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GUEST OPERATING SYSTEM BASED PERFORMANCE COMPARISON OF VMWARE AND XEN HYPERVISOR

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ABSTRACT

Present time, virtualization becomes a very effective way to make more efficient use of server resources and setup different types of servers within cloud platform including public and private. In recent time, the advance technology of CPU and its upcoming new architecture as well as new type of virtualization technology become helpful to reduce the cost of server using virtualization, but still there are overhead exist in concept of guest OS on virtual machine over virtualization platform. We have performed comparison of guest OS (Microsoft Windows Server 2008 r2, 64-bit) in two popular virtualization platform hypervisor VMware ESXi and XenServer. We find a great difference between these two virtualization platform performances. This suggests that our guest OS run on VMware ESXi very efficiently and prove better option than XenServer in virtualization.

INDEX TERMS: Virtualization, Hypervisor, VMware, Xen.

1. INTRODUCTION

Virtualization technologies have changed the businesses around the global world, by running their applications, providing them much greater power of data centers, and more recently all supported technology behind the cloud computing. Virtualization is simply the management, deployment, and provide the improve resources efficiency within cloud whether it is public or private. Virtualization provides new features such as services of reliability, management of performance level of virtual machine and enables it to applications or on any OS without

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changing its properties or its behaviors. There are some overheads still exist ,which could prevent its performance in some critical domain such as HPC (High Performance Computing) but virtualization has become the part of industry for running a growing set of applications and OSes.

Recently virtualization has been the ease with cloud industry on which virtual machine are running, can be provided services as IaaS (Infrastructure as a Services) to multiple users. Since continuous growth of industries, their rapid developments, scalability relies on virtual servers. Still the aim of virtualization technology is remain same i.e. consolidate all workloads of the industries or enterprises means one physical machine can be multiplexed virtual machine for many different users as their requirements. Which means it also enable the features that a set of physical nodes [1] allow the improve performance of an overall data centers and also improve the per-server efficiency because idle server may consume a great deal of energy [2].

Since Virtualization provides these features, all these things come up with a cost. The hypervisors, which are used to manages the entire virtualization machine on system to make it use properly [3]. Furthermore, since there are many VMs are running on a server at a single time, it also ensures that VMs do not have impact on each other. For example, CPU scheduler in hypervisor provide a fair amount of time as well as other resources to each VMs so that greedy approach can be prevent and VM do not hurt each other for these things [4].

In market current scenario of virtualization platforms are running in two types- Open Source and Commercial. Open source such as Xen, KVM and commercial like VMware ESXi, Microsoft Hyper-V etc. But the goal is same for all these platforms, to provide virtualization. Since they used different technology and guided with different features, products price are also different according to their services.

Since new CPU architecture embedded virtualization support and advances in hypervisor designs, may have advantages to improve their performances and eliminate overheads. Despite of these things all hypervisors have exhibit different level of performance. For example we have configures VMware ESXi and XenServer

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with 1 Virtual CPU (VCPU) and GB ram with Microsoft Windows Server 2008 r (64-bit) as a guest operating system. Even with this configuration and straightforward operation, we find significant performance difference of both hypervisor, as shown in Figure 1.

But our result suggested that Xen is become a poor choice for hypervisor, and it also reveals a more complicated result that both hypervisor have different strengths and weaknesses. But still the results are far more complicated for management decision system than many of system administrators are currently aware. The virtualization platform is dependent on both the nature of its resources requirement and on the type of the application it will run alongside

To understand the relative strengths and weaknesses of both hypervisors, in this paper we perform a performance comparison based on Guest Operative System which is Microsoft Windows Server 2008 r2 (64-bit). We uses those component which are directly used by hypervisor such as CPU, memory, disk, system performance for the comparison based study. We believes that this research can help to decide and take advantages of hypervisor diversity to better match with application to the platform they will run it.

