

A Survey of Issues and Approaches in Mobile Cloud Computing

B. Muthu Kumar^{1*}

¹Professor, School of Computing and Information Technology, REVA University, Bengaluru, Karnataka, India,
muthu122@gmail.com

Abstract

(MCC) Mobile cloud computing refers to the provision of the cloud computing services inside a mobile context. MCC utilises both mobile networks as well as cloud computing to provide mobile users with the best possible experience. Mobile devices don't need to have strong configurations such as CPU speed, storage capabilities, and so on, since all data as well as difficult computing modules may be processed in the clouds under mobile cloud computing. An overview of MCC applications' needs and current solutions is presented in this study. We also cover architecture, applications, main features, security challenges, advantages and disadvantages, and maybe a solution for mobile cloud computing.

Keywords: Mobile Cloud Computing (MCC), Mobile environment, Mobile networks.

1. INTRODUCTION

A decade ago, the number of people using mobile phones was a fraction of what it is now. Those who use mobile devices have full access to the data and must find a method to properly use the applications on their phones regardless of the time or even storage constraints, as an instance. Despite this, mobile devices still have, storage, computational battery, bandwidth, as well as power limitations, even if the rise is strong. They also need to be less connected as well as less secure, at least compared to whatever we are used to with fixed equipment. This is the basic need. Such constraints may be overcome with the use of the current LTE mobile network standards as well as cloud augmentation that is presently used in

* ISBN No. 978-81-955340-6-7

newer mobile apps. In order to function on a mobile phone, such apps often incorporate activities such as computer vision, image analysis, facial identification, an optical character recognition, as well as augmented reality.

These three technologies work together to deliver high-quality computing resources that may be used by both mobile users as well as cloud computing providers. When mobile devices as well as the cloud computing are combined, MCC creates a whole new infrastructure. It refers to a system beyond mobile device wherein data is stored and processed. When it comes to computing-intensive operations and storing massive volumes of data, the cloud takes the lead. It's clear that the quick rise of the (MC) mobile computing [4] is a significant breakthrough in the field of technology. Mobile computing devices, on other hand, are plagued by several resource as well as communication issues (– for example, battery life, storage capacity, as well as bandwidth) (for example, mobility as well as security) [5].

The followed criteria may be used to categorise the many uses of the mobile cloud services:

- **Sensing capability:** It is possible to use a smartphone as a sensor. Blood pressure, Humidity, as well as temperature are just a few of the numerous variables that sensors may detect. Sensor data may be uploaded to the cloud at such a later time. Users from all around the world may get their hands on this data thanks to the cloud.
- **Maintaining privacy and security of user data:** When using a mobile cloud, even a user may determine what information they want to keep private as well as what the information they want to make it public.
- **Data storage and reliability:** If such storage device fails, mobile cloud will back up such data as well as secure users' information.
- **Security of personal information:** Virtual computers in cloud provide better protection for the personal information thanks to the secured search engine.
- **Health monitoring:** It is possible to store and send data about one's health to cloud utilizing mobile devices equipped with sensors. Mostly in cloud, health centres may provide customers advice on how to keep their health in check. For the health monitoring, mobile devices may be utilised as sensors, too.
- **Sensing as a service:** For example, the mobile cloud offers a service that delivers platform, infrastructure as well as software as a subscription. As a result, a user may effortlessly switch between several programmes without having to worry about their compatibility.

Mobile cloud computing has indeed become a prominent study subject in scientific as well as industrial sectors because of the key application models inside the Internet age. It's growing more and more popular with each passing day. There are several mobile cloud computing apps available to consumers, including Google's Maps, Gmail, including Navigation systems for the Mobile, Voice Search

Advances in Cloud Computing Security: Techniques and Applications

as well as other services. It is clear from a Juniper Research report that perhaps market for the cloud-based mobile apps is \$9.5 billion for both consumers and businesses [6]. It's really the primary goal of cloud computing to offer a wide range of services as well as software through the Internet, expanding storage capacity, decreasing costs, automating systems, and divorcing service delivery again from such underlying technology. Fig . 1 illustrates mobile cloud computing infrastructure.

1.1. Benefits of Mobile Cloud Computing

- 1 Businesses save money by using mobile cloud computing.
- 2 Since of their mobility, they are able to carry out their duties more quickly and effectively.
- 3 Cloud customers use their mobile devices to investigate new capabilities that aren't available on their computers.
- 4 Using mobile cloud computing web services, developers may reach a wider audience.
- 5 It's possible that other network service providers may enter this market.

