

## Research Article

## A Mobile Cloud Computing Architecture with Easy Resource Sharing

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### Abstract

*Mobility among the masses is now in vogue. In the years to come, work in cloud clouding computing is expected to reach greater heights. Although, a new wave of evolution has broken shores, a vast expanse lies yet unexplored. The mobile cloud is Internet-based data, applications and related services accessed through smart phones, laptop computers, tablets and other portable devices .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. The proposed model aims to free mobile devices from performing these tasks; thereby, allowing the devices to run cooler and with less power than would have been otherwise required. Using a tailored algorithm to seek out the shortest route to a given cloud resource on the internet, this model maintains its own database. When a mobile device connects to the internet to seek a cloud based resource, the model identifies the request and routes it to the shortest path which it has kept track of with the aid of its constantly updated data table. This paper discusses the proposed model and aims to illustrate the manner in which mobile device users would be able to use the cloud application and also take advantage of energy savings not only in terms of power consumed, but also most importantly – time.*

**Keywords:** Mobile cloud computing, chunks of data, algorithm, database, internet.

### 1. Introduction

Mobile cloud computing refers to the availability of cloud computing services in a mobile environment. It incorporates the elements of mobile networks and cloud computing, thereby providing optimal services for mobile users. In mobile cloud computing, mobile devices do not need a powerful configuration (e.g., CPU speed and memory capacity) since all the data and complicated computing modules can be processed in the clouds (<http://www.smartdevelopments.org>; <http://www.readwrite.com>) Mobile cloud computing is the usage of cloud computing in combination with smart mobile devices. Cloud computing exists when tasks and data are kept on the internet rather than on individual devices, providing on-demand access of data. Applications are run on a remote server and then sent to user. Because of the advanced improvement in mobile browsers thanks to Apple and Google over the past couple of years, nearly every mobile should have a suitable browser according to the need. 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.

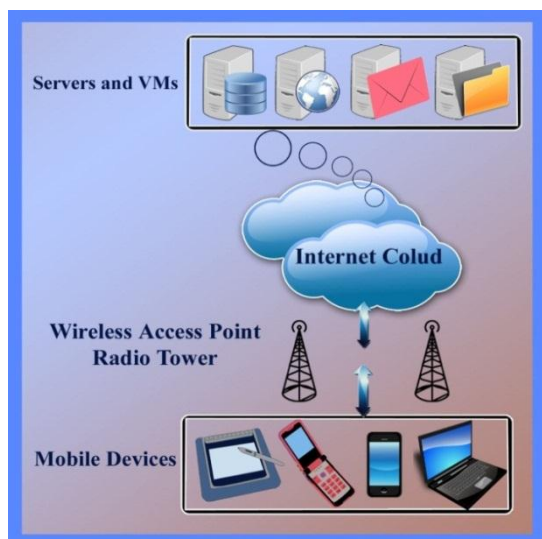
Several operators as Vodafone, (Swarnpreet Singh et al, 2012) Orange and Verizon have started to offer cloud computing services for different companies. Mobile Cloud Computing has three components, mobile device, wireless communication channel and cloud. Mobile devices have resource constraint in terms of battery power, memory, processing power and have different types of hardware, operating system, and input -output interface. Wireless communication channel has different radio access technologies such as GPRS, 3G, WLAN and WiMax with variable network conditions in terms of limited and unstable bandwidth. Cloud Computing is facing various security and privacy challenges. Security and privacy issues in mobile cloud computing are inherited from cloud computing and mobile computing. Because of resource constraints, heavy security algorithm can't be run on mobile device. We need to do efficient task portioning between cloud and mobile to resolve the security and privacy issues in Mobile Cloud Computing (Sapna Malik et al, 2012). As an inheritance and development of cloud computing, resources in mobile cloud computing networks are virtualized and assigned in a group of numerous distributed computers rather than in traditional local computers or servers, and are provided to mobile devices such as smartphones, portable terminal, and so on.(see Figure. 1). Meanwhile, various applications based on

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mobile cloud computing have been developed and served to users, such as Google’s Gmail, Maps and Navigation systems for Mobile, Voice Search, and some applications on an Android platform, Mobile Me from Apple, Live Mesh from Microsoft, and Moto Blur from Motorola. The rest of paper is organized as follows. In Section II, we discuss about mobile cloud computing ,in Section III. we discuss application of mobile cloud computing , in Sections IV. we discuss about data security issues in the mobile cloud , in Section V, VI, VII and VIII we present related work, proposed work, proposed algorithm and flowchart and in Section IX we present the conclusion part of this paper.

