



RESEARCH ARTICLE

Mobile Cloud Computing: Its Challenges and Solutions

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Abstract- Mobile cloud computing is one of the technology essential in today's mobile environment run by using mobile devices in cloud environment. It combines the features of both mobile computing and cloud computing, thereby provides optimal services to the users of mobile devices. As MCC is still at the early stage of development, it is necessary to grasp a thorough understanding of the technology in order to point out the direction of future research for ever increasing field. As Mobile Cloud Computing is the most essential fields with growing age of today's fast internet using and mobile world along with its uses it has to faces some of the issues and challenges some of them are address in this paper. As the data is cloud computing and accessing it with mobile devices all the transaction goes through the network so it is vulnerable to attack. For keeping the use of this essential tool of constant in this advance world we are giving some of the solutions to these challenges to address in the field of Mobile Cloud Computing. The mechanism that are necessary to make it secure and use MCC, the solutions mention here for detecting and preventing from attack should be properly applied.

Keywords: Mobile Cloud Computing (MCC), Smart Mobile Devices (SMD), Bandwidth, Security, Interoperability.

I. INTRODUCTION

As inventions of devices like smartphones, tablets, PDAs, etc., which are becoming an essential part of today's human lifestyle and with this world is moving towards Mobile-world. These devices are get even more important since the usage of mobile internet, leading to convenient communication tools. As the word mobile it by itself suggest that they are not bounded by time and place, which is the need of today's busy person. Users of Mobile can get rich experience of various services from their own mobile applications e.g., iPhone apps, Google

apps, etc. that run on the remote servers via wireless networks. This is the reason behind making it essential to the progress of mobile computing (MC) [1]. It becomes a powerful trend in the development of different fields like IT technology, commerce, business industry and many fields of the life fields. But at the same time, the mobile devices are facing many challenges in their resources containing battery life, storage capacity, bandwidth and communications containing mobility and security issues [5]. So, as the use of the smartphones and mobile devices their available mobile services performing much useful task, there is need to address the challenges facing by these devices.

Over the past few years, advances in the field of network based computing and applications has shown that there is a high demand for mobile applications [3]. However some common problem that all those devices share, still needs to be addressed: the limited capabilities of the devices regarding available resources like processor power, available memory and energy consumption. Commonly, cloud computing (CC) gives us a range of services which are provided by an Internet-based cluster system. Such cluster systems consist of a group of low-cost servers or Personal Computers (PCs), organizing the various resources of the computers. They offers safe, reliable, fast, convenient and transparent services such as data storage, accessing and computing to clients. A technology of Cloud computing (CC) gives its users the possibility to host and deliver services over the internet by dynamically providing computing resources [4] on demand basis in mobile nature from any remote distance. With this Cloud computing (CC) has been recognized as the next generation's computing infrastructure.

Cloud Computing offers many advantages by allowing users to use infrastructure like servers, networks, and storages, platforms containing middleware services, operating systems and software's for application programs eliminating the requirement for users to plan ahead for acquiring different resources for storage and computing power. Particularly, resources can be dynamically added and released depending on service demand and with minimal management effort. As a result, the availability of cloud computing services in a mobile environment, also called mobile cloud computing [2]. The increasing scenario towards Mobile Cloud Computing With the explosion of mobile applications and the support of CC for different variety of services for mobile users, mobile cloud computing (MCC) is introduced as an integration of cloud computing with the mobile computing and mobile devices. However, along with the usefulness of this topic of mobile cloud computing research still needs to be done on several issues as well as possible frameworks to support cloud computing on mobile devices. So that this much important topic can gain its advantage easily.

This paper presents a survey on mobile cloud computing from its emergence towards need. Section II provides a brief literature overview of MCC from its emergence to current researches, Section III gives the overview of MCC along with definitions of its important terms. Section IV presents some issues that come towards the development of MCC and we try to give some solutions to address these issues. Finally, we summarize and conclude in the last section of this paper.

II. LITERATURE REVIEW

In The mobile cloud computing (MCC) has been inherited from cloud computing soon after the cloud computing era begun around year 2007 [6]. MCC incorporates cloud computing properties with the mobile computing environment. As a development and extension of Cloud Computing and Mobile Computing, Mobile Cloud Computing, as a new phrase, has been devised since 2009 and Due to its attractive business model and the increased number of mobile phone smart-phone, tablet pc, etc. users in the world, the MCC is proving to be a potential future technology. According to the top ten strategic technology trends for 2012 [6] provided by Gartner (a famous global analytical and consulting company), cloud computing has been on the top of the list, which means cloud computing will have an increased impact on the enterprise and most organizations in 2012. The authors of [7] have presented an overview of MCC security architecture. Privacy and integrity of the data is important aspect of MCC security.