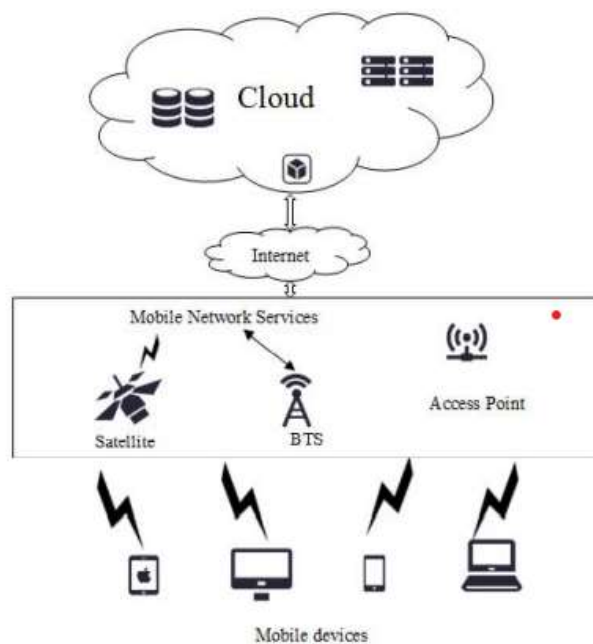


Figure 1: Architecture of Mobile Cloud Computing

- **Mobile Network** Cellular Service Providers In order to connect to mobile networks, mobile devices (such as smartphones, iPads, laptops, tablets, and etc) need satellites, BTSs whose full form is Base Transceiver Stations, or even access points. The operational interface in between mobile device as well as network operator is controlled by mobile network.

- **Internet Service** Internet Service Internet links mobile network to cloud through the Internet. Mobile users may utilise internet to connect to cloud and get resources that they require. Cloud services may be accessed wirelessly or through a 3G or even 4G telecommunications network.
- **Cloud service** Service in the cloud Service-oriented cloud architecture has three layers: SaaS that is Software as a Service, PaaS that is Platform as a Service, as well as IaaS Infrastructure as a Service (Infrastructure as a Service). Virtualization systems like VMs are offered by IaaS. (Virtual Machines). Such infrastructure services may be tailored to meet the needs of the user at any given time. To create, test, as well as deploy applications, or even PaaS offers a platform. SaaS provides access to applications as well as a database.

2. MOBILE CLOUD COMPUTING CHARACTERISTIC

Since mobile as well as cloud computing are combined in this form, mobile cloud computing exhibits both the advantages as well as disadvantages of each.

- **Entertainment:** Smartphones, which can run a wide range of apps, now account for the majority of such mobile phone market. There are a variety of ways that smartphone users may have fun while they're doing other things.
- **Communication:** The primary purpose of mobile devices like cellphones is to well communicate with everyone. Users from across the globe may connect with one other using social software in addition to phone calls.
- **Movability:** This is a fundamental feature of the mobile computing. Just on bus or even at KFC, users may get work done or even get the information they need.
- **On-demand self-service** Users may request computational resources (server time as well as network storage) as well as have them delivered to them on demand. It also makes it simpler to respond to the changes in demand within real time.
- **Resource pooling:** Cloud service providers have a vast pool of computer power at their disposal. Infrastructure as well as network facilities are included in this resource pool, which gives computing power that has never before been seen.
- **Rapid elasticity:** Some services may be automatically deployed and withdrawn based on demand from users. As a result of this feature, cloud customers may design as well as deploy services fast.
- **Cloud computing:** Using an internet connection, even users may access cloud resources as well as services.

Advances in Cloud Computing Security: Techniques and Applications

- **Virtualization:** One of the fundamental technologies involves virtualization. In an attempt to dynamically supply resources and save costs, cloud providers may use virtualization to combine resources and virtualize them.
- **Broad network access:** A wide range of client platforms, including tablets, mobile phones, workstations as well as so on, may be used to access the cloud through the Internet. Users and suppliers alike are able to the monitor and regulate the number of resources that are being used.

I. SECURING INFORMATION ON THE CLOUD

Individuals and businesses can use cloud to store large amounts of data or even applications. Moreover, the authentication, integrity and digital rights of such data or even application must be protected while processing.

- **Authentication:** A slew of different methods of authentication have been floated in an effort to keep mobile users' access to the cloud computing data safe. A few organisations adhere to open standards as well as encourage use of a variety of different forms of authentication. Such as showing how to use log-in IDs, PIN codes and passwords to gain access.
- **Integrity:** Data stored on the cloud network should be protected by all mobile cloud users. Authentication and verification are required for all access. Distinct approaches are indeed being presented to ensure the integrity of one's cloud-based information. Using an instance, every cloud user's information is labelled or initialised to them, and they are only ones who can move or even delete information from the cloud.
- **Digital Rights Management:** There has been a steady rise in the number of people who illegally download different digital material such as images, music, and video and e-book applications. The above digital contents have been protected from an illegal access by numerous methods, including provision of an encryption as well as decryption keys. There should be some sort of code or even decoding platform in order to access like digital content over mobile devices.

