# A Review Paper on Architecture of x86 Virtualization

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***ABSTRACT:*** ***In recent years, virtualisation and cloud computing have become prominent study topics. Virtualization is now being utilized by an increasing number of companies to decrease energy usage, requires prior knowledge, testing and production, dynamic load balancing and disaster recovery, virtual desktops, and improved system reliability and security. Virtualization also improves application deployment and migration by providing high availability for key workloads. Information Technology resources may be provided to end users as services via the Internet using cloud computing. Virtualization is one of the most significant cloud computing fundamental technologies. The author provide a comprehensive overview of virtualization in this article. Three technologies for x86 CPU virtualization, as well as the Xen architecture, are also discussed. In particular, we propose a virtualization-based cloud computing platform design. Finally, we look at how server virtualization performs in terms of cost, time, and energy usage.***

***KEYWORDS:*** ***Architecture, Cloud Computing, Technology, Virtual Machine, Virtualization.***

## 1. INTRODUCTION

Virtualization, according to Wikipedia, is the process of generating a virtual version of anything, such as a virtual computer hardware platform, operating system, storage device, or computer network resources. Server virtualization, network virtualization, storage virtualization, application virtualization, and desktop virtualization are all examples of virtualization. Virtualization methods have recently shown a number of benefits, including lower costs and power consumption, easier administration and deployment, improved mobile apps, and cross-platform compatibility. Cloud computing is a kind of computing in which virtualized and dynamically scalable resources are delivered as a service via the Internet. It is the combination of many technologies, such as distributed computing, utility computing, parallel computing, virtualization, and so on[1]–[6].

It is divided into three categories:

- public
- private
- Hybrid.

In most cloud computing systems, there are three tiers of service:

- SAAS
- PAAS
- IAAS.

Virtualization is now one of the most significant cloud computing fundamental technologies. When virtualization technology is used in conjunction with cloud computing, more and more businesses may benefit from lower administration, hardware, and power consumption expenses. Cloud computing services based on virtualization have recently been popular in a variety of sectors, including data centers, education, banking, and government[7]. How to design the architecture of a cloud computing platform based on virtualization, and how to evaluate the effect of server virtualization on the performance of a cloud network are two important questions concerning virtualization and cloud computing. Building a cloud-computing platform using current virtualization solutions is one potential solution to this issue.

Furthermore, the assessment findings for server virtualization performance are shown in comparison to various application instances. The emphasis of this article is on constructing a cloud-computing platform based on virtualization solutions. The architecture of the cloud-computing platform will be presented, followed by a discussion of the effect of server virtualization on cloud network performance. The following is how the rest of the paper is organized[8].

*1.1 Virtualization:*

Virtualization started as an IBM experiment in 1964, but it took a long time to develop. After VMware Inc launched commercial virtualization software on the X86 architecture in 1999, it entered a period of rapid development. With AMD, Intel, and Microsoft on board, the development has reached a tipping point.

*1.1.1 The x86 virtualization architecture:*

A layer called Hypervisor or Virtual Machine Monitor (VMM) is placed between the hardware and the operating system in the x86 virtualization architecture. As illustrated in Figure 1, VMM has two architectural types. The virtualization layer is installed directly on a clean x86-based system in Type I hypervisor architecture. Type II is a hosted architecture in which the virtualization layer is installed and executed as an application on top of an operating system. Type I is currently supported by Oracle VM, VMware ESX Server, Microsoft Hyper-V, and Citrix Xen Server, among other enterprise-class virtualization solutions[9].

*1.1.2 Three methods for x86 virtualization:*

Each VMM must integrate virtualization with CPU virtualization, memory virtualization, and device and I/O virtualization on the x86 architecture. To control access to the computer hardware, the x86 architecture provides operating systems and applications with four levels of privilege known as Ring 0, 1, 2, and 3. The x86 architecture necessitates the usage of virtualized instructions so that the guest OS running on top of the VMM may access the computer's hardware resources. However, certain sensitive instructions are difficult to capture and therefore cannot be successfully virtualized. There are now three methods for implementing virtualization in the CPU on the x86 architecture to address this issue. Figure 1 shows Two types architectures of VMM.