## 2. Mobile cloud computing

Mobile computing (Mahadev Satyanarayanan,2010) means using portable devices to run stand-alone applications and/or accessing remote applications via wireless networks. In mobile cloud computing mobile network and cloud computing are combined, thereby providing an optimal services for mobile users. Cloud computing 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 (<http://www.smartdevelopments.org>; <http://www.readwriteweb.com>).



**Fig1:** Mobile Cloud Computing

### Mobile Cloud Architecture

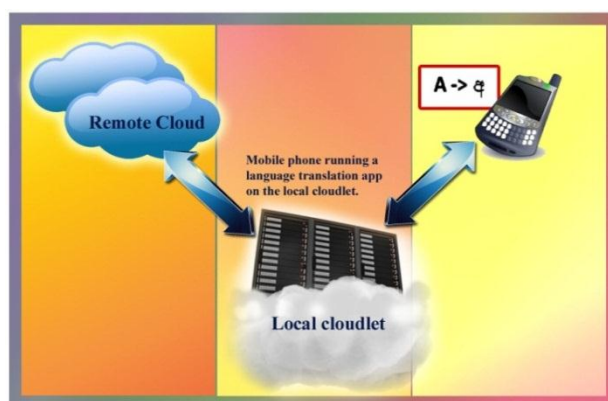
There are two types of Architecture in Mobile Cloud Computing

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

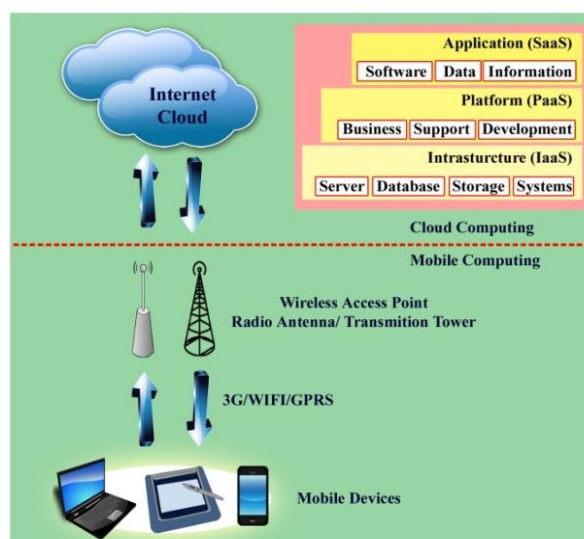
cloudlet contains cached copy of data. It is installed between client and cloud. The cost of installation is less as compared to cloud as it is only a data center at business premises. A cloudlet services only a few users and has less communication latency as compared to cloud. Cloudlet is owned by local business (Satyanarayanan *et al*,2009).



**Fig2:** Non Cloudlet Architecture



**Fig3:** Cloudlet Architecture



**Fig 4:** Mobile Cloud Model

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

### 2.1 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.

### 2.2 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.

### 2.3 Cloud Model

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

## 3. Applications of Mobile Cloud Computing

Some of the applications of mobile cloud computing are Google's Gmail drive, Maps and Navigation systems for Mobile, I- cloud from Apple Moto Blur from Motorola (with a special feature called remote wipe) Amazon 's new "cloud-accelerated" Web browser Silk. Silk is a "split browser whose software resides both on Kindle Fire and EC2. The applications reinforced by mobile cloud computing include mobile commerce, mobile learning, and mobile healthcare and other areas. Mobile applications extended extensive share in a global mobile market. Various mobile applications have engaged the recompenses of Mobile Cloud Computing. The following are the few inferences:

#### 3.1. m-Commerce

Mobile commerce (m-commerce) is a buying and selling of products using mobile devices. The m-commerce applications normally used to achieve some tasks that necessitate mobility (e.g., mobile transactions and payments, mobile messaging, and mobile ticketing). The m-commerce applications have to face various complications (e.g., low network bandwidth, high complexity of mobile device configurations, and security). Subsequently, m-commerce applications are integrated into cloud computing environment to solve these issues (X. Yang *et al*, 2010).

