Mobile Cloud Computing Research-Review, Challenges and Heterogeneity

Anil Prajapati	Kaushik Prajapati
Govt. Engineering College, Modasa	Govt. Engineering College, Modasa

Prof.Dhaval Varia
Govt. Engineering College, Modasa

ABSTRACT With the advancement of technology, every mobile user demands for optimum service yet with minimum usage of resources. Cause of advancement of wireless communication there is significant increase of mobile users. Also arising cloud computing and mobile applications. This brings out a great business and research opportunity in mobile cloud computing (MCC). MCC is integration of mobile computing and cloud computing. In this paper we present an overview of MCC in terms of its concepts, architecture, working and motivations. Paper also discusses challenges and heterogeneity of MCC. In last section discusses the future scope of research in mobile cloud computing.

I.INTRODUCTION

Mobile devices like Smartphones are the most effective communication tool today that is not bounded by place and time. Users of mobile devices getting various services from mobile applications, These mobile applications are run on the devices and/or on remote servers via wireless networks like GSM,Wi-Fi and Cellular networks. Today the faster progress of mobile computing becoming a powerful trend in the development of Information technology and in other commercial fields, but mobile devices are facing many challenges in their resources like memory storage, battery and bandwidth.

The limited resources of mobile device are barriers for quality of services.Cloud computing provides software as a service(SaaS) ,Platform as a Service(PaaS) and Infrastructure as a Service(IaaS) for network based applications. Mobile cloud computing (MCC) is introduced as an integration of cloud computing and mobile computing. Mobile cloud computing brings various services and provide facilities for mobile users to take full advantages of cloud computing.

Mobile cloud computing is a technology which is comprised of three heterogeneous technologies, mobile device, cloud computing, and wireless networking.

The objectives of the mobile cloud computing paradigm: First is to take the advantages of cloud computing and apply it to the mobile environment, Second is to utilize the advantageous cloud means utilize only when it when it improves performance, reduces resource utilization, or provides robustness, location-awareness when possible, and leverage the scalability level of cloud platforms.

II. MOBILE CLOUD COMPUTING

1) Definitions

Mobile Computing is a technology that allows transmission of data, voice and video via a computer or any other wireless enabled device. Concepts involved in mobile computing are mobile communication, mobile hardware and mobile software.

Mobile computing is not limited to Mobile Phones only, but also used in other devices like PDA, Smart phone, Tablet, I-Pad etc.

Cloud computing offers online data storage, application and infrastructure. It leverages resources of cloud for on-demand network access to a shared pool of configurable computing resources like servers, storage, applications, and services.

Mobile Cloud Computing (MCC) is a mobile computing technology in which processing is done in cloud, data stored in cloud and the mobile devices are served as a media for display. Mobile cloud computing leverages elastic resources of various clouds and network technologies toward unrestricted functionality, storage, and mobility anywhere, anytime. MCC provides services through the wireless networks based on pay-as-you-use principle.
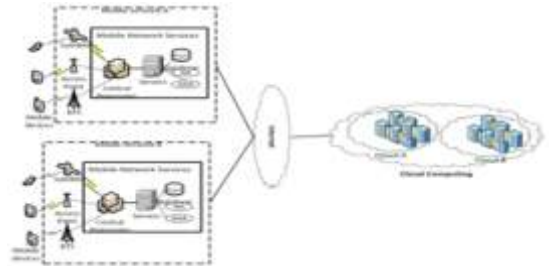

Fig.1:Mobile cloud architecture[11]

1) Why Mobile Cloud Computing?

MCC is the mobile computing technology that aims to increase the numbers of mobile devices, especially smartphones and alleviate their resource poverty. Mobile users can have access to their applications, data, and cloud services through the Internet by leveraging mobile web. Mobile cloud computing will be employed in several areas Information Technology business, like healthcare, education, rural and urban development, and social networking. MCC uses computational augmentation approaches by which mobile devices can utilize computational resources of various resources of cloud.

