

# Challenges in Implementation of Mobile Cloud Computing (MCC) in Afghanistan

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**Abstract:-** Cloud computing which makes ground for using the potential capacity, information, and resources in the form of software, hardware, and data beyond the existing context in our workplace, and organization. Particularly, our country is the emerging ICT, or information and communications technology service applications. By using the contemporary technological advancement in today's world; it's not necessary to limit our business requirement just to the available resources such as software, storage capacities, and data processing which requires huge investment in terms of technologies and management. Cloud computing eases the way for collecting, processing, and storage of big data and could easily provide us to meet the means which reduces our organization's capital expenditure as well as eliminate the whole chine of system management. This paper provides an overview of mobile cloud computing in terms of its concepts, challenges, and solutions including security issues concerning in the context of Afghanistan. It is a very cost efficient solution for many businesses including the public and private organizations dealing with big data processing, service delivery software's, and systems concerning to storage and access in contemporary technological transformation age.

**Keywords:-** Cloud Computing; Mobile Cloud Computing; Issues; Benefits; Infrastructure; Challenges, Security.

## I. INTRODUCTION

Mobile is a rapidly growing technology that influences almost every aspect of human life. In recent years, mobile computing has turned into the main rumor words in the IT industry. Mobile Cloud computing has given a way for mobile users to leverage services, and data at anytime and anywhere which is physically not stored on their mobile devices. It can be brought into play to come over various issues like storage space. This article approaches various issues faced in mobile technology and with the help of Cloud Computing how they can be preserved. It can prove very effective to cope up issues related to performance, and security of mobile devices, if; Cloud Computing is used in the environment. Mobile users gain a good experience with various services from mobile applications like voice

commands, Face recognition and run on their devices or on remote servers via wireless networks. The exponential growth of mobile computing becomes a powerful trend in the development of IT technology as well as commerce and industry. However, mobile devices are facing many issues with resources such as storage, bandwidth, battery life, etc. It has been certified as the next generation of Mobile Computing infrastructure. This is only because of the massive proliferation of it to overcome the above issues. It provides us the opportunity to execute applications on the server rather than running locally on our devices. Day by day, mobile devices are turning to be an essential part of human life. As the most effective and convenient communication tool it is not bounded. It involves mobile communication, mobile hardware/software. Currently, there are many mobile cloud applications such as video playback, document editing, web browsing, email access, Google's Map, Gmail for iPhones/Androids, etc.

## II. PROBLEM STATEMENT

To concisely indicate the concept of MCC based on background studies and to introduce general aspects of topologies, methods and service applications, problems related to the technological advancement, challenges regarding market conditions ,and regulatory implication ; especially, in developing context. Our beloved country Afghanistan is the central research problem. To extent of this paper's objective, extensive literature has been reviewed about the research to articulate the problem and propose consolidated solutions that could be beneficial in guiding future policy-making, arrangements as well as contribute to envision the implementation of mobile cloud computing. This treatise is presented in a way to portrait a concise picture of the topic.

*A. The Following are the Main Research Problems in Afghanistan*

➤ *Can cloud computing be used in mobile phone applications to execute functions faster in comparison to mobile phone applications that do not use it?*

- Do mobile phones with slow computational capabilities and good Internet connection benefit from using cloud computing based mobile phone applications, in terms of improved execution time, in comparison to mobile phones with great computational capabilities and slow Internet connection?
- Which features of mobile phone applications would benefit by the use of cloud computing to improve the execution time of mobile phones?
- What are the other possible opportunities and obstacles of using cloud computing in mobile phone applications?

**III. MOBILE CLOUD COMPUTING**

Presently, all organizations are moving their data onto the cloud. The question is why they are migrating their data to the cloud and also what is mobile cloud computing. Cloud and mobile computing have recently emerged as buzzwords in the IT sector. It is a conjunction of three technologies, namely cloud computing (CC), Mobile Computing (MC) and network? These three parts act together to construct an application that prepares computational resources to a user. The information processing is migrating from mobile devices to centralized computing information centers in computational clouds. The use of MCC comforts the user as well as the cloud provider. While the service provider gets the user free from a good number of users, many users get advantages of easy access and high storage. This is done as these devices use wireless network technology protocols or Wi-Fi for accessing the services of the computational cloud in the mobile environment. If Smart Mobile Device inherits its universe of mobility, it requires performing position attentive services which use up stocks and then changed as a low-powered customer. It also includes a security mechanism integrated with Smart Mobile Devices with the use of wireless network technologies.

