Infrastructure as a Service Cloud for Android Smartphones

Satish Hadap

Subject Matter Expert – High Performance Computing, BNP Paribas India Solutions Pvt. Ltd., Mumbai

Abstract: *This paper proposes an infrastructure as a service (IaaS) cloud for android smartphone users. It will allow user to install an virtual smartphone image to a Cloud Server and hereby can achieve high performance computing power on android device. This paper will describe the architecture to use server resources in the Eucalyptus cloud for mobile devices. This architecture will serve as Server platform, which will enable multiple user android applications on Cloud server via network.*

Keywords: IaaS, Android, Cloud, Eucalyptus Cloud, Smartphones

1. Introduction

The number of android smartphone users is increasing rapidly. Along with the growth in the number of Android users, the need for high performance computing has also increased. Android users often expect to get PC-like functionality, which requires powerful processors, abundant memory and long-lasting battery life. However, the hardware today is still very limited and application developers are forced to take these limitations into consideration. This report proposes infrastructure as a service (IaaS) cloud for android smartphone, which provides high performance computing environment for android users. It allows users to create virtual smartphone images in the cloud and to remotely run their mobile applications in these images as they would locally. The motivation is to allow android users to more easily utilize the power of the cloud and to free themselves from the limit of processing power, memory and battery life of a physical smartphone.

2. Literature Survey

2.1 Cloud Computing

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. 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. New programming languages such as HTML 5 already provide a solution by enabling data caching through a mobile device, and this allows a cloud application to continue working if connection has been momentarily loss.

2.2 Android

Android applications are written in Java, with a rich set of libraries. Anyone with a working knowledge of Java can get Android applications up and running with relative ease. Java programmers are plentiful in the marketplace (especially in this economy) and the Android platform documentation is very good. There's never been a better time to attempt the jump into mobile development. Android makes this easy. The Android platform has is the best mobile platform for inter-application and inter-process architectures. Do you have a suite of applications in mind? Want to integrate them or cross promote them? Android blows the competitive platforms away in this area. Most other platforms allow background processes (at best) but the Android platform is set up to allow for trust relationships between applications for a more tightly knit experience for users.

2.3 Eucalyptus Cloud

Eucalyptus is an open source software for building Amazon Web Services (AWS)-compatible private and hybrid clouds and it allows organizations to build self-service, elastic clouds inside the datacenter using existing IT infrastructure. Eucalyptus enables AWS-compatible private and hybrid clouds by pooling together compute, storage, and network resources that can be dynamically scaled up or down as application workloads change. Implementation of the Eucalyptus cloud for Android smartphone will result into the architecture shown in Figure 1.

Node Controller: The NC is responsible for executing actions on the physical resources that host VM instances, such as launch, inspect, shutdown, and cleanup. A Eucalyptus cloud may consist of several Node Controllers. Since each NC can manage multiple virtual machine instances, only a single NC is required for each physical machine.

Cluster Controller: The CC is responsible for managing a collection of NCs (cluster) that work together. The CC has access to both the private and public networks and is usually located on the cluster's head node or front-end server. The CC monitors the state information of all instances in the pool of NCs and coordinates the flow of incoming input requests. The CC will send an input request to the first NC that has enough free resources to handle the job description. Each CC controls a virtual pool of common servers that is similar in nature to an "availability zone" in Amazon EC2. As shown in the diagram above, there is one Cluster Controller

per "availability zone".

Cloud Controller: The CLC is responsible for processing incoming requests from external clients or administrators. Each Eucalyptus cloud will have a single CLC. It's the user-visible entry point and global decision-making component that makes high-level VM instance scheduling decisions, processes authentication and SLAs, and maintains persistent system and user metadata.
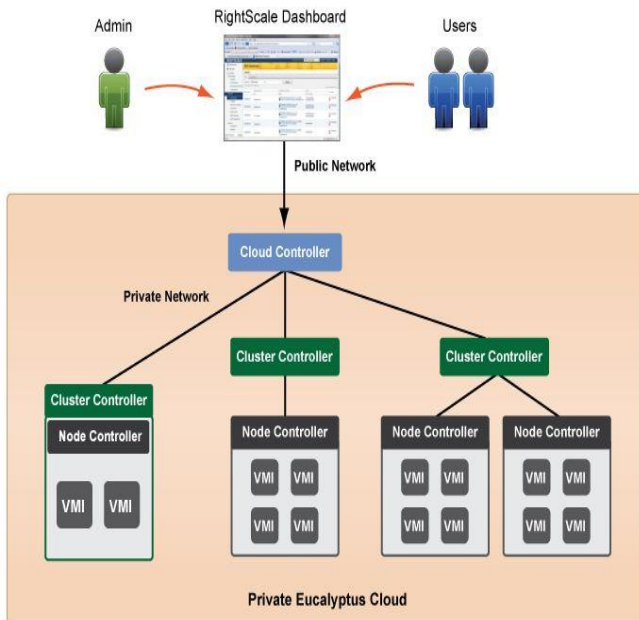

