

# **Interoperability in Mobile Cloud Computing With Off loading**

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**Abstract-** Mobile cloud computing provides rich experience to the mobile users by combining together, cloud computing and mobile computing. To give more rich experience to the mobile users we have to concentrate on interoperability between cloud service providers to avoid vendor lock-in and offloading with minimized jitter and latency problem. In order to achieve interoperability between cloud service providers, there should be a common application interface. Such an interface should be capable of satisfying both the cloud service provider's requirement as well as mobile user's requirements. It also needs to minimize the latency and jitter problem which take place when the mobile user offloads the complex computations to the cloud environment. On the whole, the open source common application interface has to provide a single direct path to interact with the cloud services without interoperability issues and also offer high quality offloading process in mobile cloud environment.

**Index Terms-**interoperability, mobile cloud computing, offloading, vendor look-in.

## **I. INTRODUCTION**

Today's world the average of using mobile devices becomes very high. The mobile device users expecting advance features in mobile devices. To provide rich experience to the user the mobile computing and cloud computing are combined together. Even though mobile devices having advance features it will have big issues in resource poorness. Cloud computing will lead to overcome these issues. In mobile cloud computing offloading plays a major role. This concept will reduce the battery power issue of mobile devices. Then the

interoperability issue will arise between cloud providers. This paper focus on both the offloading and interoperability issues in mobile cloud computing.

## **II. BACKGROUND**

This section elaborates the concept of mobile computing, cloud computing and mobile cloud computing.

### **A. MOBILE COMPUTING**

Mobile computing is the process of taking a computer and all necessary files and software out into the field. It gives the ability to use computing capability without a predefined location or connection to a network

to access the information. Mobile computing is human computer interaction by which a computer is expected to be transported during normal usage. It involves mobile communication, hardware and software.

### **B. CLOUD COMPUTING**

Cloud computing is the practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer. The cloud computing is based on a collection of many and few new concepts in several research fields like service oriented architectures, Distributed computing and grid computing as well as virtualization and it has created much interest in the last few years. The cloud makes it possible for users to access their information from anywhere at any time. Cloud computing includes the IT capabilities as a service on three levels: Infrastructure (IaaS), Platform (PaaS) and Software (SaaS).

### **C. MOBILE CLOUD COMPUTING**

Mobile cloud computing introduces the software, infrastructure and platform services to mobile devices. It's an infrastructure where both the data processing and data

storage happen outside of the mobile device. Due to mobile cloud computing mobile devices do not need a powerful configuration since all the complicated computing modules can be processed in the cloud. Mobile cloud computing brings new types of services and facilities for mobile users to take full advantages of cloud computing.

Mobile computing can be defined as a combination of mobile web and cloud computing. This integrates cloud computing into the mobile environment and overcomes obstacles related to performance (e.g. battery life, storage, and bandwidth), environment (e.g. scalability, availability) and security (e.g. reliability and privacy). The resources in mobile cloud computing are virtualized and assigned in a group of numerous distributed computers rather than local computers or servers.

There will be no need of downloading and installing applications on the mobile handsets. Users can access them directly in the cloud and display through the mobile browser.

Mobile devices have many issues like resource limitation and poor performance, etc. These issues can be solved by cloud computing. When we remove data storage and processing as a burden on the mobile device, we free up huge amounts of space for dozens of functions. Cloud computing will provide service like software as a service, platform as a service and infrastructure as a service.

These services are combined with the mobile devices and give rich experience to the mobile user. Through this even with a resource limited device user can get more service. For an example user need not have large graphical software in their mobile device to play advanced games, through the mobile cloud computing user can get the software from the cloud itself and play the game in the mobile device. Here unnecessary storage as well as cost also reduced.

### III. OFFLOADING

Offloading is a process of migrate the large computations and complex processing from resource limited devices to resourceful machines. This will improve the battery lifetime for the mobile devices and increase the performance of applications. Sending computation to another machine is not a new idea. The client-server computing model enables mobile users to launch Web browsers, search the Internet, and shop online. What distinguishes cloud computing from the existing model is the adoption of virtualization. Instead of service providers managing programs running on servers, virtualization allows cloud vendors to run arbitrary applications from different customers on virtual machines.

