Performance Analysis of Various Guest Operating Systems on Ubuntu 14.04

Prof. (Dr.) Viabhakar Pathak [1], Pramod Kumar Ram [2]

[1]*Computer Science and Engineering, Arya College of Engineering, Jaipur, India.*
[2]*Computer Science and Engineering, Poornima University, Jaipur, India.*

Abstract— Cloud computing has simply means Internet Computing. The Internet is commonly visualized as clouds. Hence the term cloud computing for computation done through the Internet. With Cloud computing users can access database resources via the Internet from anywhere. Cloud computing provides the facility to access shared resources and common infrastructure, offering services on demand over the network to perform operations that meet changing business needs. The virtualization of IT infrastructure enables the consolidation and pooling of IT resources so that they can be shared over diverse applications. With the help of virtualization logical abstraction of physical resource is possible which is very lucrative for the IT business. Thus we can save the capital of IT business. Virtualization is very important for cloud computing because the delivery of services is simplified by providing a platform, infrastructure and services for optimizing complex IT resources in a feasible manner, which makes cloud computing more cost effective. This paper presents Performance Analysis of Various Guest Operating Systems on Ubuntu 14.04.Various Guest OS performance on Ubuntu cloud of different virtual machine of Ubuntu and WinXP's performance in the CPU Time, Memory usage, and percent CPU usage in the KVM hypervisor virtualization. Our comparison was carried using Libvirt tool kit commands result and sysbench benchmark tool. Our goals are that how the different virtual machine of single host affects the performance and make informed decision about choice of best virtual machine indication to the cloud guest OS on Ubuntu.

Keywords—*Virtualization, Hypervisor, Private Cloud, KVM, MIPS.*

I. INTRODUCTION

Cloud computing has become a hot topic and Cloud implies a set of different types of hardware and software that work collectively to deliver many aspects of computing to the end user as an online service.

The term cloud computing implies access to remote computing services offered by third parties to the public Internet. Cloud computing delivers Infrastructure, Platform and software services in pay-as-you-go model to consumer [5]. It is a style of computing in which resources are provided "as a service" over the internet to users who need not have control over the technology infrastructure. With cloud computing user can access files and use applications from any device that can access

the internet. Cloud computing is a computing area, where a large pool of system is connected in a private or public network to provide dynamically scalable infrastructure for application, data and storage.

Private cloud deployment model creates proprietary computing architecture behind a firewall of an organization. We have created the hybrid cloud for the experiment. Cloud computing allows customers to reduce the cost of the hardware by allowing resources on demand.

The paper evaluates the performance of six different guest operating systems. A 64-bit OSes are Ubuntu10, Ubuntu11, Ubuntu12, Ubuntu14, Windows 7, and 32-bit OS is Win XP. The Operating Systems (OSs) are installed on KVM (Ubuntu 14.04) hypervisor in the private cloud environment. Experiments are run on the respective guest operating systems with three scenario1, scenario2, scenario3 and the system information is gathered using Libvirt tool kit commands and Sysbench benchmark tool. The paper talks about the results of this experiment. The discussion in this experiment will give an idea that how the different virtual machine of single host affects the performance of Guest OSes to choose the right virtualized guest operating system for KVM hypervisor.

II. RELATED WORK

The following papers are reviewed as part of the literature survey.

Albert Reuther, et-al [1] has discussed on Virtual Machines in High Performance Computing Systems. Author analyzes the effectiveness of using virtual machines in a high performance computing (HPC) environment. They worked on HPC Cluster and then compare the results of job launching time at LLGrid TX-2500. The VM images were Debian Linux 6.0.4 i386 installations. Hypervisors were deployed in one of two modes: type-1 and type-2. Type-1 hypervisors are installed directly on the hardware; in this deployment, the hypervisor is essentially a minimal OS for executing virtual machines. Type-2 hypervisors are installed within a host operating system, and they are executed as a process in the host OS for each guest virtual machine. Experiment were discussed on VM images from a user account on the central file system, a DDN 10K storage array, connected to the compute nodes via 10GigE core network, and 1GigE connection to each node from the rack switches and each compute node was a Dell PowerEdge 1955 blades with dual socket, dual core 3.2 GHz CPUs, 8 GB of RAM per blade, and two 36 GB

2.5" SAS hard drives. Author did not worked on of parallel jobs, such as MPI applications, that require interaction between the processes.

