

# A Mobile Cloud Computing Architecture, its Security & Future Research Challenges

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**Abstract – Mobile cloud computing (MCC) has been introduced as a new paradigm for mobile applications and it is a universal term for anything that involves delivering hosted any kind of services which includes cloud computing as a middleware, like as mobile-healthcare, mobile learning, mobile-entertainment, etc. over the Internet. Mobile cloud computing is the usage of cloud computing in combination with mobile devices or mobility hardware. Mobile cloud computing is differentiated from mobile computing in general because the devices run cloud-based Web apps rather than native apps. Users subscribe to cloud services and access remotely stored applications and their associated data over the Internet. Mobile cloud computing is a technique, or a model, which allows mobile applications to be built, powered and hosted using cloud computing technology. In this model, the cloud performs the resource-hungry activities such as processor-intensive tasks and storing massive chunks of data. This paper enlightens the current trend in Mobile Cloud Computing, its security issues/challenges and associated research challenges in which our research would be focusing on.**

## INTRODUCTION

At the present, mobile devices are increasing rapidly, since they are the easiest and the most effective communication tools. In addition, their crucial role in human life, when and where to use them are not restricted (called ETEW1) (Mobile Cloud Computing Forum). Mobile users can use different applications on their devices or receive even different kinds of services through wireless networks distantly. With increasing propagation of mobile devices technology, the popularity of this device has also increased. Some features such as mobility, optimized and easy to use are of the benefits of mobile devices. Nevertheless, the challenges of the resources of mobile devices (such as short battery life, small memory capacity and low bandwidth) and also of communication (such as mobility and data security) are the reasons for the decrease of service quality.

This means that the developers will have a much wider market and they can bypass restrictions created by mobile operating system. Mobile cloud computing gives new company chances for mobile network providers also.

## CLOUD COMPUTING

Cloud computing is denoted as “cloud” which means the supply of on-demand computing resources to

store, manage, and process data over the internet on pay-for-use basis. It is an Internet-based computing type, which is offered on demand to computer/other devices that needs data and shared processing resources.

Cloud consists of the below given essential characteristics:

- On-Demand self-service
- Ubiquitous network access
- Location-independent resource pooling
- Rapid elasticity
- Measured service

Below given are the Cloud delivery models:

- Application/Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS)

Below given are the Cloud deployment models:

- Private
- Public
- Community
- Hybrid
- Virtual Private Cloud

### MOBILE CLOUD COMPUTING (MCC)

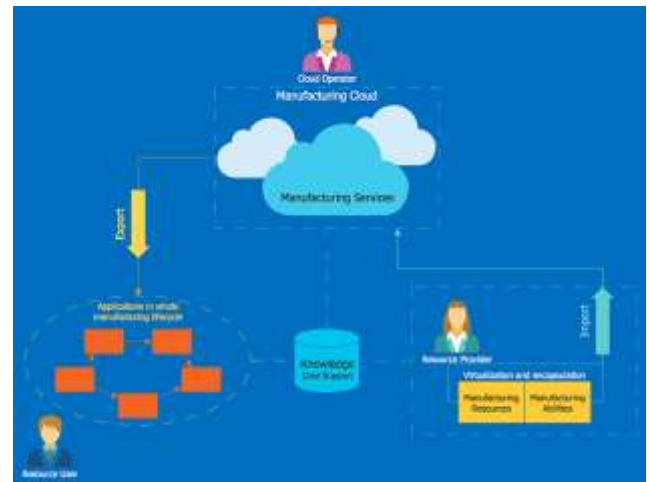
Mobile cloud computing (MCC) at its simplest, refers to an infrastructure where both the data storage and data processing happen outside of the mobile device.

Mobile cloud applications move the computing power and data storage away from the mobile devices and into powerful and centralized computing platforms located in clouds, which are then accessed over the wireless connection based on a thin native client.

- Mobile devices face many resource challenges (battery life, storage, bandwidth etc.)
- Cloud computing offers advantages to users by allowing them to use infrastructure, platforms and software by cloud providers at low cost and elastically in an on-demand fashion.
- Mobile cloud computing provides mobile users with data storage and processing services in clouds, obviating the need to have a powerful device configuration (e.g. CPU speed, memory capacity etc), as all resource-intensive computing can be performed in the cloud.

### MOBILE CLOUD ARCHITECTURE

There are two types of Architecture in Mobile Cloud Computing In Non-Cloudlet Architecture there are three components Mobile client, Transmission channel and Cloud. Mobile client requests desired service from cloud and cloud provides the service. Cloud is owned by an organization or cloud provider and services thousands of users at time. In this architecture, main disadvantage is communication latency for getting service from distant cloud. The solution to this problem is cloudlet architecture in which a local cloudlet contains cached copy of data. It is installed between client and cloud. The cost of installation is less as compared to cloud as it is only a data center at business premises. A cloudlet services only a few users and has less communication latency as compared to cloud. Cloudlet is owned by local business (Satyanarayanan et al,2009).



From the concept of MCC, the general architecture of MCC, mobile devices are connected to the mobile networks via base stations (e.g., base transceiver station (BTS), access point, or satellite) that establish and control the connections (air links) and functional interfaces between the networks and mobile devices. Mobile users' requests and information (e.g., ID and location) are transmitted to the central processors that are connected to servers providing mobile network services. Here, mobile network operators can provide services to mobile users as AAA (for authentication, authorization, and accounting) based on the home agent (HA) and subscribers' data stored in databases. After that, the subscribers' requests are delivered to a cloud through the Internet. In the cloud, cloud controllers process the requests to provide mobile users with the corresponding cloud services.