Cloud computing can save energy for mobile users through computation offloading. Virtualization, a fundamental feature in cloud computing, lets applications from different customers run on different virtual machines, thereby providing separation and protection.

There are two types of offloading: first one is offloading in the dynamic environment

changing connection status and bandwidth in dynamic time and it comes under this offloading. The changes in the environment can cause additional problems. Other one is offloading the static environment. Offloading is not always the effective way to save energy. For a code compilation offloading might consume more energy than that of local processing when the size of codes is small. Cyber foraging is the initial technology of offloading

### IV. INTEROPERABILITY

Interoperability is the ability of diverse systems and organizations to work together (inter-operate). Cloud computing can be defined as accessing third party software and services on web and paying as per usage. It facilitates scalability and virtualized resources over internet as a service providing cost effective and scalable solution to customers. Cloud computing has evolved as a disruptive technology and picked up speed in 2010 with the presence of many vendors in cloud computing space. With the presence of numerous vendors, the need is emerging for interoperability between clouds so that a complex and developed business application on clouds is interoperable.

Every new cloud service provider have their own way on how a user or cloud application interacts with their cloud leading to cloud API propagation. This kills the cloud ecosystem by limiting cloud choice because of vendor lock-in, portability, ability to use the cloud services provided by multiple vendors including the ability to use an organization's own existing data centre resources seamlessly. Business applications and data remain in cloud. There is a need for complex developed business applications on the clouds to be interoperable. Cloud adoption will be hampered if there is not a good way of integrating data and applications across clouds. Interoperable cloud services provide information exchange between diverse systems and organizations in cloud computing environment.

Interoperability in cloud computing means enabling the cloud computing ecosystem where the individuals and organizations are able to widely adopt cloud computing technology and related services in such a fashion that multiple cloud platforms can exchange information in a unified manner and ultimately works together seamlessly. Examples of such interoperability are e.g. solutions running on multiple disparate Cloud instances and use of resources in other heterogeneous Cloud instances. To realize this desired Interoperability, standards are required at all levels, e.g. infrastructure, platform, application, service, data and management.

The objectives of the interoperability are to provide Right to move applications between Cloud providers, Right to port data (quickly) between Cloud providers, Right of user to own their data, Keep overhead of certification and compliance to a minimum Apply open access/open source policies that allow extension of APIs and specs Demand side: Interoperability between Cloud services from different providers to prevent vendor lock-

in Open and flexible market to provide choice for consumers ,Transparency and technology neutrality.

Interoperability will leads the User of one Cloud accessing storage in another Cloud (to provide elastic storage), Applications and services running on (and communicating between) heterogeneous cloud platforms Application using resources (CPU, storage) in another heterogeneous cloud platform (resource bursting),Resource sharing across different time zones and Demonstration of data portability.Interoperability can be divided based on the service provided by the cloud as interoperability in IaaS, interoperability in SaaS and interoperability in PaaS.

Achieving interoperability in Infrastructure based service is not a complex process, Infrastructure service includes storage, server and operating environment etc. If the user not satisfied with a provider the user can able to migrate from one provider o another without and issues. User can get service from the providers based on their needs.

Achieving interoperability in software based service also not a complex process as like infrastructure based service. Here also the user can migrate from one cloud service provider to another based on their requirement. Migration between clouds providers will not create any issue for user in the case of software as based service. This involves programs and applications.

Achieving interoperability in platform based service is the major challenge in mobile cloud environment. When the user develop an application based on the platform of one cloud service provider and wants to migrate to another provider he need to redevelop the application to achieve the platform features of new provider. This will leads to high times as well as cost wastage. This is the area where many researches are enabled in mobile cloud environment

The existing systems will not have a common open source interface to achieve the interpretability between different cloud service providers. The proposed system involves develop of an application interface to achieve interoperability between different cloud providers with minimized latency and jitter issue of offloading in mobile cloud environment

The proposed system has the common application interface to achieve interpretability between cloud service providers with low latency and jitter problem.Mobile user can access the cloud through the mobile device itself, to achieve the interoperability between cloud service provider the open source cloud application interface is used. Through this the user will have a common standard to access all the cloud services. User can offloaded their requirements to the cloud and get service through the same interface. Due to this common interface the latency as well as the jitter issues of offloading also minimized.

