Analyze MCC and Its Obstacles in Healthy Environment

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ABSTRACT

Over the past few years, developments in the field of network-based computing and applications mobile cloud computing (MCC) has been introduced as a potential technology for mobile services. Mobile Cloud Computing (MCC) allows to broaden the restricted resources available on mobile devices to execute complex and rich mobile applications. Mobile cloud computing (MCC) impressively ranges the boundary of the mobile applications, by assimilating mobile computing and cloud computing, but it also comes into many challenges in cloud computing, e.g., data privacy and data integrity. While highly promising, mobile cloud computing for multimedia applications is still in its infancy. There are many unexplained problems need to be examined to fully harvest its potential. Green computing is a well-balanced and viable approach towards the attainment of a greener, healthier and safer environment without negotiating the technological needs of the current and future generations. For sustainable development, the working concepts of MCC and its various security issues and solutions given by researchers are investigated in this paper and emphasize the significance of green computing.

Keywords- Mobile Cloud Computing (MCC), Need before Greed (NBG), Leadership in Energy and Environmental Design (LEED), volatile organic compound (VOC).

1. INTRODUCTION

The ultimatum of mobile cloud computing is increasing progressively and developing as a most dominant technology for mobile storage in the field of computing.[1] Mobile cloud computing (MCC) has been introduced to be a potential technology for mobile services.[2] 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) discussed in mobile computing. [1].The term "mobile cloud computing" was introduced not long after the concept of "cloud computing" launched in mid-2007 Today's advancement in cloud computing provides significant benefits to mobile users as cloud infrastructures and platforms supply virtually large-scale computing power with elastic scalability and higher resource sharing and usage. This may overcome many traditional limitations in mobile computing. [2] By carrying out the advantages from mobile computing in ubiquitous, convenient mobile access, and location-ware application services, mobile cloud computing has the following unique advantages [29] [1]:

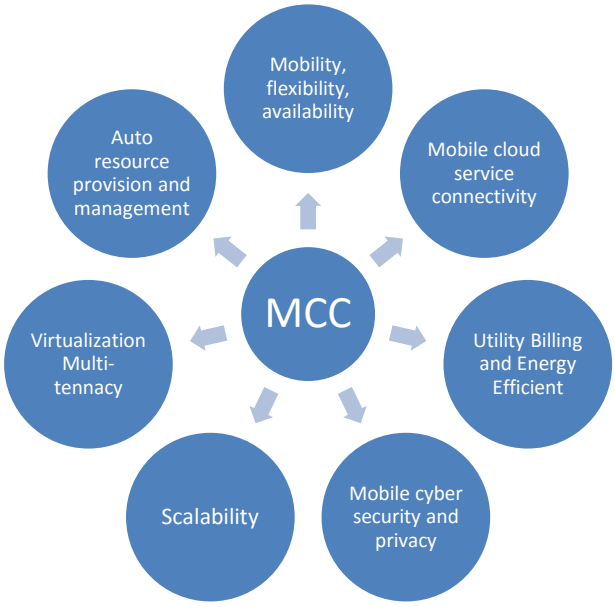

Fig 1: Primary features of MCC

- **Compute and storage efficiency:** By offloading demanding workloads and large data to the cloud, the mobile device can limit the amount of processing power and data storage that it requires. [5][6]

- **More powerful mobile applications:** Since the mobile device now has access to a powerful cloud on the back end, we have the potential to create more powerful mobile applications than previously possible.[29]

- **Energy efficiency:** Much of the resource-intensive work in mobile applications can be offloaded to the cloud, which means that mobile clients can focus more on reducing energy consumption without trading off on performance. [18]

- **Thin Mobile Clients:** Less resource demands on the mobile client means that we can build less powerful mobile devices that achieve better overall performance when coupled with a cloud platform. [18] This gives us the ability to "dumb down" the mobile clients, to the extent that they only handle user interaction and offload all application work and data to the cloud. [1]

2. CHALLENGING ISSUES TO MCC

Nowadays, it becomes very common and popular to access cloud services by using mobile devices. By a recent study [19], cloud applications will account for 90% of total mobile data traffic by 2018. To offload storage to the cloud, there are many existing storage services for mobile devices, such as Dropbox, Box, iCloud, Google Drive, and Skydrive [20]. Since mobile cloud computing (MCC) integrates mobile computing and cloud computing, all the above security issues in cloud computing are inherited in MCC with the extra resource limited mobile devices [21].

