Overview of Virtualization in Cloud Computing

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ABSTRACT: The hottest area of research in these days is cloud computing which goes in parallel with one more important concept in the development of hardware and software, virtualization technology. In this research paper, we will discuss about virtualization, before and after virtualization, its role in cloud computing, brief view about hypervisor, storage virtualization, server virtualization, benefits of virtualization.

KEYWORDS: Virtualization, Cloud Computing, Hypervisor, Storage virtualization, Server virtualization.

I. INTRODUCTION

Cloud computing can be said as a technology that allows users to access large amount of data, information and various other computing resources in a manner in which the customer uses these resources and pays for it according . If we talk about (virtualization) virtual machine, it is a machine that helps to improve the efficiency of cloud computing. With the help of virtualization, it is possible to work on multiple operating systems and applications simultaneously over the same server, hence virtualization increases the utility and flexibility of hardware.

II. WHAT IS VIRTUALIZATION?

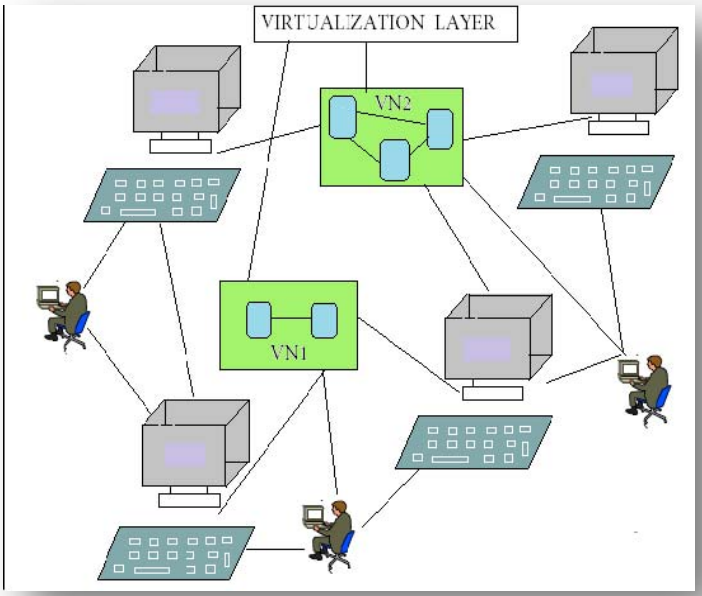
Virtualization, in the simplest and easiest words is the abstraction of computer resources. Virtualization is a component within cloud computing which allows separation of operating system from the hardware on which it is working. Virtualization has ability to allow single physical resource serve as multiple virtual resources and can even make multiple physical resources function as a single virtual resource. Virtualization has brought a great change in the working of IT organizations in all ways.

A. BEFORE VIRTUALIZATION

- One OS image on one machine
- Software and hardware tightly coupled
- Attempt to run more than one application on same machine often creates conflict
- Not so flexible and even costly infrastructure

B. AFTER VIRTUALIZATION:

- Independency of operating system and applications from the underlying hardware.
- Virtual machines can be easily provided to any system
- OS and application can be easily managed as one complete entity by wrapping up them into virtual machines.



Virtualization Infrastructure

III. ROLE OF VIRTUALIZATION IN CLOUD COMPUTING

Virtualization and multitasking operating systems have similar working capabilities. It allows a number of virtual servers to be centralized into a single physical machine. If an organization need to run two or more servers for a particular task, in case one fails, even though neither is close to full resource usage. Virtualization can help here, because relatively it is easy to migrate from one physical computer to another. So another big advantage is

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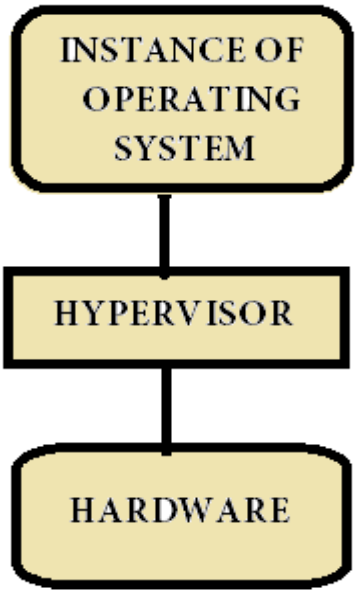
migration. Virtualization can help in energy saving, decreasing the cost and server hardware footprint and hence help the companies maximize their profit.

