



## Development of Android Based Cloud Server for Efficient Implementation of Platform as a Service

Miss. Bhagyashri D. Patil, Prof. P. L. Ramteke

Department of Computer Science & Engineering.

H.V.P.M's College of Engg. & Tech, Amravati University, India

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**Abstract:** *The number of Smartphone users and mobile applications are growing rapidly. Though smart phones are expected to have PC-like functionality, hardware resources such as CPUs, memory and batteries are still limited. To solve this resource problem, many researches have proposed architectures to use server resources in the cloud for mobile devices. The system proposed conceptual architecture of development of android cloud for efficient implementation of platform as a service, which enables multiple user Android applications on cloud server via network. Though Android is mainly designed for physical Smartphone, Android's to other features are useful to construct a server platform. Android is open-source product and runs on an x86 CPU. Android is an open-source mobile OS initiated by Google. The main reason to use Android as a server platform is that it is able to run not only for smart phones but also for the x86 platform including servers. We show three types of multi-tenant architecture for an Android server platform and discuss the direction to take to it reality.*

**Keywords:** *Server platform, Cloud servers, Cloud computing, Multi-tenancy*

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### I. INTRODUCTION

The number of Smartphone users and mobile application are growing rapidly. According to a recent report, 45 million people in the U.S. own Smartphone's and 234 million people subscribe to the mobile phone application stores [1]. There are several mobile Operating Systems (OSs), such as Symbian, iOS, Android, and Windows Mobile. Because thousands of application developers construct many kinds of applications for these platforms, users can easily enjoy their individual Smartphone lifestyle. Though Smartphone's are expected to PC-like functionality, hardware resources such as CPUs, memory, and batteries are still limited. Therefore, many application developers are forced to take into account these limitations. To solve this resource problem, some researches have proposed using server resources in the cloud for Smartphone's. From this background, we propose Android as a Server Platform that enables many users to use resources on remote cloud servers. The proposed system discuss our analysis of process to adopt Android as a server OS as follow. Using a mobile OS enables the reuse of many mobile applications that is designed to be used on Smartphone interfaces, such as software keyboards, touch panels and many sensors. Since a resolution of mobile OS is small, it is better to use a remote application via a network than a desktop OS. Android is an open-source mobile OS initiated by Google. The main reason to use Android as a server platform is that it is able to run not only for Smartphone's but also for the x86 platform including servers. The system proposes a multi-tenant architecture of Android as a Server Platform.

Cloud computing is the use of computing resources such as hardware and software that are delivered as a service over a network typically in the form of internet. Cloud computing entrusts remote services with a user's data, software and computation. Smartphone's have evolved rapidly during the last three years. Now a day, the advances in processor, memory, flash storage, and mobile communication, and software, smart phones have enabled sophisticated applications for mobile users. The current leading brands for smart phones in the market are Google Android, Apple iPhone, Microsoft Window Mobile, Black- Berry RIM and all support applications such as multimedia playback, Internet browsing, email, voice mail, social networks and location-based Services. Still, the limited hardware resources and the constrained battery capacities have strongly impacted their user experiences. Today, many Smartphone users take advantage of low-cost or free cloud-based services. The combination of smart phone and cloud-based service has worked quite successfully and has become very popular, as it essentially offloads computational workload and data storage from the user's smart phone. That way, an application could consume less power by having most of the application workload [2]. Related work describes the Integration of Mobile device and Cloud and the concept of Multi-tenancy. It also describes the Virtual Smartphone over IP. Analysis of process describes the using mobile applications running on a server.

### II. LITERATURE REVIEW and RELATED WORK

**Integration of Mobile device and Cloud:** Researches have proposed integration between mobile devices and cloud computing. Satyanarayanan et al.[3] outlined their vision of allowing mobile users to seamlessly use nearby computers to obtain cloud-computing resources by instantiating a "cloudlet" that rapidly synthesizes virtual

machines on a nearby infrastructure that can be accessed through a Wireless LAN. Canepa et al.[4] presented a framework named “Ad Hoc cloud providers”. At this framework, mobile devices can execute their jobs using other device resources around them as if it is executed on one cloud server. Our approach is closely related to that of Chun and Maniatis[5]. They proposed the creation of clone VMs to run mobile applications as if they were running on mobile devices. They recognized five categories of augmented execution to speed up mobile applications, namely Primary, Background, Mainline, Hardware, and Multiplicity, and presented a research agenda to bring the vision into reality. Their project homepage can be found in [6]. Our multi-tenant architecture for Android can be seen a specific study of Multiplicity.