Prakash P, et-al [3] discussed on virtualization Machine Guest Operating System. There are focused on Hypervisor on type-2. Multiple Guest OS was run on different -2 virtual Machine and checked their performance. Hypervisor is the core component of virtual machine (VM) system and its effectiveness greatly impacts the performance of whole system. This paper provides the performance of different guest (virtual) operating on same host operating system and also it discuss performance of two Virtualization hypervisors (type-2) available for x86 architecture-VMware Workstation and Virtual Box using benchmark applications. From performance evaluation the VMware Workstation has the best performance and also Windows 8 has the best performance as virtual operating system on both VMware and VirtualBox.

Kyu Ho Park, et- al [4] had proposed Resource Management of Many cores with a Hierarchical and a Hybrid Main Memory for MN-MATE Cloud Node. Author implemented MN-MATE, a novel architecture and management techniques for resource allocation of a number of cores, on- chip DRAM, and large size of off-chip DRAM and NVRAM. In MN-MATE, each guest OS utilized cores and various memories allocated by the hypervisor. They also proposed three resource management techniques for high performance computing in each guest OS. After that he implemented a task scheduling method to reduce contention in accessing hybrid main memory. Author also presented two memory management techniques for high performance and low energy consumption. He did not combine design and implementation about hybrid main memory-aware task scheduling and memory managements of the proposed memory architecture [p2].

P. Vijaya Vardhan Reddy et-al [2] has provided performance comparison of guest OSs with KVM based hypervisor sing SIGAR framework. They show the Memory, Disk I/O system and CPU utilization is gathered using SIGAR API on the respective guest Operating System. A Network performance and CPU utilization, the environment is architected to create low, medium and high workloads. According to them para-virtualized guest Linux scores better performance compared to other guest Oss and also can be recommended as the best-suited guest OS for KVM hypervisor in the private cloud. The authors introduced SIGAR API as a new idea for gather information for all guests OSs. They also describe the I/O test Windows performance is better than Ubuntu. Author selected the three Oss, Windows Server 2008 R2, Red Hat Enterprise Linux Server (RHEL5) and Ubuntu (Lucid Lynx 10.04).

After studying the appropriate work on operating systems (guest virtual machines) and hypervisors' performance we have carefully chosen three six guest operating systems, which represents hardware virtualized guest, para-virtualized commercial guest and para-virtualized free guest to evaluate their performances virtualization, To select a host operating and create

virtual environment through various 32 & 64 bit Guest Operating Systems. To perform the analysis of various Guest OSes under virtualization environment. To compare the performance of various Guest Operating Systems. KVM is a hybrid model hypervisor, with the standard Linux kernel.

III. SYSTEM DESIGN AND IMPLEMENTATION

This chapter is generate the implementation of different virtual machine in hybrid cloud environment and also measure the system bench marking of current host machine Guest OS on Ubuntu Cloud performance.

o *Architectural Design of Work*- The architectural setup is designed according to take iterative results in the different virtual machines.
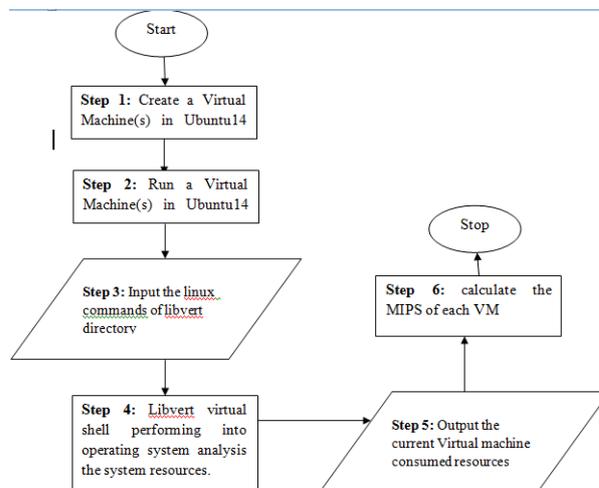

Figure 1. Architectural Diagram of performance measurement of Guest OS Virtual machine

o *Input/ Output Requirement, Variable, Assumption*- This project contains various type of input in different steps. Project's major steps are that first it create the virtual machine after that it run the virtual machine then it analysis the system load on the host and virtual machine. Various input to create a virtual machine.