The mobile users do not need high data processing and storage capabilities services on their mobile devices with the emergence of cloud resources are used for all the data processing and storage. Therefore, the MCC popularity among the mobile users is increasing rapidly and which is also highlighted in [8] that ABI research predicts that the number of mobile cloud computing subscribers is expected to grow from 42.8 million i.e. 6% of total mobile users in 2008 to 998 million and 19% of total mobile users in 2014. According to another report of Juniper shared in [9] that the demand of mobile cloud based application is increasing with rapid phase and its market value will raise 88% in the time period of five years from 2009 to 2014. Instead of the benefits which offers by MCC, it's not fulfil the expectations. The only barrier which prevents the users to adopt mobile cloud computing is that there is risks in terms of security and privacy of the data and services. Most of the IT executives and managers around the world have surveying for this. A survey conducted by a research firm Portio and published by another research firm Colt points that 68% of chief information officers (CIOs) have serious concerns about the security of cloud computing [10].

III. OVERVIEW OF THE TECHNIQUES

A. Cloud Computing

Cloud computing is the delivery of computing services over the Internet on the pay-per-use basis. The cloud-computing model allows access to information and resources on anytime and anywhere basis. Cloud services are very useful as it includes online file storage, social networking, webmail, and online business applications etc. By using these services, businesspersons can use software and hardware that are managed by third parties at remote locations. Cloud computing provides a shared pool of resources, including data storage space, networks, specialized corporate and user applications also.

Cloud computing related to computer science services and describes a type of outsourcing the computer services, without worrying about from where it is? And from how it is? One has to only pay for what they consumed. The idea behind cloud computing is similar: The user can simply use storage, computing power, or specially crafted development environments, without worrying about its internal working. Cloud computing is usually Internet-based computing which hides complex infrastructure of the internet [16]. It is a style of computing in which IT-related capabilities and services are provided “as a service”, allowing users to access their needed technology or services from the Internet without gaining knowledge of it, or control over the technologies behind servers providing services. Cloud computing delivers computing resources over the Internet, instead of keeping data on your own hard drive and offers us freedom to use a service over the Internet, at another location, to store your information or for using its its applications.

B. Mobile Computing

Mobility has become a very popular word and rapidly increasing part in today’s computing area. An incredible growth has appeared in the development of mobile devices such as, smartphone, PDA, and laptops with a variety of mobile computing, networking and security technologies. In addition, with the development of wireless technology and internet it becomes much easier and not limited by the particular office or home or organizations. Thus, more and more people have accepted those mobile devices and gives support to rise in the technology of mobile computing.

Mobile computing is described as a form of human-computer interaction by which a computer is expected to be transported during normal usage [12]. Mobile computing can be said as the collection of three major concepts: hardware, software and communication. The concepts of hardware is dependent on mobile devices, such as smartphone and laptop, or their mobile components. The second concept of Software in mobile computing is the numerous mobile applications in the particular hardware devices, such as the mobile browser, anti-virus software and games stored at remote distance on some other servers. Finally, the communication issue includes the infrastructure of mobile networks, protocols and data delivery in their use, which must be transparent to end users. With the use of the cloud-computing concept, it is easier to develop mobile computation somewhat easier.

C. Mobile Cloud Computing

Mobile cloud computing is the advanced version or it’s the combination of the two most important practical computing paradigm describe above i.e. cloud computing and mobile computing. MCC defines by Aepona [11] as a new distributed computing paradigm for mobile applications whereby the storage and the data processing are migrated from the Smart mobile devices to resources rich and powerful centralized computing data centers in computational clouds. As MCC is based on the cloud concept the centralized applications, services and resources are accessed over the wireless network technologies based on web browser of the smartphones. Many of the business persons are attracted by MCC as a profitable business option since reduces the development, execution cost of mobile applications, and mobile users are enabled to acquire new technology as a on-demand basis. It enables to achieve rich experience of a variety of cloud services for SMDs at low cost [15]. The objective of MCC is to use the computing potentials of SMDs by employing resources and services of computational clouds.

