

A Study on Virtualization in Cloud Computing

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Abstract - Cloud computing is fastest growing internet technology nowadays. It can be 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. While using this virtualized resource can be reduce wastage of storage, server and physical machines. The virtualization techniques consist of hardware, hypervisor and virtual machine monitor (VMM). It enables intellectual IT resources on demand dynamic allocation of resources such as network, storage, application, server and client. This hypervisor becomes significant as a way to develop system security, provide greater flexibility, scalability and reliability. In recent years, there is an increased desire to use virtualized systems in enterprise mainly focused on 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 the elasticity of the resources in cloud computing environment.

Keywords: Cloud Computing, Virtualization, Virtual Machine Monitor (VMM), Hypervisor.

I. INTRODUCTION

Cloud computing is technology that helps users to have access to large number of computing resources. Individual persons and organizations can avoid investments and simply use the resources what they are used in their machine. This process is done in pay per use way. When it comes to virtualization virtual machine is a machine inside the machine which does not exist in the real world. Moreover, it can have its own OS and provide applications of users. Virtualization is getting popularity in enterprise cloud computing environments because of realized cost savings and improved management. Finally, the result is resource sharing and server consolidation.

Virtual machines offer hardware independence, encapsulation and isolation. The benefits of virtualization include disaster recovery, testing, training, product evaluations, quality assurance, software development, decreased provisioning times, improved security, server consolidation, increased hardware utilization, and finally it simplified administration task.

II. VIRTUALIZATION

Virtualization is a very important technology of Cloud Computing environment. It provides two important features abstraction and encapsulation [3]. It is about creating an abstract layer between hardware and software. Mostly, the virtualization layer is set above the physical layer of the Cloud's architecture. Virtualization technology is used widely in Cloud Computing data centres owing to the benefits offered, such as utilizing resources, lowering costs, easier management of servers, server consolidation, and live migration of virtual machines. Through virtualization, the more 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. Moreover, virtualization in Cloud Computing can propose dynamic configurations for different kind of application resource requirements, and combined these resources for different needs. Furthermore, it can expand responsiveness by monitoring, maintaining and provisioning resources automatically. It enables to get benefited

from virtual machines that can improve scalability as well as bestowing other advantages like security, cost effectiveness etc.

The main objective of virtualization is to collaboratively utilize the IT resources for example storage, processor and network to maximum level and to reduce the cost of IT resources which can be achieved by merging multiple idle resources into shared pools and creating different kind of virtual machines to do different tasks simultaneously. The resources can be allocated or altered dynamically.

Techniques of Virtualization: Virtualization techniques used in cloud computing environment. The user should be aware of some basic techniques such as emulation, hypervisor, full, para and hardware assisted virtualization. This software is known as a Hypervisor[7], also known as a virtualization manager. It sits between the hardware and the operating system, and assigns the amount of access that the applications and operating systems have with the processor and other hardware resources.

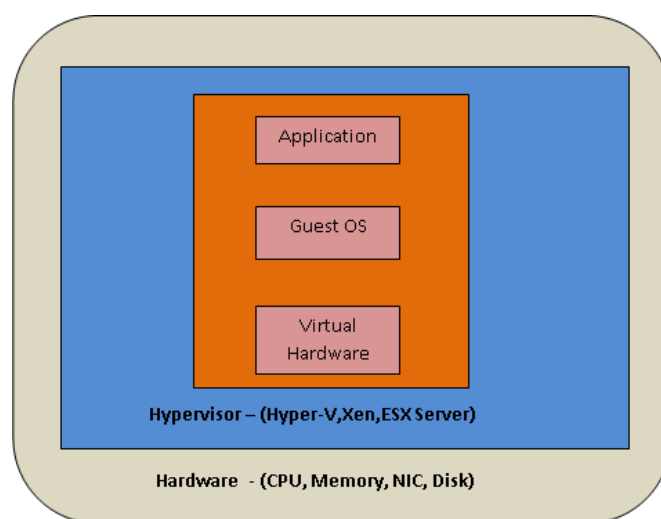


Figure 1: Hypervisor (VMM)

Emulation: It is a one kind virtualization technique [6] which changes the behaviour of the computer hardware to a software program and lies in the operating system layer which lies on the hardware. Emulation offers enormous flexibility to guest operating system but the speed of translation process is low compared to hypervisor and requires a high configuration of hardware resources to run the software.