The common open source application interface should ensure application portability, elasticity at the level of application components, freedom to choose the programming paradigm a build own stack of software needed for the application, language independence,

Protocol syntax and semantic enforcements, RPC solution, Stubs to Driver API and Proxies to Connector and all resources of the same type are exposed with the same interface

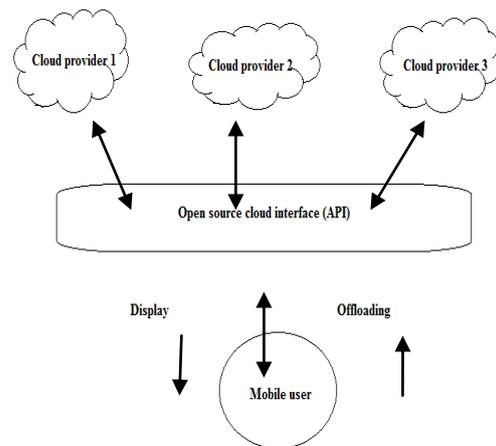


Fig 1.Architecture of Proposed Open Source Cloud API with Offloading

All the connections are two way connections because the mobile user will offload the complex computation and processing to the cloud through the common interface and the interface connect to the cloud service providers. Again as a result from the cloud provider interface will get the service and connected with the mobile cloud user to ensure the service.This is how the proposed system works and the design of the system will appear

## V.IMPLEMENTATION

There are several cloud providers supporting platforms like open source, windows and ios. The developers must consider the type of platform supported by the providers when they develop an application. Cross platform is impossible without any changes.To achieve interoperability between clod providers a search engine application is developed with SDK support using php. For an example Windows Azure will support Microsoft windows platform applications. Nokia mobiles will support this platform but other open source cloud providers will support open source operating systems like android, ios. Samsung as well as iphones supports such platforms. When a mobile application developer wants to build an application which works in all the cloud platforms there should be a SDK supported API layer Using Zend studio that API layer is created.

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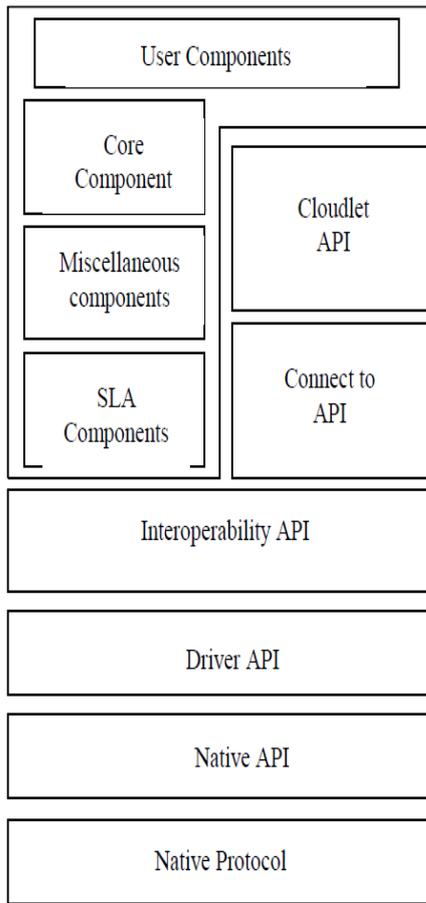


Fig2.API Layer  
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## VI.CONCLUSION

There are many challenges in mobile cloud environment. In that this project focuses on the major challenges like achieving interoperability between cloud providers and reducing the latency and jitter problem of offloading process. The existing systems will provide some interface and common layers to achieve interoperability between cloud providers. But those systems are failed to satisfy the requirements of both mobile cloud service provider as well as the mobile cloud users. In order to achieve interoperability is project proposes an open source application interface as a common interface to get service from various service providers and through performance analysis the jitter and latency problem of offloading is also measured. Through achieving interoperability among different cloud service provider we can avoid vendor lock-in and get rich experience even with the resource poor mobile device itself along with high quality latency and jitter minimized offloaded services.

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