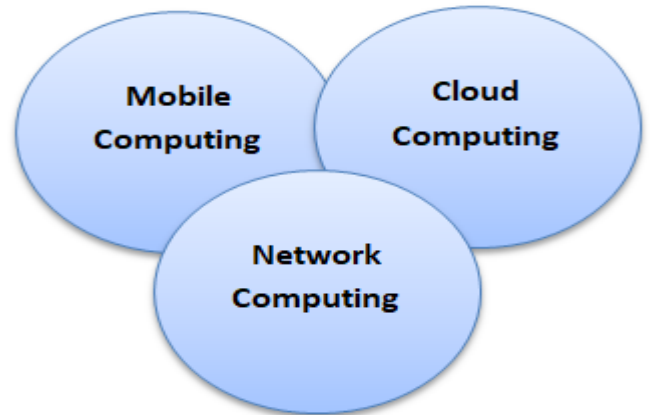


Fig 2 Scope of Mobile Cloud Computing Model

**IV. MOBILE CLOUD COMPUTING CHALLENGES AND ISSUES**

Mobile Cloud Computing is considered as an extension of Cloud Computing. Implementation of similar dynamic technologies involves their own challenges and issues. Though, the Cloud is computationally powerful but mobile devices have restricted resources which calls for a need to have a balance of both components. In the following part, some issues and challenges in Mobile Cloud Computing are discussed:

*A. Limited Resources and Resource Poverty*

Because of having limited resources in mobile devices, the use of Cloud Computing in mobile devices is complicated. As compared to the personal computers, mobile devices have a smaller portion of calculative ability, battery limitation, storage capacity and poor reveal. Comparison of personal computers with every mobile device illustrates that at what price the depict of the wireless phone is performed. Mobile devices use Cloud Computing because of having limited resources in mobile. It has a smaller amount of computational ability, storage capacity and deficient reveal as incomparable to personal computers. Comparison of PCs with all mobile devices (Like iPhones Android, and etc.) demonstrate that at what price the characteristics of the wireless phone are performed. Mobile devices have:

- 3 Times Less Processing Power
- 8 Times Less Memory
- 5 Times Less Storage Capacity
- 10 Times Less Network Bandwidth

*B. Network Related Issues*

The whole procedure is based on the network. Thus there are some topics related to networks like bandwidth, availability, and latency. Of which, network is the main requisite for implementing Cloud Computing. In the mobile area, there are scripts with distinctive approach technologies like 3G, 4G, or Wi-Fi networks. Everyone has their self-outlines and standpoints; therefore the user need seamless connection handover schemes to avoid connection failure while moving from one network access point to another.

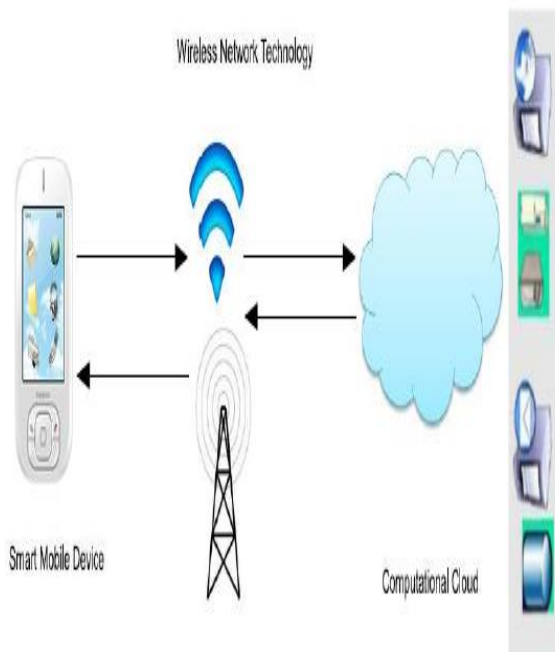


Fig 1 MCC Model

➤ *Bandwidth*

It's an important topic in MCC. In these times, on mobile phones social media websites are very common; however, they need much more bandwidth. The number of customers using these social media raises the requirement for a moderated high bandwidth website. If social media be stopped to enlarge the bandwidth of the website, then regularly the execution of the website on all phones will humiliate. Thus, in the case of an application that needs more internet speed like online gaming that need high processing speed and the lowest network latency. Mobile internet can't supply the same speed at every area. Then, accessing the information through the cloud is harder.