Input	Parameter
RAM	1024 MB
Secondary memory	8 GB
CPU core	2 for every VM

Figure 2. Input for the create Virtual Machine and its parameters

After that analysis of system load parameters are:

Input	Description
CPU time	Time which the CPU used for particular Instruction for program
Memory Utilization	Memory used for Virtual Machine
Buffer memory	Buffer memory used by Virtual Machine
Cache Memory	Cache Memory used by Virtual Machine

Figure 3. Input for analysis the virtual machine

o   *Hypervisor (kernel-based virtual machine) setup-* The hypervisor, also known as a Virtual Machine Monitor (VMM) is the software layer which enables virtualization. It is responsible for creating the virtual environment on which the guest virtual machines operate. It supervises the guest systems and makes sure resources are allocated to the guests as necessary. In this project the Kernel-based virtual Machine (KVM) is used for experimentation. Kernel-based Virtual Machine is a kernel module for the Linux operating that allows for full virtualization in X86architecture.
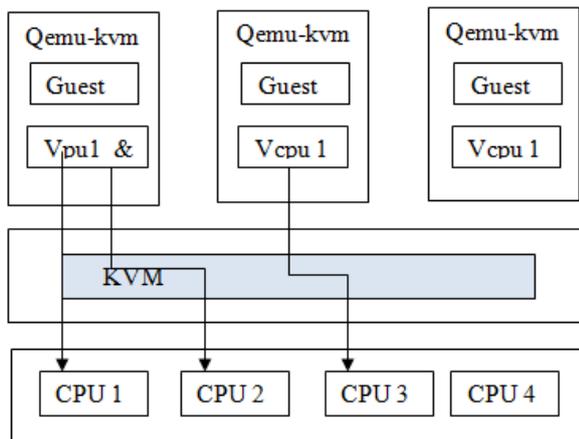

Figure 4. General architecture of KVM

To check that KVM is installed in the system:

 # kvm-ok
If it give that kvm is already installed then ok otherwise it give that hardware is not supported for this system for virtualization.
Installation command of KVM in Ubuntu14.04 is
 # apt-get install kvm

o   *Details of Hardware-* Hardware Configuration for the system under test (SUT):

Component	Value
Processor	Intel core i3-2-2120 CPU @ 3.30 x 4
Core	4
RAM	3.7 GiB
Graphics	Intel Sandybridge Desktop
OS type	64-bit
Memory	223.6

Figure 5 Hardware used for System under Test

IV. EXPERIMENTAL ANALYSIS

o   *Description of Data Variation-* Every time the data is evaluated by the Libvirt Commands and variation of data in every Virtual Machine is evaluated. Finally performance is checked by sysbench benchmarking tool. We have use four different flavors of Ubuntu10, Ubuntu11, Ubuntu12.04 and Ubuntu14.04 as linux Virtual Machine for Window Virtual Machine use Window XP.

Scenario	Virtual Machines (64-bit OS)
Scenario 1	Ubuntu10, Ubuntu11, Ubuntu12, Ubuntu14
Scenario 2	Window XP Ubuntu10 + Window XP
Scenario 3	Ubuntu10, Ubuntu11, Ubuntu12, Ubuntu14, Win XP (32-bit OS), Win 7

Figure 6. Virtual Machine and its Combination in Different Scenarios

o   *Description of Experimental Variations-* Every scenario has fix parameter to create a virtual machine after that evaluate the results for every virtual machine. Brief variations of scenarios are as follow.

•   *Scenario 1 – When Single Virtual Machine runs at a time:* In this scenario only single virtual machine runs at time. After stable the virtual machine result is evaluate for every virtual machine. The parameters of results are CPU time and memory of Host machine (Ubuntu14.04). After that evaluates the result of virtual machine VCPU time, CPU Time, VCPU information. This scenario has four Ubuntu flavor Ubuntu10, Ubuntu11, Ubuntu12, Ubuntu14.04.

