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Mobile Cloud Computing In Institution: Views and Issues

Sheela D. V. [1] and DivyaShree D. [2]
Asst. Professor, Computer Science Department
Soundarya Institute of Management and Science,
Soundarya Nagar, Sidedahalli, Nagasandra Post, Bangalore – 73

ABSTRACT

Cloud integrated mobile application provides the functions for building a virtual environment for the next generation of institution. The effect of mobile cloud computing on the traditional M-Learning gives the necessary solutions on the development of information and communication technology (ICT) which has global trend with Internet broadband connectivity and rich education. Therefore, there is a need to redesign the educational system to meet the need better. Mobile cloud computing provides a solution to academic institutions for their browser-based applications which can be accessed through mobile devices in addition to being available to a variety of laptop and desktop computers, provided internet access is available. Mobile application provide great accessibility for learning and teaching as now a days, every person is using hand held devices for various tasks but it faces some issues. By incorporating cloud computing in mobile ICT will give lots of advantage for institution with lower cost and high benefits.

KEYWORDS: Mobile Computing, ICT, MCC, M-Learning, Cloud Computing

1.1 INTRODUCTION

At present, most of the conservative education forms are becoming not being suitable for requirements of social progress and educational development and not being able to catch up with the changes of learning demand in time, thus computer networks have brought opportunities for it. One of the most promising paradigms for education is M-learning. M-learning is commonly referred to the intentional use of networked information and communications technology (ICT) in teaching and learning. Some other terms are also used to describe this mode of teaching and learning including online learning, virtual learning, distributed learning, network and web-based learning can replace cumbersome resources such as textbooks, visual aids, and presentation technology. Mobile Cloud Computing is a new paradigm that provides an appropriate pool of computing resources with its dynamic scalability and usage of virtualized resources as a service through the Internet. The resources can be network servers, applications, platforms, infrastructure segments, Wifi and mobile devices. In integration of m-learning and network, emphasis is

placed on building of software and hardware platform of m-learning system, functional structure, network security management and training, information technology integration to teaching, campus network environment, online education, semantic web technologies-based multi-agent system. Mobile Cloud computing applications provide flexibility for educational universities, schools and institutions. The mobile and cloud platform in institutions campuses provides effective infrastructure and deployment model for their dynamic demands. The benefits of mobile cloud computing can support education institutions to resolve some of the common challenges such as cost reduction, quick and effective communication, security, privacy, flexibility and accessibility.

1.2 MOBILE COMPUTING

Mobility has become a very popular word and rapidly increasing part in today's computing area. An incredible growth has appeared in the development of mobile devices such as, Smartphone, PDA, GPS Navigation and laptops with a variety of mobile computing, networking and security technologies. In addition, with the development of wireless technology like WiMax, Ad Hoc Network and WIFI, users may be surfing the Internet much easier but not limited by the cables as before. Thus, those mobile devices have been accepted by more and more people as their first choice of working and entertainment in their daily lives. So, what is Mobile computing exactly? In Wikipedia, it is described as a form of human-computer interaction by which a computer is expected to be transported during normal usage. Mobile computing is based on a collection of three major concepts: hardware, software and communication. The concepts of hardware can be considered as mobile devices, such as Smartphone and laptop, or their mobile components. Software of mobile computing is the numerous mobile applications in the devices, such as the mobile browser, anti-virus software and games. The communication issue includes the infrastructure of mobile networks, protocols and data delivery in their use. They must be transparent to end users. [1]

1) Features: The features of mobile computing are as follows

a) Mobility: Mobile nodes in mobile computing network can establish connection with others, even fixed nodes in wired network through Mobile Support Station (MSS) during their moving.

b) 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.

c) Frequent disconnection and consistency: as the limitation of battery power, charge of wireless communication, network conditions and so on, mobile nodes will not always keep the connection, but disconnect and consistent with the wireless network passively or actively.

d) Dis-symmetrical network communication: servers and access points and other MSS enable a strong send/receive ability, while such ability in mobile nodes is quite weak comparatively. Thus, the communication bandwidth and overhead between downlink and uplink are discrepancy.

e) 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.

