

On Mobile Cloud Computing in a Mobile Learning System

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Abstract:

In the recent years, the nature of the Internet was constantly changing from a place used to read web pages to an environment that allows end-users to run software applications. Interactivity and collaboration have become the keywords of the new web content. This new environment supports the creation of a new generation of applications that are able to run on a wide range of hardware devices, like Mobile Phones or Personal Digital Assistants (PDAs) and this development gives rise to Mobile Cloud Computing. Mobile Cloud Computing at its simplest refers to an infrastructure where both the data storage and the data processing take place 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 smartphone users but a much broader range of mobile subscribers.

In this work, Mobile learning system is designed based on electronic learning (e-learning) and mobility, within the context of mobile cloud computing. However, traditional m-learning applications have limitations in terms of high cost of devices and network, low network transmission rate, and limited educational resources; this cloud-based -learning application is introduced to solve these limitations. A mobile website is developed as well as a mobile application, this services which will be offered free, which will then gather relevant information in relation to the individuals' topic of interest from a database located on a remote server and also web-links gotten from the cloud (internet) to expand the knowledge and understanding of the individual in the area of interest.

Keyword: Cloud Computing, Mobile Learning System, Mobile Devices

1. Introduction

Cloud Computing is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the internet). It exists when tasks and data are kept on the internet rather than on individual devices, providing on-demand access. Applications are run on a remote server and then sent to the user.

Mobile-learning happens when people are away from their offices or classrooms. On the way back home from school or office, most people prefer to listen to music, the radio news, or sports programs. When they get home, if they want to learn, mobile devices are not likely to be their main choice. The more likely choices would be DVD/CD Players, videotapes, computers installed with learning software or computers with high speed access to the Internet for e-learning. Mobile phones will mainly be used for communications with other people, not for learning purposes. M-learning does not replace traditional learning, but is just another way of learning using a new technology. Most mobile phones have a small memory and storage capacity in mobile phones, which limits the length of emails, the opening of attachments, and the use of tabs or multiple windows.

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.

2. Design 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.

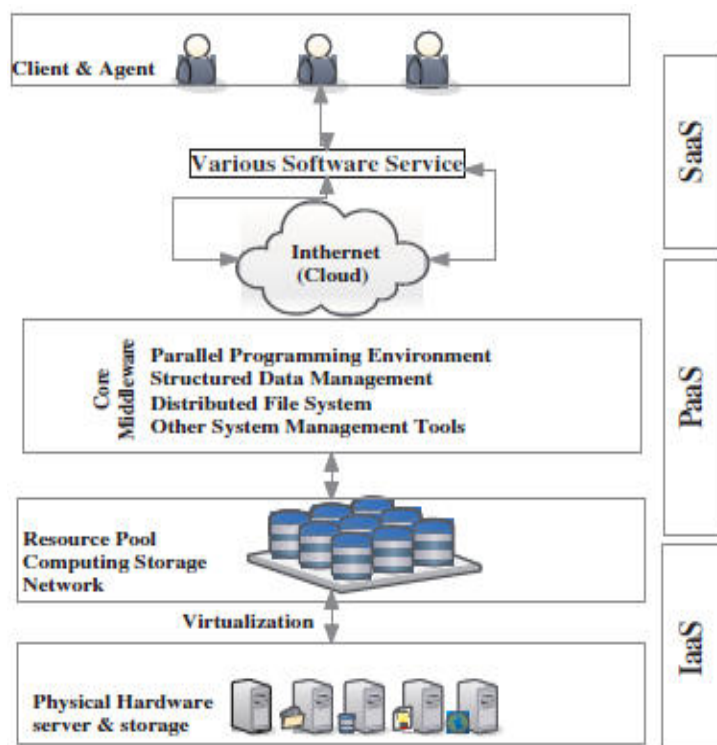


Figure1: The Framework of Cloud Computing (Source: S. Shankar, 2009).

2.1 Mobile Cloud Computing

Nowadays, both hardware and software of mobile devices get greater improvement than before, some smartphones such as iPhone 4S, Android serials, Windows Mobile serials and Blackberry, are no longer just traditional mobile phones with conversation, SMS, Email and website browser, but are daily necessities to users. Meanwhile, those smartphones include various sensing modules like navigation, optics, gravity, orientation, and so on which brings a convenient and intelligent mobile experience to users. In 2010, Google CEO Eric Schmidt described mobile cloud computing in an interview that 'based on cloud computing service development, mobile phones will become increasingly complicated, and evolve to a portable super computer. In the face of various mobile cloud services provided by Microsoft, Apple, Google, HTC, and so on, users may be confused about what mobile cloud computing exactly is, and what its features are. 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.