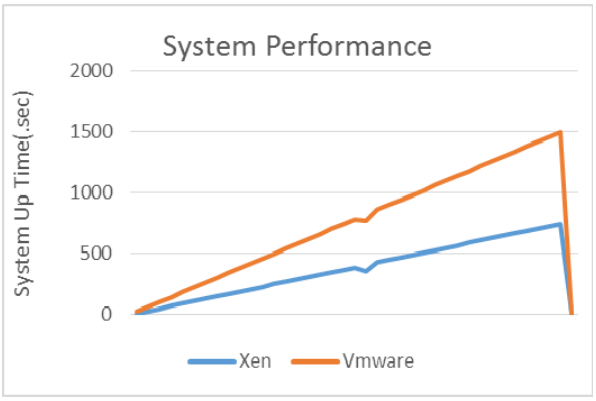

Figure 1: Overall Performance of VMware and Xen

2. BACKGROUND

Virtualization simply provide a way for computing the various resources through all VMs by taking hardware/software partitioning, emulation, time sharing, and all other resources. In reality operating system controls the hardware resources, but virtualization provide a new layer between the OS and the hardware for much more interaction. This new layer actually provide infrastructural support to the multiple VMs or guest OS that can be run on hardware and separate from each other as well as keep their independency. Generally this new layer is known as a Hypervisor or VMM (Virtual Machine Monitor).

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There are three different approaches to virtualization: Para-virtualization (PV), full-virtualization (FV), hardware-assisted virtualization (HVM) showed in Figure-2. Para virtualization refers to the modification to the guest operating system, i.e. it simply defines the OS how to make requests to the hypervisors when it needs to access to the restricted resources as well as other needs. It means modifies the guest OS so that it is aware of being virtualized on a single physical machine with less performance loss. This approach limits the supportive nature to open source operating system such as Linux because hypervisor in turn performs the task on behalf of the guest kernels. Full virtualization supports all type of guest without modifying them using the binary translation. Hypervisor simply translate the physical page to machine page, which redirect to the correct page in actual physical memory. This capability allows the hypervisor including High availability, Distributed resources scheduling Distributed Power Management, Fault Tolerance, Recovery Manager and other features. Hardware assisted virtualization is supported by enabling AMD-V and Intel-VT technology introduce virtualization in x86 type architecture itself. Where first generation hardware support only with CPU virtualization and later generation also support I/O virtualization as well. The emergence of this virtualization reduces the use of par virtualization guest operating system in real time manner.

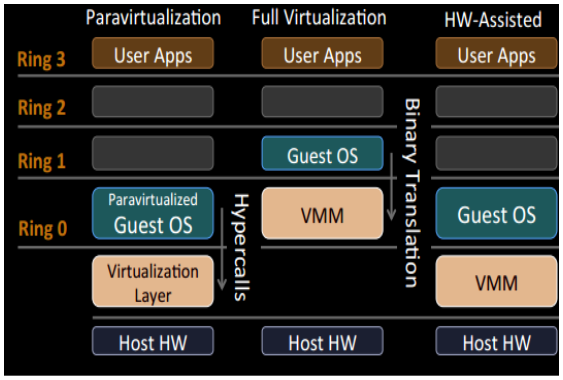

Figure 2: Virtualization Approaches

Our target hypervisors are VMware ESXi and XenServer. Both hypervisor are different in architecture, different use. While Xen is open source hypervisor. XenServer managed server virtualization which is built on Xen Hypervisor. It use para-virtualization approach in which guest OS modifies and aware of bring virtualized on a single physical server. It's a complete virtual infrastructure which adds a 64-bit type hypervisor with live migration technique of VMs, full management, tools, console needed to move application over VMs and other features. Since it is based on Xen open source design, it is highly reliable, secure,

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available virtualize platform that helps near native application to improve their performance. It run on higher privilege level then the guest operating system kernels. In Xen structure hypervisor run on ring 0 and migrating guest operating system running on ring 1. Whenever guest operating system try to run any kind of privilege instruction, processor in VM will stop and trap it into Xen hypervisor or ring 0. In Xen hypervisor, guest operating system manage hardware page table of VMs, but they can only read it directly i.e. they don't have right to alter the page table without permission of Xen hypervisor.

