

Towards Mobile Cloud Computing

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Abstract— Mobility is the critical dimension in today's computing world. The field of mobile computing has rapidly developed during last few years. The diversity of the computing devices helps in widespread adoption of mobile computing. Mobile computing and cloud computing together has been introduced excellent technology called Mobile Cloud Computing for mobile devices. Mobile Cloud Computing incorporates the features of cloud computing to mobile environment and vanquishes the issues related to performance. This paper attempts to give an insight into mobile computing, cloud computing and mobile cloud computing.

Index Terms—Mobile Computing, Cloud Computing, SaaS, IaaS, Paas..

I. INTRODUCTION

Mobile Computing is a technology that allows transmission of data, voice and video through a computer or any other wireless enabled device without having to be connected to a fixed physical link. Mobile computing is "taking a computer and all necessary files and software out into the field". Mobile Computing is a general term used to refer to a variety of devices that allow people to access data and information from where ever they are. It describes ability to use the technology to wirelessly connect to and use centrally located information and/or application software through the application of small, portable, and wireless computing and communication devices. Provides decentralized (distributed) computations on distinguished devices, systems, and networks, which are mobile, synchronized, and interconnected through mobile communication standards. Mobile device does not restrict itself to one application, such as, voice communication. It offers mobility with computing power and also facilitates a large number of applications on a single device. Mobile Computing also called pervasive computing when a set of computing devices, systems, or networks have the characteristics of transparency, application-aware adaptation, and have an environment sensing ability.

Limitations of Mobile Computing

1. Insufficient Bandwidth: Mobile Internet access is generally slower than direct cable connections, with the use of technologies such as GPRS, and more recently 3G networks. These networks are available within range of commercial cell phone towers. High speed wireless LANs are inexpensive but have very limited range.

2. Security Standards: When using mobile, one is dependent on public networks, which requires careful use of Virtual Private Network (VPN). Security is a major concern while concerning the mobile computing standards. One can attack the VPN easily through a huge number of networks interconnected through the line.

3. Power consumption: When a power outlet is not available, Mobile computers depends on battery power. Compact size mobile devices, often means unusually use expensive batteries to obtain the necessary battery life. Mobile computing should look into Greener IT [3], in such a way that it saves the power or increases the battery life.

4. Transmission interferences: Weather and the range from the nearest signal point can interfere with signal reception. Signal reception in tunnels, buildings, and rural areas is often poor.

5. Potential health hazards: People using mobile devices while driving are often distracted from driving and thus assumed more likely to be involved in traffic accidents. Cell phones may interfere with sensitive devices. There are assertions that cell phone signals may cause health problems.

6. Human interface with device: Screens and keypads of mobile devices tend to be small, which may make them hard to use. Other input methods such as speech or handwriting recognition require training.

II. CLOUD COMPUTING

Cloud computing is a type of computing that relies on sharing computing resources rather than having local servers or personal devices to handle applications. In the simplest terms, cloud computing means storing and accessing data and programs over the Internet instead of on your computer's hard disk. The cloud is just analogy for the Internet. In cloud computing, the word cloud (also phrased as "the cloud") is used as a analogy for "the Internet," so cloud computing is a type of Internet-based computing, where different services — like servers, storage and applications — are delivered to an organization's computers and devices through the Internet.

Cloud computing is a great change of information system; it brings about not only convenience and efficiency problems, but also great challenges in the field of data security and privacy. Security becomes a bottleneck of cloud computing development, the security has been regarded as one of the greatest problems in the development of cloud computing.

The US Department of Commerce's National Institute of Standards and Technology defines cloud computing as “a model that enables ubiquitous, convenient and on-demand network access to a shared pool of configurable computing resources such as networks, servers, storage, applications, and services that can be rapidly provisioned and released with minimal management effort or service provider interaction.”[1,2]

Wikipedia defines cloud computing as “the delivery of computing as a service rather than a product, where shared resources, software and information are provided to computers. Cloud computing provides software, data access, computation and storage services that do not require end-user knowledge of the physical location and configuration of the system.” The Cloud Computing services have been considered as the following.

A. Platform as a Service (PaaS)

PaaS is an application development and deployment platform provided as a service to developers over the Web. Middleman’s equipment can be used to develop programs and transfer it to the end users through internet with the help of servers. The Cost and Complexity of Development and Deployment of Applications can be reduced to a great extent by developers by using this service. Thus the developers can reduce the cost of buying and reduce the complexity of managing the required Infrastructure. PaaS provides all the essential services to support the complete life cycle of building and delivering web applications. It also provides all the services available from the Internet. PaaS consists of infrastructure software, a database, middleware, and development tools.