In compute virtualization, a virtualization layer resides between the hardware and virtual machine (on which an operating system is running). The virtualization layer is also known as hypervisor.
The hypervisor provides standardized hardware resources (for example: CPU, Memory, Network, etc.) to the virtual machines.

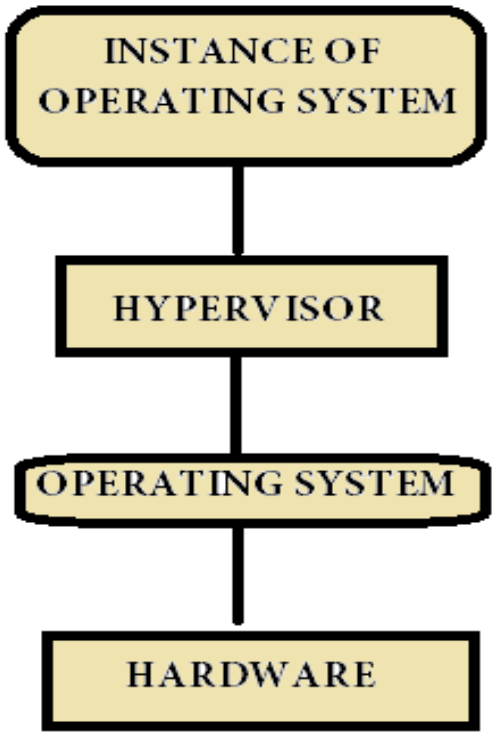
Hypervisors are categorized into two types: hosted hypervisor and bare-metal hypervisor.

Type 1 (Bare-metal hypervisor): In this type, the hypervisor is directly installed on the x86 based hardware. After installing the hypervisor desirable instance of operating system is installed over that hypervisor. Hence, it is more efficient than a hosted hypervisor. Desktop computers use such type of hypervisor.



BARE METAL HYPERVISOR

Type 2 (Hosted hypervisor): In this type, an operating system is installed on the hardware and then the hypervisor is installed on that operating system. Over this hypervisor an instance of operating system is installed.
Since it runs on an operating system, it supports the huge range of hardware configurations.



HOSTED HYPERVISOR

IV. STORAGE VIRTUALIZATION

At present scenario, the most severe problem is the management and storage of large amount of data. If somehow we lose access to that information, even for few days, companies working on big projects shall be in great loss. This complex situation has become an obstacle in achieving important business goals. This problem of accessing the data can be improved by virtualizing the storage system. In simple words, we can say that it is easy to manage virtual resources than to manage physical resources.

There are mainly five types of storage virtualization: disk, tape, file system, file and block virtualization.

1) Disk Virtualization: This is the oldest form of all and has been implemented since decades in various disk drive firmwares.
A magnetic disk comprises of cylinders, heads and sectors (CHS) and the capacity of disk depend on number of these cylinders.
The CHS address is transformed into consecutively numbered logical blocks which are used by operating systems and host applications.
This is known as logical block addressing (LBA). This has revolutionized the manner in which the host computers dealt with disks.
Now, the size of disk is determined by the number of these logical blocks.

2) Tape Virtualization: This type of virtualization is used in tape library components and comes under 2 basic areas:

virtualization of tape media and virtualization of the tape drives.

a) Tape Media Virtualization: This makes use of online disk storage which acts as a buffer and hence allows reading and writing of data to and from physical tape media. This way improves the backup performance as well as enhances its service life. Moreover, it improves restore performance and mean time to tape data by avoiding the time-consuming mounting and unmounting of tapes.

b) Tape Driver Virtualization: The biggest problem of open systems users is an attempt to share physical tape drives in tape libraries among as many hosts as possible. Tape drive virtualization in this context establishes tape drive pools guaranteeing the integrity of
data and ensures controlled access to these drives and prevents conflicts between applications and servers as data is written to or read from tape media.

