A Critical Study On Virtualization and Hypervisor

[1]Miss.Shivanjali Sambhajirao Patil, [2]Prof.Sheetal Deshmukh
[1]PG Student, [2]Prof. Bharti Vidyapeeth(Deemed) University, Pune

Yashwantaro Mohite Institute of Management Karad, Maharashtra

[1]PG & MCA Department,
[1]PG Student , Karad, India .

1) Abstract -

Virtualization and cloud computing are the technologies that go hand in hand. Cloud computing is an emerging technology that represents a new computing paradigm. It will enable individuals and organizations to access a pool of computing resources in pay as you use fashion. This technology helps small and medium companies or any company on the earth for that matter to eliminate the need for capital investment. Cloud computing offers many service models such as Platform as a Service (PaaS), Infrastructure as a Service (IaaS) and Software as a Service (SaaS). It bestows many deployment models such as private could, public cloud, community cloud and infrastructure cloud. With this technology the computing resources have been commoditized in the similar fashion which commoditize water and electricity. However, cloud computing cannot become affordable solution without the technology virtualization. Therefore virtualization is the technology on top of it cloud computing is built. Virtualization is the process of creation of virtual counterpart of something like hardware, network, storage device, and operating system.

Cloud computing is growing trend in internet technology that enable on demand network access to a shared pool of configurable resources. The virtualization is a core part of cloud computing which enables physical resources to partition into virtual resources so that they can be shared among individual virtual machines. This sharing of virtualized resources can reduce wastage of storage, server and physical machines. The virtualized environment in cloud computing consists of the underlying hardware, hypervisor and virtual machines (VMs) which enables intellectual IT resources on demand dynamic allocation of resources such as network, storage, application, server and client. Virtualization using hypervisor becomes significant as a way to develop system security, provide greater flexibility and reliability. Currently, there is an increased desire to use virtualized systems in enterprise in order to reduce cost and more efficiently utilize resources. This paper describes different types of hypervisor and virtualization techniques, how it helps to expand elasticity of the resources in cloud computing environment.

2)Introduction -

Cloud computing is technology that helps users to have access to huge computing resources. This access is given in the way useful to society. Individuals and organizations can avoid investments and simply use the resources as if they are in their machine. This is done in pay per use fashion. When it comes to virtualization virtual machine is a machine inside the machine which does not exist in the real world. However, it can have its own OS and serve applications of users. Virtual machines provide hardware independence, isolation, and encapsulation. The benefits of virtualization include disaster recovery, training, product evaluations, testing, quality assurance, software development, improved security, decreased provisioning times, server consolidation, increased hardware utilization, and simplified administration.

Virtualization is a vital technology of Cloud Computing which offers two important features abstraction and encapsulation [2]. It is about creating an abstract layer between hardware and software. Usually, the virtualization layer is set above the physical layer of the Cloud's architecture. Virtualization technology is used widely in Cloud

Computing data centre showing to the benefits offered, such as utilizing resources, lowering costs, easier management of servers, server consolidation, and live migration of virtual machines [18]. Through virtualization, the number of hardware resources used in Clouds can be reduced to minimize the capital cost as well as the cost of power consumption and cooling systems. For instance, through server consolidation, multiple (virtual) servers can be allowed to run simultaneously on a single physical server. Also, live migration of the virtual machine to the not fully utilized physical servers would allow more and more physical servers to be turned off, which would lead to better achievement of energy efficiency for data centres. Furthermore, virtualization in Cloud Computing can offer dynamic configurations for different applications' resource requirements, and aggregate these resources for different needs. Additionally, it can improve responsiveness by monitoring, maintaining and provisioning resources automatically. Therefore, all these features offered by Virtualization are used in Clouds in order to meet the criterion of the business requirements of SLAs.

Virtualization allows for the partitioning of physical resources into virtualized containers. These containers, more commonly referred to as virtual machines, are functionally nothing more than sets of files that represent virtual hardware, executing in the context of a hypervisor. This virtual hardware provides a platform on which an operating system and applications can be installed and can be configured to provide almost any service that a physical server typically provides. These services include email, database, hosting, file and print, monitoring, management, and more. The virtualized environment consists of the underlying hardware, the hypervisor, the Virtual Machine Monitor (VMM), the virtual machines (VMs), and the operating systems and applications installed on these virtual machines.