Mobile cloud computing has number of advantages as describe earlier. But on the other hand, as any other new technology, Mobile Cloud Computing also faces a number of challenges. Mobile cloud computing is a mixture of two major technologies that are Cloud computing and Mobile Computing [22]. The cloud is highly equipped with maximum computing facilities, whereas the computing ability of mobile devices is limited. Hence there are some challenges in implementing Mobile Cloud. These challenges are related to resources, network and security. In [23] and [24], the authors have discussed a number of challenges faced by Mobile Cloud. These challenges include:

• **Limited Computing Power and Battery:** The computing power and battery backup of mobile devices are less compared to the Laptop computers. This barrier is required so as to keep the cost of the mobile device as less as possible.

• **Latency and Bandwidth:** proper operation using mobile device requires low latency and high bandwidth. However due to network problems such as low signal reception from the tower, high latency and low bandwidths are resulted leading to inefficient operation.

• **Availability:** Another issue in Mobile Cloud is the availability of internet connection. Due to low signal reception from the tower there might be frequent disconnections leading to inefficient operation.

• **Security of Users and Mobile Devices:** Though the use of mobile devices, user privacy is on the risk. Some private information like the present location of the user is being exposed. Another issue is the security of the mobile devices. Since the mobile device is connected to the internet, it is exposed to threats like Viruses, Malware and Hacking.

• **Security of Data on Cloud:** When using the cloud, the user's data may reside on the cloud. This leads to some data security issues like confidentiality and integrity of data. The data may be available to an untrusted person in the cloud. Data security in the cloud is an important area of research work for the future.

After analyzing different problems in MCC we can summarized the major challenging issues in Mobile Cloud Computing as follows:

a. How to effectively save battery power in Smartphone is a major issue. [5][6]
b. MCC performance (e.g., battery life, storage, and bandwidth) [2][7]
c. Operating environment (e.g., heterogeneity, scalability, and availability) [2]
d. Security (e.g., reliability and privacy) [1] [22]

3. PROPOSED SOLUTIONS TO MCC CHALLENGING ISSUES

Mobile Cloud Computing is one of the latest trends in the information technology sector, which is still a developing paradigm. Definitely, the technology will undergo numerous changes in the future, in terms of security issues, best policies and standards [22]. But the present need is how we can avoid or eliminate these issues so we can effectively use the MCC. To overcomes obstacles and challenging issues related to the performance (e.g., battery life, storage, and bandwidth), environment and security (e.g., reliability and privacy) [3][4] various techniques are used some of them are as follows [1]:

a. **Offloading** (Offloading is a solution to augment these capabilities of mobile systems by migrating computation to more resourceful computers, such as servers.) [5][6]
b. **Load balancer** (load balancer efficiently allocates resources to increase application processing speed) [7][8]
c. **Central controller server** (The problem in cloud network is the higher response time of nodes while performing data communication through co-operative caching. This problem can be overcome by placing a Central Controller device as a hub in star topology network) [10]
d. **Green Computing** (It minimize the use of electricity as well as energy and reduce the environmental dissipate) [11]

Offloading:

Mobile devices suffer from poor battery life, limited resource, and limited storage capacity. To deal with these constraints, offloading is performed [5].

Offloading means the transfer of data from a computer or digital device to another digital device [6].Offloading is a solution to augment these capabilities of mobile systems by migrating computation to more resourceful computers, such as servers. [8] This is different from the traditional client–server architecture, whereas thin client always migrates computation to a server. [6].