Mobile cloud computing has the following unique advantages [3]:

1.Powerful mobile applications: Now mobile devices has access to a powerful cloud , So developers has the potential to create more powerful mobile applications.

2. Computation offloading: Much of the resource-intensive work in mobile applications can be offloaded to the cloud, So energy consumption of mobile device will reduce.

3. Compute and storage efficiency: By offloading demanding

workloads and large data to the cloud, the mobile device can limit the amount of processing power and data storage.

4. Thin Mobile Clients: Less resource demands on the mobile client.

5. Maximize the resource sharing and reuse of existing computing resources.

6. Leverage the mobile handsets to the existing and future cloud-based network and mobile enabled service infrastructures.

7. Eliminate existing limitations of the current mobile devices.

Benefits of MCC to businesses [3]

1. MCC expanding the scope of enterprise mobile connectivity from mobile users to the cloud community.

2. MCC increasing resource sharing and utilization in networks, cloud resources, and mobile devices.

3. Sharing mobile information and applications, cloud applications and SaaS systems by connecting to diverse sensor networks and mobile devices.

5. Cost reduction in mobile-based application.

6. Reducing energy consumption.

Benefits of MCC to mobile users and customers [3].

1. Increasing the battery life and computing power of mobile devices by offloading computation tasks.

2. Make mobile devices virtual, portable and personal desktops that are provided with unlimited virtual mobile data storage and processing power.

3. Eliminating problems of the network connectivity and standard problems.

4. Enabling diverse virtualizations of wireless networks, mobile devices, and connectivity to existing cloud infrastructures and technologies.

5. Offering unlimited mobile connectivity to emergent mobile cloud infrastructures, platforms, application stores.

III. HOW MCC WORKS?
A. Architecture for Mobile Applications in Cloud Environment:

Fig. 2: The OpenMobster Architecture for MCC[10]

B. Services needed by a mobile cloud client:
The most essential services are:
Push: It manages any state updates being sent as a notification from the cloud server.

Sync: This service synchronizes all state changes made to the mobile or its applications back with the Cloud Server.
Network: It manages the communication channel needed to receive Push notifications from the server.
Database: It manages the local data storage for the mobile applications.
OfflineApp: It is a service which carries the management capabilities to create smart coordination between low-level

services like Sync and Push.
InterApp Bus: Provides low-level coordination/communication between the suites of applications installed on the device [10].
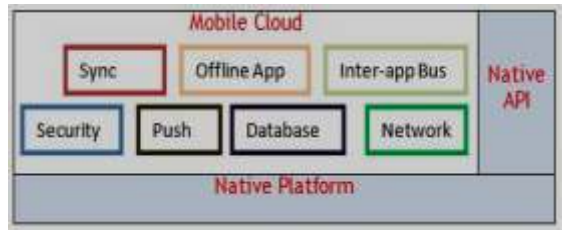

Fig.3: Client Cloud Stack[10]

C. Services needed by a mobile cloud server:
These are the essential services that must be provided to the mobile apps by the server.
Sync: This service synchronizes device side App state changes with the backend services where the data actually originates.

Push: This service monitors data channels for updates.
Secure Socket-Based Data Service: Provide plain socket server or a SSL-based socket server or both.

Security: Security component provides authentication and authorization services.
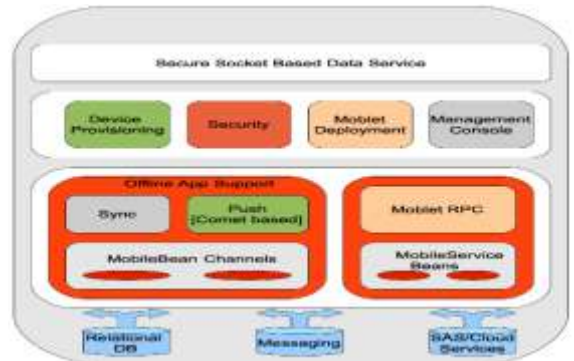Management Console: It provides user and device provisioning functionalities[2].