VMware ESXi is a commercial based hypervisor which is capable of live migration using with VM motion and boot option from network attached device. It used full virtualization approach in which hypervisor handle all things like I/O instruction guiding the all hardware and software installation information. It manages all things under virtual table and also implies the shadow version of system structure such as page table. The virtual and physical tables are mapped using guest operating system page table. Then after that hypervisor translate these physical pages which also known as frame, to the machine page, that is correct page of physical memory. This help VMware hypervisor to control and manage overall system performance within guest OS as well memory structure for better performance. VMware hypervisor provide a host of capabilities using vSphere cloud computing platform. These capabilities enhance the performance of hypervisor which include High Availability, Power Management, Resource Scheduling, Fault Tolerance, Recovery Manager, Live migration of VMs.

3. RELATED WORK

The following papers are studied to understand above the relevant work which had happened in some selected research area.

In virtualization, overhead in performance involve performance depreciation to the native or host performance. Some research work have been done to measure this overhead of virtualization in expect of different hypervisor such as VMware ESXi, Xen, KVM. For that purpose Menon used a toolkit which is called Xenoprof. It is a system wide statistical tool which is implemented specially over Xen hypervisor. This study is performing

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under single processor as well as multi-processor. These researches allow managing to correct bugs and improve the network performance efficiently [5].

VMware also research the comparison between VMware ESXi and Xen. This research is based on 32-bit system where guest operating system is also 32-bit. It is mainly based on Enterprise Infrastructure System i.e. how we able to use virtualization in enterprise infrastructure can and which hypervisor is best suited for this purpose. Conclusively VMware ESXi becomes better option to choose the virtualization hypervisor at enterprise infrastructure viewpoint. [6].

Another research has been done in which a component based performance comparison perform. In this research four type of hypervisor has been chosen from market point of view those are- VMware, Xen, KVM and Microsoft Hyper-V. But in the conclusion no hypervisor seem to be best among them because all hypervisor perform best in some point. But if we talk about overall performance Xen become most efficient hypervisor among them [7].

4. METHODOLOGY

The methodology for our experiment of hypervisor comparison is to drill down each resource component one by one using with Microsoft Windows based performance monitoring tool. The component includes CPU, memory, system up time and disk performance. Each component perform distinct with each hypervisor. And we place general workload during our experiment.

When VM is created within each hypervisor, we assign certain number of CPU and per core processor. However these virtual CPU does not guarantee a particular physical CPU is dedicated to VM.

We installed VMware ESXi 4.1.0 and XenServer 5.6.0 on system to measure the performance of the hypervisor using the guest operating system which is Microsoft Windows Server 2008 re (64-bit) and all performance test carry out with using this guest OS and after that we compare the result on which hypervisor our guest OS run efficiently.

5. RESULT

5.1 EXPERIMENTAL SETUP

The goal of our system is to provide in all aspect of complete fairness that can

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prove the system performance in a fair manner way.

HARDWARE SETTING:

For a fair comparison, hardware setting of the physical machine is exactly same for both hypervisor one by one using a single server machine. For physical machine setting we use Intel® Xeon® with 2.27 quad core processor which contain 8 GB ram. And every hypervisor provided with 80 GB hard disk.

VIRTUAL MACHINE:

Virtual is setup with one virtual CPU (VCPU), with 4 GB ram memory, disk space 50 GB. These are all the setting for virtual machine on hypervisor.

GUEST OS:

In hypervisor, we use Microsoft Windows Server 2008 r2 (64-bit) Data Center Edition for the experiment purpose. And during the experiment we see on which hypervisor our guest perform better and in which quality matter.

BENCHMARKING TOOL:

For experiment reading purpose we depend internal monitor tool of our guest OS i.e. Microsoft Windows Server 2008 r2. Since Microsoft provide "Performance Monitor" service with their software package, we use them to takeout the measurement of our hypervisor effect on guest OS.

PERFORMANCE ANALYSIS:

This is the final part of analysis of our experiment where we setup our experiment with different measurement and different component. On the basis of these component analysis we conclude our result on the aspect that on which hypervisor our guest OS run best without compromising its features.

CPU ANALYSIS:

When we run our guest OS on both hypervisor, we calculate their CPU usage power of both hypervisor in term of Megahertz (MHz) and average use of CPU.

After comparing with each other we find that from the guest OS point of view VMware average usage time better than XenServer. In both hypervisor when we run our guest OS at initial time they catch up with high value but after that we can see clearly that VMware VCPU perform better without consuming more power (in MHz) than XenServer.

