

An Experimental Examination of Mobile Cloud Computing and IOT: Application, Techniques and Issues



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Abstract: A technology in which voice, video and data can transfer through a computer or any wireless device is known as mobile computing. There is no need to connect to a fix physical link in mobile computing. By using the cloud computing mobile computing the powerful mobile applications can build.

The approach of mobile cloud computing allows the developers to design the applications especially for mobile users. And the applications are not bounded with the memory capacity, computing process and operating system of Smartphone. From a remote web server through mobile browser the mobile cloud computing centered simply accesses. On the recipient Smartphone it is not necessary to install the client application.

Index Terms: mobile computing; mobile cloud computing; mobile operating system; Smartphone.

I. INTRODUCTION

To interact with the world in recent days it have to develop a technique for shifting the technologies which can change the way of program. In these techniques mobile computing and cloud computing are two prominent research files that can produce the effective impact. To promote smart phone it is necessary to develop a network for Internet-enabled devices, Internet of Things (IoT) is also a solution for getting the better result [8]. Detailed description about mobile cloud computing and IOT are described in next sections.

II. MOBILE COMPUTING

The set of products, operational strategies, procedures, IT technologies and services through which user can access the information, related resources, capabilities and computation on mobile is known as mobile computing. Mobile technologies are not restricted to any geographic location because it can refer as access in motion.

Many mobile devices can connect with wi-fi or wireless technology or with local area networks. They can also connect through wide area networks.



Figure 1: Mobile Computing

a. Mobile Computing advantages

Some advantages of mobile computing are:

1. Personalization: it possible to create the mobile application for personal use.
2. Social connection: by using several mobile applications it is possible to interact with many users by using internet
3. Connectivity: by using mobile applications it is possible to connected to many resources at any time.

b. Mobile Computers Types

Since 1990's there have been developed so many mobile computers. Some of them are:

1. Smartphone
2. Laptop
3. Mobile data terminal (MDT)
4. Tablet personal computer
5. Personal digital assistant (PDA)

III. MOBILE CLOUD COMPUTING

To develop a strong computational research for cloud computing users, network operators and mobile users the mobile cloud computing is used as a combination of mobile computing and cloud computing [1][2][3]. To give the user a strong experience the mobile cloud computing goal is to develop strong mobile application on a plethora of mobile devices [4]. The mobile cloud computing provide business opportunities for both mobile networks and cloud service providers [5] [6]. The mobile cloud computing can defined as a technology that enables the various resources of mobile and cloud computing towards unrestricted storage, mobility and functionality of mobile devices at anytime, anywhere with the help of internet or Ethernet [7].

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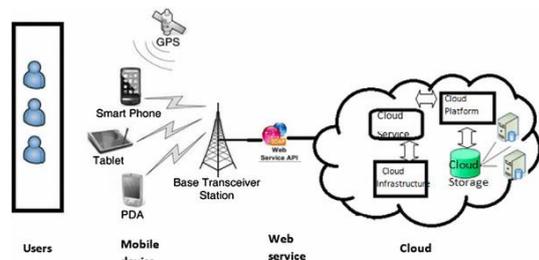


Figure 2: Mobile Cloud Computing

a. Mobile Cloud Computing Applications

Mobile cloud computing applications refer to a software program that can be used by several portable computing apparatus over the internet. Mobile cloud app and mobile web apps are two types of applications that are almost the same. In both applications, data is stored externally and can be accessed through a browser using the internet. Both applications run on external servers of mobile devices [8].

b. Smart phone with cloud computing

For defining the smart phone, there are several ways. Characteristics of a smart phone are given below:

1. It is necessary for the smart phone to run the applications that are stored.
2. Smart phones have options to send and receive messages.
3. There should be a recognizable operating system of a smart phone.
4. Smart phones should have a recognizable internet connection.
5. Smart phones should provide an advanced feature of calling.

In the recent scenario of cloud, it is based on the strategy that large size information devices can provide information and updates to both old and new customers. Now it has been seen that cloud has clients like all hand-held devices, mobile phones, and tablets. If a phone is developed in a way that for a large distributed network, every phone behaves like a node, then the overall computer will have much more power and capability [9].

c. Benefits and services of Mobile Cloud computing

Some benefits and services of mobile cloud computing are given below:

1. The business that is using mobile cloud computing can reduce the overall cost.
2. In this field, more network providers can join with their set up.
3. Because of portability, the owner of enterprises can get mobile cloud computing.
4. By using mobile computing, developers can reach a large market.
5. By using mobile cloud computing, the mobile user can access more features on their mobile phones.

IV. ROLE OF CLOUD COMPUTING IN IOT

The way in which daily routine work is completed is generally transformed by using the Internet of Things (IoT). It is possible in recent days that a person can control their cooling devices with the help of mobile. Earlier, this could be done by SMS, but by use of the internet, it can be easier now.