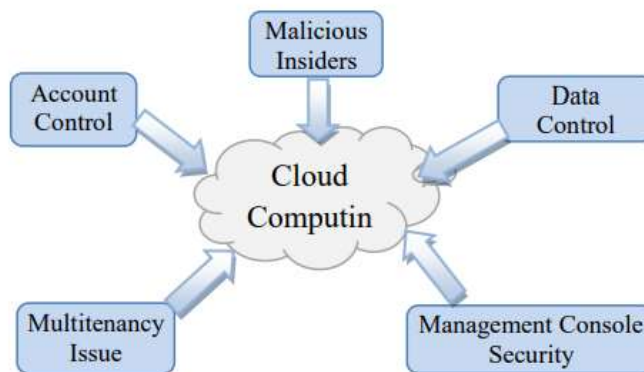


Figure 2: Categorization of threats in MCC

3. MOBILE CLOUD COMPUTING - CURRENT TRENDS

3G is perhaps the most popular mobile technology in use today, and 3G-enabled mobile computers are being developed.

- **3G:** When the (ITU) International Telecommunications Union released the (IMT-2000) that is called International Mobile Telecommunications-2000 standards in the year 2000, 3G or 3rd generation mobile was introduced. Wide area wireless phone, even video calls, including mobile Internet as well as TV in the mobile environment are only some of the features of the action services.
- **Global Positioning System (GPS):** A space-based system of navigation, (GPS) the Global Locate System, may be used in any weather conditions, anywhere near the Earth wherein there is a clear line of sight to at least four GPS planetoids. Additionally, civil as well as commercial buyers throughout the globe now have more demanding options thanks to the GPS initiative. Improved worldwide air traffic control, resistance, including location services rely on GPS.
- **Long Term Evolution (LTE):** For the mobile phones as well as data depots, LTE is indeed a high-speed data transmission protocol. As a result of innovative tone approaches, it has capacity as well as speed of GSM or EDGE as well as UMTS/HSPA networks but is more efficient. It has to do with the usage of 4th Generation (4G) mobile technology.
- **5G** For the first time, 5G cellular communications technology goes above and beyond previous generations of the mobile technologies. To put it another way, 5G isn't merely next generation of the mobile communications. Instead, 5G technology is quite diverse. In past, systems had been shaped more through the possibilities offered by newer technologies. New 5G technologies has indeed been pushed by specific applications. A wide range of purposes, including audio communications, remote control, large video downloads, including low data rate capabilities such as remote sensors as well as Internet of the Things, have propelled the development of 5G.
- **WiMAX:** To increase data speeds from 30 to 40 megabits per second, WiMAX that is the "Worldwide Interoperability for Microwave Access " is indeed a wireless communication test method that can now provide data rates of up to 1 gigabit per second across a fixed location. A component of 4G (4th Generation) wireless communication, or 4th generation. With such a signal radius of around 50 kilometres, WiMAX offers the metropolitan area network that outperforms the traditional Wi-Fi LAN's 30 metre wireless range. Cable-modem as well as DSL connections may be replaced by WiMAX because of its ability to transmit data quickly, however the capacity should be shared among several users, which results in slower speeds in most cases. The "final mile" is where WiMAX goods and services are also most probable to occur by consumers. For ISPs but also carriers, WiMAX means not having to utilise physical cabling (copper, even cable, and so on.) to link clients' premises towards the Internet.

4. MOBILE CLOUD COMPUTING LIMITATION

By using mobile cloud computing, subscribers will be able to quickly and easily access their cloud-based files, applications, and other data. Because mobile devices as well as wireless networks are so unique, they provide the most significant obstacle to cloud computing on the go. All of these difficulties make using the app more difficult than it would be on a stationary cloud device. When it comes to the cloud computing, overall quality of the wireless connectivity, as well as the cloud computing's support for mobile devices, are all key considerations to keep in mind. Listed below are the most common issues and the solutions for the mobile cloud computing:

Security and Privacy in the Cloud: Increasingly, security as well as privacy have taken centre stage in the mobile cloud computing. The organization's private data as well as secret information will inevitably be exposed when it establishes a cloud-based architecture. That cloud service provider will then be in charge of managing, safeguarding, and storing them. Before making a choice, all available options should be considered. As a result, consumers may be reluctant to hand up their personal information to the third party.

Low Bandwidth: In the mobile cloud context, bandwidth is indeed a critical problem since mobile network resources are substantially fewer than those of conventional networks. As a result, P2P Media Streaming may be used to distribute tiny amounts of bandwidth among subscribers in the very same region that are watching the same movie. Each user may transmit or exchange portions of same material with a second user that use this process, leading to an enhancement inside quality of the sent information, particularly for the video transmission.