Mobile cloud computing technique try to focus on alleviating resources limitations in SMDs by employing different strategies of augmentation; such as screen augmentation, energy augmentation, storage augmentation and application processing of SMD. There are number of approaches and argue that MCC handles that are needed to high-end hardware, reduces ownership and maintenance cost, and alleviates data safety and user privacy. The MCC model is composed of three major components consisting of smartphones, PDAs, etc., wireless internet technology and computational cloud. This is done as these Devices use wireless network technology protocols or Wi-Fi to access the services of computational cloud in mobile environment. If SMD inherit its nature of mobility, it needs to execute location aware services which consume resources and then

turned as a low-powered client. Fig. 1 [2] shows a generic model of MCC in which the cloud that provides off-device storage, processing, queuing capabilities. It also includes the security mechanism integrated with SMD with the use of wireless network technologies. MCC utilizes cloud storage services [13] for providing online storage and cloud processing services for augmenting processing capabilities of our mobile devices [14].

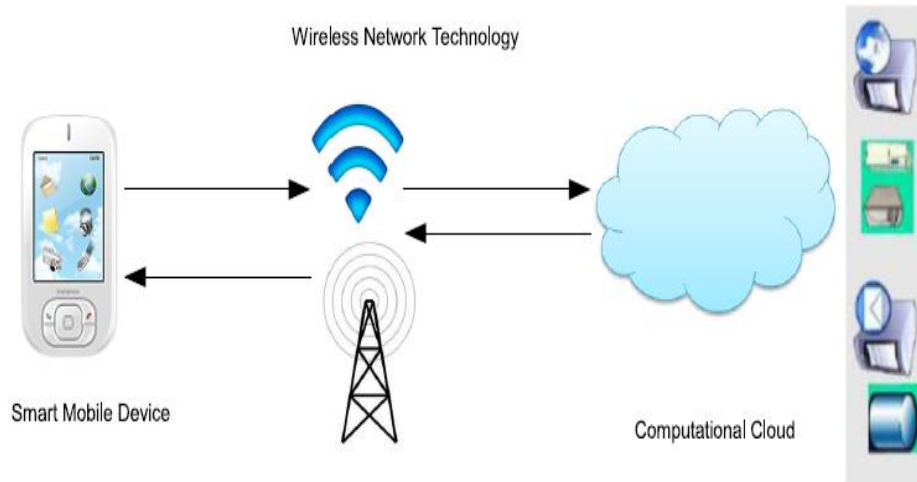


Fig. 1 Mobile cloud computing model [2]

IV. CHALLENGES AND SOLUTION FOR MOBILE CLOUD COMPUTING

A. Challenges Regarding Mobile Communication:

1) Low Bandwidth Problem:

In communication network Bandwidth is one of the important thing as the radio resource for wireless networks are transmitted over networks according to the amount of bandwidth is present for transferring the content in the network.

As the bandwidth is limited sharing the limited bandwidth among different mobile users located in the same area or workstation and probably involved in the same content to be transferred. This results in the improvement of the quality and this solution is applied mainly for the case when the users in a certain area are interested in the same contents. It collects user profiles that are using the network periodically and creates decision tables, Based on which the users decide whether or not to help other users download contents that cannot receive by them due to the bandwidth limitation.

2) Lack of Resource of Mobile Devices:

Comparing mobile device with older desktop PC shows that how the cost feature of mobility is being achieved. As there is lack of resources makes it hard for the adoption of mobile cloud computing in general conditions.

For overcoming this limitation of mobile devices and there resources, they are added to the cloud infrastructure so that they can be used on anytime on anywhere basis makes it easy for most of advanced applications. As the mobile device performances, and the resource constraints of mobile devices going on increasing and fixed devices will remain and must be accounted for the types of application selected for mobile cloud computing [18].

B. Challenges of Network

1) Challenges of Wireless Network and Access Control Policies:

Wireless network is base for carrying out cloud computing and it has its own intrinsic nature and constraints. For better performance the consistent network bandwidth is important but actually variable data rates, longer latency and connectivity with gaps in coverage are the main problems associated with network in the MCC. Some uncontrollable factors are also responsible like weather for varying bandwidth capacity and coverage [17]. For implementing MCC, accessing the network with heterogeneous access scenario and different access technologies like WiMAX, WLAN, 4G, and so on, having their own policies and restrictions.