3) Hypervisor/Virtual Machine Monitor (VMM)

The components of the virtualized environment include the hypervisor and the VMM. Most resources agree that the VMM is involved with the scheduling of virtual resources on their underlying physical counterparts, however in some cases the VMM is referred to as the hypervisor itself while in others this is merely a component of a hypervisor in a broader context. To avoid confusion, the VMM will not be a specific point of focus in this paper, since its meaning would change based on context. A hypervisor, also known as the virtual machine monitor (VMM), is the host layer of software that enables multiple virtual machines or operating systems to operate on a single physical server [24]. In general hypervisors are directly responsible for hosting and managing virtual machines on the host or server. The host is another name for the physical server and hypervisor. The virtual machines that run on the host are called guest VM or guest operating system [12]. Furthermore, a hypervisor provides a uniform view of the underlying hardware, which means that it can operate on hardware of different vendors. Hence, virtual machines can run on any available and supported computers, since the hypervisor isolates software from hardware. System administrators, who maintain and operate a computer system and network, are also able to view their hardware as a pool of resources, which allows new functionalities that are described in figure 1. It shows number of guest operating system (window, linux and Mac) are installed on hypervisor.

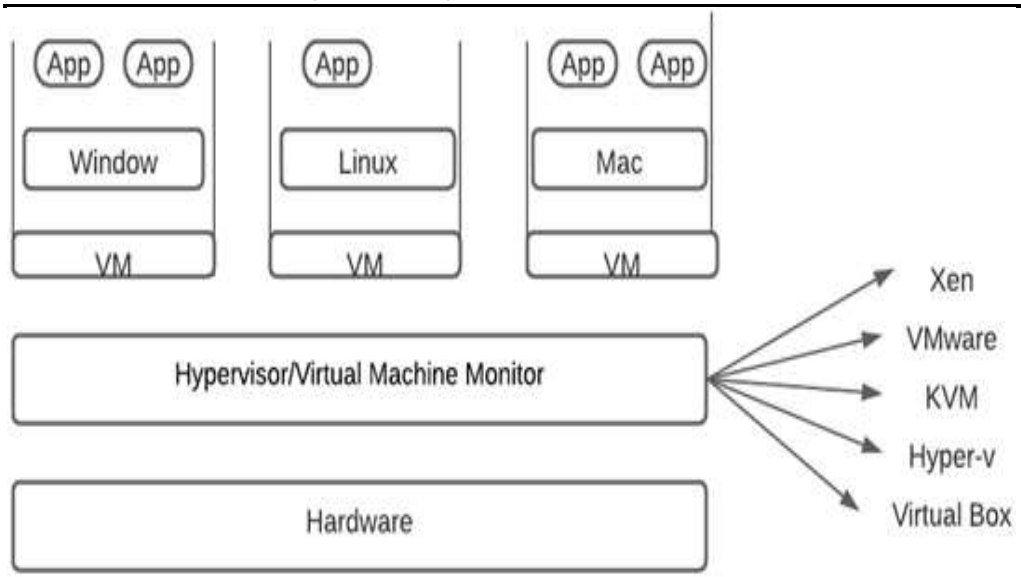


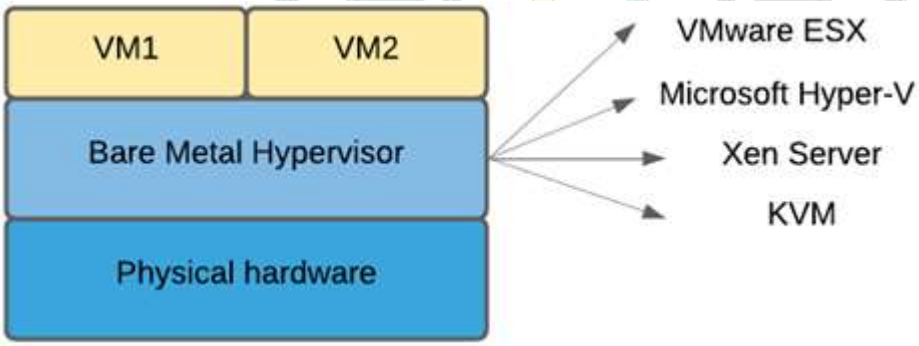
Figure 1: Hypervisor (VMM)

There are two types of hypervisors called “Type 1” and “Type 2”.