•   *Scenario 2 – This is hybrid environment of WindowXP, WindowXP and Ubuntu1:* In this scenario Ubuntu's flavor Virtual Machine runs at a time. Combination of Ubuntu's flavor and WinXP's virtual machine runs at time. After stable the virtual machine result is evaluate for every virtual machine. The parameters of results are CPU time and memory of Host machine (Ubuntu14.04). After that evaluates the result of virtual machine VCPU time, CPU Time, VCPU information. This scenario has two Virtual Machine WindowXP and WindowXP+Ubuntu10

•   *Scenario 3 – When all Virtual Machine runs parallel at a time:* In this scenario different-2 virtual machine runs parallel at a time. After stable the virtual machine results is calculated of all virtual machine. Through of results are CPU time and their frequency all of virtual machine at Host Machine (Ubuntu 14.04) is MIPS at Guest OS. Each virtual machine Guest OS is 64-bit except Win XP.

V. RESULT AND DISCUSSION

o   *Scenario 1:   Running the different virtual machine of the Only Ubnutu flavours:*

1. When Virtual machine (Ubuntu10) run in host.
2. Virtual Machine (Ubuntu11) runs in the host.
3. Virtual Machine Ubuntu12.04 runs in the host.
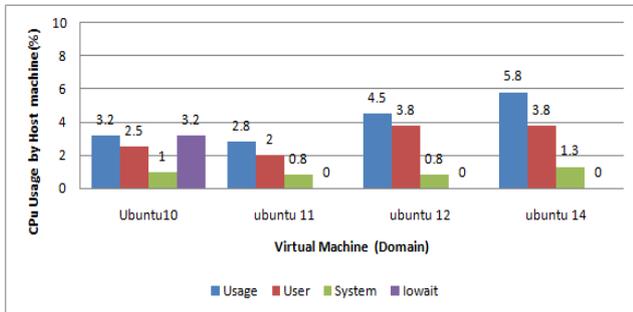4. Virtual Machine Ubuntu 14.04 run in the host.

Figure 7. Comparative analysis between Hosts (Node) with parameter of CPU Usage States in Different-2 Virtual Machines

This figure shows the comparative analysis of Host Machine (Ubuntu14.04) with the parameter CPU use. The Usage of CPU in Processing the Virtual machine Ubnutu14.04 consumes the maximum CPU Usage 5.8 %. So it clear that ubuntu14.04 consume the maximum CPU for processing the virtual machine. Ubuntu14.04 also consumes 3.8 % of CPU in User processing. This is the maximum in the all virtual machine. The only virtual machine which use the I/O wait is ubnutu10.
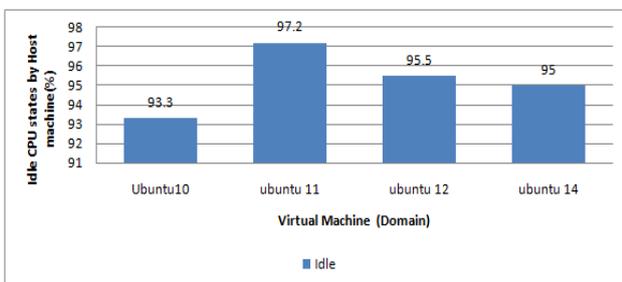

Figure 7. Comparative analysis graph between Hosts (Node) with parameter Idle CPU states Usage in Different-2 Virtual Machines

This figure shows the comparative analysis of Host Machine (Ubuntu14.04) with the parameter Idle CPU stats. The Idle CPU usage of Virtual machine Ubnutu10 is lowest so it can be said that Ubnutn10 has maximum load in all virtual machine. Ubuntu11 has 97.2 % Idle of CPU and this Virtual Machine has minimum load.
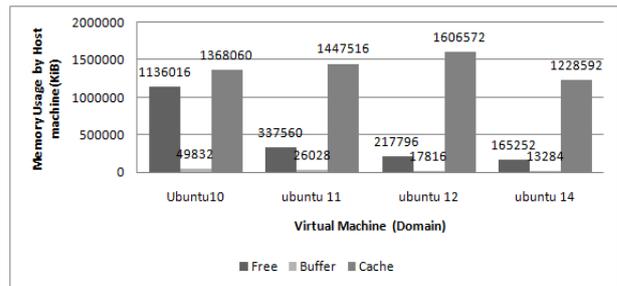