Prone to Attack: Information stored in cloud seems to be more exposed to external hack assaults as well as threats. There is no such thing as total security just on internet. Just on internet, hackers including malevolent users are continuously on the lookout for the opportunity to steal sensitive data as well as information.

Limited Control and Flexibility: Because all apps including services are hosted in distant or even the third-party virtual environments, consumers have minimal control over how hardware as well as software work together. Because distant software is now being utilised for the mobile cloud computing, it often lacks the functionalities of a local programme.

Dependency and Vendor Lock: Inherent in the mobile cloud computing's reliance on an ISP is a significant drawback. If a customer wishes to change providers, the process of transferring significant amounts of data through one provider to another may be very time consuming and frustrating. Choosing a vendor is a really important decision, which is just one of the many reasons why.

Increased Vulnerability: Cloud-based solutions that deal with privacy as well as security are a more attractive target for the hackers as well as other bad actors since they are all available to public internet. Several of the greatest names on the internet are the victims of significant attacks and security lapses. Nothing about the internet can be guaranteed to be completely safe.

B. Muthu Kumar

The Mobile cloud computing problems may be reduced using the following techniques: Utilizing regional data centres, wireless networks may benefit from increased bandwidth as well as more mobile-friendly content over the web.

- Deploy an application processing node just at "edge" of the cloud computing to speed up data transmission.
- (DIC) that is Data-intensive computing and energy-intensive computing, including virus detection on the mobile devices, may be duplicated to the cloud utilising virtualization including imaging technologies.
- Dynamically improve cloud application push as well as division through the mobile terminals.

5. CONCLUSION

It is the primary goal of mobile cloud computing for empowering mobile user, independent of mobile device's resource limits, by offering a smooth and the rich functionality. Even while mobile cloud computing is indeed still in its infancy, it has the potential to become the dominant paradigm for mobile applications in the future. An introduction to the mobile computing, followed by a discussion of its evolution and the direction the technology may go in the future, all while navigating the many classes as well as security concerns that may arise. Mobile computing has made it possible to capture video including audio while on the move. Movies, academics, and talkative content may all be followed with ease. One may acquire all the fun they desire when browsing the internet for the flood data thanks to the advancement and display of the high-speed data ally at such an extravagant cost. The internet provides access to a wide range of entertainment options, including news, movies, and films. This wasn't created prior to the rise of mobile computing.

An overview of the MCC's architecture as well as features is presented in this publication. MCC is sometimes characterised in literature as a huge difficulty. Open research topics in this domain and associated techniques are presented in just this taxonomy, concentrating on the low bandwidth, the computational offloading and the heterogeneity and etc. We'll look at ways to enhance resource allocation in the MCC environments, like how to distribute as well as offload tasks based on quality of service (QoS) profiles as well as cost functions.

REFERENCES

1. Abolfazli, S., Sanaei, Z., Ahmed, E., Gani, A., &Buyya, R. 2014. Cloud-based augmentation for mobile devices: motivation, taxonomies, and open challenges. *Communications Surveys & Tutorials*, IEEE, 16(1), 337-368.

Advances in Cloud Computing Security: Techniques and Applications

2. Liu, F., Shu, P., Jin, H., Ding, L., Yu, J., Niu, D., & Li, B. 2013. Gearing resource-poor mobile devices with powerful clouds: architectures, challenges, and applications. *Wireless Communications, IEEE*, 20(3), 14-22.
3. Sarah Perez, August 4, 2009, Why cloud computing is the future of mobile, http://www.readwriteweb.com/archives/why_cloud_computing_is_the_future_of_mobile.php, Retrieved on February 2015.
4. Satyanarayanan M. 2010. Proceedings of the 1st ACM Workshop on Mobile Cloud Computing & Services: Social Networks and Beyond (MCS).
5. Tavel, P. 2007. Modeling and Simulation Design. AK Peters Ltd.
6. S. Perez, Mobile cloud computing: \$9.5 billion by 2014, <http://exoplanet.eu/catalog.php>, 2010.
7. G. Deepak and B. S. Pradeep. "Challenging Issues and Limitations of Mobile Computing." *International Journal of Computer Technology & Applications*, vol. 03, Feb. 2012.
8. P. Yadav and N. Chaudhary. "Mobile Computing the Future of Digital Era." *International Journal of Computer Applications*, pp. 23-27, 2015.
9. P. Mell and T. Grance. "The NIST definition of cloud computing." , Sep. 2011.
10. Bahar, A. N., Habib, M. A., & Islam, M. M. 2013. Security architecture for mobile cloud computing. *International Journal*, 3(3), 2305-1493.