#### 3.2. m-Learning

Mobile learning (m-learning) is an electronic learning (e-learning) and mobility. However, traditional m-learning applications have limitations in terms of high cost of devices and network, low network transmission rate, and limited educational resources (X. Chen *et al*, 2010; H. Gao *et al*, 2010; Jian Li, 2010). Cloud based m-learning applications are presented to solve these limitations, for example utilizing a cloud with the large storage capacity and powerful processing ability, the applications offer

learners with much comfortable services in terms of information size, processing speed.

#### 3.3. m-HealthCare

MCC in medical applications is used to minimize the limitations of traditional medical treatment [e.g., small physical storage, security and privacy, and medical errors (D. Kopec *et al*, 2013)]. Mobile healthcare (m-healthcare) offers mobile users with appropriate help to access resources easily. m-Healthcare provides healthcare organizations a diversity of on-demand services on clouds rather than standalone applications on local servers.

#### 3.4. m-Banking

M-Banking is an uprising in traditional banking services, where user can avail the bank services provided to them through their mobile despite of location and time (Z. Li *et al*, 2001). Transaction can be done even if user is busy in his routine work via SMS or the mobile Internet but can also use special programs, called mobile applications, downloaded to the mobile device.

#### 3.5. m-Game

Mobile game (m-game) is a prospective market producing incomes for service providers. M-game can completely offload game engine requiring large computing resource (e.g., graphic rendering) to the server in the cloud, and gamers only interact with the screen interface on their devices (Jasleen *et al*, 2013) demonstrates that offloading (multimedia code) can save energy for mobile devices, thereby increasing game playing time on mobile devices.

## 4. Data Security Issues in the Mobile cloud

#### 4.1. 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.

#### 4.2. 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.

#### 4.3. Data Location and Relocation

Cloud Computing offers a high degree of data mobility.