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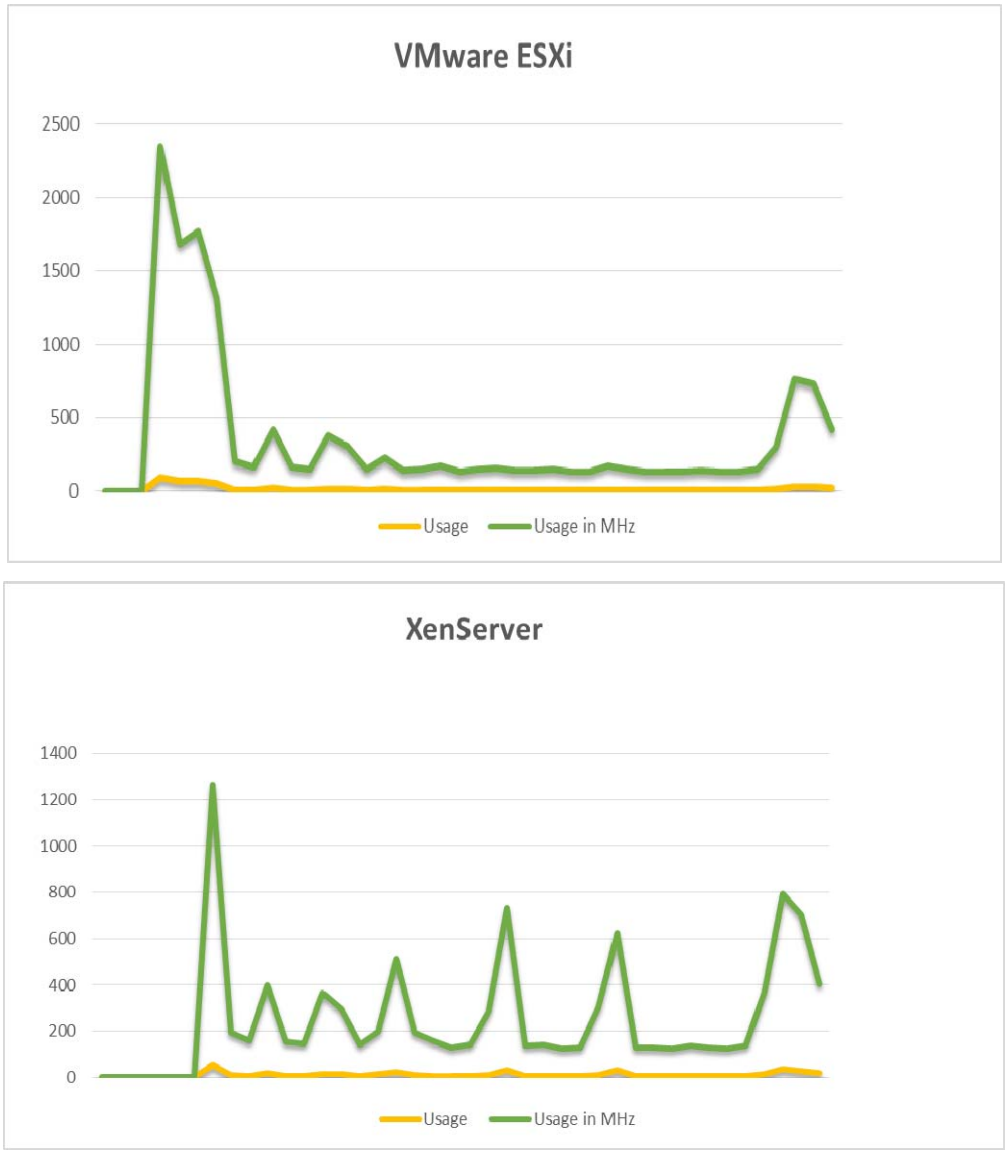

Figure 3: Processor Performance Comparison of VMware ESXi and XenServer

(Lower is better)

Memory Analysis – To perform this analysis we use guest OS default performance monitor system i.e. "Performance Monitor". We set counter for a periodic interval and note al the reading. We only calculate active and consumed memory i.e. Read and Write performance of memory. After getting all the data from both hypervisor we compare them both and at the end we conclude that from the guest OS point of view VMware memory consumption is less than XenServer in term of both Read and Write terms. So we can say that VMware perform better than XenServer.