Figure 1: IaaS cloud architecture for Android

3. Proposed System:

Eucalyptus products are used to implement Cloud Computing architecture. It will be setup on a Linux platform i.e. Ubuntu operating system (version 11.04 or higher). Virtual machines (VM) running in the Cloud environment will be of Android operating system, Linux operating system and Windows operating system.
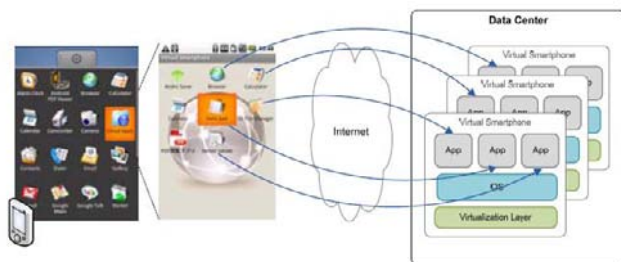

Figure 2: Proposed system

The Android user can use any virtual machine as per his/her requirement. The Virtual machine instances are not bound by limited computational power. Clients will access these virtual machines through an application. Thus, enabling use of applications that require high processing power. The application will run on android platform that will let user gain full access over cloud server for their virtual machine images in cloud. User will access a virtual operating system from his phone. Virtual instance will use resources of the cloud server. Thus it will save the resources of the mobile

device. Users are unaware of the processing at the backend and thus the only GUI visible to them is the Android VM as shown in Figure 2. User will be able to save his data on the cloud which can be accessed from anywhere and anytime. The application will let user run their favorite operating system images on our cloud also let them to back up their data. Virtual Machine provides Android users with higher ram, larger storage and better computing power for running Android applications.
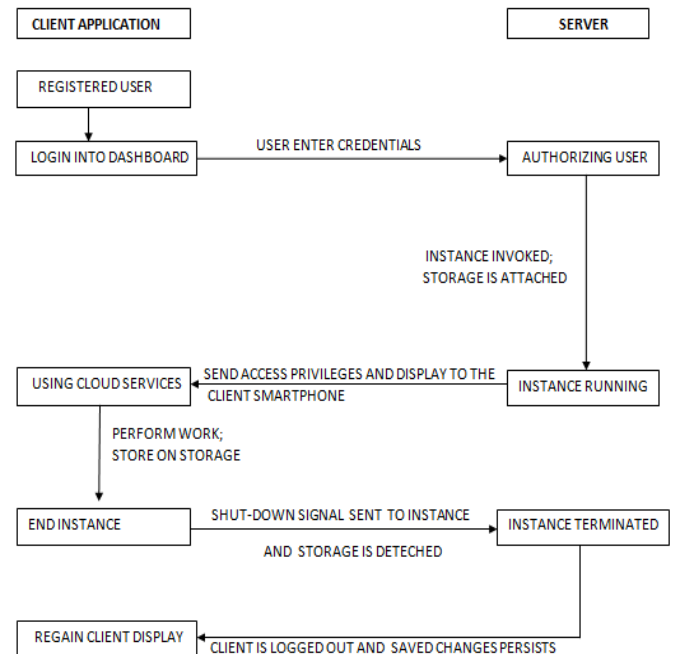

Figure 3: Application architecture Diagram

This system consists of two-tier architecture as shown in Figure 3.

3.1 Client Application

The Client Application requires username and password. This application will establish a connection with the Server, after which, the user would see the VM Screen, instead of the screen of his physical device. After the connection, the packets flowing between the Client's Application and the Server are:
a) Client to Server: inputs from keyboard, joystick, and touch screen.
b) Server to Client: display of the instance on the smart phone

3.2 Server

The Server is further divided into two servers.
a) Front-end Server: It includes eucalyptus-cc eucalyptus-sc eucalyptus-walrus.
a) Node Server: It includes eucalyptus-nc.

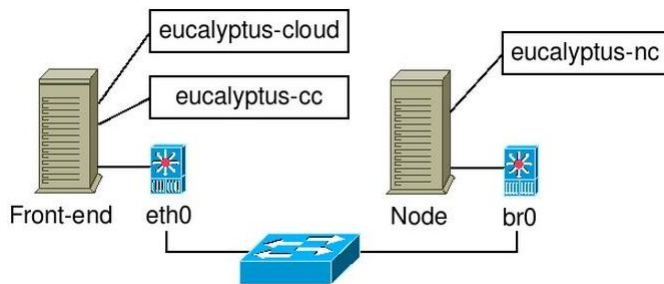The front-end and Node servers are connected using a bridge as shown in Figure 4:

Figure 4: Front-end and Node servers connected via bridge

4. Conclusions

This paper has presented an IaaS Cloud for Android smartphone system that allows android users to create virtual images of various operating systems in the cloud and access these images remotely from their physical android smartphone. The proposed system integrates the remote environment with the local environment and allows users to run remote applications as they would run locally. The applications running on cloud can be easily accessed by physical android smartphone. It boosts the performance of mobile applications by providing virtually unlimited computing resources at user's fingertips, without draining the physical device resources. However, there will be considerate amount of delay while accessing virtual images running on cloud. These delays are due to lack of high end cloud resources and moderate speed network connection. Implementing cloud on high configuration computers and making use of 4G high speed connections will eliminate the delay problem.

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Author Profile

Satish Hadap has completed Bachelors's in Computer Engineering from University of Mumbai in May 2013. He is currently working as a Subject Matter Expert on High Performance Computing in BNP Paribas India Solutions Pvt. Ltd., Mumbai.