2.2 Concepts and Principle

The mobile cloud computing is a development of mobile computing, and an extension to cloud computing. In the previous mobile device-based intensive computing, data storage and mass information processing have been transferred to 'cloud' and thus the requirements of mobile devices in computing capability and resources have been reduced, so the developing, running, deploying and using mode of mobile applications have been totally changed. On the other hand, the terminals which people used to access and acquire cloud services are suitable for mobile devices like smartphone, PDA, Tablet, and iPad but not restricted to fixed devices (such as PC), which reflects the advantages and original intention of cloud computing. Therefore, from both aspects of mobile computing and cloud computing, the mobile cloud computing is a combination of the two technologies, a development of distributed, grid and centralized algorithms, and have broad prospects for application. Mobile cloud computing can be simply divided into cloud computing and mobile computing.

Those mobile devices can be laptops, PDA, smartphones, and so on which connects with a hotspot or base station by 3G, WIFI, or GPRS. As the computing and major data processing phases have been migrated to 'cloud', the capability requirement of mobile devices is limited, some low-cost mobile devices or even non-smartphones can also achieve mobile cloud computing by using a cross-platform mid-ware. Although client in mobile cloud computing is changed from

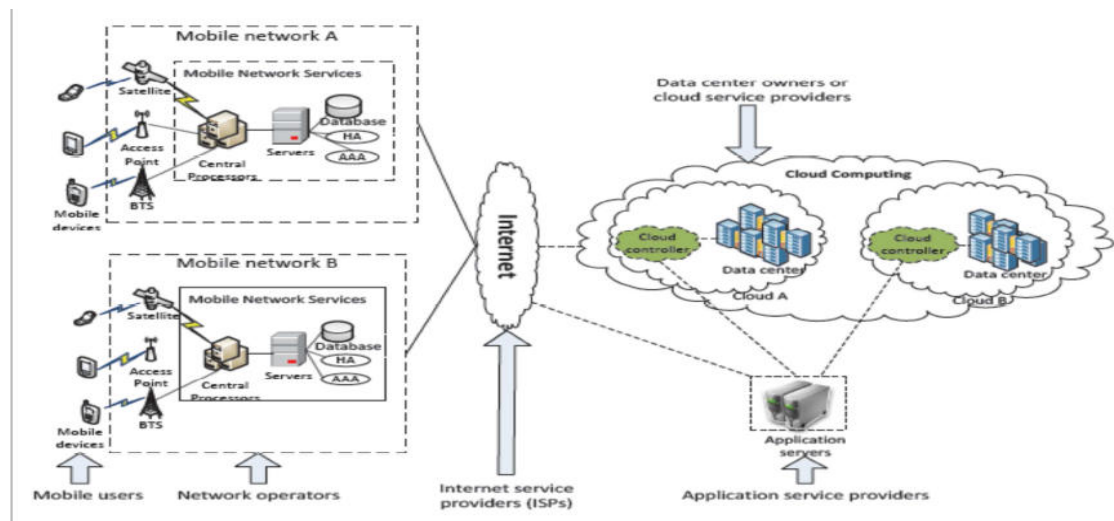


Figure 2: General Mobile Cloud Computing Architecture (Source: Hoang T. Dinh, Chonho Lee, Dusit Niyato, and Ping Wang, 2011).

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.

3. Mobile Learning (M-Learning)

'The success of mobile learning will ultimately revolve around a mosaic of rich converged experiences. These experiences will rest, in turn, on a foundation of converged network and device technologies, wireless services, rights management, content management, search management, and transactional processing power.' (Wagner, 2005). In some respects, this is perceived as a revolution of 'just-in-time' and 'just-for-me' information delivery; however, the employment of mobile devices will be far from a panacea for the problems currently faced in education unless implementations of m-learning take heed of lessons 'e-learned' (Wagner, 2005).

Learning models, and more specifically the effectiveness of various learning methods and techniques, have been studied for decades. Exploring the different learning styles, expected training outcomes, and forms of instruction are important components of evaluating these models. In many situations, especially those involving military personnel or first responders, providing instruction or training that can be accessed on the go is essential. These end users often need information that can be updated regularly and accessed anytime. For example, immediate access to training content, real-time intelligence and operational data on a portable device can provide first responders a significant advantage when accomplishing their mission. The "mobile" in "mobile learning" has two implications:

- **Learner mobility:** learners are able to engage in educational activities without the constraints of having to do so in a tightly delimited physical location. To a certain extent, learning can happen outside a classroom or in various locations, requiring nothing more than the motivation to do so wherever the opportunity arises – from books, electronic resources, places and people.
- **Mobile devices:** portable, lightweight devices that are sometimes small enough to fit in a pocket or in the palm of one's hand. Typical examples are mobile phones, smartphones (like the iPhone), palmtops, and handheld computers like the iPad or PDAs (Personal Digital Assistants); Tablet PCs, laptop computers and personal media players like the iPod can also fall within its scope. These devices can be carried around with relative ease and used for communication and collaboration, and for teaching and learning activities that are different from what is possible with other media.