1.3 CLOUD COMPUTING

In the era of Mobile phones, many users found that the mobiles they bought 2 years ago cannot keep pace with the development of software nowadays; they need a higher speed processor, a larger capacity memory, and a higher performance Operation System (OS). That is the magic of Moore's Law which urges user upgrading their mobiles constantly, but never ever overtaken the development of techniques. Thus, a term called Cloud Computing burst upon our lives. Cloud Computing has become a popular phrase since 2007. However, there is no consensual definition on what a Cloud Computing or Cloud Computing System is, due to dozens of developers and organizations described it from different perspectives. C. Hewitt [2] introduces that the major function of a cloud computing system is storing data on the cloud servers, and uses of cache memory technology in the client to fetch the data. Those clients can be PCs, laptops, Smartphone and so on. R. Buyya [3] gives a definition from the perspective of marking that cloud computing is a parallel and distributed computing system, which is combined by a group of virtual machines with internal links. Such systems dynamically offer computing resources from service providers to customers according to their Service level Agreement

(SLA). However, some authors mentioned that cloud computing was not a completely new concept. L. Youseff [4] from UCSB argue that cloud computing is just combined by many existent and few new concepts in many research fields, such as distributed and grid computing, Service-Oriented Architectures (SOA) and in virtualization. In this paper, we consider the cloud computing is a large scale economic and business computing paradigm with virtualization as its core technology. 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) 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. Internet (Cloud) Physical Hardware server & storage Resource Pool Computing Storage Network Virtualization Parallel Programming Environment Structured Data Management Distributed File System Other System Management Tools Core Middleware Client & Agent IaaS, PaaS Various Software Service SaaS.

a) Infrastructure layer: it includes resources of computing and storage. In the bottom layer of the framework, physical devices and hardware, such as servers and storages are virtualized as a resource pool to provide computing storage and network services users, in order to install operation system (OS) and operate software application. Thus it is denoted as Infrastructure as a Service (IaaS). Typically services in this layer such as Elastic Computing Cloud of Amazon [5].

b) Platform layer: this layer is considered as a core layer in the cloud computing system, which includes the environment of parallel programming design, distributed storage and management system for structured mass data, distributed file system for mass data, and other system management tools for cloud computing. Program developers are the major clients of the platform layer. All platform resources such as program testing, running and maintaining are provided by the platform directly but not to end users. Thus, this type of services in a platform layer is called Platform as a Service (PaaS). The typical services are Google App Engine [6] and Azure from Microsoft [7]. c) Application layer: this layer provides some simple software and applications, as well as costumer interfaces to end

users. Thus we name this type of services in the application layer as Software as a Service (SaaS). Users use client software or a browser to call services from providers through the Internet, and pay costs according to the utility business model (like water or electricity) [8]. The earliest SaaS is the Customer Relationship Management (CRM) [9] from Salesforce, which was developed based on the force.com (a PaaS in Salesforce). Some other services provided by Google on-line office such as documents, spreadsheets, presentations are all SaaS.

2) Features: the features of Cloud Computing are as follows:

a) Virtualization: the 'Cloud' can be considered as a virtual resource pool [10] 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 centres. 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.

b) Reliability, 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. If failure happens on a server or VM, the cloud computing systems transfer and backup those data to other machines, and then delete those failure nodes from the systems automatically in order to make sure the whole system has normal operation [11]. Meanwhile, cloud can be extended from horizontal and vertical [12] in a large-scale network, to process numerous requests from thousands of nodes and hosts.