Virtual Machine Monitor or Hypervisor: A software layer that can monitor and virtualize the resources of a host machine and it presenting to the user requirements. It can be seated between operating system and hardware[6]. Mostly, hypervisor is classified as native and hosted. The native based hypervisor runs directly on the hardware while host based hypervisor runs on the host operating system. The software layer creates virtual resources such as CPU, memory, storage and drivers. In general hypervisors are directly responsible for hosting and managing virtual machines on the host or server. Physical server and hypervisor we can call it as a host. The virtual machines that run on the host are called guest VM or guest operating system [4]. 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 [5]. Let we will discuss about hypervisor types in the following session.

Types of Hypervisor

“Type 1” and “Type 2” are two types of hypervisors. Here, we are focuses on Type 1(bare-metal hypervisors) which are installed directly onto physical hardware. Secondly, class of hypervisor (Type 2), known as hosted architectures, requires a mainly operating system such as Windows, Linux, or Mac OS in order to function.

Type 1(Bare-metal hypervisor) A bare metal hypervisor also called as a Type 1 hypervisor, is virtualization software that is installed on hardware directly. The hypervisor enables a computer to separate its operating system from its core physical structure and hardware. It allows for the opportunity to house many clients on the same server. The hypervisor in figure 2 is a “bare metal” hypervisor. This represents the majority of the hypervisor market today.

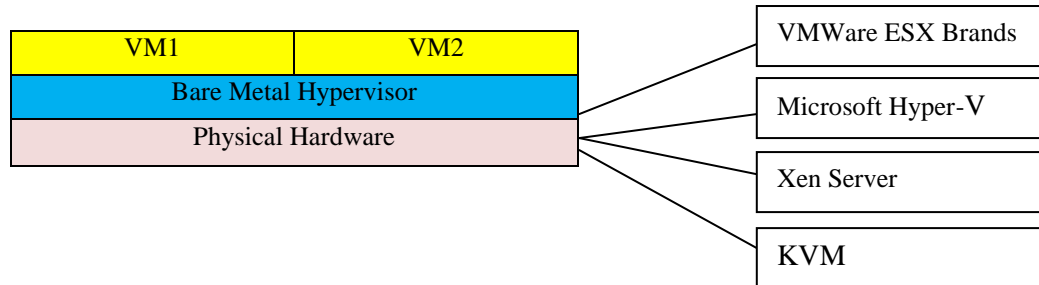


Figure 2: Bare Metal Hypervisor

Hypervisors allows 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. Many different hypervisors have been developed, a few of which are listed in the following table:

Table 1: Bare-Metal Hypervisors

X86 Hypervisors	Vendor	Types of Virtualization	Licensing
Xenserver	Citrix	Para,Full	Open Source
EsXi	VMware	Para,Full	Proprietary
Hyper-V	Microsoft	Full	Proprietary
KVM	RedHat	Full	Open Source

Some of the x86 hypervisors can support both full and para-virtualized operating systems. Fully virtualized systems are unaware they are running in a virtualized environment, and there is none of the modifications to the core operating system are required in order for them to function. The other one is Para-virtualized systems, are specifically modified to work in concert with the hypervisor. In recent advances in CPU virtualization technologies, para-virtualized systems used to enable performance improvements.

Advantages

- Easy to manage
- Allows higher density hardware
- Flexibility and scalability

Disadvantages

- Need specific HW component
- Accurate HW requirement
- Too costly

B. Type2 (Hosted hypervisor)

A Type 2 hypervisor, also known as a hosted hypervisor, is a virtual machine manager that is installed as a software application on an existing operating system. This hypervisors support guest virtual machines by coordinating calls for CPU, memory, disk, network and other resources through the physical host's operating system. This provides it easy for an end user to run a virtual machine on a personal computer. We can say in other words Type 2 hypervisors are positioned between the hardware and virtual machines that is installed on top of an operating system.