The cloud computing provides database storage, IT resources, applications, computing power, so it is required in many areas to combine with IoT. The cloud computing and IoT features are shown in the table given below:

Parameter	Internet of things	Cloud computing
Big Data	Acts as a source for big data	Acts as a way or a means to manage big data
Reachability	Very limited	Far spread, wide
Storage	Limited or almost none	Large, virtually never ending
Role of Internet	Acts as a point of convergence	Acts as a means for delivering services
Computing capabilities	Limited	Virtually unlimited
Components	Runs on hardware components	Runs on virtual machines which imitate hardware components

Table 1: internet of things and cloud computing parameters

Internet of things and cloud computing both work for enhancing the efficiency in daily routine work and both have a connection that complements each other. The IoT provides lots of data, and cloud computing provides a way to pass that data. To provide a pay-as-you-use model, many service providers offer cloud services, taking benefits of this [11].

a. Cloud Computing Categories

The cloud computing is generally used for photos, applications, videos, delivering data. It has the cloud that acts as a center of data on the internet. The IBM divided cloud computing into six categories as follows:

1. **Public Cloud:** this is basically developed for using data publicly. Any company can own and operate this space and it gives quick access to users on a public network.
2. **Private Cloud:** it is similar to a public cloud but only one entity can access the data at one time. It can be specifically designed for a particular organization or system.
3. **Hybrid Cloud:** in this type of cloud, it is found like a private cloud but accesses the public cloud.
4. **Software as a service (SaaS):** in this type of cloud, the applications that are based on the cloud run on off-site computers. Other companies and people who connect to the computer of the user can own these devices through a web server.
5. **Platform as a service (PaaS):** to create and deliver the applications which are based on the cloud, all the necessary services are provided by this type of cloud. So there is no need to purchase hosting, software, hardware, etc.
6. **Infrastructure as a service (IaaS):** on the basis of per user, IaaS provides companies with networking, data centers, storage, and servers.

b. IOT Cloud Applications

The real action takes place on the cloud. To and from the sensor or gateway APIs and other interfaces, the commands and data along with IoT cloud applications [12]. To store and read data accurately, different APIs need to be integrated. For the development of cloud applications, best practices are:

1. Design of database

In any IoT creation, data storage is a major task because IoT stores lots of data. Analysis of the sensor node and according to design, a database is included by best practices. It is also optimized for data management.

2. Security of application

Security is a major concern in IoT cloud computing because there is always a possibility of hacking the data. The network across which data packets are sent should be encrypted first, and it is enabled with TLS/SSL certificates so the devices and sensors which access the data remotely can be averted.

3. Cloning of application

In case of heavy traffic the cloning application help to avoid overloading of data. This application is must enabled on the IoT cloud application because this the best way to handle increased traffic.

4. Server Scalability

The server has an option of auto scaling depend on the projected and current number of end user. For this feature service like AWS-EC2 can enabled.

c. Types of Cloud Computing Models for IoT Solutions

Cloud Computing Models	
Infrastructure as a Service	Platform as a Service
<ul style="list-style-type: none"> It offers virtual servers and storage to the enterprises. Basically, it enables the access to the networking components like computers, data storage, network connections, load balancers, and bandwidth. Increasing critical data within the organization lead to the security vulnerabilities and IaaS can help in distributing the critical data at different locations virtually (or can be physical) for improving the security. 	<ul style="list-style-type: none"> It allows companies to create software and applications from the tools and libraries provided by the cloud service providers. It removes the basic needs of managing hardware and operating systems and allows enterprises to focus more on the deployment and management of the software or applications. It reduces the worry of maintaining the operating system, capacity planning, and any other heavy loads required for running an application.

Table 2: cloud computing model for IOT

d. Benefits of Cloud in an IoT System

There are a several benefits of using a cloud in Iot system. Some of them are as follows:

1. Advance monitoring and analytics

In order to feel the seamless experience for user constant monitoring and analysis are very necessary. In advance development of cloud applications this type of services enabled with cloud.

2. inter-device connectivity is smoother

the sensor is communicative with user as well as with others in an IoT. Along with IoT gateway the cloud application check that different actuators and sensor without any disturbance should able to communicate to each other.

e. Challenges in IOT cloud computing

There are many challenges arise due to rapid growth in IoT cloud applications. Researches do many works on this topic but there is still need to develop research to face the many challenges. In IoT management there are several challenges arise. They are:

1. Adversaries of internet
2. Heterogeneity and device mobility
3. Data management
4. Data storage
5. Integrity
6. Privacy
7. Confidentiality

V. DEVELOPING THE ENTERPRISE ARCHITECTURE OF MOBILE CLOUD COMPUTING AND IOT

To develop a Enterprise Mobile Cloud Application MobileStack is used. For last 20 years it provides a strong background in wireless and mobile applications. For fulfill the requirement of an enterprise it has to develop an an enterprise

mobile cloud application.

By integrating various components of mobile cloud services MobileStack has developed an Enterprise-MobileStack services platform.

VI. CONCLUSION

A technology in which voice, video and data can transfer through a computer or any wireless device is known as mobile computing. There is no need to connect to a fix physical link in mobile computing. By using the cloud computing mobile computing the powerful mobile applications can build.

Mobile cloud computing focused are for the most part gotten to by means of a versatile program from a remote web server, ordinarily without the requirement for introducing a customer application on the beneficiary phone. To build up a solid computational research for distributed computing clients, organize administrators and versatile clients the portable distributed computing is utilized as a blend of portable figuring and cloud computing. The manner by which day by day schedule work are finished are commonly changed by utilizing Internet of Things (IoT). It is conceivable as of late that a people can control their cooling gadgets with the assistance of versatile.

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AUTHORS PROFILE



Taranpreet Kaur's educational qualification is MCA, M. Phil and having 14 years of teaching experience as Assistant Professor, Dept. of Computer Science. She has attended three refresher & orientation program at Punjabi University, Patiala, six workshops, and published eighteen research papers (Two Scopus Indexed) in national and international conferences. She has written two book chapters and two books and two are in progress.