

# Performance of Kernels in Virtual Machines: An Introduction to KVM Hypervisor

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**Abstract:** The topic “performance of kernel in Virtual machine” explains the usage and importance of kernel in VMMs. How they are used and how they are helpful in the communication in between the hardware and software. The microkernels in regard to kernels continue the work of the kernel in a higher level with a specific server that is used to perform the task in a convenient way. Different kernel based virtual machines are very portable for the task completion. The KVM's therefore describes an infrastructure that takes in both the kernels and virtual machine. This integrates the quality of the work and computability of the tasks performed. The whole research paper will focus on the KVM's virtualization performance and the importance of the kernel in the KVM's which will prolong to hypervisor. The whole circle will paper will circle around the Kernels, Virtual machines , performance of the KVM's hypervisor.

**Keywords:** application, kernels, KVM's, microkernels, performance, virtual machines.

## 1 INTRODUCTION

### 1.1 Kernels:

An operating system always works with the help of some communication protocol whether that protocol is any topology or any other significant module. This module can be a kernel which is used for the communication happening between the hardware and software. This operation then completes the instructions that are performed in the operating system. The interaction of the kernels and virtual machines can easily be observed by the architecture and the structure of the working machine.

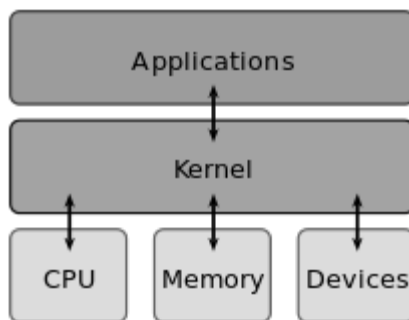


Fig. 1 kernel

The above figure describes the work and performance of a kernel in an operating system as how it is interrelated with the applications i.e. software and the hardware devices. The kernel is interconnected with the CPU, memory and the devices.

### 1.2 Virtual Machines:

The virtual machines are itself an image to complete the tasks via some application or some other means .the virtual machine is actually the description of a given computing system. It describes the structure, implementations and the functions it involves in the system.[1] (Smith & Nair, 2005)

There are different kinds of virtual machines which perform their specific functions namely 'System' and 'Process' virtual machines, these machines perform their own tasks and hence are specified to their locations to complete the duties. System virtual machine has its own platform which execute the operating system whereas process virtual machine has its own capacity to execute. It normally executes one or a single program

There are different concepts which are motivated by different researchers and engineers to compute the compatibility of the virtual machines. These are generally compiled by the researchers for the completeness of the software that is going to execute the program of the operating system.

A virtual machine is itself a program that executes the program which are single headed or those which are abstract. Abstract virtual machines describes itself as a machine which execute the code whose specifications are given inspite of the physical device.

### 1.3 Kernel based Virtual machines:

It is structure or mainly an infrastructure which is used for the Linux which will step forward to hypervisor.[2](Huynh & Hajnoczi, 2010) says that it's functionality is to support x86 processors. It requires a processor with extension having hardware virtualization. Para virtualization is another term used in the KVM's which usually control the devices usability

and the performance of the KVM's ad took the use of para-virtual box and para-virtual Ethernet card.

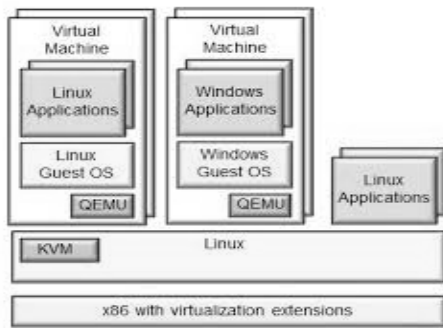


Fig:2 KVM

#### 1.4 KVM Hypervisor:

[3](Popek & Goldberg, 1974) It is actually a single host which operates multiple programs single handedly. It is that device which will perform the executions by staying on host window and computing the programs executions. [4](Dall & Nieh, 2014)It is a manager which executes the programs from its side and gives resourceful instructions to the resources. It uses the technique of streamlining to improve the performance of virtualized environments.[5] (Dall & Nieh, 2014)

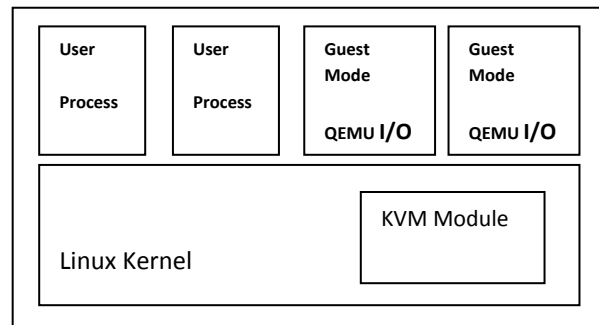
## 2 RELATED WORK

Different types of work had been done so far regarding the performance of kernels in virtual machines. Different types of techniques have been applied in the name of experiments, researches, journals, scientific experiments etc.