There are three Mobile Cloud Models (Daniela Popa et al, 2013):

#### Client Mode

In this model, mobile device act as client and mobile user access service is offered by cloud by thin layer of interface web browser. Cloud charges for services till the duration client is connected. Client model depicts Software as a Service model of Cloud computing.

#### Client / Cloud model

In client /cloud model, the concept of task partitioning comes in which mobile users give a part of task to cloud for processing.

#### Cloud Model

In cloud model, mobile device itself is the part of cloud. One or more mobile devices create the structure of cloud.

## DATA SECURITY ISSUES IN THE MOBILE CLOUD

### Privacy and Confidentiality

Once the client host data to the cloud there should be some guarantee that access to that data will only be limited to the authorized access. Inappropriate access to customer sensitive data by cloud personnel is another risk that can pose potential threat to cloud data. Assurances should be provided to the clients and proper practices and privacy policies and procedures should be in place to assure the cloud users of the data safety. The cloud seeker should be assured that data hosted on the cloud will be confidential.

### Data Integrity

With providing the security of data, cloud service providers should implement mechanisms to ensure data integrity and be able to tell what happened to a certain data set and at what point. The cloud provider should make the client aware of what particular data is hosted on the cloud, the origin and the integrity mechanisms put in place.

### Data Location and Relocation

Distributed computing offers a high level of information portability. Buyers don't generally know the area of their information. Notwithstanding, when an endeavor has some delicate information that is continued a capacity gadget in the Cloud, they might need to know the area of it. They may likewise wish to determine a favored area (e.g. information to be kept in India). This, at that point, requires a legally binding understanding, between the Cloud supplier and the purchaser that information should remain in a specific area or live on a given known server. Additionally, cloud suppliers should assume liability to guarantee the security of frameworks (counting information) and give strong validation to protect clients' data. Another issue is the development of information starting with one area then onto the next. Information is at first put away at a fitting area choose by the Cloud supplier. In any case, it is regularly moved starting with one place then onto the next. Cloud suppliers have contracts with each other and they utilize each other's assets.

### Data Availability

Customer data is normally stored in chunk on different servers often residing in different locations or in different Clouds. In this case, data availability becomes a major legitimate issue as the availability of uninterrupted and seamless provision becomes relatively difficult (Ali Newaz Bahar et al, 2013).

## CHALLENGES AND SOLUTIONS

The major challenge of mobile cloud computing comes from the characters of mobile devices and wireless networks, as well as their own restriction and limitation, and such challenge makes application designing, programming and deploying on mobile and distributed devices more complicated than on the fixed cloud devices. In mobile cloud computing environment, the limitations of mobile devices, quality of wireless communication, types of application, and support from cloud computing to mobile are all important factors that affect assessing from cloud computing. Table 1 gives an overview of challenges and some solutions about mobile cloud computing.

| CHALLENGES                        | SOLUTIONS   |
|-----------------------------------|---|
| Limitations of mobile devices     | Virtualization and Image, Task migration          |
| Quality of communication          | Bandwidth upgrading, delivery reducing, Data time |
| Division of applications services | Elastic application division mechanism            |

## ADVANTAGES

- **Extending battery lifetime:**
  - Computation offloading migrates large computations and complex processing from resource-limited devices (i.e., mobile devices) to resourceful machines (i.e., servers in clouds).
  - Remote application execution can save energy significantly.
  - Many mobile applications take advantages from task migration and remote processing.
- **Improving data storage capacity and processing power:**
  - MCC enables mobile users to store/access large data on the cloud.

- MCC helps reduce the running cost for computation intensive applications.
- Mobile applications are not constrained by storage capacity on the devices because their data now is stored on the cloud.
- **Improving reliability and availability:**
  - Keeping data and application in the clouds reduces the chance of lost on the mobile devices.
  - MCC can be designed as a comprehensive data security model for both service providers and users:
    - Protect copyrighted digital contents in clouds.
    - Provide security services such as virus scanning, malicious code detection, authentication for mobile users.
  - With data and services in the clouds, then are always(almost) available even when the users are moving.
- **Dynamic provisioning:**
  - Dynamic on-demand provisioning of resources on a fine-grained, self-service basis
  - No need for advanced reservation
- **Scalability:**
  - Mobile applications can be performed and scaled to meet the unpredictable user demands
  - Service providers can easily add and expand a service
- **Multi-tenancy:**
  - Service providers can share the resources and costs to support a variety of applications and large no. of users.
- **Ease of Integration:**
  - Multiple services from different providers can be integrated easily through the cloud and the Internet to meet the users' demands.

## CONCLUSIONS

Mobile cloud computing refers to the combination of mobile networks and cloud computing with an aim of benefiting the network operators, mobile users, and cloud providers. Usually it's a technology that leverages the elastic resources of network technologies and varied clouds toward unrestricted mobility and functionality. Mobile Cloud Computing, as a development and extension of Cloud Computing and Mobile Computing, is the most emerging and well accepted technology with fast growth. The combination of cloud computing, wireless communication infrastructure, portable computing devices, location-based services, mobile Web etc. has laid the foundation for the novel computing model. In this paper we have given an overview of Mobile Cloud Computing architecture, that help the mobile user to connect their cloud resource within a short time or searching the resource in a short time.

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