Cloud Computing Performance Benchmarking and Virtual Machine Launch Time

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ABSTRACT
This research is to study the performance of cloud computing platforms in the perspective of information technology (IT) management. Two separate test clouds of Eucalyptus and OpenStack were established on identical hardware. The BYTE UNIX benchmark suite was employed to conduct various performance tests on both clouds. While the OpenStack cloud out performed Eucalyptus considerably in the larger size copy test, the Eucalyptus cloud performed better than the OpenStack in the tests of serial excel and serial shell scripts. Scripts were written to compute the amount of time that was needed for the clouds to launch a virtual machine (VM) in two different ways. On average, it took a shorter time to launch a VM instance in both clouds when several VMs were created simultaneously than that when they were created one by one, the results showed a variation with different numbers of VMs that were launched concurrently.

Categories and Subject Descriptors
H.4 [Information Systems Applications]: Miscellaneous;  
H.3.4 [Information Systems]: Systems and Software—Performance evaluation (efficiency and effectiveness)

General Terms
Experimentation

Keywords
Cloud computing, Performance, Eucalyptus, Open Stack

1. INTRODUCTION
Eucalyptus [5, 4, 3] and OpenStack [6] are two fast developing cloud computing platforms that can be used to build private and public clouds. This research aims to provide IT professionals and system administrators with an easy to understand comparison of these two platforms with industry standard test results for virtualization and resource management issues.

2. METHODOLOGY
Two separate test clouds of Eucalyptus and OpenStack were built on identical hardware. Each of the clouds was made with two computers. One was a DELL T4400 with 2 GB of RAM and 1 hyper threaded 64-bit Pentium 4 and the other was a DELL T410 16 core 12 GB RAM tower server. A Cisco 2600 Series Router was used for routing. A Brocade Fast Iron Edge GS 648P-POE switch was used for switching on the internal network.

Scripts were written to compute the amount of time that it takes the cloud to procure resources for launching a VM instance. We define this amount of time as VM launch time or VM start time. The BYTE UNIX benchmark suite [1]

Figure 1: VM serial launch time. X-axis: the number of VMs that were running at the end of the current VM launch; Y-axis: the average time in seconds taken by the operation of a VM launch.
was employed to conduct multiple performance measures on both the Eucalyptus cloud and the OpenStack cloud.

3. RESULTS AND DISCUSSIONS

3.1 VM launch time

There are two ways to launch VMs in a cloud environment. The VMs can be launched in serial, one at a time in succession, or in parallel, several VMs being launched at the same time. The serial VM launches showed a drastic difference in the time taken for a VM to start (Fig. 1). On average the VM launch time was 10-12 seconds in the Eucalyptus cloud, while it was between 3.5-6 seconds in the OpenStack cloud.

Parallel VM launches were done by using one command to simultaneously launch several images at one time. As shown in Figure 2, for launching one or two VMs the Eucalyptus cloud was slower than the OpenStack. While launching three or more VMs simultaneously, the Eucalyptus cloud is faster than OpenStack. In addition, the individual VM launch time decreases with the increase of the number of VMs launched with one command in the Eucalyptus cloud, while the opposite trend holds in the OpenStack cloud. This is mainly due Eucalyptus not resending the image for multiple instances. On the other hand, the OpenStack management system handles each VM instance as if it was being launched individually.

3.2 VM performance benchmarking results

Figure 3 shows the the benchmarking results of VM performance in both clouds. The Eucalyptus cloud outperformed OpenStack slightly in the tests of serial excel and serial shell scripts, while the OpenStack cloud performed considerably better than Eucalyptus in the larger file copy test. Especially, in the “file copy 4096 buffer size 8000 max blocks” test, the OpenStack cloud out performed more than 16% over Eucalyptus.

In addition, by running the benchmarks on the traditional hardware stack on our computer node and in our cloud environment on a single instance utilizing 16 cores, we saw a 4% gain in the OpenStack cloud and a 15% gain in the Eucalyptus cloud. This result suggests that the cloud computing management system exploits the computing resources on the same hardware stack better than the bare-metal system.

3.3 Interface

For the interface comparison we looked at how easy it was to administer, setup and use the clouds. We also looked at how well they were documented. The Right Scale cloud management interface [2] was integrated into the Eucalyptus cloud, while the OpenStack’s Horizon was integrated into the OpenStack cloud. Compared with Right Scale, the OpenStack’s Horizon has a relatively poor interface in terms of easiness for resource management and system administration. For example, the Right Scale would allow us to integrate a private cloud into a public cloud through its user friendly interface. This feature has not been implemented in the Horizon.

4. REFERENCES