➤ *Availability*

Availability of services has become an essential topic in MCC than Cloud Computing with wired networks. Mobile users may not be talented to join the cloud and obtain services due to traffic overcrowding, and network failures.

➤ *Latency*

The mobile cloud structures involve three elements: Mobile Client, Transmission Channel, and Cloud. The latency as the petition is delivered to the cloud and back to the mobile device upon completion. It is the time takes for information to pass from one point on a network to another. Suppose X in Afghanistan sends a data packet to server Y in India. Server X sends the packet at 07:30:00.000 AFT and server Y receives it at 07:30:00.130 AFT. Thus, 0.130 seconds is the amount of latency on this path. This measurement helps software engineer understand how quickly a webpage will load for users. The principal causes of network latency is distance, A high amount of latency results in poor websites performance affects SEO , and can induce users to leave the website.

## V. CHALLENGES RELATED TO MOBILE APPLICATIONS

➤ *Interoperability*

In an association, workers use varied phones like iPhone, Android, BlackBerry, etc. which often poses interoperability issues as all these phones have distinctive OS and therefore the public application in the network needs to be compatible with all the devices used by the employees.

➤ *Cloud Application Flexibility*

Whether the applications are going to be upheld by a particular mobile cloud infrastructure or cannot be determined by the foundations. It needs opposite cloud infrastructure characteristics along the device network bandwidth and latency. For instance, a weak application such as web-search needs less bandwidth and can prepare maximum results on a 3G. However, if the user makes rumors about the content of strong applications that contain enormous images such as face recognition then it will need more bandwidth so that the huge image data can be forwarded speedily to the servers which operate the face recognition algorithm.

➤ *Mobile Cloud Convergence*

Taking an entire benefit of the Mobile Cloud Computing distribution of the data is the fundamental topic. Remarkable number of applications are offline, some are online. Offline applications make the presentation and business logic locally on the mobile device post downloading the data from the back side whereas online applications keep their business logic and computation on the cloud in another area from the mobile as the computing power of mobile devices is not as powerful as the principal computing platforms.

## VI. SECURITY ISSUES IN MOBILE CLOUD

Since cloud computing deals with data storage, it is very significant to save the stored data safely and securely. Every cloud user wants their information to be safer as the data can contain some confidential information. Any unauthorized person can modify it, to harm the data. Mobile applications that are spread out on the cloud may have remarkably sensitive data about the customer if the application is miserably written the data can be hacked and could raise a risk to both provider and customer.

➤ *Privacy*

In the literal terms, privacy refers to a state in which one is not observed or disturbed by other people. "Privacy is the biggest challenge in MCC as user's data is equipped slightly by the cloud computing provider. Third-party interactions may lead to an unauthorized access to important data which consequently result in the potential loss of personal data. There can be many untrusted and risky Cloud Computing providers that can entice you into their system to plagiarize data.

➤ *Malicious Attacks*

As network is an undivided section of cloud computing so they are susceptible to attacks. At present more outside websites have been accessed by unauthorized users which have lots of opportunities to access the network and user information. Some attacks used by the criminals are:

- *Denial of Service (DoS)*

Cloud is vulnerable to Denial of Services attacks thus more than one customer can use the cloud at the same time which can make DoS attacks more damaging.

- *Side Channel Attacks*

In such kind of attack, a spiteful virtual machine is appointed close to an object cloud server to compromise the cloud security and then a side-channel attack is rune.

➤ *Authentication Attacks*

In case of hosted and virtual services authentication is a weak point and generally has been targeted. All users can be authenticated in many methods, and these mechanisms, which are used to protect the authentications are regularly been targeted by attackers.