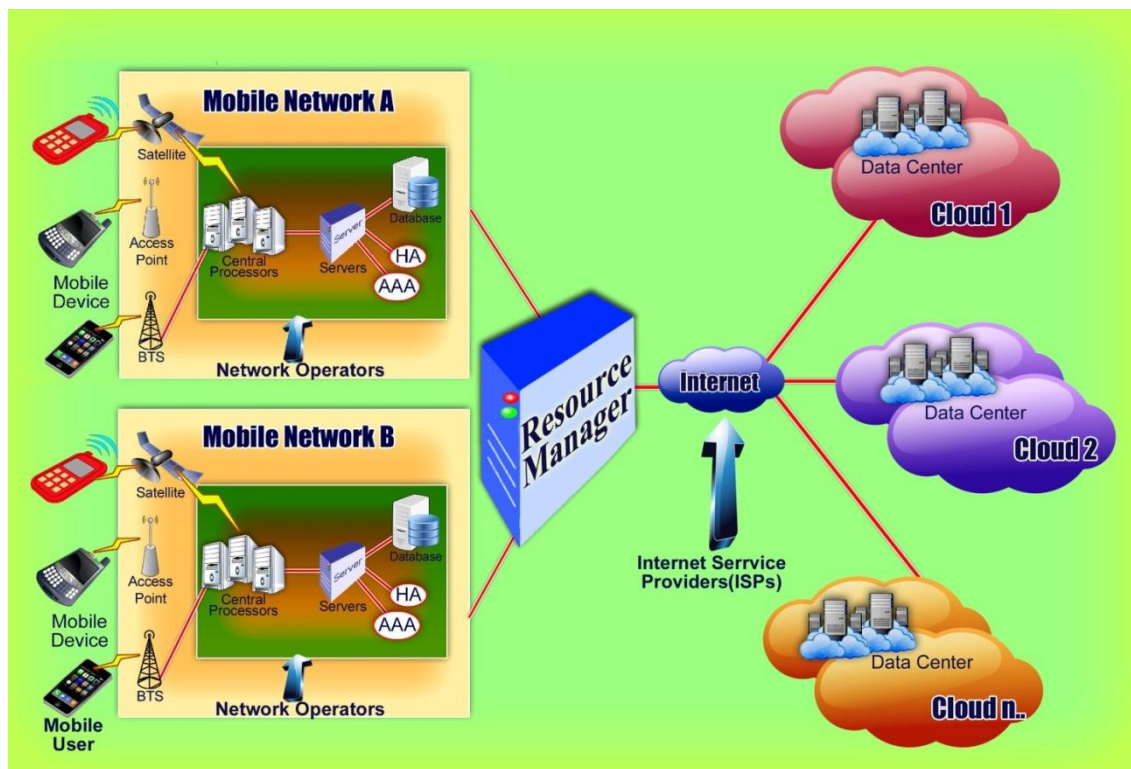


Fig 5: Proposed Architecture of Mobile Cloud Computing

Consumers do not always know the location of their data. However, when an enterprise has some sensitive data that is kept on a storage device in the Cloud, they may want to know the location of it. They may also wish to specify a preferred location (e.g. data to be kept in India). This, then, requires a contractual agreement, between the Cloud provider and the consumer that data should stay in a particular location or reside on a given known server. Also, cloud providers should take responsibility to ensure the security of systems (including data) and provide robust authentication to safeguard customers’ information. Another issue is the movement of data from one location to another. Data is initially stored at an appropriate location decide by the Cloud provider. However, it is often moved from one place to another. Cloud providers have contracts with each other and they use each other’s resources.

4.4. 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).

5. Related Work

So far, industrial and scientific communities have been doing various researches for responding to the above challenges. Some typical research projects and cases are presented in the following. A complete outline on various

researches and trends in cloud computing has been presented in (<http://www.smartdevelopments.org>). The authors gives a survey of MCC, which helps general readers have an overview of the MCC including the definition, architecture, and applications. The issues, existing solutions and approaches are presented. The authors in paper (<http://www.readwriteweb.com>) discuss here multiple techniques and methods for mobile cloud computing. It explores both general-purpose cellular cloud computing solutions and application-specific solutions. It also discusses instances of cellular cloud computing where mobile devices serve as the cloud rather than the client. Finally authors discuss some issues raised by this technology such as privacy and data ownership. In paper (<http://www.vodafone.com>) the authors discuss the architecture of MCC (Mobile cloud computing) with the different services needed by the client and the server in MCC.

6. Proposed Work

We are proposed here a mcc based architecture using our proposed model RM (Resource Manager), that help us in this following manner .when the mobile users want to access the cloud based application they first connect our proposed model and this model then connect the user to

proper cloud resource within little time using our proposed algorithm and mobile user easily connect their cloud based application. The architecture of MCC can be shown in Figure 5. In Figure 5, mobile devices are connected to the mobile networks via base stations (e.g., base transceiver