Figure 8. Comparative analysis between Hosts (Node) with parameter Memory Usage in Different-2 Virtual Machines

This is comparative figure of Memory usage by host machine when different-2 virtual machine is running on to host. Ubnutu14.04 has least free memory (165252KiB) so it uses the memory maximum. After analyze the buffer memory the virtual machine again the ubuntu14.04 use minimum in all virtual machine which is (13284 Kib). After that analyzed the cache memory again the ubuntu14.04 uses the minimum cache memory which is (1228592 Kib). Ubntu10 has the maximum free memory (1136016 Kib). Thus we can say that ubuntu14 use the maximum memory and the ubuntu10 use the minimum memory of the host machine.

o *Scenario 2 Performance of Virtual machine with Window XP and its combination with Ubuntu flavours:*

1. Virtual Machine Window XP run in the host
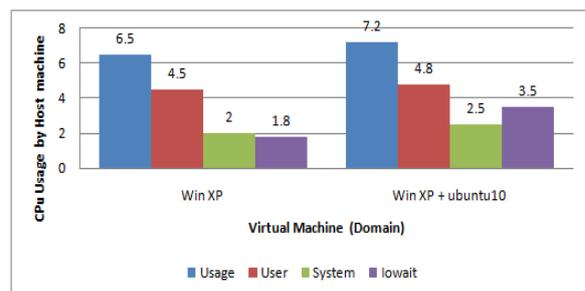2. Combination of Virtual Machine Window XP and Ubuntu10 run in the host

Figure 9. Comparative analysis between Host (Ubuntu14.04) CPU usage in the Window XP VM and XP + ubuntu10

In this figure comparative analysis of Host Machine (Ubuntu14.04) with the parameter CPU usage while the window XP runs and combination of Window XP + ubuntu10 run simultaneously. It shows that usage time is taken by WinXP+ubnutu10 is 7.2 % which is greater than single XP System. The user time of WinXP+ubuntu10 is 4.8 %. I/O wait of WinXP+ubuntu10 is 3.5% which is greater than single XP virtual machine. Thus it can be said that combination of WinXP+ubuntu10 takes more system CPU percent.
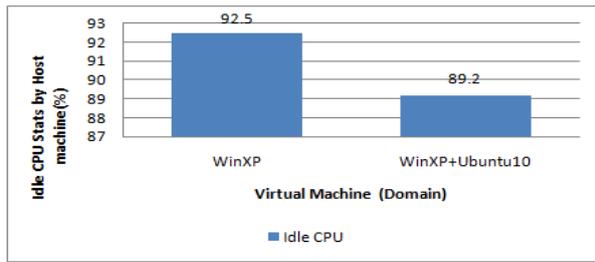
Figure 10. Comparative analysis of Host (Ubuntu14.04) in Idle CPU usage in the Window XP VM and XP + Ubuntu10

This figure shows the comparative analysis of Host Machine (Ubuntu14.04) with the parameter Idle CPU stats. The Idle CPU usage of Virtual machine Window XP+Ubuntu10 is lowest (89.2%) so it can be said that Window XP+Ubnutu10 has maximum load in all virtual machine. Only Window XP has 92.5 % Idle of CPU and this Virtual Machine has minimum load.
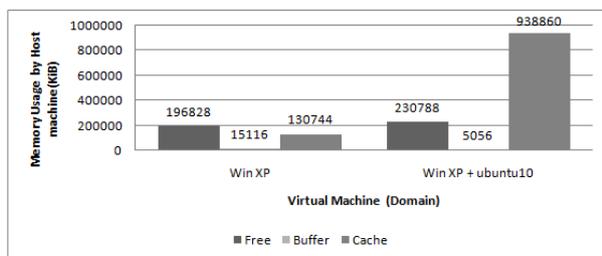

Figure 11. Comparative analysis between Host (Ubuntu14.04) in idle CPU usage in the Window XP VM and XP + ubuntu10

This is comparative figure of Memory usage by host machine when Single WinXP and combination of WinXP+ubuntu10 run. The memory use of winXP+ubuntu10 less then Single XP because while output condition I run the single ubuntu10. The free memory of WinXP+ubuntu10 is 230788(Kib). Buffer memory is used by single XP is greater than other VM which is 15116 (Kib).