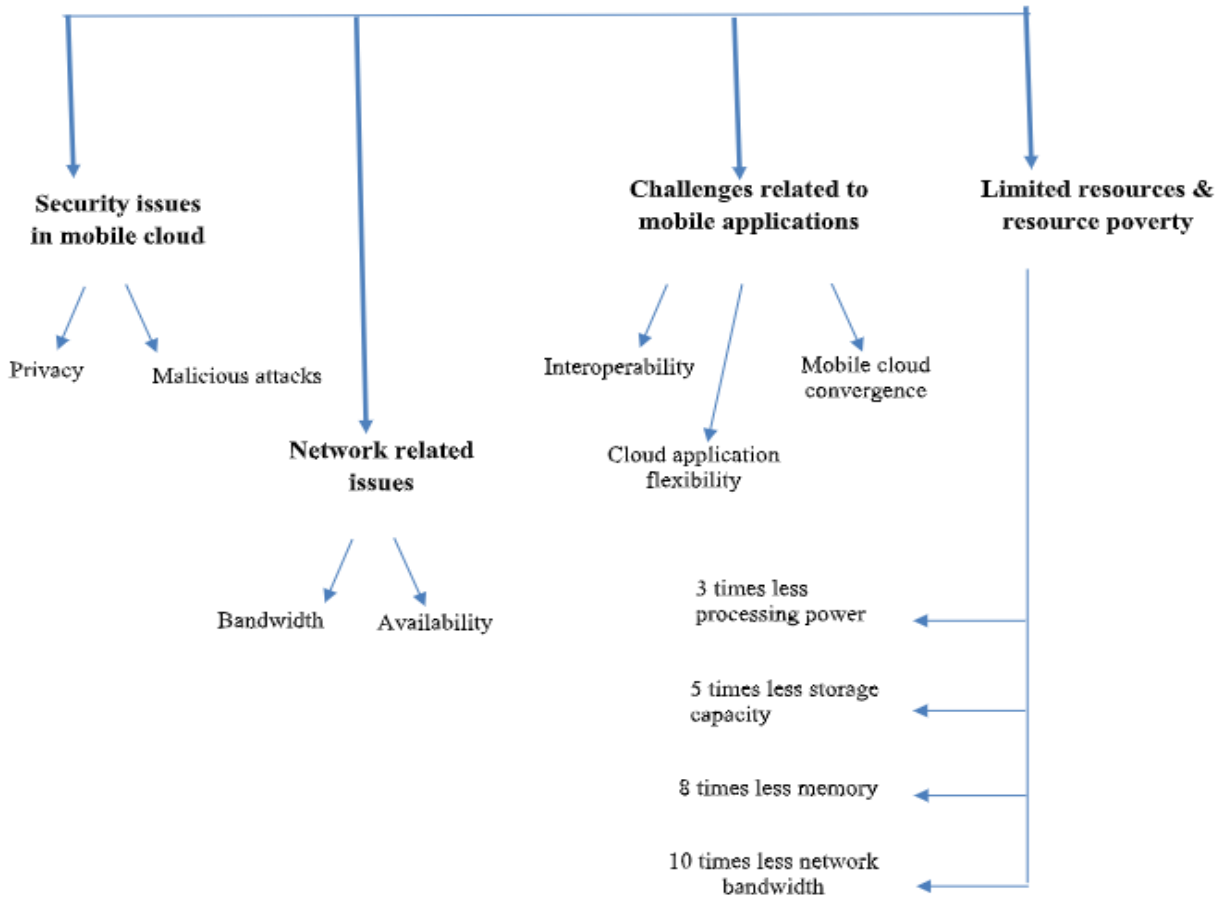


Fig 3 Issues and challenges of Mobile Cloud Computing

**VII. SELECTED ARCHITECTURE FOR MOBILE CLOUD COMPUTING**

Mobile Cloud Computing’s fundamental structure is constructed from: moveable customers, ISP, mobile operators, and Cloud Service providers. Cell phones for the largest part of cellular telephones correspond with multi-purpose systems with the assistance of base stations, access focuses, and satellites. On the versatile system supplier side, the data sent from the cell phones are worked on the focal processors, servers, and database. The fundamental correspondence is formed from both stakeholders. For the largest part, the multi-purpose system provider is comparable to a center good with Simple Object Access Protocol services result taken from the cloud provider to the moveable cloud. There are too special applications of Mobile Cloud Computing by taking advantage of the cloud supervisors without taking advantage of the system provider, specifically through the web. The moveable system director transmits the moveable client’s requests to the cloud through the web. In the cloud, the cloud supervisor’s protocol to inquire for the investigator to consider being similar to cloud organizations to give moveable customers.