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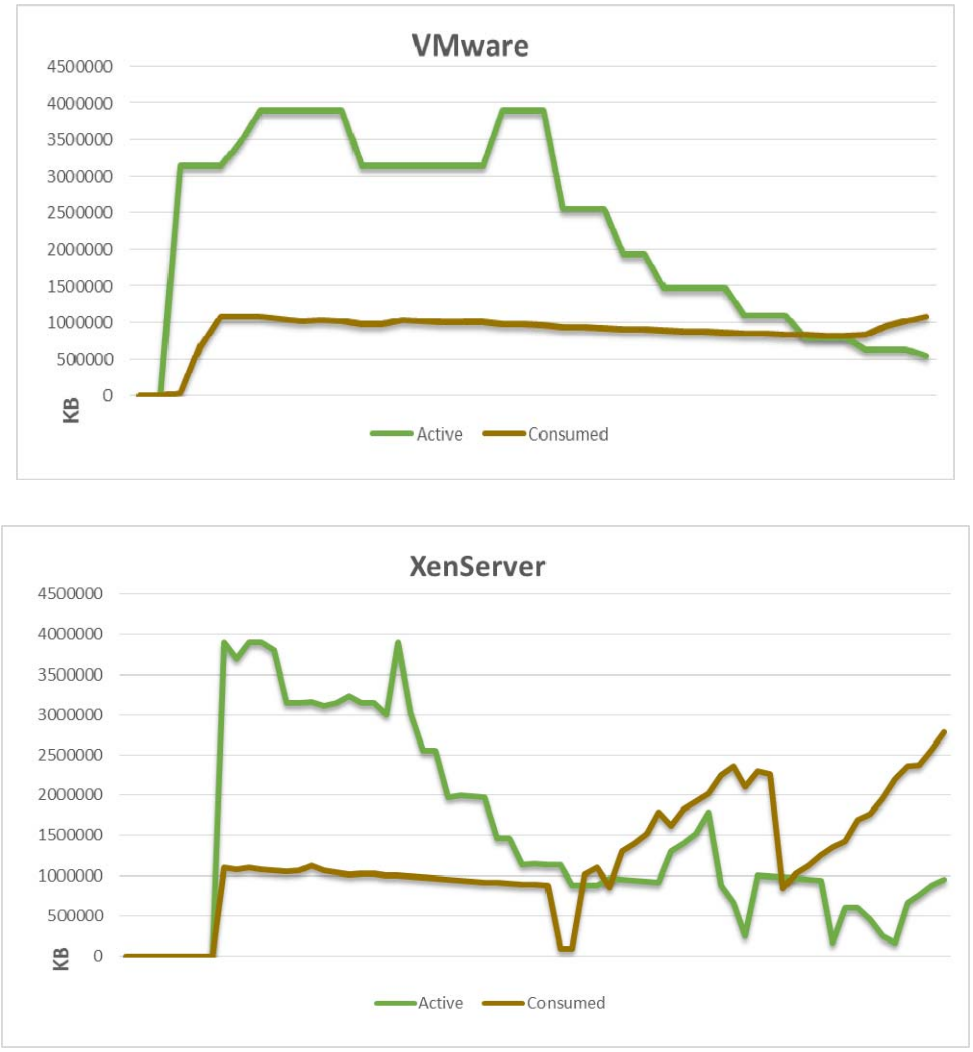

Figure 4: Memory Performance Comparison of VMware ESXi and XenServer (Lower is better)

DISK ANALYSIS:

To perform the disk analysis we do the same thing like memory analysis. We set the counter to read rate and write rate of the disk performance and we calculate this reading for a fixed time interval.

After analyze the data from both hypervisor we compare them both and at the end we summarize that VMware disk read and write rate and better than XenServer . So we can say that our analysis of Disk performance from guest OS point of view, VMware prove better than XenServer.