Fig 4: Mobile Cloud Server[10]

IV. CHALLENGES
Mainly the challenges of mobile cloud computing are comes from the characteristics of mobile devices, wireless networks, and restriction and limitation of it.
Following are some challenges in mobile cloud computing that affects the working of it:

A. Limitations of mobile devices
A mobile device has some limitations in terms of resources. In mobile cloud environment resources of mobile device are important to consider. The mobile device is resource-constrain. The processing capacity, storage, battery time, and network communication of smartphones should be improved consistently with the development of mobile computing[2].

B. Quality of communication
In the wireless network end to end physical connection is not present. The data transfer rate in mobile cloud computing environment is constantly changing and the connection is discontinuous due to the existing clearance in network

overlay. Data centre in large enterprise and resource in Internet service provider normally is far away to end users, especially to mobile device users. In wired network the network latency delay only 50 ms while in wireless network it may 200 ms.

C . Division of Application Services

In mobile cloud computing the computation is offloading to cloud. In order to dynamically shift the computation between mobile device and cloud, applications needed to be split in loosely coupled modules interacting with each other[9].

D. Network Security Challenges

Today mobile devices run security checks itself on device, Computation and battery power is required for this security checks. Mobile cloud computing has introduced model where detection services are carried out on cloud, It saving the device processing and memory requirements, but it requires the increase of bandwidth.

E. Requirement of Elastic Mobile applications

Users can access elastic mobile applications using mobile browser. Mobile users need requested service should with quality and by optimized resource utilization. This requirement particularly manifests in Mobile Cloud Computing due to the structural limitations of mobile devices. Elastic Mobile Applications are proposed in to deal with this condition as these applications can be launched on the device or cloud, and can be switched between the two according to dynamic changes in accordance with the computing environment or user preferences.

F .Challenges in Networks
1. Constrains of Wireless Network:

Wireless network is heart of cloud computing. It is base for communication in Cloud. Wireless network has some issues need to consider. These issues like data rate constraint, weak throughput, longer latency delays and intermittent connectivity issues.
Handoff for Heterogeneous Network Access Schemes:
Handover schemes requires for avoiding connection failure and connection reestablishment when moving from one network access point to another.

2. Network Latency:

An overall delay in the response of applications is attributed to following factors:

- ➢ Processing time at the data centre
- ➢ Processing time on device
- ➢ Network latency
- ➢ Data transport time

4. Browser dependency:

Mobile users access the internet through the browser. In order to get speedy mobile internet access new technologies like HTML5 are being developed, which provide facility of local caching.

5. Low bandwidth:

Low bandwidth of mobile network is another issue .It directly concern in the Cloud computing domain. So it requires improvement in network bandwidth. Enough bandwidth improve data transfer across cloud and other devices.

G. Challenges in cloud   environment:

Various cloud providers are available and cloud may be private or public or hybrid. Interoperability becoming barrier for the quick development of cloud computing. There is no common cloud standard being followed by different cloud providers who have their own API's. A proposed solution is Open Cloud Computing Federation(OCCF).Two main problems that are the result of lack of open standards:
1.Unreliable availability of a service.
2.Service provider lock-in. An absence of portability makes it impossible for data and application transfer.

V. HETEROGENEITY

We have present the architecture of mobile cloud computing and challenges in it. Major challenges like open platform, access medium have their root in Heterogeneity. When two or more components of different characteristics are integrate together heterogeneity comes in picture. Heterogeneity in Mobile cloud computing is the existence of differentiation among components of like architecture, hardware, infrastructure and technologies of mobile devices, clouds, and wireless networks [5].

Heterogeneity in Mobile Devices: It is because of technological variation in terms of operating system, software,hardware, platform like iPhone, Android, Windows,etc, features and communication medium among mobile devices.

Heterogeneity in Clouds: There are numerous cloud vendors provide different services with custom-built policies, infrastructures,platforms, and APIs that make the cloud landscape heterogeneous. Such variations cause interoperability and portability as major challenges in cloud computing.

Heterogeneity in Wireless Networks: In MCC, the majority of communications takes place in the wireless network environment which is a heterogeneous communication medium. Variations in wireless networks and their related technologies impact the delivery of cloud services and affect mobility, augmentation, and usability of smartphones[1] .