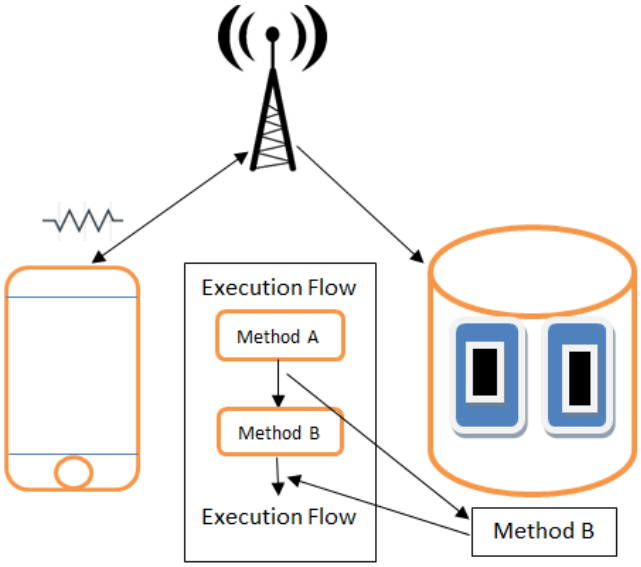

Fig2: Offloading Process

The key difference is that computation offloading migrates programs to servers outside the users' immediate computing environment; process migration for grid computing typically occurs from one computer to another within the same computing environment, that is, the grid. [8]

Load Balancer:

A smart load balancer efficiently allocates resources to increase application processing speed for data and request response of memory stored by mobile devices in a secure manner [7]. In cloud computing, load balancing is defined as the ability for the system to take incoming application data from the user, measure the computational requirements and determine which of the availability zones it needs to be stored in. It is also required to handle any incoming data to an application so that the processing ability of that application is not overloaded [8]. The load balancer will have two main functions:[2]

- Finding the best location that information should be stored
- Finding the best path a request should take to retrieve the information.

In mobile cloud networks, this poses a problem, due to the heterogeneity of the incoming and outgoing data types and security. In load balancing methods, the request from the user is granted based on the current availability in each of the zones and if the request can be filled without overcoming the system. The overall basis of how a cloud load balancer is deployed can be categorized as either in software or in hardware [9].

A smart load balancer will be able to intelligently define the incoming requests by predicting the needs of the request based on the data type. It will be possible to utilize the discussed methods in part within the algorithm of the smart load balancer to effectively maintain large networks. [30] This proposed method of a smart load balancer will establish a set level of Need before Greed (NBG) in the system when requests are made. [23] This parameter is used to determine whether the request from the user should be granted based on total resource capacity required, type of data, or the priority level of the user. When allocating resources, NBG will consider priority users that absolutely require the system before any others. [30]

Central Controller Server

The Central Controller device keeps track of the status of all other devices during the communication by running passive scan over the devices. Central Controller concept will increase the performance, efficiency, response time and it provides easy access to other devices to obtain the status of devices that are connected by a star topology network with the central controller [10]. In this case cost may increase but the overall speed up of the system will also increase. Again, by increasing the power of the battery, the battery life can also be increased so that users of the Smartphone devices do not face problem of recharging very frequent. [1] A touchpad device can be used with smart phones via wireless network to overcome the problem of typing in the mobile device.

Green Computing

Green computing refers to environmentally sustainable computing. It minimizes the use of electricity as well as energy and reduce the environmental dissipate when we are using a computer. Therefore, it is the study and practice of using computing resources efficiently.

Green computing and energy saving has been a hot research topic in the past years. As pointed out in [11], the research issues and solutions in MCC can be classified in three areas: a) green computing in mobile devices, b) green computing in servers and computing infrastructures, and c) networks and communications. In our view, green computing in MCC must address the issues and needs in the two areas.

Energy-efficient communication with the increasing need of multimedia data communication in the wireless world, MCC must address the following three issues and needs.

• Similar to [12], more energy-efficient communication protocols are needed to support mobile communications in MCC.

• Energy-efficient migration and synchronization techniques and solutions for mobile content/data in MCC are needed.

Like [13][14], more intelligent solutions are needed to support the discovery and selection of underlying wireless networks and mobile connectivity to deal with diverse energy consumption of different wireless networks and technologies.

• Energy-efficient mobile cloud infrastructure to reduce the energy consumption, future mobile cloud infrastructures and data centers must address the following special issues and needs.

• Similar to [15] [16] [17], energy-efficient resource allocation and management methods and solutions are needed in cloud data center, storage clouds and network clouds in MCC.

• Vertical energy-efficient intelligent solutions are needed crossing different layers (such as infrastructures, platforms, and Mobile SaaS) to provide system-level energy monitor and analysis so that cost-driven and green-based resource allocations and management decisions can be made [18].