**Multi-tenancy:** Royon et al. proposed multi-user, multi-service execution environment named “virtual service gateway” [7]. They classified existing multi-application environment approaches by modifying Java runtime, and proposed an overlay approach to run virtually original application. As modifying approach has advantages of performance and isolation, overlay approach has advantages of usability on a standard Java Virtual Machine. Bezemer discussed the direction of multi-tenancy [8]. This new concept of providing software service is generally known as SaaS (i.e., Software as a Service). However, the adaptation of such a model necessitates that the applications which are required to be provided as a service should be generalized for users or groups of users. The users or user groups ordinarily correspond to a company or group of companies/businesses and are termed as tenants. In this regard, the architecture of SaaS applications needs to be customized to support certain characteristics — e.g., configurability, maintainability and scalability — to support diverse number of users[9]. They recognized five features of a multitenant platform, namely Performance, Scalability, Security, Zero-Downtime and Maintenance, to prevent maintenance nightmare. The proposed system discusses and evaluates a proposed architecture based on some of these features.

**Virtual Smartphone over IP :** Beyond constructing a mobile application platform, the system has previously proposed a proof of concept prototype implementation named “Virtual Smartphone over IP” [10]. An overview of the implementation is shown in Figure 1. In this prototype, Android-X86[11] is adopted on a mobile server OS running on a hypervisor. The client program installed on a physical Smartphone can remotely interact and control Android-x86 images. The client program transmits various events from the physical device not only the keyboard but also the touch screen and various sensors such as GPSs, accelerometer, and thermometers, to the mobile server OS and receives graphical screen updates from it via Virtual Network Computing (VNC). These programs enable to use server side virtual mobile OS applications as if it is running on a physical Smartphone.

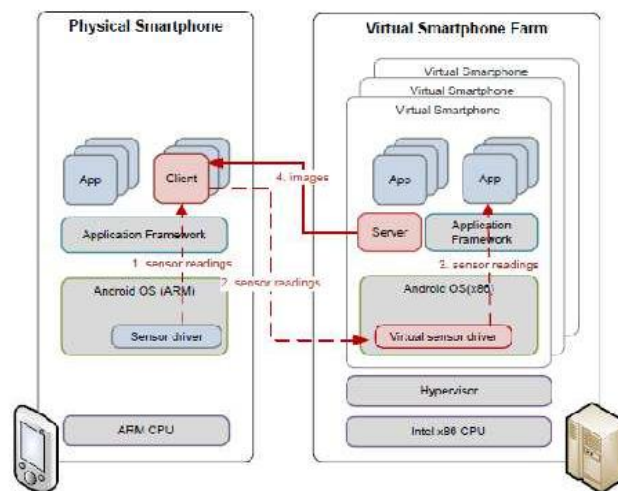


Figure 1: Overview of Virtual Smartphone over IP system.

The performance evaluation using a common Smartphone and a server shows that our virtual Smartphone on a server is at least 10 times faster than on a physical Smartphone.

### III. ANALYSIS of PROBLEM

**Mobile Application Platform on Cloud Server :** As a numbers of service providers such as Dropbox[12] and Zumodrive[13] provide online storage services, the architecture for remotely using mobile application on server has many benefits for users. This approach, called Mobile Application Platform on Cloud Server, intends to handle not only user data but also user applications in a cloud server [14]. This approach changes the application lifecycle as follows. “Write once, run everywhere. Install once, use everywhere.” Figure 2 illustrates an overview of the concept. By executing a mobile application in the cloud server, users and developers free from device limitation such as CPU power, memory, and battery, and from device software environment such as OS or version. Moreover, once a user installs an application on the cloud server, she/he can use the application anywhere, an any device.

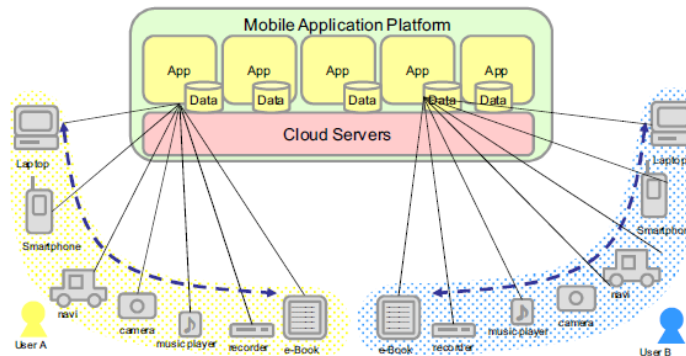


Figure 2. Mobile Application Platform.

**Multitenant for Android :** Multi-tenancy, which means that software running on a server provides services to many users, is one of important features for cloud computing. From the viewpoint of both economy and ecology, it is beneficial to share hardware resources among users. Using a mobile OS would be more effective than using a desktop OS because the resource requirements of mobile OSs are smaller. However, to the best of our knowledge, there is still no service that uses Android as multi-tenant system. The proposed system discusses the multi-tenant architecture for Android and how to construct it.

**Multi-tenant architecture for Android :** This section discusses the process to construct multi-tenant architecture for Android based on related work. The proposed system discusses the three types of approach, hypervisor-layer, kernel-layer, and framework-layer, for multi-tenant architecture.