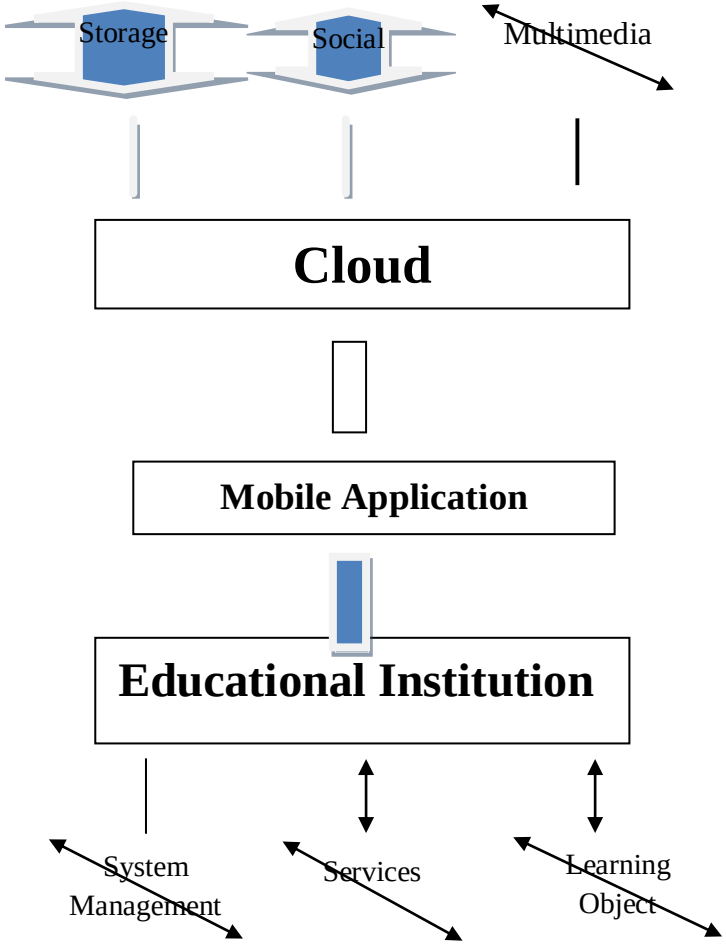
c) Large-scale: in order to possess the capability of supercomputing and mass storage, a cloud computing system normally consists of thousands of servers and PCs. Google Cloud Computing, for example, has already controlled 2% of all servers or about 1 million servers located in two hundred different places in the world, and will move upward to 10 million servers in the next decade[13].

d) 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.

3) Challenges: First of all, cloud computing needs an improved mechanism to provide a safe and high efficiency service as the numerous invoked third-party software and infrastructures are implementing in computing. In addition, due to data centers of resource using a mass of electricity, efficient resource scheduling strategy and methods are required in order to save energy. Furthermore, as a Service Level Agreement (SLA) is established between users and service providers in cloud computing, so the performance and analysis of services are necessary to be monitored. Last but not least, simple and convenient application interfaces are indispensable for service providers in cloud computing, thus a uniform standard is required eagerly.

1.4 MOBILE CLOUD COMPUTING M-LEARNING ARCHITECTURE

The M-learning cannot completely replace teachers; it is only an updating for technology, concepts and tools, giving new content, concepts and methods for education, so the roles of teachers cannot be replaced. The teachers will still play leading roles and participate in developing and making use of M-learning cloud. The blended learning strategy should improve the educational act. Moreover, the interactive content and virtual collaboration guarantee a high retention factor. On the other hand, M-learning cloud is a migration of mobile and cloud computing technology in the field of m-learning, which is a future m-learning infrastructure, including all the necessary hardware and software computing resources engaging in m-learning. After these computing resources are virtualized, they can be afforded in the form of services for educational institutions, students and businesses to rent computing resources. The proposed M-learning cloud architecture can be divided into the following layers: Infrastructure layer as a dynamic and scalable physical host pool, software resource layer that offers a unified interface for M-learning developers, resource management layer that achieves loose coupling of software and hardware resources, service layer, containing three levels of services (software as a service, platform as a service and infrastructure as a service), application layer that provides with content production, content delivery, virtual laboratory, collaborative learning, assessment and management features.



1) Infrastructure layer: is composed of information infrastructure and teaching resources. Information infrastructure contains Internet/Intranet, system software, information management system, some common software and hardware and mobile device; teaching resources is accumulated mainly in traditional teaching model and distributed in different departments and domain. This layer is located in the lowest level of cloud service middleware, the basic computing power like physical memory, CPU, memory is provided by the layer. Through the use of virtualization technology, physical server, storage and network form virtualization group for being called by upper software platform. The physical host pool is dynamic and scalable, new physical host can be added in order to enhance physical computing power for cloud middleware services

2) Software resource layer: mainly is composed by operating system and middleware. Through middleware technology, a variety of software resources are integrated to provide a unified interface for software developers, so they can easily develop a lot of applications based on software resources and embed them in the cloud, making them available for cloud computing users.