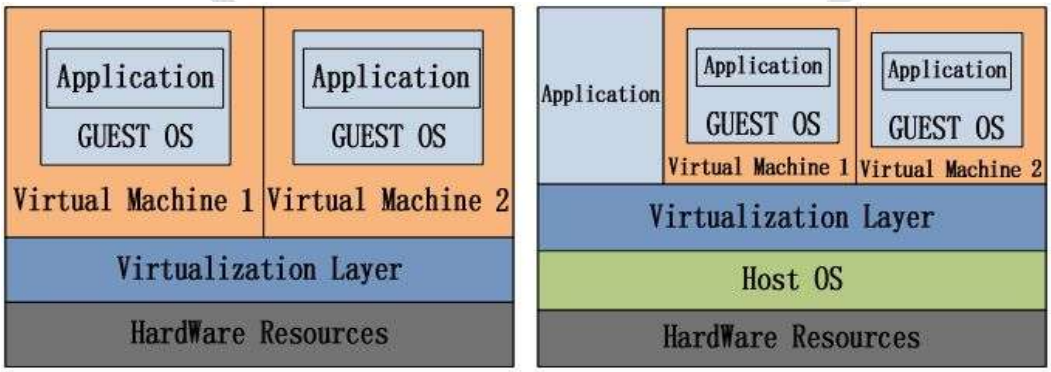


**Figure 1: The above figure shows two types architectures of VMM.**

*1.1.3 Full Virtualization using binary translation:*

Hypervisor operates on bare hardware as the host operating system in a fully virtualized environment, while the virtual machines controlled by hypervisor run the guest operating system. Through a mix of binary translation and direct execution, the hypervisor enables complete virtualization. Through the translation of a limited set of processor instructions, binary translation virtualizes sensitive instructions. On the virtual computers, other instructions may be immediately performed[10]. The guest OS has no way of knowing whether it is installed on the actual system or the hypervisor. Full virtualization provides the benefits of easier transfer and mobility. It gives virtual computers the greatest isolation and security. On virtualized or native hardware, the unmodified guest OS instance may operate. Its major flaw is that it uses binary translation work, which results in poor performance. Microsoft Virtual Server is one of several complete virtualization solutions available.

*1.1.4 Para virtualization or OS-assisted virtualization:*

This method necessitates the hypervisor managing each virtual machine and allowing them to be self-contained. This method introduces a new virtual instruction in the guest operating system known as Hyper calls, as well as a call interface in the hypervisor via which instructions may be directly executed by the hypervisor layer. High speed and minimal virtualization overhead are two benefits of para virtualization. Because the para virtualized virtual machine and operating systems must be modified, it has poor compatibility and portability. Xen server, for example, is an example of para virtualization.

*1.1.5 Hardware Assisted Virtualization:*

A full virtual operating system may directly call to hardware resources by expanding and updating the CPU instruction set and processor-operating mode. Intel VT and AMD-V are two common technologies.

*1.1.6 The Xen architecture:*

Xen is a type-I hypervisor that supports both para virtualization and full virtualization and is open-source. The Xen Hypervisor, Domain 0 and Domain U are the three most fundamental components, as illustrated in Figure 2. Because virtual machines share a common processing environment, Xen Hypervisor operates directly on top of the hardware while also controlling their execution. The domain 0, which is based on a modified Linux kernel, includes hardware drivers as well as management tools for virtual machines.