3) File System Virtualization: In this form, some file servers manage shared network access to files in the file system. That file system is accessed by many users on the network regardless of the operating systems they run on.

4) File Virtualization: This automates the migration of rarely used data to less expensive secondary storage media like optical disks, tape drives etc. This migration is visible to both users and applications.

5) Block Virtualization: This creates virtual storage devices from physical disks, which are as large, fast and available as storage consumers require. All these factors are met by combining multiple numbers of different capabilities of block virtualization. Suppose, a user is in need of additional disk capacity then additional volumes are generated or enlarged to those which already exist.

V. SERVER VIRTUALIZATION

The main concern of IT organizations is minimum investment on resources and infrastructure so as to get a maximum output.

The best method to achieve this is through server virtualization. Basically server virtualization enables use of multiple virtual servers (virtual machine) on a physical server by using virtualization software. Here each virtual server behaves as a physical device running its own operating systems. The most popular software is devised by VMware, Microsoft and Citrix.

Advantages of use of server virtualization:

1. Virtualization of data centers have led to minimum use of servers which in turn have reduced cost of power consumption, cooling and maintenance.

2. Reduction of number of servers has led to less data center space area requirement.

3. Server virtualization use servers to its full processing capabilities.

4. Virtual servers provide an independent platform for testing new applications or operating systems to programmers.

5. Recovery of data is easy.

Server virtualization is subdivided into three types:

1. Full Virtualization:

In full virtualization hypervisor directly uses components of physical server. The hypervisor hides all virtual servers from one another operating on the same physical machine. When applications run on virtual servers, the hypervisor has to depend on physical server for the resources which are to be provided to the requesting virtual server as each of them doesn't have knowledge regarding others. This in turn makes the physical server to preserve some processing power for hypervisor so that it can run application. This slows the overall performance of server.

2. Para-virtualization:

In para-virtualization , all the virtual servers are aware of each other and thus operating system of each virtual server working on physical server is aware of needs of other operating system that are being requested by the physical server .Here hypervisor needs less processing power for running applications. Thus overall server performance is improved.

3. OS-level virtualization:

In this type of virtualization, there is no need of hypervisor. Here the physical operating system with virtualization capacity plays the role of hypervisor. The major drawback of this virtualization is that operating system of each virtual server should be same and each virtual server remains independent from all the others.

VI. BENEFITS OF VIRTUALIZATION

1) Server consolidation- As discussed above, with the help of virtualization it is possible to run multiple virtual machines on a physical server. This reduces the requirement for physical servers.

2) Isolation- As virtual machines can access all types of physical resources of a physical machine by sharing, they are completely independent of each other. Suppose there are four virtual machines working on a single physical hardware and one of the virtual machines gets damaged due to some reason then it will make no change on the working of the remaining virtual machines.

3) Encapsulation- Virtual machine can be said as a complete package containing many virtual resources including various applications operating system and the

hardware on which it is installed. It makes virtual machines easy to manage and portable.

For instance, a virtual machine can be moved and copied from one system to another just like a file or a picture or a document.

4) Hardware independence- A virtual machine is configured with virtual components such as CPU, memory, network card, that are completely independent of the underlying physical hardware. This gives the freedom to move a virtual machine from one
x86 machine to another without making any change to the device drivers, operating system, or applications.

5) Reduced cost - Compute virtualization reduces the following direct costs: space for physical machines, power and cooling, hardware and annual maintenance.

CONCLUSION

One of the important cost and energy saving and hardware-minimizing techniques used by cloud providers is virtualization.

With OS virtualization each VM can use a different operating system (OS), and each OS is isolated from the others.

Use VMs to enable different services to run in separate VMs on the same physical machine.

"Virtualization is foundational element of cloud computing and helps deliver on the value of cloud computing", said by the director of product marketing VMware, Mike Adams [1].

REFERENCES

[1] http://www.businessnewsdaily.com/5791-virtualization-vs-cloud-computing.html