

# A Study on Emerging Trends and Challenges in Mobile Cloud Computing

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**Abstract**-The proficiencies of mobile devices and mobile application continues to improve swiftly in relation to speed, computing power, storage and real world user friendly applications. Survey carried out by the Gartner Company (Famous global analytical consulting company) predicted more users to access the internet from the mobile devices than from the PCs by the year 2013. The outburst of the development in smart phones, applications and cloud computing concept has introduced Mobile Cloud Computing (MCC) as a dynamic technology for mobile devices. Mobile Cloud Computing (MCC) incorporates cloud computing into the mobile environment and overcome some problems in performance (e.g., battery life, storage), environment (e.g., scalability, availability) and security (reliability and privacy). Since MCC is still at primary stage of development we have to first theoretically understand the technology which would later on help us in the prediction of future research. In this paper, we introduce the background and theory of Mobile Cloud Computing (MCC), the benefits of MCC, challenges faced in MCC and finally some proposed possible future solution.

**Keywords** - Mobile Cloud Computing; Authentication Authorisation and Accounting; Cloud Computing

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## I. INTRODUCTION

The IT industry has always been active with the modernized inventions since the very first creation of computers. In the early days, huge scale machines and mainframe computers were used to implement different tasks and various applications. Nowadays we are doing the same tasks but in a flexible, cheaper and portable manner, either by using desktop computer or mobile devices to bond together servers so as to create cloud computing. As a major application model in the era of the internet, cloud computing has become a substantial research topic of scientific and industrial societies since 2007. It provides resources to the consumers such as the computing infrastructure according to the user's requirement [1, 2]. It is not limited to personal computers but also applies on mobile technology. Mobility and Ubiquity are vital ingredients needed for the next generation network. Therefore a combination of electronic devices like smartphones, Tablets, global mobile network and cloud computing, resources converge together to form a new field of Mobile Cloud Computing (MCC).

## II. OVERVIEW OF MOBILE CLOUD COMPUTING

Before going through Mobile Cloud Computing at foremost we have to get a better understanding of Cloud Computing and Mobile Computing.

### A. Cloud Computing

In the IT organisation, users have come to realise that the Desktop PC/Lab-tops they once bought two or three years ago cannot keep up with the pace of the software expansion contemporary.

In their conclusion they prerequisite a higher speed CPU, large storage hard-disk and advanced operating system. Upon further enquiry they came across the topic of cloud computing that later exploded to a worldwide subject.

Cloud Computing is referred to the use of network structure software and capacity to provide resources to users in an on-demand environment as shown in Fig 1.. In cloud computing tasks and data are stored on the internet rather than on individual devices, providing on-demand access and in addition the application are run on remote server before conveyed to the user [3].

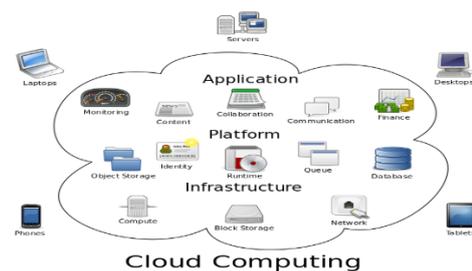


Fig 1. Cloud Computing

### B. Mobile Computing

Mobility has become a very common word in the rapid growth of today's computing era. An implausible progression continues in the evolvement of mobile devices for example smart phones, Tablets, GPS Navigation and Lab-tops with a multiplicity of mobile computing, networking and security technologies [5]. The following are features of Mobile Computing: -

- a. **Mobility:** - Portable nodes along with fixed nodes can be used to establish connection with other networks through Mobile Support Solution (MSS) during motion.
- b. **Diversity of network condition:** - Networks using mobile nodes are not uniquely distinct, they come in variety of forms such as wired or wireless conveyed with dissimilar bandwidth.
- c. **Frequent disconnection and consistency:** - Mobile computing is not perfect, there is a limitation example battery power, costs of wireless communication and so forth. The portable nodes linked to the mobile device do not have constant and perfect signals instead the signals varies from inactive to active vice versa.
- d. **Dis-symmetrical Network Communication:** - The ability of networks differs, server and other access points may have strong capability to send and receive in communication whereas in portable node you get a fifty chance of success or failure.
- e. **Low reliability:** - Since the signals in mobile computing is vulnerable to interference and snooping then the mobile computing network systems will have to go through each layer of the structure before it address the security issue.

### III. MOBILE CLOUD COMPUTING

The term Mobile Cloud Computing was introduced long after the launch in the concept cloud computing [4]. It widely attracted attentions of industrialists from different area of the globe as a profitable business option that reduces the development and running cost of mobile users and as a new technology to achieve rich experience in variety of mobile services at low cost and promising solution for green IT/Computing.

Mobile Cloud Computing is an infrastructure where both the data storage and data processing happens outside of the mobile device and into the cloud [6, 7].

#### Concept and Principle

Mobile Cloud Computing (MCC) is a combination of mobile computing, cloud computing and mobile internet. In MCC data processing and storage is transferred from the mobile devices to powerful and centralised computing podium located in clouds. Cloud can be accessed with the help of wireless connections via web browser on the mobile devices.

#### Architecture

The mobile user's request and information are transmitted towards a server that provides mobile network services. Using AAA (Authentication Authorisation and Accounting)

and the subscriber's data stored in the network database, the mobile operators then provide the service to the mobile user.

The subscriber's request is delivered to the cloud via internet. A Cloud controller/management process the request to provide mobile users with corresponding cloud services. Fig 2 is diagramming the MCC Architecture.