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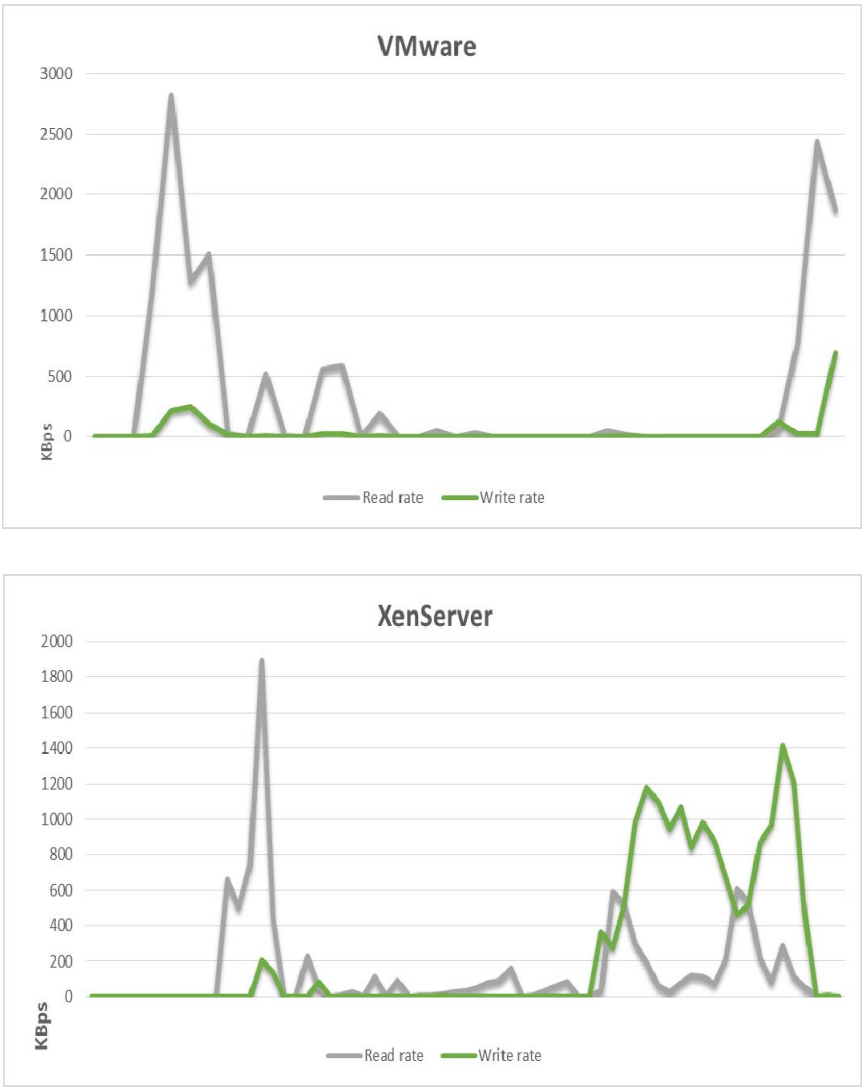

Figure 5: Disk Performance Comparison of VMware ESXi and XenServer

(Lower is better)

SYSTEM ANALYSIS:

After conducting overall system uptime from both hypervisor, from our guest OS point of view we find VMware uptime is continue increasing according to time where XenServer take initial increase but after a certain time its system uptime is decrease with large margin. SO we can say that system performance of VMware proves better than XenServer.