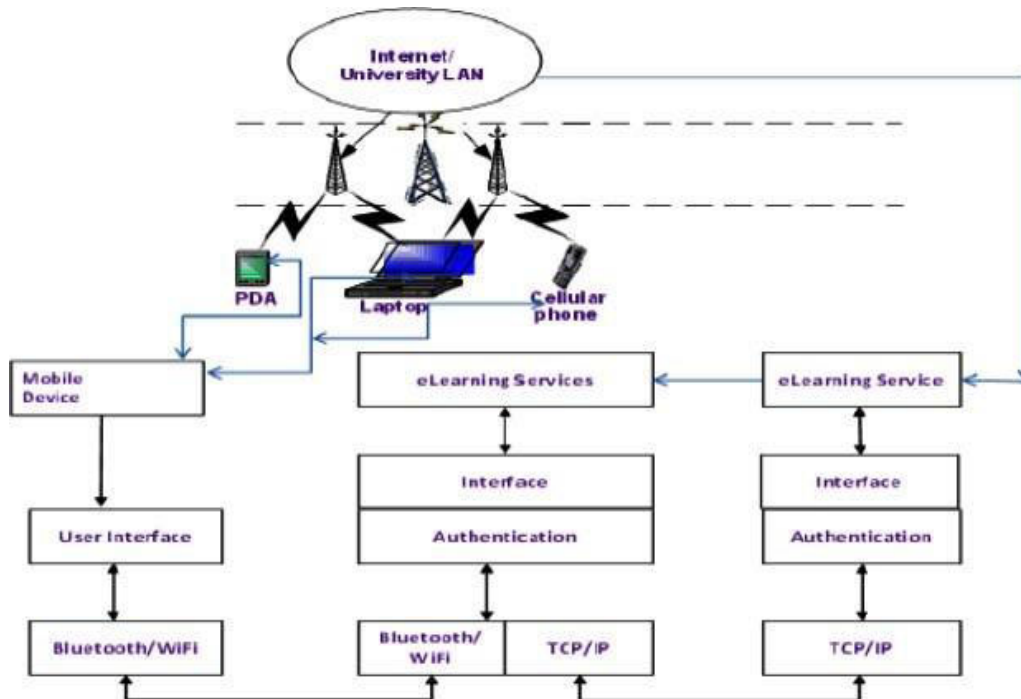


Figure 3: Architecture for Cloud based m-learning (Abu Taha Zamani, 2014).

4.0 Design Methodology

One of the popular ways of accessing learning information from the internet asides using the inbuilt mobile web browser is mobile applications, and for this mobile applications to be developed by application developers, the use of cloud computing comes in, because in using mobile applications that interact with the web, a user searches for a learning information or clicks on a content of choice in the application and information is displayed to the user.

5.0 Results and Discussion

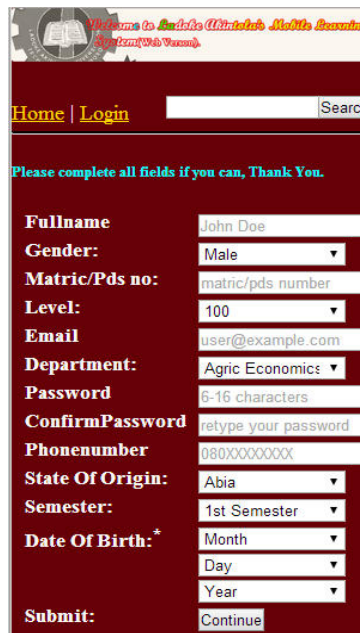
The developed models were implemented using Html, Php, Mysql, Ajax for the mobile website and Java for the mobile application (see appendix for codes). The model is developed in such a way that a user has to register on the mobile website to be able to use the full functions on the mobile application, but on the interest of the user, if he/she wishes to use the mobile application service, which is accessible on the mobile website. The mobile website offers three major components which relates to every cloud computing technique. They are Reading, composing and commenting on articles, Downloading material resources, For logged in users, access to read current semester courses.