As the wireless network is an important thing to support MCC functioning there should be the proper mechanism for minimizing the latency, increasing the bandwidth and decreasing the connectivity gap. We should keep different access schemes for avoiding connection failure and connection re-establishment. In order to give faster access for mobile devices, most providers are offering 4G/Long Term Evolution (LTE) services. These services on the basis of data storage capacity, plug and play features, low latency, etc. This provides download peak rates up to 100 Mbps and upload up to 50 Mbps [18].

2) Seamless Connection Handover:

Currently executing application is terminated or it returns error message when one move from one access point of network to another point or one move from Wi-Fi network to 3G-based cellular network. Because this creates the situation of communication failure and connection reestablishment.

So, for providing data communication using cellular network mobile operators are trying to set up Wi-Fi Aps on street. This system is helpful to offload traffic of Wi-Fi systems can be reduced, and is to provide seamless in reduced cellular traffic congestion.

C. Challenges Related To Mobile Applications

1) Interoperability:

There are lots of mobile devices running on different platform including iPhone, Android phones, BlackBerry and others also. This variety of devices are used by people in the same organization or a group of people sharing single network. And in such situation interoperability issue becomes a major challenge in pulling/ pushing data across multiple devices.

An application that are run on mobile cloud infrastructure should be supported by certain mobile cloud infrastructure that can easily be judged possibly on the basis of its requirements against the cloud infrastructure characteristics. Along with the device, network bandwidth and latency vectors should perform computation intensity, network bandwidth, and network latency properly.

2) Mobile Cloud Convergence:

Data distribution is an important issue for achieving advantage of mobility by making integration with cloud computing with mobile world. As for using this cloud computing application services with mobile devices there some issues with computation of data, battery life and performance of this devices in distributed platform.

Mobile cloud convergence is the technique that provides performance improvement and solution to the computation power problem. For this there is a partition of application takes place such that parts that need more computation run on the cloud and run on the mobile device. Wireless technologies, advanced electronics and internet are important to achieve pervasive and ubiquitous computing [18].

D. Challenges Regarding Security

1) Information Security Devices Privacy:

As cloud computing basically deals with providing all type of services, data storage and processing. As all this is done remotely, so security is an important concern for all who are using these services. We are concerning here with Mobile Cloud Computing hence its necessary to check the security related to mobile devices along with cloud computing platform, which is the key concern in this area. This is because there is possibility of device stolen or misplaced, which leads to crucial data to be compromised.

Now days as various security threats are born, cloud platforms also offers many robust built-in security measures like SSL and digital certificates provides as to enable external security [18]. Misuse of data from stolen/ misplaced mobile devices can be avoided by wiping of these mobile device remotely. For detecting security threats on any mobile device is done by installing and running security software's programmers called "Antiviruses" which are readily available in the market.

2) Security Attacks and Hacking:

All networking activates are susceptible to one or other type of malicious attacks. As there is more use of Web sites that are sometimes accessing malicious code sites, for accessing the network and operational data of that particular person or organization. There are some event at that time after implementing best measures for providing the best security policies to data and information trained attackers with best surfing May creates incidents that normally inescapable as:

- There are various policies and schemes are now days available such as Fair Information Practice Principles (FIPP) which require rigorous controls and procedures to protect the privacy of individual persons data as well as organizations information.

- Encryption is technique that is best for providing most effective way to maintain integrity and confidentiality of information.
- Along with other internal servers Web 2.0 servers may further mitigate the threat of unauthorized accessing of information through social media, Web sites and other internet sources.

V. CONCLUSION

This paper describes the Mobile Cloud Computing which is a hybrid model that is combination of Mobile devices accessing the services that are remotely available on the cloud. It is becoming the active research field, due to excessive usage of mobile devices by large amount of individuals and cloud computing by many organization is in initial stage. In this paper we focus on the today's most important field MCC as the demand of mobile devices are increasing. Along with this as the usage of internet is also increases very much the data storage is shifted in the cloud environment that leads to the development of MCC. As all the transaction is on the mobile network with the use of internet the chances of different kinds of threats are increasing, we have mention some of the challenges that Mobile Cloud Computing has to suffer. As we studied that MCC is very important for today's advance technical world, creating the necessities for finding the solution to the possible attacks on this MCC technology.

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