3) Resource management layer: is the key to achieve loose coupling of software resources and hardware resources. Through integration of virtualization and cloud computing scheduling strategy, on-demand free flow and distribution of software over various hardware resources can be achieved.

4) Service layer: has three levels of services namely, SaaS (Software as a service), Paas (Platform as a service), IaaS (Infrastructure as a service). In SaaS, cloud computing service is provided to customers. As is different from traditional software, users use software via the Internet, not to need a one-time purchase for software and hardware, and not to need to maintain and upgrade, simply paying a monthly fee.

5) Application layer: is the specific application of integration the teaching resources in the cloud computing model, including interactive courses and sharing the teaching resources. The interactive programs are mainly for the teachers, according to the learners and teaching needs, taken full advantage of the underlying information resources after finishing made, and the course content as well as the progress may at any time adjust according to the feedback, and can be more effectiveness than traditional teaching. Sharing of teaching resources include teaching material resources, teaching information resources (such as digital libraries, information centers), as well as the full sharing of human resources. This layer mainly consists of content production, educational objectives, content delivery technology, assessment and management component.

1.5 KEY BENEFITS OF MOBILE CLOUD COMPUTING BASED M-LEARNING.

There are numerous advantages when the m-learning is implemented with the cloud computing technology, they are:

1) Low cost: m-Learning users need not have high end configured mobile to run the m-learning applications. They can run the applications from cloud through their mobile phones, tablet PC having minimum configuration with internet connectivity. Since the data is created and accessed in the cloud, the user need not spend more money for large memory for data storage in local machines. Organizations also need to pay per use, so it's cheaper and need to pay only for the space they need.

2) Improved performance: Since the mobile and cloud based m-learning applications have most of the applications and processes in cloud, client machines do not create problems on performance when they are working.

3) Instant software updates: Since the mobile and cloud based application for m-learning runs with the cloud power, the mobile software's are automatically updated in cloud source. So, always m-learners get updates instantly.

4) Improved document format compatibility: Since some file formats and fonts do not open properly in some mobile phones, the cloud powered m-learning applications do not have to worry about those kinds of problems. As the cloud based m-learning applications open the file from cloud.

5) Benefits for students: Students get more advantages through cloud based m-learning. They can take online courses, attend the online exams, get feedback about the courses from instructors, and send their projects and assignments through online to their teachers.

6) Benefits for teachers: Teachers also get numerous benefits over mobile and cloud based m-learning. Teachers are able to prepare online tests for students, apps to deal and create better content resources for students through content management, assess the tests, homework, projects taken by students, send the feedback and communicate with students through online forums.

7) Data security: A very big concern is related to the data security because both the software and the data are located on remote servers that can crash or disappear without any additional warnings. Even if it seems not very reasonable, the cloud computing provide some major security benefits for individuals and companies that are using/developing m-learning solutions.

1.6 ISSUES

Mobile cloud computing has the potential for improving the efficiency, cost and convenience for the universities and educational sectors, but it has few limitations such as;

1) Not all application runs on cloud

2) Risk related to data protection and security and its integrity

3) Organizational support

4) Dissemination politics, intellectual property

5) Security and protection of sensitive data

6) Maturity of solutions

7) Lack of confidence

8) Standard adherence

9) Signal disturbance

10) Security, hand-off delay, limited power, low computing ability.

11) The Quality of Service (QoS) in mobile computing network is much easier to be affected by the landforms, weather and buildings.

1.7 CONCLUSION

This paper describes the Mobile Cloud Computing which is a hybrid model that is combination of Mobile devices accessing the services that are remotely available on the cloud. It is becoming the active research field, due to excessive usage of mobile devices by large amount of individuals and cloud computing by much organization is in initial stage. In this paper we focus on the today's most important field MCC as the demand of mobile devices are increasing. Present economic situation will force different educational institutions and organizations to consider adopting a cloud solution. Universities have begun to adhere to this initiative and there are proofs that indicate significant decreasing of expenses due to the implementation of cloud solutions. The aim of our work was to identify an architecture which will be using Mobile Cloud Computing based M-learning within higher education. Mainly, we have considered the benefits of mobile cloud architecture. Future research will include a study regarding the attitude and strategy for migration to the proposed architecture based on mobile clouds.

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