Greening Data Centers:

Data center efficiency can be improved by using new energy-efficient equipment, improving airflow management to reduce cooling requirements, investing in energy management software, and adopting environmentally friendly designs for data centers and adopting new measures to curb data centers' energy consumption [25]. So proper management of data

centers is the need of the hour. Three broad measures are outlined below to greening data centers [25]:

a. Energy Conservation: I.T industry is investing lot of time and money to devise new and effective ways to conserve energy. Companies like IBM, Hewlett Packard, Spray Cool, and Cooling are working on technologies such as liquid cooling, nano fluid cooling systems, and in-server, in-rack, and in-row cooling. Other novel ways of making a data center more environmentally friendly include using new high-density servers, using hydrogen fuel cells as alternative green power sources, and applying virtualization technologies that reduce the total power consumption of servers and lower the heat generated [28].

b. Eco-friendly design: Eco-friendly data center designs use a synthetic white rubber roof, paint, and carpet that contain a low volatile organic compound (VOC), countertops made of recycled products, and energy-efficient mechanical and electrical systems at optimal efficiency. [23] Eco-designs make use of both natural light as well as green power, which is basically electricity generated from solar or wind energy, to run the data center. Enterprises that adopt eco-friendly designs can get tax incentives and also gain a competitive advantage, because more and more customers want to work with eco-friendly firms. While building a new data center provides complete design control, IT professionals can take proactive measures like using energy-efficient windows, skylights, and sky tubes, and changing the paint and carpet to a low-VOC variety to reduce heat, add light, and discard materials that contain toxic chemicals in existing data centers. Many American enterprises are adopting the Leadership in Energy and Environmental Design (LEED) standards maintained by the US Green Building Council [26] for building new data centers. LEED promotes a "whole-building approach" to sustainability, focusing on five key areas: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.

c. Virtualization: Virtualization is a major strategy to reduce data center power consumption. The objective of virtualization is to manually use the computing resources to maximize the capacity and to diminish the rate if IT assets.[32] In virtualization, one physical server hosts multiple virtual servers. [31] Virtualization enables data centers to strengthen their physical server infrastructure by hosting multiple virtual servers on a smaller number of more powerful servers, using less electricity and simplifying the data center. Besides getting much better hardware usage, virtualization reduces data center floor space, makes better use of computing power, and greatly reduces the data center's energy demands. Many enterprises are using virtualization to curtail the huge energy consumption of data centers. In order to tackle the issue of data centers' huge power consumption, leading IT enterprises formed a non-profit group called the Green Grid [27] in February 2007. [31] This group has the responsibility to define and propagate the best energy-efficient practices in data center operation, construction, and design, and drive new user-centric metrics and technology standards.

4. DISCUSSION

This paper analyzes the mobile cloud computing and discusses its issues regarding security, environment, performance and energy consumption. This research explored which factors improved app performance when computation is offloaded to the cloud, the nature of these factors, and how variations in these affect app performances for local and offloaded computations.

As a result, it proposed solution against various MCC issues, which are convenient in solving security issues like privacy and data security, improve battery life, and reduce energy consumption, migration issues, application development platforms and the various mobile cloud computing applications.

5. CONCLUSION

The major object behind the mobile cloud computing is to empower the mobile user by providing a seamless and rich functionality, regardless of resource (e.g., battery life, storage, and bandwidth) limitations of mobile devices. We have given an extensive review of current mobile cloud computing research, discussion about challenging issues in its environment and their solutions in this paper. This paper focuses on the technical part of the enabling technologies and discusses the challenges and existing solutions from several aspects such as energy conservation. Offloading involves power consumption in executing an application and during communication with the remote cloud. To better utilize the

resource on the cloud, there is a trade-off between transmission energy cost and local execution energy cost. This paper has explored a number of mechanisms for providing data security so that Mobile Cloud Computing can be widely accepted by a number of users in future.

TABLE-I

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
Performance Quality and efficient resource allocation	Load Balancing, central controller server, Offloading
Energy Consumption	Green Computing, Greening data centers

Table 1 -gives an overview of proposed challenges and some solutions about mobile cloud computing.

6. FUTURE WORK

In future, the work can be done on the proposed scheme for providing data confidentiality with data integrity so that Mobile Cloud Computing will be widely accepted and also Offloading frameworks and optimal partitioning schemes which are portable across all the mobile execution platforms. The emphasis of this study is on current trends in Green Computing; challenges in the field of Green Computing and the future trends of Green Computing. Mobile Cloud Computing is a vast field which still needs to be discovered more.

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