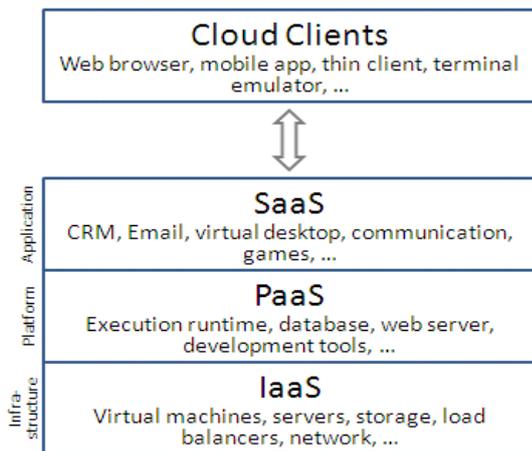


Figure1.0 Cloud Computing Layers

B. Infrastructure as a Service (IaaS)

IaaS is the delivery of associated Software and hardware as a service. Software like operating systems, virtualization technology, file system and hardware like server, storage and network, and associated. IaaS is an evolution of traditional hosting to allow users to provide resources on demand and without require any long term commitment. The IaaS provider does very little management other than keep the data center operational and end-users must deploy and manage the

software services themselves-just the way they would in their own data center.

C. Software as a service (SaaS)

SaaS reassign programs to millions of users all the way through browser. This can save some cost on software and servers, for users. And for Service provider’s, they only need to maintain one program, this can also saves storage space and cost. SaaS provider hosts and manages a given application in their own or leased datacenters and makes it available to multiple tenants and users using the Web. Some SaaS providers run on another cloud provider’s IaaS or PaaS service contributions.

2.1 Benefits of cloud computing

- **Location Independence:** In a cloud based computing environment user can access his data through a end terminal by punching in an key for identification or password. The data does not reside on a specific end user terminal; the end user does not have to worry about a corrupted hard disk or a faulty RAM. User will not lose his data even if his machine breaks down.
- **High Availability:** Most cloud based services implement Continuity and Disaster Recovery solutions that back up the user data. That means even if the primary server is down, or is under maintenance, the back-up system still serves the end users. It is safe to assume that most of the cloud based services are run from world class Data centers, thus it minimizes the risk for any kind of downtime in the first place.
- **No Updates:** Since applications are also resides on servers of service providers that is where all the updates are implemented. That means any operating system or application patches, new versions or any other kind of changes that required, are responsibility of the service provider. So end user always gets the latest version.
- **No need for an Antivirus:** As all the data resides on service providers servers, they implement security solutions for protecting the data.

III. MOBILE CLOUD COMPUTING

Smart phones, tablets, and cloud computing is inclining in the new, rapidly growing world of mobile cloud computing. Mobile cloud computing is one of the hottest new technology of today's markets. Widespread adoption of Cloud computing and mobile is changing our lives. An explosion of mobile and handheld devices is also significantly contributing to world IP data traffic. Cloud computing seems to be the right choice for such data demand, because of its ubiquitous network access, on-demand self-service, rapid scalability and other features. Mobile devices are constrained by their processing power, battery life and storage. Cloud computing provides a virtualization of infinite computing resources. It is a new platform that combines the mobile devices and cloud computing to create a new infrastructure, where cloud performs the heavy computing-intensive tasks and storing massive amounts of data. Mobile cloud computing combines cloud computing and mobile networks so it brings benefits for mobile users, network operators, and also to the cloud

providers. In this new architecture, data processing and data storage happen outside of mobile devices. Mobile Cloud computing at its simplest refers to an infrastructure where both the data storage and the data processing happen outside of the mobile device.

