Mobile Cloud Computing (MCC): Open Research Issues

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Abstract - In the past few decades together with an explosive growth of the mobile applications and emerging of cloud computing concept has become one of the industry buzz words and a major discussion thread in the IT world since 2007. MCC integrates the cloud computing into the mobile environment and overcomes obstacles related to the performance (e.g., battery life, storage, and bandwidth), environment (e.g., heterogeneity, scalability, and availability), and security (e.g., reliability and privacy) in mobile computing. This paper shows the key open research issues associated with the mobile usage of cloud computing which helps general readers to have an overview of the MCC, their issues, existing solutions and approaches. In addition, some research aspects should be considered in further work.

Index Term – Cloud Computing, Mobile Computing, heterogeneity, scalability and availability

I. INTRODUCTION

Mobile devices (e.g., Smartphone, Tablet Pcs, etc) are densely used in today's scenario and still get even more important since the usage of mobile Internet. The growth of the number of applications available for those devices in the last few years has shown that there is a high demand for mobile apps. However one common problem that those entire devices share still needs to be addressed that are limited capabilities of the devices regarding available resources like processor power, available memory and especially energy consumption.

A technology recently emerged in the IT industry offers an opportunity to solve those problems. Cloud computing (CC) gives its users the possibility to host and deliver services over the Internet by dynamically providing computing resources. Cloud computing eliminates the requirement for users to plan ahead for acquiring different resources, such as storage and computing power, and therefore, is attractive to business owners. Moreover, enterprises can provide resources depending on service demand. In particular, resources can be dynamically added and released depending on service demand and with minimal management effort. The availability of cloud computing services in a mobile environment, also called mobile cloud computing, might thus be a possible solution for the earlier mentioned lack of resources of mobile devices. However research still needs to be done in order to solve several open issues like resource discovery, session connectivity, Data delivery, Task division, better service as well as possible frameworks to support cloud computing on mobile devices.

This paper delivers an insight into how cloud-computing techniques can be used to support mobile devices and which open issues are associated with it. Moreover, this paper focuses on two of these open issues, i.e. mobility and resource discovery as well as mobility and session connectivity and shows how these open issues could effectively be solved.

II. OVERVIEW OF MOBILE CLOUD COMPUTING: FUTURE SCOPE

It is seen that mobile world is primarily dependent of two factors one is Network Stability (2G, 3G, TD-LTE, WIFI, WIMAX etc.,) and second is Handset availability (Feature phones, Smart Phones, Ultra Smart Phones).

The Mobile Cloud Computing Forum defines MCC as follows [1]:

"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 Smartphone users but a much broader range of mobile subscribers".

That is we can say that in near future because of MCC there will be no need of installing and downloading applications on the mobile handsets (smart phones, tablets, etc.) users can access them directly in the cloud and display through the mobile browser, it is analogous to Software-as-a-Service provisioning of cloud computing also their are some predictions for organizations, in near future mobile phones expected to overtake PCs as the most common Web access device worldwide by 2013-14.
Precisely, MCC provides mobile users with the data processing and storage services in clouds. After this implementation mobile devices will not need a powerful configuration (e.g., CPU speed and memory capacity) since all the complicated computing modules can be processed in the clouds.

III. Open Issues and Future Research Direction:

Several research works has been going for the development of MCC for tackling open issues. However, there are still some issues that need to be addressed which we have analyzed. In this paper we are trying to integrate all the possible open issue and research directions in the development of secure MCC. Although some projects of mobile cloud computing has already been deployed around the world there is still a long way for secure business implementation. These can be club as:

(a) Low Bandwidth.
(b) Standard Interface.
(c) Task division.
(d) Data delivery.
(e) Network Access Management.
(f) Pricing.
(g) Utilize Multiple Clouds in a Unified Fashion.
(h) Quality of Service.

3.1 Low Bandwidth:

As we have seen that many research scholars has propose the optimal and efficient way of bandwidth allocation or the bandwidth limitation is still a big concern because the number of mobile and cloud users is dramatically increasing. And to improve the bandwidth limitation the emerging technologies such as 4G network and Femtocell are used to overcome the limitation and bring a revolution in improving bandwidth.