4)Types of hypervisor

Type 1(Bare-metal hypervisor)

Type 1 is a hypervisor that is installed directly on the hardware and is also called a “bare- metal” hypervisor. The hypervisor in figure 2 is a “bare metal” hypervisor. Type 1 hypervisors are dominantly used on the server market.



Hypervisors are an important component of virtualized environments. Hypervisors are programs that allow multiple operating systems(as shown in figure 2), known as guests, to run in virtual machines in an isolated fashion, and thus share a single physical machine, or host.

Advantage of Type 1 hypervisor

· **Enhance security**

· **Allows higher density hardware**

· **Hypervisor has direct access to HW**

5)Type2 (Hosted hypervisor)

Hypervisor, which runs on host operating system that provides virtualization services such as I/O and memory management. This is also known as a hosted approach Hypervisor. In other words Type 2 hypervisors are positioned between the hardware and virtual machines that is installed on top of an operating system. In contrast to type 1, the hypervisor is placed above the operating system and not below the operating system or virtual machines. This allows for an additional operating system to be run in a virtual environment on top of an existing operating system.

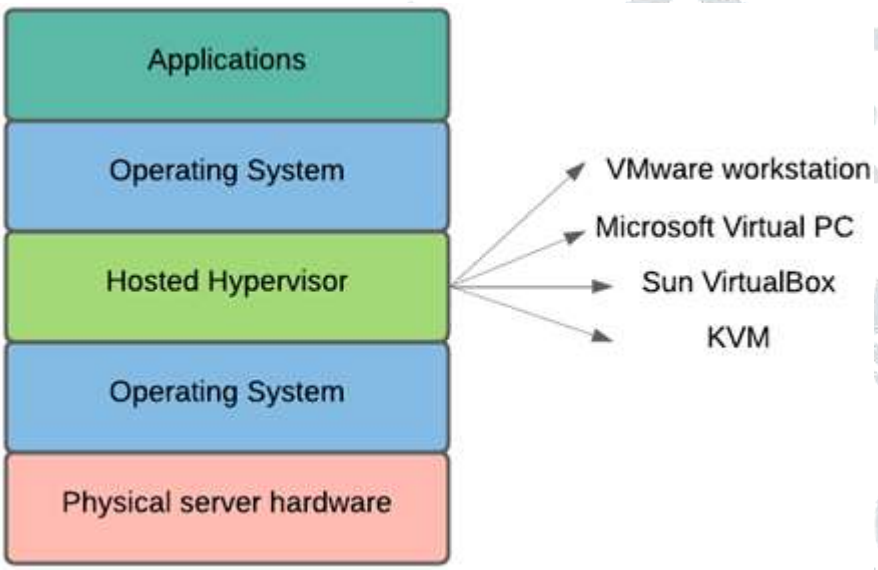


Figure 3: Hosted Hypervisor

Hosted hypervisors can be used to run a different type of operating system on top of another operating system. For example, if a user with a Linux OS wants to run an application that is designed for Windows, he or she can run a Windows OS in a virtual environment on top of the Linux OS and vice versa.

Advantages of Type 2 hypervisor

· Host OS Controls HW access

· Ease of access

· Allows for multiple operating systems

6)Conclusion:

Virtualization has become more attractive in recent years as cost controlling measures are sought out in enterprise environments to reduce IT costs and effective utilization of cloud resources. This paper explored the virtualization in cloud computing and various type of hypervisor used for resource management in virtualized environments. In this paper Type 1 and Type 2 Hypervisors are described and

each hypervisor has its own merits and demerits. In an effort to improve performance of these virtualized systems, accurate performance measures, modeling and simulation are needed.

This paper studied the virtualization and hypervisor on which cloud computing is based. It throws light into both cloud computing and virtualization. Virtualization improves the

efficiency of cloud computing. Virtualization is done with many resources like I/O, OS, network, storage and so on. Virtualization improves scalability beside making the cloud solutions cost effective. These two technologies go hand in hand in providing state of the art services to end users. Individuals and organizations can access to various kinds of clouds in pay per use fashion and obtain services pertaining to infrastructure, platform and software. Scientific and high computing tasks can take advantage of cloud computing.

7)References :

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