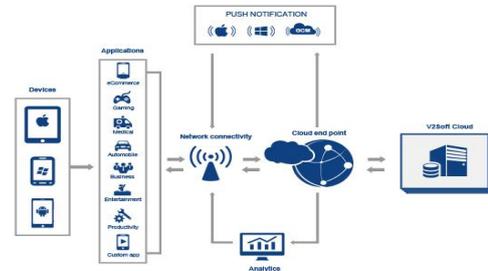


Fig 2. MCC Architecture

### IV. BENEFITS OF MOBILE CLOUD COMPUTING

Mobile Cloud Computing moves the computer power and data storage away from the mobile devices and into the cloud platform. This presents apps and mobile computing not only to smartphones but also a wider range of mobile subscribers. The following lists out the benefits of Mobile Cloud Computing:-

- Mobile Cloud Computing overcomes the boundaries of mobile devices over processing power and data storage.
- Extends battery life by shifting the execution of commutation intensive application to cloud [9, 10]
- Reduces the chance of data and application loss on the mobile devices
- Increases the security level for mobile devices by centralized monitoring and maintenance of software.
- It can become one-stop shopping option for users of mobile devices since Mobile Cloud Operator can concurrently act as a virtual network operator providing e-paymentservices, data storage and other shopping services[8].
- Provide additional technical functionalities in particular context-and-location awareness enabling personalization of service in an attractive functionality.
- It may initiate cloud computing business particularly in addressing business to consumers.

### V. CHALLENGES AND POSSIBLE SOLUTION

The major challenges of mobile cloud computing comes from the characters of mobile devices and wireless network

as well as their own restriction and limitation and such challenges makes application designing, programming and deploying on mobile and distributed devices more complicated than on the fixed cloud devices [12]. The following are some challenges faced in mobile cloud computing: -

#### Limitation of mobile devices

In this section we focus on resource-constrain. Smartphones have gone through levels of improvement over the past years with features such as CPU capability and memory, size of screen, wireless communication and operating system but there still exist restraint such as computing competence and energy resource to deploy complicated application whose outcome can result to a major challenge in mobile cloud computing [11].

For instance if battery technology cannot advance in a short period of time then finding a method on how to effectively save battery power will become a chief concern in the future.

#### Quality of communication

There is a big difference between wired and wireless connection in relation to bandwidth prestige [14, 19]. The degree of data transfer through wired connection provides a steady bandwidth while that of the wireless continuously changes from connect to disconnected state vice versa mainly due to clearance in the network delay [20].

Network latency and weather condition contribute to fluctuations in bandwidth and network overlay. Network latency in wireless is delayed to 200ms a mile while on wired it is 50ms.

#### Division of application services

In MCC environment, as result to limitation of resources a division of applications is formed so as to use the size of cloud computing in-order accomplish of other purpose example the core computing task could be processed by cloud while mobile device takes responsibility of simple tasks only [13, 15].

The major issues affecting mobile cloud computing are: - data processes in data centre and mobile device, network handover delay and data delivery time. The following are strategies used in response to the challenges: -

- Upgrade bandwidth of wireless connection by making the web content more suitable for mobile network using regional data centres.
- Organise application processing nodes at the edges so as to reduce data delivery time

- Duplicate mobile devices to cloud using virtualization and image technologies such as virus scanning in mobile devices.
- Dynamically adjust application directed to cloud and the division with mobile terminals.
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## VI. OPEN RESEARCH ISSUES

Though mobile cloud computing has been installed and used worldwide there are aspects that require further perfection: -

**Data delivery:** - Mobile devices have challenges such as cloud accessing, consistent accessing, data transmission etc, that could be solved using a unique application (service) and middle-ware (which provides platform for all mobile cloud computing system)

**Task Division:** - In theory the researchers could divide tasks from mobile devices into multiple sub-tasks and run them on cloud. The problem is lack of algorithm on how to divide the tasks that would run on the device and on cloud.

**Better Service:** - The purpose of mobile cloud computing was to provide PC-like services to mobile terminals but due the alteration between PC and phone platform we cannot directly implant these services. Hence supplementary and research studies need to be carried out in order to get appropriate and friendly service for mobile devices [17].

**Standard Interface:** -The interface between mobile device and cloud is based on the web. In some cases the interface may not be fit for mobile devices and hence it result to overheads [16, 18].

**Quality of Service:** - PC and mobile devices differ diversely in many characteristics henceforth you cannot directly shift the services from PC to mobile. Mobile users may face delay in communication with the cloud as result to overcrowding triggered by limitation bandwidth, network disconnection and signal dilution.

**Trust, Security and Privacy Issues:** - Trust is an important substance on the community of cloud computing models. Construction on a trustable, secure environment is still an open issue and seems to get worst when the internet is applied as bridge between front-ends and back-end devices within wired or wireless network.

## VII. CONCLUSION

The concept of cloud computing provides a brand new opportunities for the enlargement of mobile applications since it allows the mobile devices to maintain a very thin layer for user application and shift the computation and processing overhead to the virtual environment .

The goal of mobile cloud computing is to provide rich mobile computing through unified communication between front users (cloud mobile users) and end users (cloud

providers) regardless of assorted, wireless environment and underlying platforms in global roaming. We conclude this paper by providing possible solution in following areas: -

- **Limitation of mobile devices**

This area can be amended by using virtualization and image technology along with immigration task from terminal to cloud.

- **Quality of communication**

This zone can be perfected by using wired network instead of wireless so as to reduce the proportion of data delivery in wireless environment. Upgrading the bandwidth is another possible solution for increasing performance but it invites additional costs to the user.

- **Division among application service**

This region can improved by arranging an effective elastic application division mechanism which estimated to be the finest solution to guarantee the service in Mobile Cloud Computing, though it might be complicated but promises a high impact result.

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