage and network capability which can be self-provisioned, metered, and available on-demand. IaaS providers offer these cloud servers and their associated resources via dashboard and/or API. IaaS clients have direct access to their servers and storage, just as they would with traditional servers but gain access to a much higher order of scalability. Users of IaaS can outsource and build a "virtual data center" in the cloud and have access to many of the same technologies and resource capabilities of a traditional data center without having to invest in capacity planning or the physical maintenance and management of it. IaaS is the most flexible cloud computing model and allows for automated deployment of servers, processing power, storage, and networking. IaaS clients have true control over their infrastructure than users of PaaS or SaaS services. The main uses of IaaS include the actual development and deployment of PaaS, SaaS, and web-scale applications. Typically services in this layer such as Elastic Computing Cloud of Amazon [5].

1.2.3 Platform as a service: PaaS functions at a lower level than SaaS, typically providing a platform on which software can be developed and deployed. PaaS providers abstract much of the work of dealing with servers and give clients an environment in which the operating system and server software, as well as the underlying server hardware and network infrastructure are taken care of, leaving users free to focus on the business side of scalability, and the application development of their product or service. As with most cloud services, PaaS is built on top of virtualization technology[2]. Businesses can requisition resources as they need them, scaling as demand grows, rather than investing in hardware with redundant resources. Examples of PaaS providers include Heroku, Google App Engine, and Red Hat's OpenShift. The typical services are Google App Engine [6] and Azure from Microsoft [7].

1.2.4 SOFTWARE AS A SERVICE: In some ways, SaaS is very similar to the old thin-client model of software provision, where clients, in this case usually web browsers, provide the point of access to software running on servers. SaaS is the most familiar form of cloud service for consumers. SaaS moves the task of managing software and its deployment to third-party services. Among the most familiar SaaS applications for business are customer relationship management(CRM)[8] applications like Salesforce, productivity software suites like Google Apps, and storage solutions brothers like Box and Dropbox. Use of SaaS applications tends to reduce the cost of software ownership by removing the need for technical staff to manage install, manage, and upgrade software, as well as reduce the cost of licensing software.In some ways, SaaS is very similar to the old thin-client model of software provision, where clients, in this case usually web browsers, provide the point of access to software running on servers. SaaS is the most familiar form of cloud service for consumers. SaaS moves the task of managing software and its deployment to third-party services. Among the most familiar SaaS applications for business are customer relationship management applications like Salesforce, productivity software suites like Google Apps, and storage solutions brothers like Box and Dropbox.

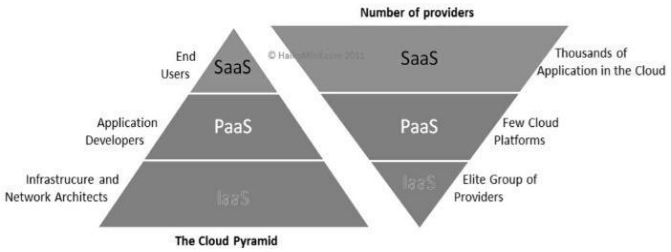

Fig3. Hierarchy of services

2. **Virtualization**: The "Cloud" can be considered as a virtual resource pool [4] where all bottom layer hardware devices is virtualized. End users access desired resources through a browser and get data from cloud computing providers without maintaining their own data centers. Furthermore, some virtual machines (VMs) are often installed in a server in order to improve the efficiency to use resources; and such VMs support load migration when there is a server over-load.

2.1 Full Virtualization: Used with full virtualization is a hypervisor such as VMware's vSphere Hypervisor or Microsoft's Hyper-V server. This hypervisor allows multiple operating systems to run simultaneously on a host computer, while also monitoring the physical server's resources and keeping each virtual server independent of other virtual servers running on the physical machine. Each guest server can run on its own operating system, such as both Linux and Windows.

2.2 Para Virtualization: The Para-virtualization technique offers a software interface to virtual machines that is similar, but not identical to underlying hardware. Unlike full server virtualization, guest servers are aware of one another when using Para-virtualization. A Para-virtualization hypervisor does not need large amounts of processing power to manage guest operating systems because of this, as each OS is already aware of the demands placed on the physical server.

2.3 OS level Virtualization: In contrast to Para-virtualization and full virtualization, OS level virtualization does not use a hypervisor at all. Instead, this approach allows the host to perform all aspects of a fully virtualized hypervisor. Each virtual server is independent of one another, but can have mixed operating systems. As guest servers must remain the same OS, this is called a homogeneous environment.

3. Why mobile cloud computing?

3.1 Mobile devices face many resources challenges(battery life, storage, bandwidth etc)

3.2 Cloud computing offers advantages to users by allowing them to use infrastructure platforms and software by cloud providers at low cost and elastically in on demand fashion.

3.3 Mobile cloud computing provides mobile users with data storage and processing services in clouds, obviating the need to have a powerful device configuration (e.g. CPU speed, memory capacity etc), as all resource-intensive computing can be performed in the cloud.

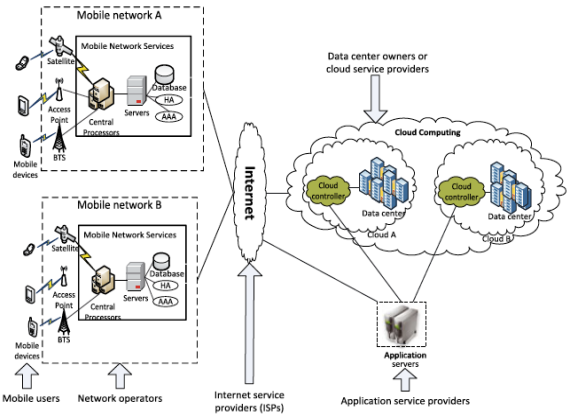

Fig4. MCC Architecture

3.4 MCC Popularity-According to a recent study by ABI Research, more than 240 million business will use cloud services through mobile devices by 2015.

Table 1.Challenges and Solutions of Mobile Cloud Computing[9]

Challenges	Solutions
Limitations of mobile devices	Virtualization and Image, Task migration
Quality of communication	Bandwidth upgrading, Data delivery time reducing
Division of applications services	Elastic application division mechanism

4. Advantages of Mobile Cloud Computing

Mobile cloud applications move the computing power and data storage away from mobile phones and into the cloud, bringing apps and mobile computing to not just smart phone users but a much broader range of mobile subscribers [3].

I. Mobile Cloud Computing will help to overcome limitations of mobile devices in particular of the processing power and data storage.

II. Mobile Cloud Computing can increase security level for mobile devices achieved by a centralized monitoring and maintenance of software, It can also become a one-stop shopping option for users of mobile devices since Mobile Cloud Operators can simultaneously act as virtual network operators, provide e-payment services, and provide software, data storage, etc. as a services.

5. Conclusion and Future work

Today's mobile applications are demanding compute intensive capabilities such as speech recognition, natural language processing, computer vision and graphics, machine learning, augmented reality, planning and decision making. The ultimate goal of MCC is to provide rich mobile computing through seamless communication between front-users (cloud-mobile users) and end-users (cloud providers) regardless of heterogeneous, wireless environments and underlying platforms in global Roaming. In this paper, empowering mobile users, mobile computing will be able to break free of the fundamental constraints that have been keeping us from transform many areas of human activity. We conclude that there are some main optimization approaches in MCC, which are focusing on the limitations of mobile devices, quality of communication, and cloud services, Standard Interface, Quality of service, Security & privacy Issues. Deploying an effective elastic application division mechanism is deemed to be the best solution to guarantee the application service in MCC; its complicated, but promising high impact results.

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