1. Hypervisor: The hypervisor-layer approach uses the Virtual Smartphone over IP system as already stated in related work. Each user owns her/his Android OS image on a server and freely runs her/his application in a separate VM. Multi-tenancy is achieved by running multiple users VMs in a server via a hypervisor.
2. Kernel-layer : The second approach implements multi-tenant function in kernel-layer. This approach changes android Os to run multiple user application in separate processes. This approach is similar to an ordinary thin client server running multiple user application in a server. The main challenge is that original Android supports only one display and keypad device since android is mainly designed to work on a Smartphone.
3. Framework-layer : Another approach is to create a multi-tenant function at framework-layer, similar to existing a Java-based multi-tenant framework. This approach remodels Android the framework and APIs to support multiple user application. The main challenge is how to run exiting Android application in modified framework.

The quantitative evaluation of these three types of architecture is illustrated in Table 1. As shown in, the hypervisor-layer, approach is feasible and good for maintenance [10]. However, it seems to have a scalability limitation caused by a hypervisor. Because each VM try to separately maintain their resources, it is difficult to control unused resources. The other two approaches have advantages in scalability but have disadvantages in maintenance because they change the android OS. From the viewpoint of running existing application, the kernel-layer approach is better because it does not changes Android runtime environment. Moreover, we assume that the kernel-layer approach is easy to develop because Android is implement based on the Linux kernel so that can support multiple displays, keypads, and application.

Table 1, Quantitative evaluation of proposed architecture.

Multi-tenant type	Scalability	Application usage	Mentenance
Hypervisor	×	○	○
Kernel	○	○	×
Framework	○	×	×

#### IV. CONCLUSION

The proposed system Development of Android cloud for efficient implementation of platform as a service, system that enables the use of sharing server-side Android OS among multiple users. The system also showed the technical difficulty and approach related to multi-tenant architecture for Android OS, which is originally designed to use single user. The proposed Android architecture is planning to develop a prototype system about multi-tenant. The system believes that proposed architecture shows high performance on virtual image-based virtualization for mobile application.

## REFERENCES

- [1]. Android Phones Steal Market Share.  
[http://www.informationweek.com/news/mobility/smart\\_phones/showArticle.jhtml?articleID=224201881](http://www.informationweek.com/news/mobility/smart_phones/showArticle.jhtml?articleID=224201881).
- [2]. Naresh Kumar N (M.Tech), 2 Prof. Mohan K , “GCM Service Driven Communication With An Android Application In Cloud Computing” , ISSN: 2278-0181, May 2013.
- [3]. M.satyanarayanan, V. Bahl , R.Caceres, and N. Devise, “The case for VM-based Cloudlets in Mobile Computing” , IEEE persive Computing, Carnegie Mellon University, Microsoft Research, AT&T Research, Lancaster University , 2009.
- [4]. G. H-Canepa and D.Lee, “A Virtual Cloud Computing Provider for Mobile Devices” . San Francisco : MCS’10, 2010.
- [5]. B. G. Chun and P. Maniatias. “Augmented Smartphone Application through Clone Cloud Execution”, ACM, Intel, Berkeley, Princeton, 2011.
- [6]. Clone Cloud Project at Intel Research,. <http://berkeley.intelresearch.net/bechun/clonecloud/>.
- [7]. Y. Royon, S. Frenot, and F. L. Mouel, “Virtualization of Service Gateways in Multi-provider Environments” , Heidelberg : CBSE 2006, 2006.
- [8]. C. P. Bezrmer and A. Zaidman, “Multi-tenant SaaS Application: Maintenance Dream or Nightmare? Antwerp” , Belgium : IWPSE-EVOL’ 10,2010.
- [9]. Arsalan Shahid, Muhammad Naeem Ahmed Khan. , “Object-Relational Mapping Framework to Enable Multi-Tenancy Attributes in SaaS Application” , International Journal of Cloud Computing and Services Science, ISSN: 2089-3337, 2012.
- [10]. E. Y. Chen and M. Ito. , “Virtual Smartphone over IP. Montreal” , QC, Canada: IEEE WOWMOM, 2010.
- [11]. Android-x86 project – Run Android on your PC (Android-x86 –Porting Android to x86). <http://www.android-x86.org/>.
- [12]. Dropbox – Home – Online backup, file sync and sharing made easy. , <http://www.dropbox.com/> .
- [13]. Zumodrive- Enjoy your media and documents from every device. , <http://www.zumodrive.com/> .
- [14]. M. Toyama, S. Kurumatani, J. Heo, K. Terada, and Eric, Y.chen, . “Android as a Server Platfom” , Midori-cho, Mausashio-shi, Tokyo, 180-8585, Japan, IEEE Consumer Communication and Networking Confernece, 2011.