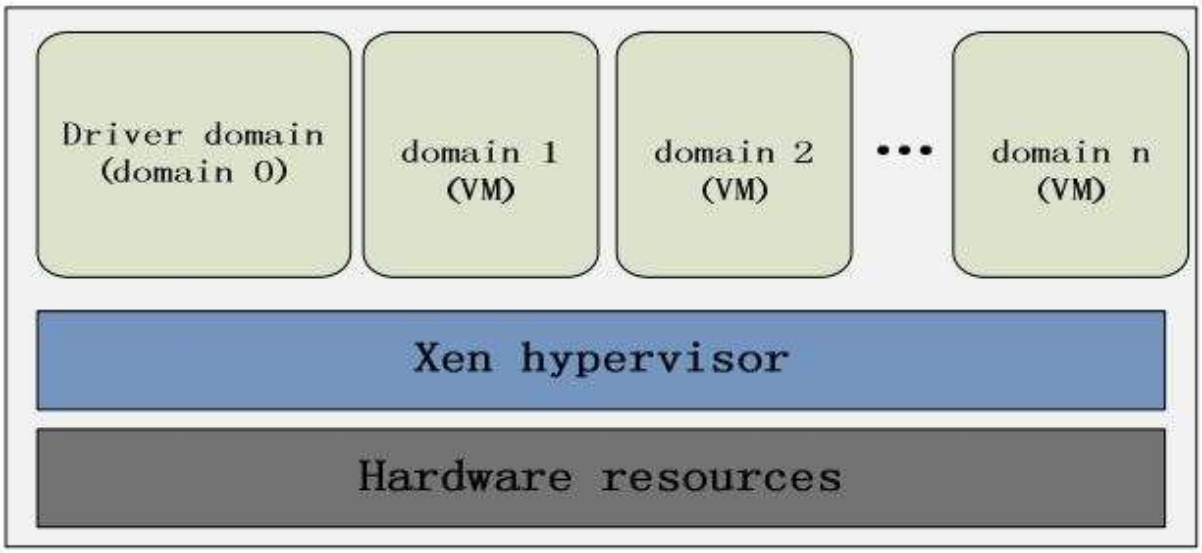


**Figure 2: The above figure shows the Xen Architecture.**

It can communicate with other virtual machines and has access to physical I/O resources. Before any additional virtual machines can be launched, Domain 0 must be running. Domain U is a Xen hypervisor-based client operating system. It is unable to access the hardware resources directly. Domain U, on the other hand, may run in parallel. In conclusion, there is currently no open standard for defining and managing virtualization. Currently, each business builds its own virtualization solutions. However, many experts believe that new hardware aided virtualization will reduce the requirement for para virtualization and complete virtualization in the future. Figure 2 shows the Xen Architecture.

*1.2 Applying Virtualization to Cloud Computing:*

Cloud computing is the supply of computing as a service rather than a product, in which shared resources, software, and information are delivered as a utility via a network to computers and other devices. Dynamic scalability, on-demand resource division, high availability, high performance, and load balancing are all features of a well-designed cloud-computing platform. Cloud computing encompasses a wide range of research topics, including energy management, stability, virtualization, and scalability, among others. In cloud computing, virtualization is only one of many key technologies. Cloud computing controls the hardware in a distributed shared resource pool via virtualization. Virtualization may increase resource usage and dynamically distribute all IT resources.

Currently, VMware's vCloud and Xen Cloud Platform solutions are often utilized to create cloud platforms. Based on the powerful Xen hypervisor, the Xen Cloud Platform is an enterprise-ready server virtualization and cloud-computing platform. Users may access VM consoles, examine VM information, conduct power operations, manage VM snapshots, and move VMs across server hosts in a pool using the Xen Cloud Platform. VMware vCloud is a virtualized version of VMware's cloud infrastructure software. The author shows how to use the VMware vCloud tools to create a cloud computing architecture. Figure 3 shows the three-tier cloud-computing platform based on the VMware vCloud tools.