Figure 4: Interface of the mobile website (lautechmls.net78.net)

4.1 Registration Process

Users are expected to register in order to have full access to the resources. Un-registered users have limited access to the resources such as reading of articles alone and downloading materials of their choice. When a user registers, they are expected to supply their names, level, matric number, email, phone number, current semester, and password for security.



The registration form includes the following fields and options:

- Fullname: John Doe
- Gender: Male
- Matric/Pds no: matric/pds number
- Level: 100
- Email: user@example.com
- Department: Agric Economics
- Password: 6-16 characters
- Confirm Password: retype your password
- Phonumber: 080XXXXXXX
- State Of Origin: Abia
- Semester: 1st Semester
- Date Of Birth: Month, Day, Year
- Submit: Continue

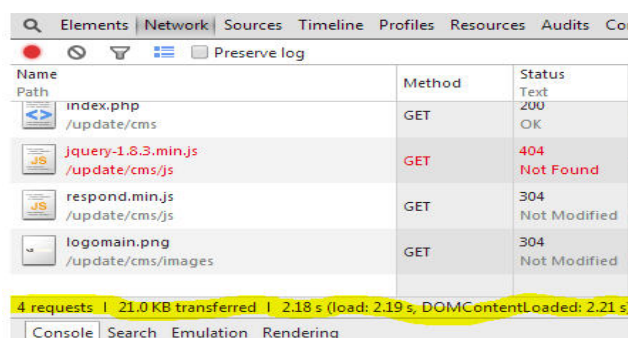
Figure 5 The registration webpage.

4.3 Student Settings

This is one of the major functions of the whole model, students visit to learn what they wish to learn, if the resources they have aren't sufficient enough. As explained before, student registers, and on registration they enter their level and current semester, that information is then processed which outputs the courses for that semester for the student and for their level. A student can change their information in their control panel, the control panel contains the current semester, email, name, and level.

The Load Balancer determines which server needs to manage the load (either the active, or both), i.e. the incoming service request from the user. Both active and passive servers can be connected to a storage area network and the network infrastructure. The server takes additional data from the storage area network that needs to be processed. The advantage of this architecture is that it offers an interactive mode on mobile devices, as a special benefit from using the Data center within the mobile cloud environment

Due to low speed internet connection, the webpage has been optimized to reduce the download time and speed of the webpage, to open fast on mobile devices. Analyzing the webpages load time, using google chromes' developer extension. The webpage loads at 2.18seconds.



Name	Path	Method	Status
index.php	/update/cms	GET	200 OK
jquery-1.8.3.min.js	/update/cms/js	GET	404 Not Found
respond.min.js	/update/cms/js	GET	304 Not Modified
logomain.png	/update/cms/images	GET	304 Not Modified

4 requests | 21.0 KB transferred | 2.18 s (load: 2.19 s, DOMContentLoaded: 2.21 s)

Figure 6: Snapshot of the webpage's load time.

According to the technology development trend, increased speed and density of Integrated Circuits, Enhanced Transmission capacities on Optic Fibre Networks and Networking Flexibility, Distributed and Open Platform-based Communication Software, Capacity Growth and new Application Services on Wireless, Emergence of Next-Generation Networks (IP-based), Delivering QOS for Real time services, Ubiquity of networks through RFID & IPv6 (Next Generation Internet) are the demand of the age.

The mobile cloud model scenarios share some common feature that we have already discussed previously, are summarized below:

- User-centric security and privacy protection: A major incentive for mobile users using the mobile clouds is to protect users' data.
- Strong reliability and fail-over protection: Damage and loss of mobile devices are common due to their small and portable nature. The mobile cloud learning system provides a suite where the student can re-access the information.

Conclusion

The cloud computing has the significant scope to change the whole education system. In present scenario the e-learning is getting the popularity and this application in cloud computing will surely help in the development of the education offered to students which will increase the quality of education offered to them.

In this compilation we describe mobile cloud computing, a new transdisciplinary research area based on traditional mobile computing and cloud computing. The description is based on the developed mobile learning system. The design features layout the capabilities to assist modern mobile applications.

Mobile storage space, low speed internet connection, less data processing function on mobile devices, have been observed to be a product of negativity that repel learners from using mobile systems as another additional form to learn apart from the conventional methods i.e books and lectures. In past years till date efforts have been exerted to the development of this alternative method. The developed model is a website, adaptive to all mobile phones with different sizes and a mobile application for a specific mobile device. The analysis of the result revealed that the developed system offers a much better, efficient and fast means of accessing learning resources with very minimum limitation.

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