3.2 Standard Interface

Firstly a question arises that how to leverage interoperability to make full use of cloud computing with mobile broadband.
We also predict that in the near future, consumers will be demanding more from their mobile devices, which will result in fuelling growth in the mobile apps market. And we believe that open interoperable systems are vital, as mobile broadband and cloud computing capabilities will drive the next wave of growth in mobile broadband because the current interface between mobile users and cloud are mostly based on the web interfaces. However, using web interfaces may not be the best option. First, web interface is not specifically designed for mobile devices.
Therefore, web interface may have more overhead. So in this case we need to develop some standard protocol for networking, broadband signaling for communication and the interface for error free transition so that their can be seamless interacting between mobile users and cloud services. Also it is been seen that HTML5 technique with HTML5 WebSockets interface is being used as a feasible solution to ensure that it will work in MCC efficiently.

3.3 Task division

It is been found that classifying the tasks or applications from mobile devices into multiple sub-tasks / modules and deliver some of them to run in cloud, can be an intelligent approach to the resource limited mobile devices. However, we do not have an optimal, effective strategy or algorithm on how to classify these tasks and modules because through these approaches we cannot find out which module should be processed by cloud and which one by Mobile devices.

3.4 Data delivery

We have analyzed that due to the feature of resource constrained, mobile devices such as PDAs in terms of memory, processing power, battery lifetime and screen size are vital point of concern.

Applications for such devices need to be resource conserving and lightweight enough to achieve a level performance deemed usable. The application programmer also needs to take into account the strain put on these resources during execution time, and there are often tradeoffs to be made as to where to execute processes and store information, whether it be locally on the mobile device or remotely on a more powerful device.

3.5 Network Access Management:

Before moving to Network Access Management Scheme what we have came across is that current network strategies are no longer sufficient to enable a shift to the mobile cloud computing. The main limitations of current network approaches are:

(1) Inefficient use of network bandwidth.
(2) Inability to apply security policies.
(3) Poor network visibility.
(4) Lack of control.
(5) Inconsistent user experience.

So to diffuse these deficiencies we need a cloud Intelligent Network, Organizations that adopt a cloud-intelligent network will realize many benefits such as:

(1) Low Infrastructural Cost
(2) Ability to adapt quickly to the changing business climate.
(3) Simplified management enables IT to spend more energy on strategic initiatives.
(4) Assured experience

Precisely we can say that an efficient network access management not only improves link performance for mobile users with cloud usage but also optimizes bandwidth usage. The possible solution for this case can be Cognitive Radio over fibre Technologies which possesses some benefits like.

(1) Increase Flexibility.
(2) Improve Spectral Utilization and Efficiency.
(3) Performance Benefits.
(4) Improve Communication Structure.
(5) Enabling Broadband.

3.6 Pricing

The venture of Mobile Service Provider (MSP) and Cloud Service Provider (CSP) are integrated in MCC Technology. However, MSPs and CSPs have different Services Management, Customers Management, Methods of Payment and Prices. Therefore due to these issue it leads to a problem because we did not know how to set price between them and how it will be divided among different entities and how the customer will pay.

For example, when a mobile user runs mobile gaming application on the cloud, this involves the game service provider (providing a game license), mobile service provider (accessing the data through base station), and cloud service provider (running game engine on data center). The price paid by the game player has to be divided among these three entities such that all of them are satisfied with the division. Therefore in this case revenue sharing has to be carefully developed for MCC, which will help all different entities to give seamless performance so that every individual will give there best so that end user can be benefited.

3.7 Utilize Multiple Clouds in a Unified Fashion:

Mobile Cloud computing needs to find out some potential solution for service convergence, that is which helps to enable provider to support a cross-cloud communication and allow users to implement mobile services and applications. Moreover, 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 because in near future these services will be differentiated according to the types, cost, and availability and based on quality.

3.8 Quality of Service (QoS)

When a mobile user need to access any services or resources then he need to request to servers located in a cloud. In this case, the mobile users may face some issues such as congestion due to wireless bandwidths, network

disconnection, and the signal attenuation caused by mobile users' mobility. Elements of network performance within the scope of QoS often include availability (uptime), bandwidth (throughput), latency (delay), and error rate and to overcome all these factor new research directions are expected.

IV CONCLUSIONS

The basic purpose of Mobile Cloud Computing is providing PC-liked services to mobile Terminals. However, as the existing different features between mobile devices and PCs, we cannot directly transplant the services from PCs' platform to mobile devices.

According to a recent research, a New York- based firm, study that more than 240 million businesses will use cloud services through mobile devices by 2015. That traction will push the revenue of mobile cloud computing to $5.2 billion. With this importance, with this prospective we had provided an overview of mobile cloud computing in which its open issue and research directions in the development of secure MCC have been presented.

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