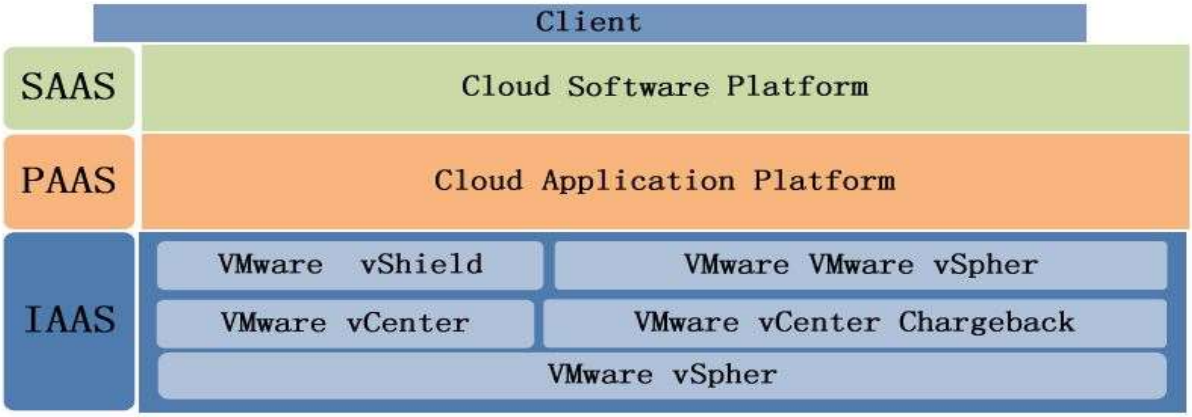


**Figure 3: The above figure shows the three-tier cloud-computing platform based on the VMware vCloud tools.**

The cloud computing platform solution has a three-tier structure, as illustrated in Figure 3. The SAAS layer is mostly used to virtualize terminal applications. The PAAS layer serves as a platform for cloud application development, allowing developers to build portable cloud apps. The VMware vCloud builds the IAAS layer, which is a cloud-based architecture. VMware vCloud Director, VMware vSphere, VMware vShield, VMware vCenter Chargeback, and VMware vCenter are the five major components of VMware vCloud. They are at the heart of the computer infrastructure. Customers may use the VMware vCloud Director component to integrate infrastructure resources into a virtual data center resource pool and consume these resources on demand. It may also utilize technologies like linked clones and snapshots to drastically speed up infrastructure access. Layer 2 isolation, NAT, firewall, DHCP, and VPN are among the network security services provided by the VMware vShield component. It provides virtualization protection for virtual data centers and cloud computing environments, as well as increased application and data security for the user. The VMware vCenter component serves as a centralized management point for monitoring virtual infrastructure and automating everyday activities. It also scalable maintains huge data centers. Resource metering and pricing models are provided by the VMware vCenter Chargeback component. Its primary purpose is to assist customers in obtaining accurate cost estimates and analyzing cloud-computing services. It may also assist customers in better understanding resource costs and how to improve resource usage and lower total cloud computing infrastructure expenses. The VMware vCloud tools are built on top of vSphere, which includes capabilities like server virtualization, storage virtualization, and network virtualization. It can conduct real-time virtual machine migration and automated load balancing between hosts. It also conducts non-disruptive storage migration, frees up precious storage space, and reduces virtual machine storage and I/O bottlenecks. Briefly, the IAAS layer is the foundation of a cloud computing services platform, and it can be built using VMware vCloud tools. A public or private cloud platform for businesses may be created using the architecture illustrated in Figure 3.

## 2. DISSCUSSION

The author has discussed about the architecture of x86 virtualization, Virtualization includes cloud computing, distributed systems, storage virtualization, application virtualization, and desktop virtualization. Lower prices and power consumption, simpler administration and deployment, better mobile applications, and cross-platform compatibility are just a few of the advantages that virtualization techniques have lately shown. Cloud computing refers to the delivery of virtualized and potentially scalable resources as a service via the Internet. Virtualization also helps with implementation and migration by ensuring that critical workloads are always available. Cloud computing allows end users to access information technology resources as services via the Internet. One of the most important cloud computing basic technologies is virtualization. In this essay, the author provides a thorough introduction of virtualization. The Xen architecture, as well as three solutions for x86 CPU virtualization, are also addressed. The author has propose a virtualization-based cloud computing platform architecture in particular.

## 3. CONCLUSION

The author has concluded about the architecture of x86 Virtualization, the author have discussed the evolution of virtualization and examined the design of a virtualization commercial product in this paper. We took virtualization technology and applied it to cloud computing, creating a cloud platform using VMware vCloud tools. Finally, several implementation examples are used to describe the performance assessment of server virtualization on the cloud platform. We provided several performance advantages, such as obtaining

overall cost benefits, decreasing power usage, and saving time, based on our study and analysis of virtualization and cloud computing technologies. Future research may focus on the usage of cloud - based computing in Data Stream Retrieval to see how successful it is in this setting.

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