These all focus on the innovation of the new trend and new search for the development of the virtualization of the operating system so far. The virtualization is quite old in the field of computing but many new ideas are approachable in it. These ideas so far have been developed into a new technique like hypervisor which was introduced in 2015. As far as the KVM is related it was introduced in 1960 in the field of computing. The KVM therefore evolved into a emerging new technique which not only covers the whole software programs but also create a connection with the hardware. The roots have evolved into emerging technical heights where it can and it has mesmerized the whole computing industry. With every passing year the advancement was clearly seen as the KVM was introduced in Intel and AMD.

KVM main task is to consolidate the server to optimize the work by consuming the energy.

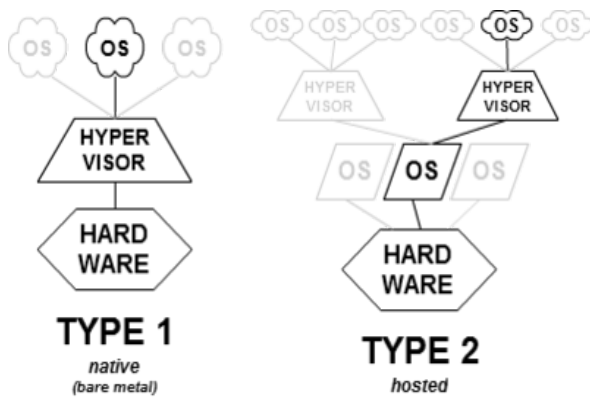
The KVM has its own monitor which shows that how the work is performed on the system. When the KVM kernel mode is loaded in it shows some extensions which are dev/ kvm. These extensions describe the file which is operating the program so far. Different system calls are given to create the new virtual machines, new interfaces, and assigning memory to virtual machines. QEMU as described above is a hardware tool which provides hardware like network cards, cd drives and hardware.[6] (Hirt, 2010)



The above diagram illustrates the architecture of the KVM in the Linux based system. The above figure shows the three modes known as kernel guest and user-mode. Each mode has its own functionality to accept and execute the instructions. The user mode will try to access the instructions to the system and these accessing will awake the kernel mode active and it will activate the guest mode. The guest mode will apply the execution of the I/O which will automatically complete the task which started with the user mode.

As far as you have heard about the virtual machine or virtual box, they are the VMs. But when you come around the KVM which is also known as Hypervisor and they are present in Xen machine and it's also known as VMMs.

These hypervisors as shown in the figure is software, hardware or a firmware tool which are used to run virtual machines. Its characteristically shows two types of hypervisors; one of them is bare metal hypervisor and the second is OS hosted hypervisor. Both have distinctions in their origins that their operating system and the systems that they are working on.[7](Popek & Goldberg, 1974)



### 3 ANALYSIS

Now there is a question that how the KVM architecture works with all the tools and the entire infrastructure. Hence, for that a complete diagram shows its functionality and the work it does in the operating system and the result or the execution it shows when it interacts with its tools. The tools like QEMU and vcpu helps the KVM and provides it with the management of the VMM's or the hypervisor.

In KVM there are specific illustrations which actually describes the programming internally, the QEMU which is a version to explain the execution of the instructions. One of the processors which are ultimately important in the computing is x86 processor. The working architecture of the virtual machine is clearly shown a hypervisor actually means. The hypervisor is actually a hardware tool which shows that how the programming done on the operating system really establishes a virtual machine or virtual machine monitor. This monitor control the outlook of the machine in such way that it emerges into a vast new experience for the engineers and for the researchers like the work done on the Xen Machine and multiple other applications that been a part of the KVM hypervisor or VMMs.[8] (Armand & Gien, 2009)

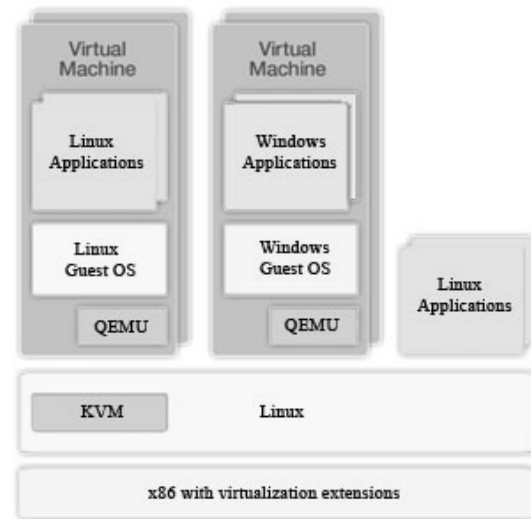


Fig: 4 KVM hypervisor architecture

[9] (Camargos, Girard, & Ligneris, 2008) The figure describes that how the process is being taken out in the virtual machine. In a Linux operation different processes are taken out in a single time. The x86 processor can host the (both) Linux and the windows mode, which is in the form of the guest mode. So analysis is this that execution will be done both on the Linux mode and the guest window mode, which will use the QEMU and the KVM as part of the tools to complete the execution.