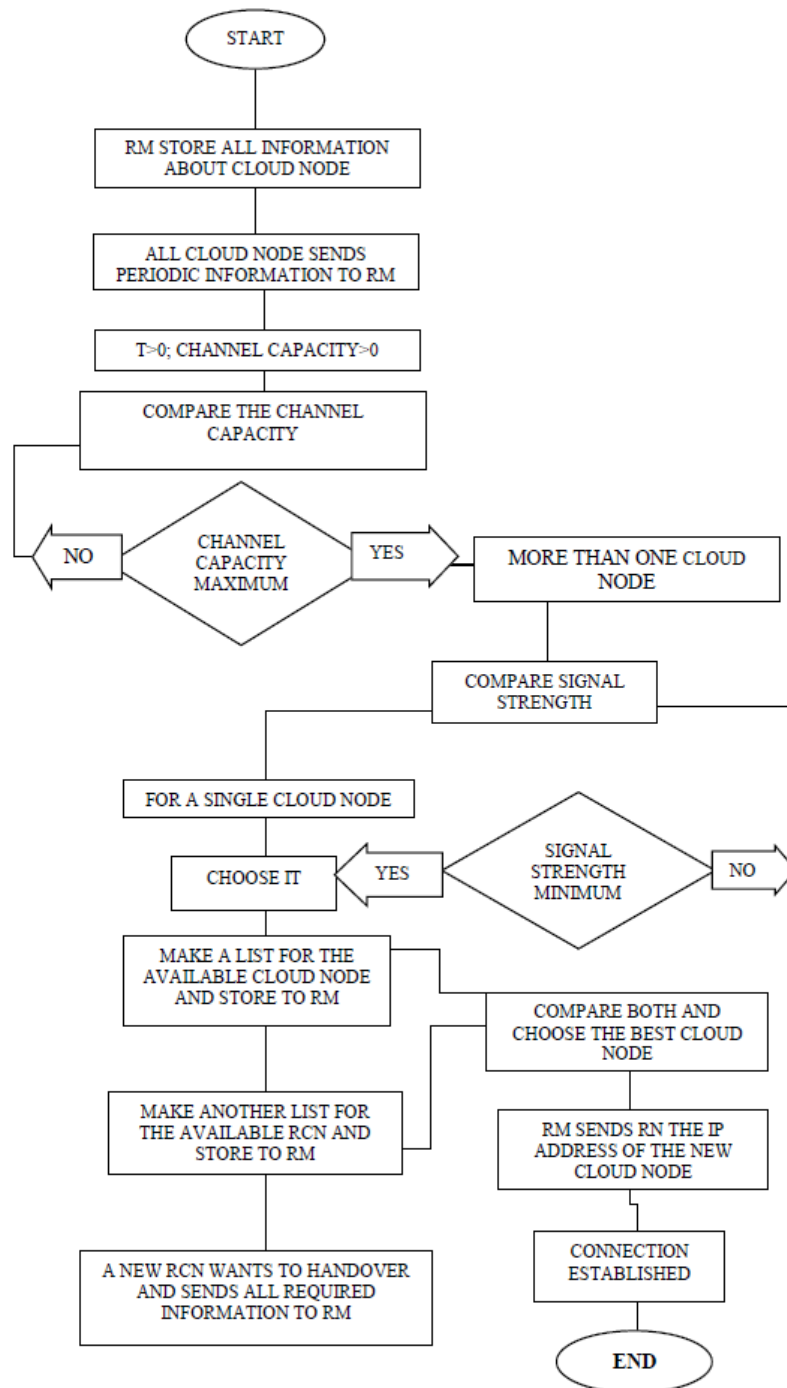


Fig 5 Flow chart

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 our proposed model RM (Resource Manager) and it connects the proper cloud location through the Internet.

**7. Algorithm**

- 1) RM (Resource Manager) stores all information about Cloud Nodes like capacity, IP address, and shortest node distance and any kinds of information about the nodes..
- 2) All Cloud nodes send periodic information to RM.
  - a) Channel capacity
  - b) Storage space
 Both of the information varies time to time and also area to area.
- 3) Now for t=0, compare channel capacity if the channel capacity >0  
Continue;

Else stop

- 4) Compare channel capacity, choose the maximum one.
  - 5) If the channel capacity of the two Cloud nodes to handover is same,
  - 6) Compare the signal strength. Choose the lowest signal strength of same channel capacity.
- Else go back to 4
- 7) Repeat 4-6 every time while choosing a new cloud node to handover.
  - 8) Make a list of the available cloud node and store it to RM.
  - 9) Now, If a new Remote cloud node RCN wants to handover, signal strength decreases under a certain level i.e. threshold level, it sends a Handover Request to RM via its current cloud node containing
    - a) IP address of the current cloud node.
    - b) IP address of the adjacent satellite, If RCN/RCN1 is connected to CN/RCN2 through more than one Data Center by ISLs.
    - c) IP address of RCN
    - d) Position of RCN
    - e) The direction of the RCN
  - 10) Now RM again makes a list of available RCNs.
  - 11) Now comparing the first list and second list it chooses the best cloud node to handover.
  - 12) Once the cloud node is selected, RM sends RCN the IP address of the new cloud node.
  - 13) Now the connection is established.

## Conclusions

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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