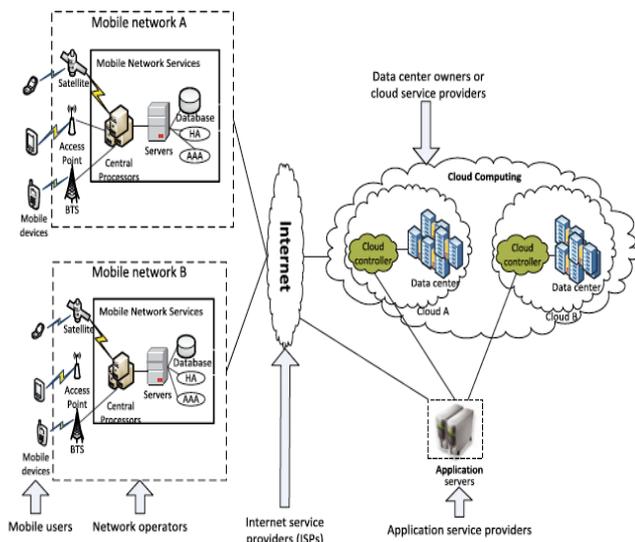


Fig.2 Mobile Cloud Computing Architecture

Mobile devices are connected to the mobile networks via base stations that establish and control the connections and functional interfaces between the networks and mobile devices. The request is sent by Mobile users and information is transmitted to the central processors that are connected to servers that provide mobile network services. The requests of subscribers are delivered to a cloud through the Internet. Cloud controllers process the requests to provide mobile users with the corresponding cloud services from the cloud.

3.1 Advantages of Mobile Cloud Computing

There are several advantages of using cloud computing for mobile devices, such as listed below:

- **Real time data availability:** One of the major advantages of mobile cloud computing is that you can get access to real time data, whenever and wherever you want. The data and applications are managed by a third party i.e. cloud service provider; it is very easy to update your data and accessing it in real time. Moreover, it can be accessed by multiple persons simultaneously.
- **Flexibility:** Another advantage of mobile cloud computing is the fact that you can access your data from anywhere in the world by using a mobile device. Your location does not matter as long as you have a mobile device which is connected to the internet that will let you access both applications as well as data from anywhere.
- **Multiple platforms:** Unlike traditional applications, this supports for multiple platform. In other words, you can easily access the data and applications stored in the cloud whatever the platform you are using doesn't matter.

IV. ISSUES & CHALLENGES IN MOBILE CLOUD COMPUTING

Where there are advantages, there are disadvantages as well. Following are some of the main disadvantages of Mobile Cloud Computing:

- **Security:** Security of data is one of the major concerns of cloud computing. It is often seen that mobile users provide very sensitive information, which must be protected; which can lead to major damages, if the information is not protected.
- **Performance:** Another major concern with mobile cloud computing is its performance. So, checking with your service provider and understanding their track record is advisable. Because its feel is not as good as native applications.
- **Connectivity:** The most important thing for mobile cloud computing is the Internet connection. So, you should make sure that you have a good internet connection before opting for these services.
- **Latency:** The latency is a major challenge faced when we consider mobile cloud. Because the speed of the internet connection is quite constant on a broadband but it is not the case on the mobile internet. Due to the signal strength difference in different places and gaps in coverage there is fluctuation in speed. Weather also causes bandwidth fluctuation, hence affecting latency. Working on the cloud becomes very problematic due to latency.
- **Battery:** The next major concern for mobile phone users is battery. Smart phones are daily charged. As the operating system and display are the main parts of using up the battery. Also the use of internet, gaming, phone calls, and messaging increases the battery usage. Execution in cloud can help this cause, as it reduces burden of application execution. For this reason non-display applications should be put up on the cloud for mobile.
- **Compatibility:** Mobile cloud will be accessed using different technologies like GPRS, WCDMA and other different technologies. Because of these differences in technology it is difficult to make the working environment homogenous. To overcome this hurdle, some technologies are coming up but it still remains a challenge big enough to trouble. Architecture has been suggested to overcome this problem, which will make the network access easy for the user.
- **Locked-Down Services:** The amount of freedom provided by a network provider to a mobile user is not much. If the applications are not digitally signed then the users are not able to run applications. Apple, RIM and every major device are not giving much freedom to the user as they are locked. A developer needs to provide some freedom to the user as well as has to obey the rules of the provider. This has become a major challenge.

- **Limited Resources:** The hardware configuration in a mobile device is much less than a full blown machine. Processing power of a mobile device is 3 times less than a normal desktop, and has battery limitation and a huge memory storage difference. Thus there is limitation on its capability of receiving and processing data. Normal mobile handset could not work with HTTP and these limitations gave rise to WAP. The lack of resources have become a hurdle in mobile cloud computing.

V. CONCLUSION

The concept of cloud computing provides a brand new opportunity for the development of mobile applications since it allows the mobile devices to maintain a very thin layer for user applications and shift the computation and processing overhead to the virtual environment i.e. cloud. A cloud application needs a constant connection that might prove to be an Achilles heel for the cloud computing movement. However as mobile internet capabilities continue to get better; it is likely that solutions to this particular problem will become apparent.

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