Therefore it is clearly seen that the KVM when joined with Linux give a better performance either it is executing a single process or a multiprocessing. Hence the kernel based virtual machines are no longer dependant on any other material or tool, it has its own tools and hardware with which it's connected and executed. These calculations and readings describe the KVM hypervisor as an elaborative and distinguished tool. The distinguishing factor is its capacity to process out all the instructions which are being entered in the kernel.[10] (Sudha, Harish, Nandan, & Usha, 2013)

The studies have revealed that there are some factors that really affect the system like Unix, Linux and other Unix-like systems. Therefore there is always some need to bring out the best of the processors for the system and the system will always be dependent on the kernels to cooperate with them.

The fig 5 (a) is complete description of the process of the Xen machine, its deployment and data transfer through different layers and through different hardware. It is Type 1

virtualization and it consists of para- virtualization technique.

The fig5 (b) is a detailed diagram of the KVM machine that how it operates and how it completes the process which is entered for the execution. The diagram includes the tool QEMU for the processing and in which the file systems and devices are also interconnected. Due to which the process calls like vcpu () or iothread are initialized and compiled to give a better result. It is type -2 virtualization and it's a full virtualization technique.

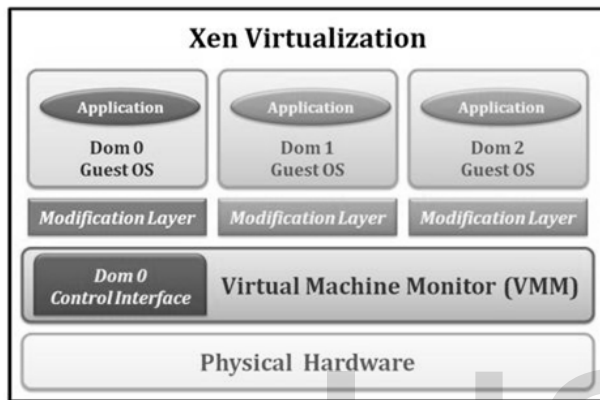


Fig5 (a)

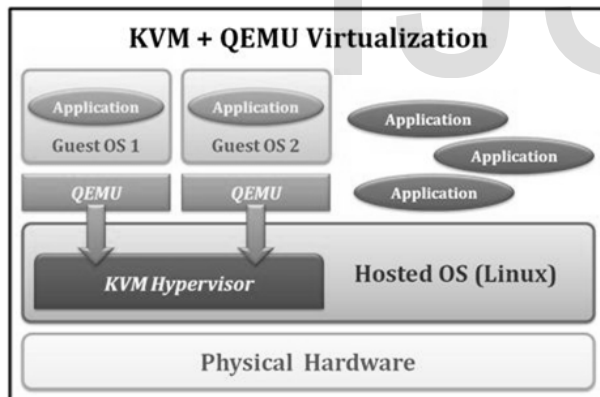


Fig5 (b)

## 5 References

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The clear picture of the connectivity of hardware and software shows the relevance and integrity of the processors over machines. It reveals that how the memory is correlated with the management of this overall study comprehends the use of kernels in the field of computing as a connector which connects the memory and the hardware with each other. Thus it controls the operating system in manageable way which conveys the data and the instructions in controlled manner. These all circumstances has always lead to the thinking of a new and more technical infrastructure of the kernel based virtual machine which in the future not only show the best of it uses but also increase the consumption of energy and with that execution of the more data.

## 4 CONCLUSION:

The whole conclusion of this term paper is that the kernel is always a best tool for the management of the memory and for the consumption of the energy that is used of the process.

The virtual machine is an old but an innovative tool in the field of computing which will always become more spectacular if it's used dynamically with other modules. The interaction of the virtual machine and kernel will bring great changes in the field of computing and the correlation of the KVM and the hypervisor will dramatically become more splendid and more vulnerable for the researchers and scientists .They will have a chance to bring the mode to the great extent where the hardware and the software both have a chance to match up.

The study brings into notice about the different platforms of hypervisor and Xen machine in which the kernels and virtual machines have worked together. This collaboration of the machine will no doubt will enhance the features of the virtualization the high limits.

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