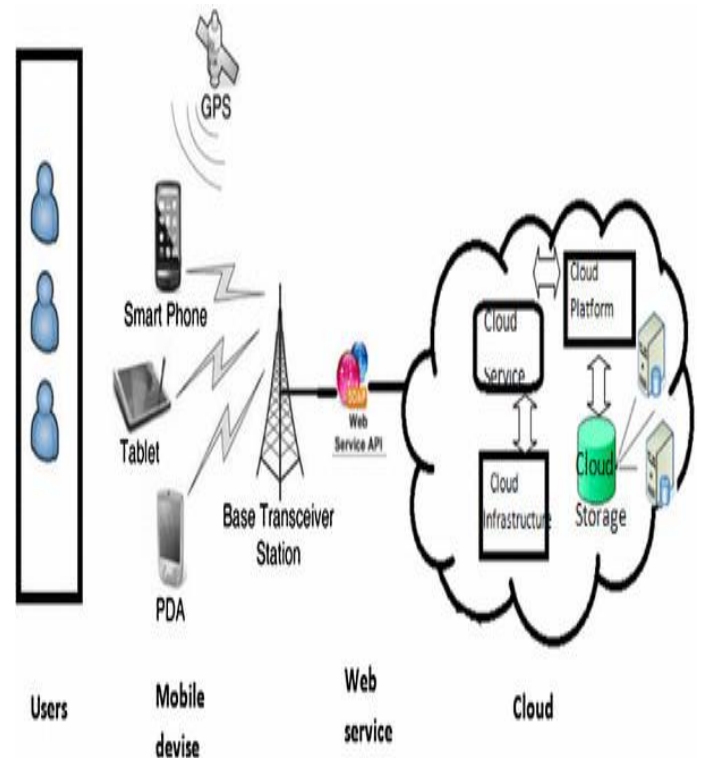


Fig 4 Architecture of Mobile Cloud Computing



## VIII. BRIEF HISTORY OF CLOUD COMPUTING (CC)

In the every emerging and upgrading era of Computer Systems, it is generally found that the older devices, say a laptop bought two years ago cannot match the speed with the development of software nowadays; requires a higher speed CPU, a larger capacity hard disk, and a higher performance Operation System. It compels the user to upgrade their devices constantly, but never overtake the development of techniques. Thus, a term called Cloud Computing burst into our lives. Since 2007, Cloud Computing has become a fairly common term. It is a new concept that provides great opportunities in many areas and it is accessible to everyone, everywhere and every time including clouds referring to the internet and the web. It permits businesses and consumers to use applications without installation and get at their files on any computer with internet access. This writing, focused on some papers that show different risks in the cloud and the distinct existing solutions that address these various problems. Like all computer systems, this new technology suffers a serious problem that reduces trust between client and provider.

➤ *The Following are the Different Definitions of Cloud Computing*

- The term cloud computing is defined metaphorically; some analysts and researchers such as Buyya (2008), Forester (2008) perceives cloud computing systems as updated virtualized versions, usable on the Internet.
- Youseff (2008), Armbrust (2009), and Vaquero (2009) consider cloud computing to be more: it is the increasing capacity and the adding of new capabilities without investing in infrastructure, new human resources and licenses.
- C. Hewitt introduces that the major function of a cloud computing system is storing data on the cloud servers, and uses of cache memory technology in the client to fetch the data. Those clients can be PCs, laptops, smartphones and so on.
- Erdogan (2009) reports that two things are considered essential about cloud computing: saving money and simplified software delivery.
- Leavitt (2009), by deleting the necessity of purchasing and maintaining the infrastructure of hardware and software, cloud computing assists corporations.

## IX. CHARACTERISTICS OF CLOUD COMPUTING

➤ *The National Institute of Standard and Technology (NIST) Describe Cloud Computing with Five Fundamental Characteristics Such as*

- On-demand self-service – Cloud donors all needed computing resources as per demand of the user (Geetu, 2016).
- Broad network access – Users can retrieve cloud services using desktops, laptops, smartphones, etc. over the internet.

- Resource pooling – Cloud providers create a timetable of resources for the user as per their agreement (Geetu, 2016).
- Rapid elasticity – Cloud computing can allocate and de-allocate the services as per acceptance (Geetu, 2016).
- Measured service – Cloud providers have whole control over the usage of resources (Geetu, 2016).

