Modelling and Analysis of a Cloud Operating System for Real-time Services
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Voice over IP (VoIP) is a revolutionary technology for phone portability, rich media service, and reduced costs. In our project we plan to study the performance of Real time services in the cloud.
Our research mainly consists of two phases - Modelling and Analysis.

Phase1: Modelling

As a part of our research, we plan to build a VoIP cloud that will have several instances of real time services like an IP PBX server, Billing Server, IVR, Call Recording and SIP Proxy running on different virtual machines in the cloud. The "Build your own cloud" feature in the "CloudLab" project helps to build our own VoIP cloud where we can have the opportunity to place and develop our own networking software to configure and schedule the components of real time services. Currently we are trying to setup the VoIP cloud using "OpenStack". The CloudLab's "profiles" help us in accelerating the construction of our cloud as we can use the physical hardware and software needed to transform it based on our needs. The Chameleon's support for "heterogeneous computer architectures" and "bare metal access" helps in building our VoIP cloud by mixing and matching with different hardware, software and networking components available. This feature also helps us to schedule enterprises of different sizes and produce confident results against the existing public clouds. For example. The observed lifetime for a virtual machine on EC2 over the last 3 years has been about 200 days. After that, the chances of it being "retired" rise hugely [1].

We need to setup an IP PBX server in the cloud as an IaaS (Infrastructure as a Service). We considered Asterisk PBX server which is an open source framework for building communication applications and can run in a Virtual Machine in a cloud as a communication server. Asterisk can run on a number of Operating systems but Linux is the officially supported operating system. We believe the modeling phase will result in development of a tool that can automate modeling and configurations in VoIP cloud and can provide the end users with the various configurations. The existing mechanism is tedious and requires certain expertise level on part of the end user to know the basics of configuring a real time server such as Asterisk IP PBX. The VoIP cloud will be built in a way that all the real time services with different versions of them are installed and running in different virtual machines. The users can select any version of the real time service and use them without complex configurations. This results in automation of configurations of all the versions of real time services that are in the VoIP Cloud.

One of the major disadvantages we encountered when we installed and ran Asterisk on Windows Azure public cloud is the performance of the Linux Operating System is low with respect to the number of cores and is cost dependent as shown in figure 1.

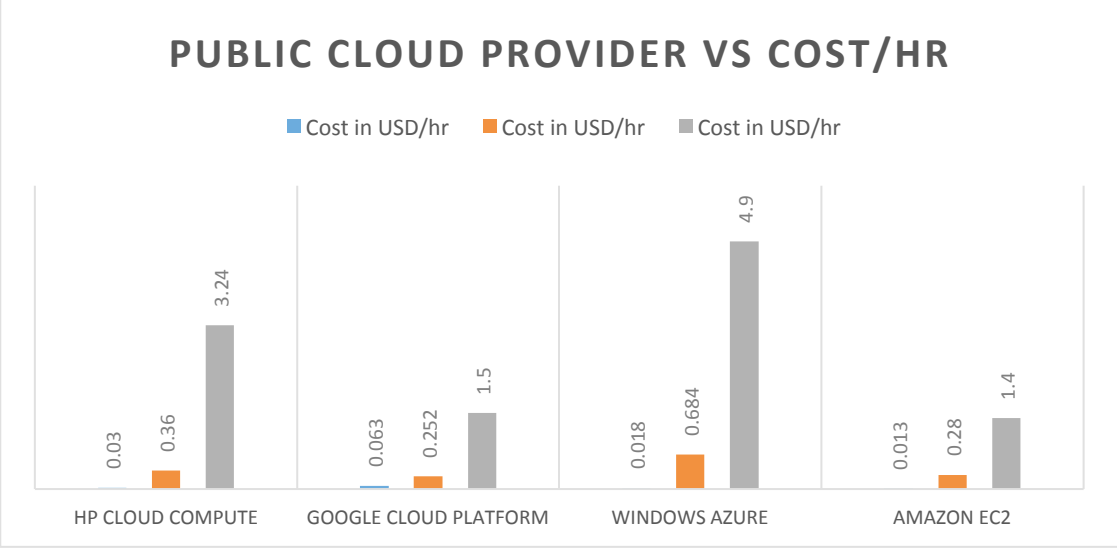

Figure 1: Major public cloud providers and the cost in USD/hr for running Linux O.S instances (The specifications of public clouds are vendor specific)

Phase 2: Analysis

This phase is equally important as the Modelling phase, and includes measuring the Quality of Service (QoS) for VoIP traffic and studying the performance analysis. The performance of this VoIP cloud increases significantly using "CloudLab" as the clusters are distributed and crafted for specific use. We can use the high performance and low-noise virtualization in "Chameleon" cloud as they are connected by a dedicated 100G network between the sites. Further, the QoS for VoIP traffic in a relatively new cloud will be high as compared to that of existing public clouds-considering the depreciation of hardware components present in them.

Majority of the public cloud vendors are scalable, accessible and elastic where we can change the specifications of the purchased resources at any point of time. The above key features seems to be promising but performance, security and costs are big challenges for the customer. Apart from these, the major disadvantage is that we cannot install and run our own OS; the features that are supported by a public cloud are purely organizational centric. For Example, Windows Azure does not provide an inbuilt VPN package to non-Windows Operating Systems. The multi-cores provided in "Chameleon" helps in accelerating multiprocessing in a single physical package unlike the single, dual or quad processors that are provided by many public clouds. This helps to boost the performance with increased response time in running CPU-intensive processes.

In summary, the purpose of our research is to develop a VoIP cloud with the real time services and build a tool that can help users to use these real time services without going through the trouble of complex configurations.

Reference:

1. Seldo.(2012,December18).http://blog.awe.sm/2012/12/18/aws-the-good-the-bad-and-the-ugly/#~oU8mx5ocBkW9hD.

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"Dr. Ram Dantu has 15 years of industrial experience in the networking industry, where he worked for Cisco, Nortel, Alcatel, and Fujitsu and was responsible for advanced technology products from concept to delivery. He is a full professor in the Department of Computer Science and Engineering, University of North Texas (UNT). During 2011, he was a visiting professor at Massachusetts Institute of Technology (MIT) in the School of Engineering. He is the founding director of the Network Security Laboratory (NSL) at UNT, the objective of which is to study the problems and issues related to next-generation networks. He is also the director of the Center for Information and Computer Security at UNT. He has received several NSF awards in collaboration (lead PI) with Columbia University, Purdue University, University of California at Davis, Texas A&M University and MIT. During the last 6 years he received 10 research awards from the National Science Foundation (NSF) for a total of $5M. He was selected as a member of Innovation Corps of NSF in 2011.

Dr. Ram Dantu's research includes security and safety in mobile applications in health care and transportation sectors. In addition, he has been researching on the prevention of DoS and spam attacks in the VoIP networks. Prior to UNT, he was a technology director at Netrake (a startup acquired by Audio Codes), where he was the architect of the redundancy mechanism for VoIP firewalls. His additional experience includes being a technical director at IPMobile (a startup acquired by Cisco), where he was instrumental in the wireless/IP product concept, architecture, design, and delivery. In addition to more than 150 research papers, he has authored several Requests For Comments (RFCs) related to MultiProtocol Label Switching (MPLS), SS7 over IP, and routing. Due to his innovative work, Cisco and Alcatel were granted a total of 25 patents, and another 10 are pending. He has co-chaired three workshops on VoIP security. For the last two years he has been organizing the workshop SOMIC (Security on the Move and In the Clouds) at UNT.