1. *Scenario 3 Virtual Machines running on Ubuntu flavour:* Combination of Virtual Machine Ubuntu10, Ubuntu11, Ubuntu12.04, Ubuntu14.04 and Windows XP run in the host.
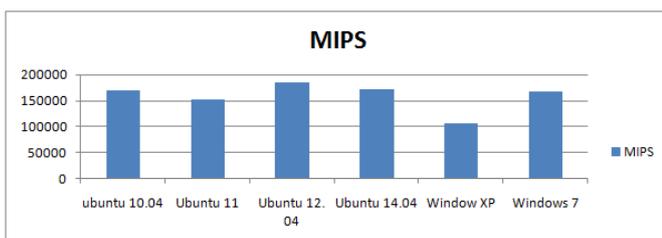

Figure 12. MIPS of Ubuntu10, Ubuntu11, Ubuntu12.04, Ubuntu14.04, Win XP simultaneously

This figure shows the MIPS status of Ubuntu10, Ubnutu11, Ubuntu12.04, Ubuntu14.04 and Win XP. When the HDD of every domain is 8GB and RAM is 2048 MB. Ubuntu 12.04 has maximum MIPS and its CPU frequency is 3100 MHz, CPU time 59.4sec as expected Ubuntu 14.04 use the CPU frequency 2700 MHz and CPU time 63.8 sec.

VII.CONCLUSION

Paper evaluates the performance measurement of different Virtual Machines in hybrid cloud system using KVM hypervisor. To achieve this virtualization a hybrid cloud model was created and various virtual machines were implemented in Ubuntu14.04. After that result evaluated using Levitt commands. In scenario 1 the Ubnutu11 has minimum load because it's idle time 97.2 %. But Ubuntu12 has maximum free memory. It depends on current load to system. In scenario 2 the Ubuntu12.04 has maximum MIPS on 64-bit OS. Only Win XP has 32-bit OS and their MIPS is 106400.

To achieve the final result the work is further divide into subtasks, like creating the various Virtual Machines in Ubnutu14.04 LTS with KVM virtual machine in different scenarios. After that experiment the results of every Virtual Machine are compare the results with benchmarking and sysbench tool. I will work on the effect of Virtual Machines performance in infrastructure change as RAM, Memory, and No. of CPU Core. To evaluate the performance of various system with benchmarking tool like ramspeed, unibench and C-Ray. The implementation of pirated (Virus infected) Window XP Virtual Machine and its comparison with genuine Window XP virtual Machine.

REFERENCES

[1] Reuther, A.; Michaleas, P.; Prout, A.; Kepner, J., "HPC-VMs: Virtual machines in high performance computing systems," High Performance Extreme Computing (HPEC), 2012 IEEE Conference on, pp.1, 6, 10-12 Sept. 2012.

[2] Reddy, P.V.V.; Rajamani, L., "Performance comparison of different operating systems in the private cloud with KVM hypervisor using SIGAR framework," Communication, Information & Computing Technology (ICCICT), 2015 International Conference on, pp.1,6, 15-17 Jan. 2015.

[3] Prakash P and Biju R Mohan., "Evaluating Performance of Virtual Machine on Hypervisor (Type -2)," Association of Computer Electronics and Electrical Engineers, 2013 Proc. of Int. Conf. on Emerging Trends in Engineering and Technology, pp.1,9, 15-17 Jan. 2013.

[4] Kyu Ho Park; Sung Kyu Park; Woomin Hwang; Hyunchul Seok; Dong-Jae Shin; Ki-Woong Park, "Resource Management of Manycores with a Hierarchical and a Hybrid Main Memory for MN-MATE Cloud Node," *Services (SERVICES), 2012 IEEE Eighth World Congress on* , pp.301,308, 24-29 June 2012.

[5] M. Murugesan; S. Nathiya , " Attack Prevention Of Multi Owner Data Sharing For Dynamic Groups In The Cloud," International Conference on Innovation in Science, Engineering, Technology and Management *(ICISETM),* Seventh Sense Research Group on, April 2014.