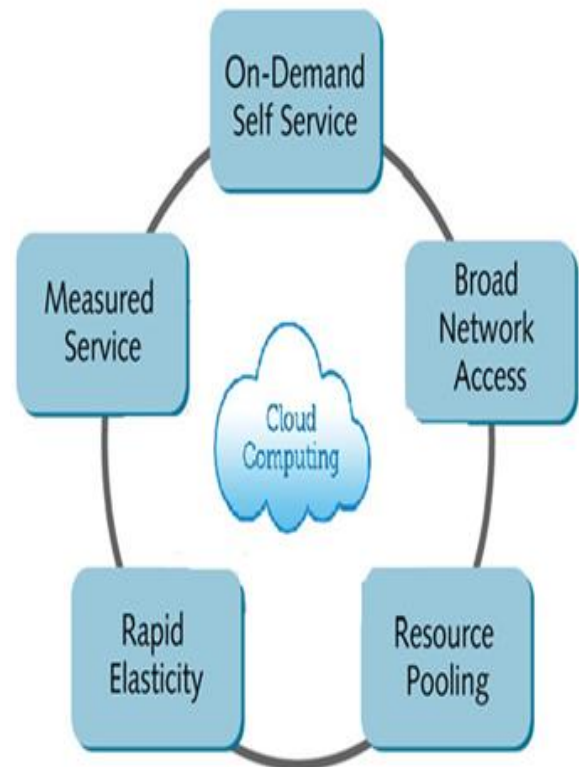


Fig 5 Physical Structure

## X. CLOUD COMPUTING TRENDS

- *India:-* The state government of Jammu and Kashmir in India has taken up cloud computing for their government services. The Data Centre that belongs to the government can be found in Madhya Pradesh provides e-government services on the cloud such as trade licenses and birth certificates.
- *Afghanistan:-* Afghanistan is a country that suffered wars and insecurity for several decades. Therefore, according to Messmer, 2010 was the first time the USA military ran cloud computing in remote areas of Afghanistan to help warfighters in the field to enhance surveillance and decision-making information. In Afghanistan, the private universities Network Design Architectures are based on the cloud. Few universities already started cloud computing technology for educational use. The main goal of a suggested prototype is; on designing deliberations for the private cloud distribution model in the educational background for the University to efficiently the services such as transfer of software, providing of development platform, storage of data, and computing.

- *Australia:-* Australian taxation office and Australian DBCDE.
- *US:-* Departments such as the U.S Army, Air Force, Department of Education, Defense information System Agency (DISA) and many more agencies.
- *Other countries:-* like South Korea, Italy, Germany, UK and Canada also migrate to the cloud.
- *Private cloud:-* Deployments increase both server and storage resource utilization efficiency and decrease the cost of (h/w, s/w) & maintenance the cloud resources, this paradigm offers many benefits to enterprises, industries and universities. A lot of IT companies improve new cloud-based applications, and build new cloud infrastructure.

#### XI. AREAS, WHERE CLOUD COMPUTING HAS BEEN VERY HELPFUL, ARE LISTED BELOW

- Reduced implementation and maintenance costs
- Big Data Analytics
- Increased mobility for a global workforce
- Management Information System(MIS)
- Scalable and Flexible infrastructures.
- IT department transformation (focus on innovation vs. Maintenance and implementation).
- “Greening” of the data center.
- Increased availability of high-performance applications to small/medium-sized businesses.
- Social Networking (Such us, Facebook, Twitter, WhatsApp, Instagram, YouTube and etc.)
- Agriculture
- Education / Art

#### XII. ADVANTAGES OF MOBILE CLOUD COMPUTING

- *The Introduction of MCC Provides Enormous Benefits to the Users.*
- It is fast and flexible.
- It shares resources, which means any mobile device with access to a network, can use mobile cloud apps. Thus, users can enjoy cloud computing with iPhones, Android or OS devices.
- It lets users, securely and quickly collect and integrate information from many sources.
- *Specific Advantages Generated by Applications Designed Under Mobile Cloud Computing Architecture*
- Enjoy better processing power and data storage capacity
- Run more proficiently, thus extending battery life
- More user-friendly and easier to integrate
- Well founded and scalable

In a nutshell, MCC is easier to keep us updated, needs fewer resources from user devices, and benefits from data security measures set in place by the cloud host.

#### XIII. DISADVANTAGES OF MOBILE CLOUD COMPUTING

- *Data Security:* Nowadays, mobile users provide sensitive data through the network, and if it is not secured can cause major detriments. You have to select the most authentic service provider who can preserve your information safe and secure.
- *Connectivity and Performance:* Mobile cloud computing depends on the internet; this can affect your access and use.
- *An internet connection is a mandate.*

#### XIV. MOBILE CLOUD COMPUTING EXAMPLES AND APPLICATIONS

- *Listed Below are Some of the Most Common Fields where Mobile Cloud Computing Applications are:*
- Social Media
- Email
- Finance and Commerce
- Healthcare

#### XV. CHALLENGES AND LIMITATIONS OF CLOUD COMPUTING IN AFGHANISTAN

According to Researchers, 90% of business firms will be using cloud computing services by 2022. Despite all the development and potential of cloud computing services, there are multiple challenges of cloud computing services that businesses face in Afghanistan. Here we have compiled a list of challenges of cloud computing that need to be taken care of, to grasp the maximum capability of the cloud.