  Heterogeneity in mobile cloud computing can be classified as follows:
1) Hardware Heterogeneity: Variety of hardware with different architecture is used between mobile devices, cloud servers, and network infrastructures. It causes the hardware heterogeneity in MCC.

2) Platform Heterogeneity: In mobile cloud computing the platform heterogeneity is the availability of various Operating systems, programming languages, and data structures. Currently, mobile OSs such as Google's Android and Apple's iOS, Windows each with multiple versions.For instance, Android offers Java language, native code with JNI, and C/C++, while iOS supports Objective-C [1].

3) Feature Heterogeneity: In mobile cloud computing variations in features of the mobile and cloud domains. Feature heterogeneity in smartphones is due to variation in native features like multimedia, sensing, and interaction tools, visualization area, and networking technologies.

4) API Heterogeneity: APIs play an important role in delivering a rich experience to mobile users. Application Programming Interface (API) is an interface supplied by Operating system vendors or service providers that allows an application written in a high-level language to access specific data or functions from the API distributor [1].

VI. FUTURE SCOPE OF RESEARCH IN MCC
In upcoming years, all mobile devices will be extensively

used in computing and there will be no need of downloading applications to mobile handsets to use them. Users will be able to access these applications on the cloud via their mobile browser. This will enhance the approach of using software as a service and in the near future, the use of PCs in organizations will decrease.Although the area will record tremendous success, further scope of research is required in this area to address the challenges of mobile cloud computing. Environmental challenges in which the server and client will communicate[8].

VII. CONCLUSION

Mobile cloud computing is technology trends in the future .it combines the advantages of both mobile computing and cloud computing, it provides optimal services for mobile users. Cloud computing maintain a very thin layer for mobile user applications and shift the computation and processing overhead to the virtual environment. Mobile cloud computing is a source of challenging research problems in information and communication technology today. Challenges and heterogeneity of MCC that we discussed are barriers for implementation for MCC.

REFERENCE   [1] Zohreh Sanaei, Member, IEEE, Saeid Abolfazli,Member, IEEE, Abdullah Gani, and Rajkumar Buyya, Senior Member, IEEE, "Heterogeneity in Mobile Cloud Computing:Taxonomy and Open Challenges", IEEE COMMUNICATIONS SURVEYS & TUTORIALS, VOL. 16, NO. 1, FIRST QUARTER 2014. | [2] Dipayan Dev,Krishanlal Bishanb," A Review and research towards Mobile cloud computing", 2nd IEEE International Conference on Mobile Cloud Computing, Services and Engineering,2014. | [3] Ruay shang Chiuang,Jerry Gao,Volker Gruhen,"Mobile Cloud Computing Research-Issues,Challenges and Needs" IEEE Seventh International symposium on service oriented System engineering,2013 | [4] Longjhao Zhong.Beizhan wang,Haifang Wie,"Cloud Computing Applied in Mobile Internet", (ICCSE 2012), July 14-17,2013, Australia. | [5] Anupriya Tuli,Nitasha Hasteer,Megha Sharma,Abhay Bansal ,"Exploring challenges in mobile cloud computing- An Overview"[6] Pragya Gupta,Sudha Gupta,"Mobile cloud computing-The Future of cloud", International Journal of Advance research in Engineering,Vol 1,Issue-3,September 2012. [7] Moztaba Elizadeh,Wan Haslina Hasan,"Challenges and oppotuniteis of mobile cloud computing",Malasiya [8] Prerna lal, An article on "Cloud based Mobile Solutions". [9] Alagiavanan sarvanana,Karthik Jeyakumar,"Implementation Challenges in Mobile cloud computing",International journal of computer science and information technology Reseach,Vol-1,Issue-1 ,October 2013. | [10] https://openmobster.googlecode.com/svn/wiki/content/app-developer-guide/html/architecture.html | [11] http://en.wikipedia.org/wiki/Mobile_cloud_computing