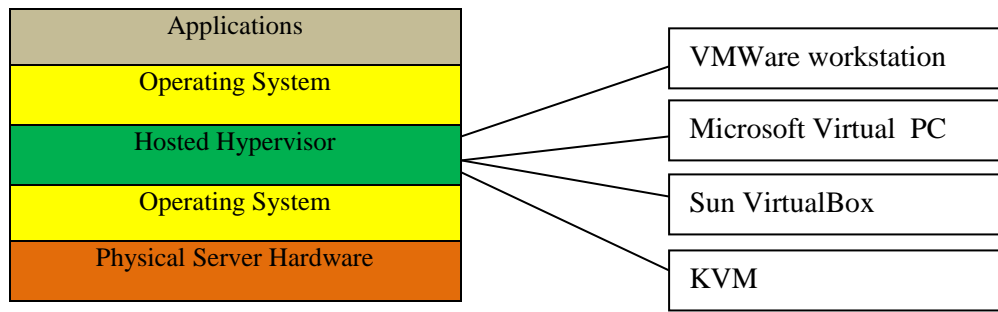


Figure 3: Hosted Hypervisor

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. Table 2 shows some common Type 2 hypervisor used in virtualization in cloud computing.

Table 2: Hosted Hypervisor

X86 Hypervisors	Vendor	Types of Virtualization	Licensing
VirtualBox 6.0	Oracle(sun)	Para	Open Source
VMWare Workstation	VMware	Para,Full	Proprietary
Virtual PC	Microsoft	Full	Proprietary
KVM(Kernel Based Virtual Machine)	RedHat	Full	Open Source

Advantages

- Easy to access
- Allows for multiple operating systems
- Easy to monitoring or backups

Disadvantages

- Less performance and security
- Lower VM density
- Needs a host OS first

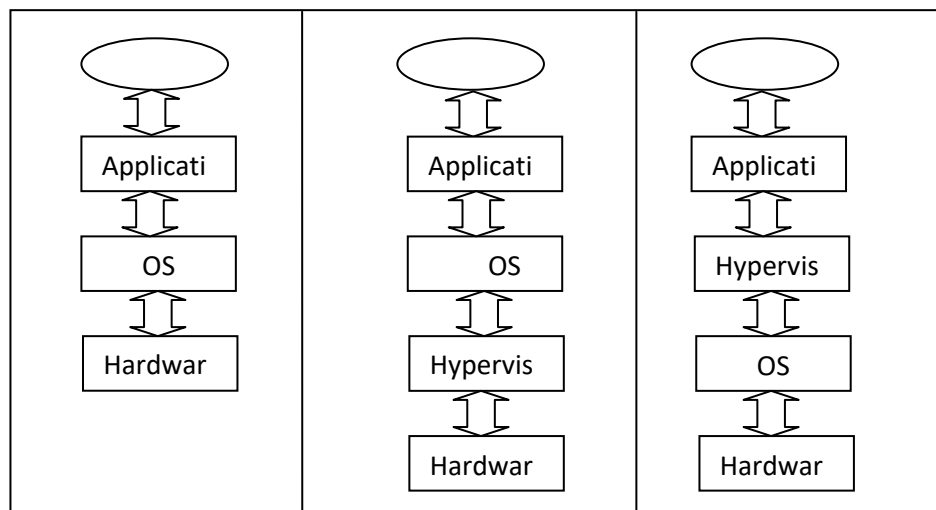


Figure 4: Comparison of Traditional Model Vs Bare Model Vs Hosted Mode

III. VIRTUALIZATION TYPES

There are three types of virtualization for example Server virtualization, Client virtualization and Storage virtualization. The below architecture explains the categorization of virtualization techniques are illustrated in Fig 5.