- Security / Password Security
- Cost Management
- Internet Connectivity
- Control of Governance
- Performance
- Data Migration
- Interoperability and Portability
- High Availability (HA) and Reliability

It is a good platform for organizations to grow and exceed. You should aware of this while adopting cloud computing.

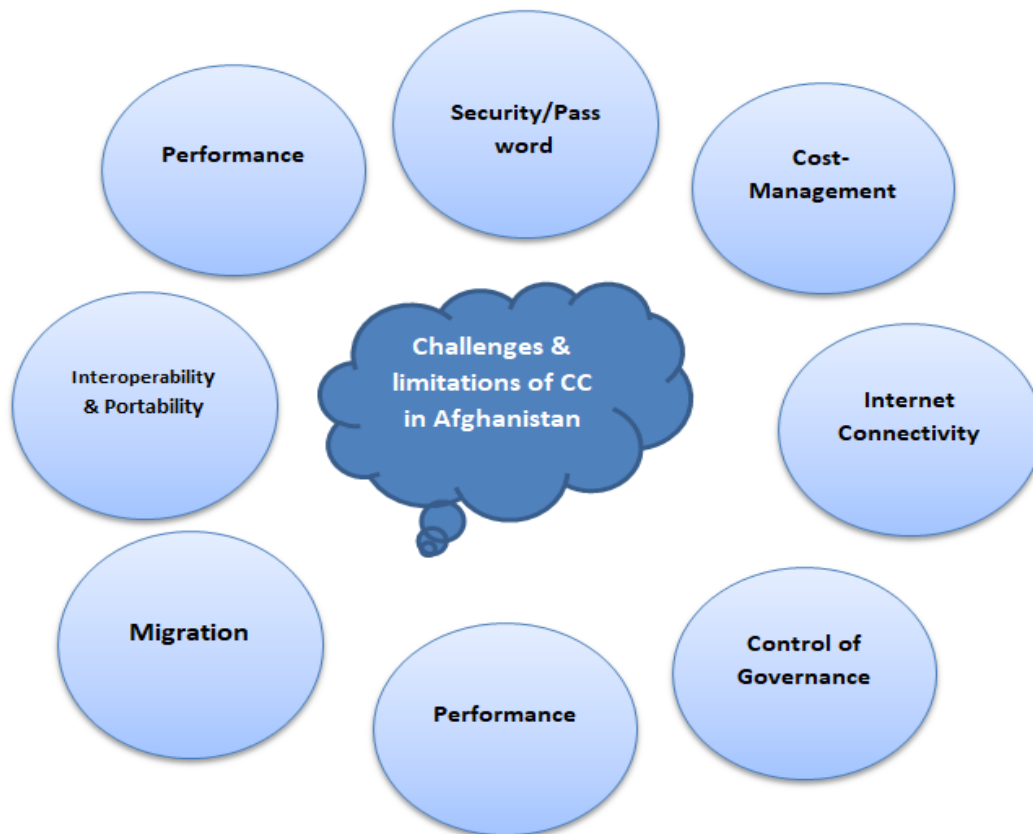


Fig 6 Limitations

## XVI. SUGGESTIONS

The suggestions are a few thoughts to be shared and considered for the future study of MCC. The aim of the activity is the implementation and challenges of MCC in Afghanistan. It is a recent technological and market trend in telecommunication and IT in Afghanistan. Despite the rapidly growing ICT in the country during the last two decades, there is still a need for infrastructure development and universal service applications addressing the inclusion and managing issues of resources for achieving the goals for a sustainable economy. Many public and private organizations still rely on to more extent, distinct information systems and storage. However, a National Data Center was established in the government domain and functioning for some public businesses including a few banks. Cloud Computing applications require further policy and infrastructure development efforts. Obtaining the role of a hub, Afghanistan tends to digitally connect the region and for this strategic goal, the Afghan government formulated a dramatic change in its policy for the telecom sector. An Open Access Policy (OAP), which also exist government-owned company Afghan Telecom, opens the market for national fiber optic network competition has been issued and the Afghanistan Telecommunication Regulatory Authority (ATRA) issued three licenses to private investors to develop their own Organization for Community Networks in the country. This study involves strong literature reviews with different research approaches; the initial part is the basis of CC and then its services and usage. It also includes research articles from different researchers who have covered data storage techniques and have applied them in different areas.