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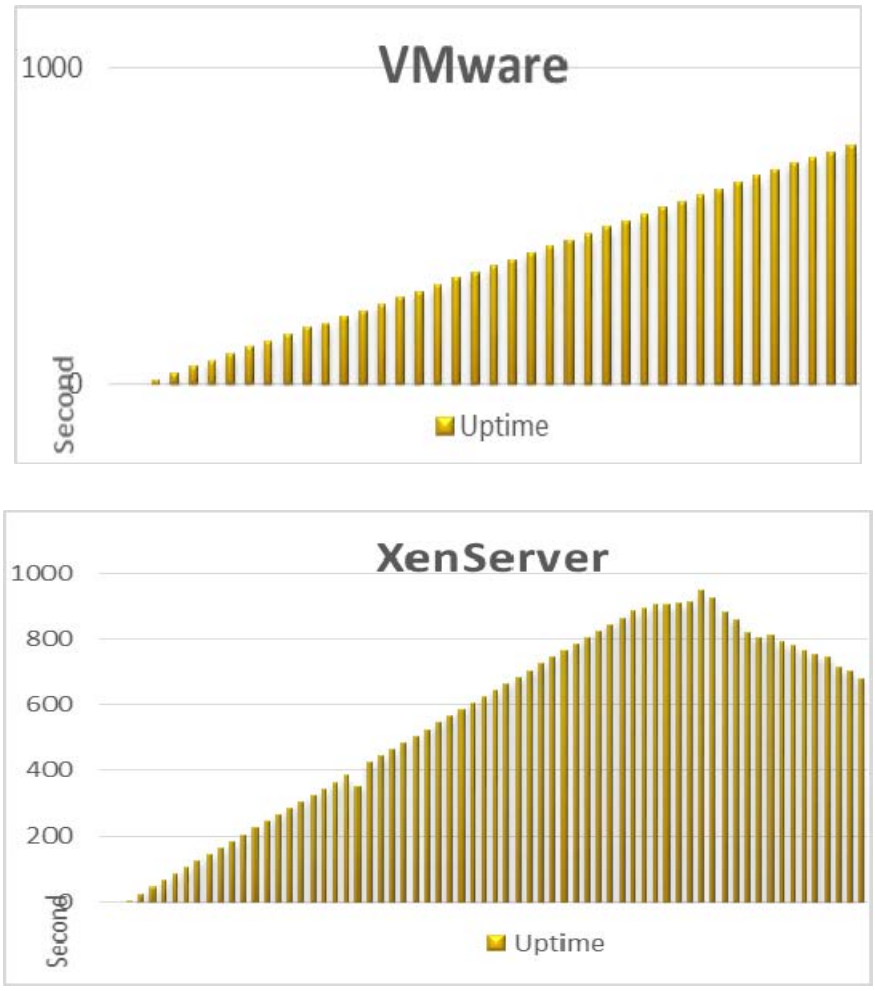

Figure 6 - System Performance Comparison of VMware ESXi and XenServer

(Gradual increament is better)

6. CONCLUSION

The objective of this experiment is to measure the performance of our guest OS performance on two most useful virtual machine monitor or hypervisor which are VMware ESXi, and XenServer. After the evaluation of all performance category we conclude that VMware exhibit an impressive performance over XenServer. For example- CPU usage time is low in VMware under the same condition like Xen, but it perform nicely. We believe that our experiment result shows a benefits for the large size of data centers as well as cloud. While there is a potential possibility to improve the performance of the virtualized platform so that it can extend its limits according to the requirement. And future work can also be consider with different guest OS on cloud or

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multiple hypervisor on cloud environment which can show us the best performance over the enterprise infrastructure.

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REFERENCES

[1] Vijayaraghavan Soundararajan and Kinshuk Govil, "Challenges in building scalable virtualized datacenter management," SIGOPS Oper. Syst. Rev., vol. 44, no. 4, pp. 95–102, Dec. 2010.

[2] Luiz André Barroso and Urs Hölzle, "The case for energy-proportional computing," Computer, vol. 40, no. 12, pp. 33–37, Dec. 2007.

[3] Timothy Wood, Ludmila Cherkasova, Kivanc Ozonat,and Prashant Shenoy, "Profiling and modeling resource usage of virtualized applications," in Proceedings of the 9th ACM/IFIP/USENIX International Conference on Middleware, New York, NY, USA, 2008, Middleware '08, pp. 366–387, Springer-Verlag New York, Inc.

[4] Ludmila Cherkasova, Diwaker Gupta, and Amin Vahdat, "Comparison of the three cpu schedulers in xen," SIGMETRICS Perform. Eval. Rev., vol. 35, no. 2, pp. 42–51, Sept. 2007.

[5] Menon, A. et Al. (2005) Diagnosing Performance Overheads in the Xen Virtual Machinen Environment. Conference on Virtual Execution Environments (VEE'05).

[6] VMware (2007) A Performance Comparison of Hypervisors VMware. White paper Feb 1, 2007.

[7] A Component-Based Performance Comparison of Four Hypervisors Jinho Hwang The George Washington University 2013.

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