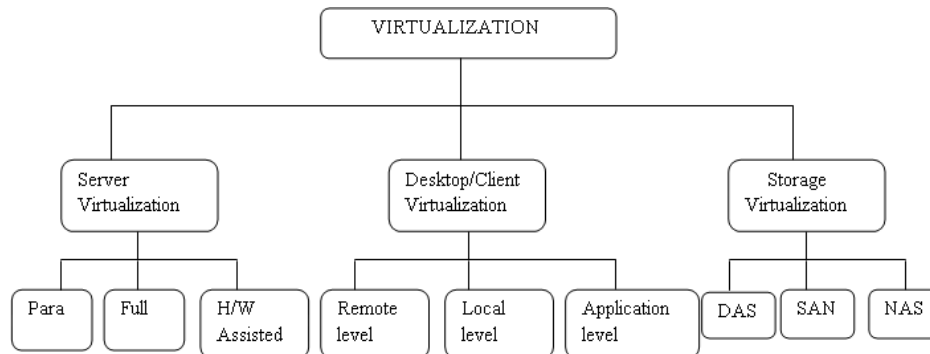


Figure 5 : Virtualization Types

Server / Hardware Virtualization: In server virtualization, single server performs the task of multiple servers by portioning out the resources of an individual server across multi-environment. The hypervisor layer allows for hosting multiple applications and operating systems either locally or remotely. The advantages of virtualization include cost savings, less capital investment, easy to access and efficient use of resources. Server/Hardware virtualization is further subdivided into the following types:

Para Virtualization: This technique offers special hyper calls that alternate the instruction set architecture of host machine. It communicates between hypervisor and guest operating system. It shows to improve efficiency and performance in this stage. In para virtualization, the resources can be easily accessed rather than full virtualization model. Because all resources must be followed in full virtualization model. The drawback of this technique is to modify the kernel of guest operating system using hyper calls. It can be suitable with open source operating systems.

Full Virtualization: Full virtualization is a one kind virtualization technique used to provides a VME that completely imitates the underlying hardware. In this environment, any software capable of execution on the physical hardware can be run in the VM, and any OS supported by the underlying hardware can be run in each individual VMs. Users can run multiple kind of guest OS simultaneously. In full virtualization, the VM simulates enough hardware to allow an unmodified guest OS to be run in isolation. It helps in a number of situations. Such as, in OS development, experimental new code can be run at the same time as older versions, each in a separate VM [8].

Partial Virtualization: In this type of hardware virtualization, the software may need modification to run.

Client Virtualization: This client virtualization technology alerts the system administrator to do virtually monitor and update the client machines such as workstation desktop, laptop and mobile devices frequently. It can able to enhance the client machines management and improves the security to defend from hackers and cybercriminals. It offers the work convenience and security. As one can access remotely, you are able to work from any location and on any one PC. It provides a better flexibility for employees to work from home or on the go. It also protects secret data from being lost or stolen by keeping it safe on central servers.

Client Virtualization Types

There are three types of client virtualization. Remote or server hosted virtualization, local or client hosted virtualization and application virtualization. First, it can be hosted on a server machine and operated by the client across a network. Second, it can used to secure and virtualized operating environment that runs on local machine. Third, it provides multiple ways to run an application which is not in traditional way.

Storage Virtualization: Storage virtualization is the process of presenting a logical view of the physical storage resources to a host computer system, treating all storage media (such as hard disk, optical disk,

tapes, etc.) in the enterprise as a single pool of storage. It makes the abstraction of logical storage from physical storage. There are three different kinds of data storage used in virtualization, namely DAS (Direct Attached Storage), NAS (Network Attached Storage) and SAN (Storage Area Network).

DAS is the traditional method of data storage where storage drives are directly attached to server machine. NAS is the shared storage mechanism which connects through network. NAS is mainly focused on file sharing, device sharing and backup storage among the machines. SAN is used to share with different server over a high speed network. In this type of virtualization, many network storage resources are present as a single storage device for easy access and more efficient management of these resources.

Advantages and Disadvantages of virtualization

There are different types of benefits in Virtualization, such as it optimizes hardware resource utilization, saves energy and low cost and it used to create to run multiple applications and various operating systems on the same SERVER at the same time. It offers various **advantages** as follows:

- Increased storage management in a heterogeneous environment
- Easy to access, updates, better availability
- Improved storage utilization, efficiency and flexibility.

Disadvantages:

- Spend amount to get software license.
- Need to train IT staff in virtualization.

IV. CONCLUSION

This paper reviewed various kinds of virtualization techniques, types and also hypervisor techniques and what the challenges in cloud computing environment. Such as reduce costs and the effective utilization of cloud resources. Like rapid elastic providing in virtual machines, various elastic application programming model. Apart from that the virtualization techniques give the universal support, while the users used in resource management issues and security issues before moving into cloud. In future, I can try to develop new policies, framework and techniques to maintain elastic resources and data availability and finally I can give the better performances of cloud services could steps into next higher level.

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