Secure data storage by different researchers is also included in this literature study. Next, a few case studies are also referred to in this context in which users will try to find the pros and cons of different variations conducted and implemented at various organizations. Additionally, the advantages are secured cloud accessing, and security-based cloud access services. Further, embedment of identity over mobile devices for the sake of protection is possible that can be configured, and personalize on each employee's mobile device. It can also use as a personal security token. Corporate-based security features and policies are available in this app to enhance security on mobile devices.

## XVII. ANALYSIS

The analysis shows that with mobile phones' functions, settings, and circumstances it is not beneficial to offload the cloud. It is faster to let the mobile phone execute this type of function. For example, a wordlist with 1500 words was used instead of 15000000. One factor is the size of the task; if the task is big enough it will eventually be beneficial to offload to the cloud. Another important part is to consider the cloud servers and cloud vendors. In this case, Google App Engine was used, but as previously explained it is not the only cloud vendor out there. Several cloud vendors offer different types of services with different capacities. In my view, cloud tests are affected by the bandwidth ratio. The timer function starts before the connection to the cloud. Servers are established and stops when all data is transferred back. For example, 1000 KB images would delay to download if the connection only allowed a 30 kb/s download ratio in comparison to 300 kb/ . This example does also apply to the cloud tests in this

research paper. In theory, the mobile phones that could be considered slow, or old, would be more suitable for offloading functions to the cloud. Computation-heavy tasks would take long time to execute because of insufficient hardware. If the network connection were good and fast, then it would be quick to transfer data to the cloud servers where it would be processed. On the other hand, there are fast mobile phones with slow network connections. In this case, the mobile phone can more easily carry out heavy computer tasks. Transferring the task to the cloud servers would take a long time because of the slow network connection. Therefore, fast phones with a bad connection would be less suitable for cloud offloading. Today there are already quite many mobile phone applications that use cloud computing to some extent and there is nothing that points to a decline in this trend. Therefore, I believe that cloud computing proves to be even more integrated with mobile phones in the future.

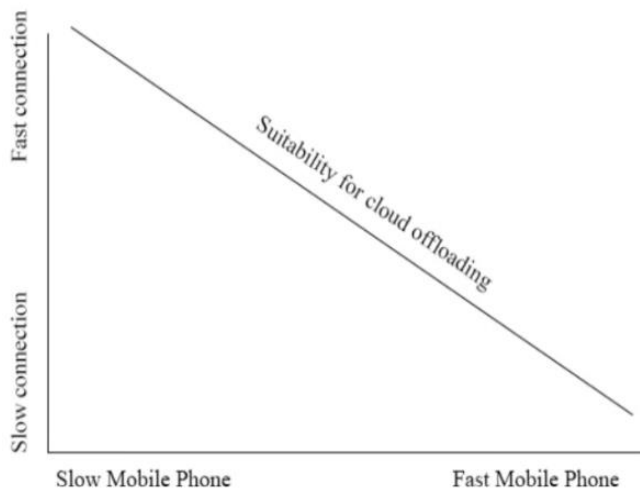


Fig 7 Suitability for Cloud Offloading

## XVIII. CONCLUSION

This paper provides an overview of concepts, achievements, research issues, and challenges about MCC. Mobile Cloud Computing, as it stands today, offers many exciting opportunities. However, the challenges that the research community faces are quite significant. Mobile Devices quickly turn to be an important section of human life. As a more efficient and comfortable communication technology, it is not bounded. Mobile users earn excellent experience of enduring services from mobile applications which operate on their devices or remote servers through wireless networks. The growth of Mobile Computing becomes an effective mode in evolution of IT technology and also trade and manufacturing fields. It suggests some benefits to overpower the overhead issues. Both, of them make a great contribution to our daily lives. Mobile cloud computing, as a development and extension of mobile and cloud computing, has inherited high mobility and scalability, and become a key research topic in recent years. Thus, Cloud computing and Mobile Cloud Computing are the future of most sectors in government agencies in different countries.

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