

# Virtualization in Cloud Computing

Sangeeta Singh<sup>1</sup> Swati Atri<sup>2</sup>

<sup>1</sup>Uttar Haryana Bijli Vitran Nigam, Panchkula, India <sup>2</sup>Arya Kanya Mahavidyalya, Shahabad, India

**Abstract**— Cloud computing is a framework that provides everything as a service on demand by use of high speed internet. Any IT company or a single user may take benefit of cloud computing by pay per use strategy. A user who pays for a service on cloud computing need not to care about the maintenance and storage of his personal information. In this way an IT company or a user can use the resources via cloud computing, which they were not able to purchase. Virtualization is the central part of cloud computing which enables a physical resource to behave as a logical one. It exists in various forms such as Hardware virtualization, Network virtualization, Storage virtualization, Desktop virtualization, Data virtualization, Software virtualization, Memory virtualization etc. This paper reviews the concept of virtualization in cloud computing, its types, benefits and drawbacks of virtualization.

**Key words:** Cloud Computing, Network Virtualization, Data Virtualization, Memory Virtualization, Virtual Machine Monitor

## I. INTRODUCTION

Cloud computing is a type of Internet based computing that provides shared computer processing resources and data to computers and other devices on demand. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources (e.g., computer networks, servers, storage, applications and services), which can be rapidly provisioned and released with minimal management effort. Cloud computing and storage solutions provide users and enterprises with various capabilities to store and process their data in third-party data centre that may be located far from the user—ranging in distance from across a city to across the world. Cloud computing relies on the sharing of resources to achieve coherence and economy of scale, similar to a utility (like the electricity grid) over an electricity network. One of the appealing aspect of cloud computing is that it hides the complexity of IT technology from the users and developers. No need to know the details of how a service is generated, it is the service provider job to provide a corresponding abstract layer.

The Power of cloud computing lies in virtualization. Virtualization saves energy, cost and reduces hardware utilization and provides multiple applications and various operating systems running on the same server at the same time. It increases the flexibility, efficiency and utilization of existing computer hardware [1] [2] [3].

The rest part of the paper is organized as follows: Section II contains literature survey Section III describes the virtualization architecture. Section IV explains the types of virtualization. Section V and VI describes the benefits and drawbacks of virtualization and the last section is conclusion part.

## II. LITERATURE SURVEY

In [4] Dusit Niyato suggested that the workload to be processed on a virtual machine can be outsourced (i.e.

moved) to the service provider in public cloud. Due to virtualization technology, the workload can be shifted from the private cloud to the public cloud. They named it as an optimal resource management framework for cloud computing environment. A virtual machine manager (VMM) is introduced in private cloud to minimize the cost of outsourcing.

In [5] Wen-Hwa Liao et al presented a virtual private network architecture for cloud computing, which can have a large number of connections. Their architecture is based on a hub and spoke. The process of VPN connections can be managed by this architecture.

In [6] Yuriy Brun et al. address the problem of preserving the privacy of the data which is distributed for computation over the cloud. They introduced style technology. This style technology preserves the privacy of computational data.

In [7] Anita Kumari Nanda et al. suggest that the cloud computing is making its new paths in computer science world. It consumes all recent technologies like virtualization, utility computing, distributed computing and networking. They presented service oriented architecture because it offers platforms and softwares as services.

In [8] Sampada Kembhavi et al. presented an algorithm that can auto upload the data in the cloud environment without having any license. The data are uploaded after the proper authentication.

## III. VIRTUALIZATION ARCHITECTURE

The concept of virtualization in cloud computing is executed through virtual machines, where each machine may have different operating system to serve a different user. The architecture of virtualization depends on the position of a Virtual Machine Monitor (VMM) which is also called Hypervisor [9] [10]. So there are two possible architectures as shown in the figures below.

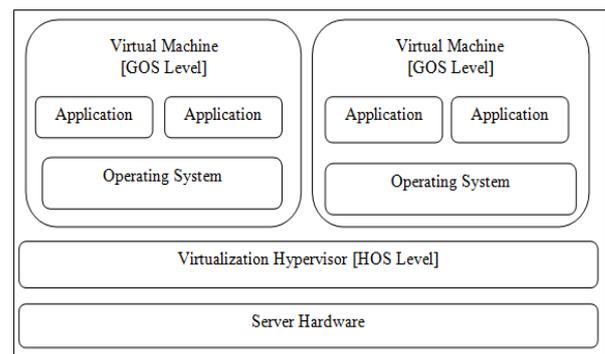


Fig. 1: Native or Bare-metal Architecture

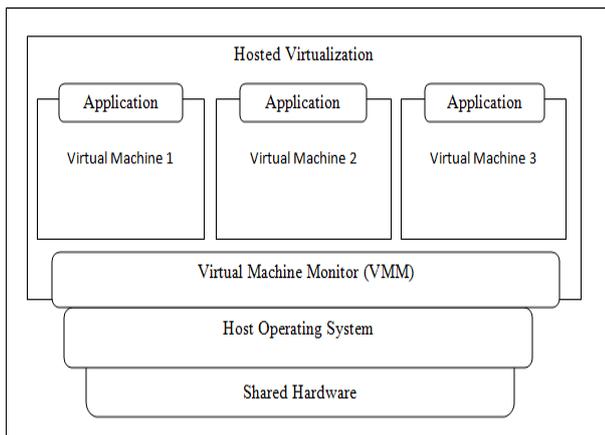


Fig. 2: Hosted Virtualization Architecture

Virtual Machine Monitor (VMM) or Hypervisor is a software layer which can virtualize or monitor the resources of a host machine. It lies between hardware and operating system. Basically, Hypervisor is of two types- native and hosted depending upon its position in architecture. Figure 1 shows native hypervisor which runs directly on hardware. Whereas figure 2 shows host based hypervisor which runs on the host operating system. In this way the software layer creates virtual resources such as memory, CPU and drivers [11].

#### IV. TYPES OF VIRTUALIZATION

It would be easier to understand virtualization in cloud computing once we know about different types of virtualization [12].

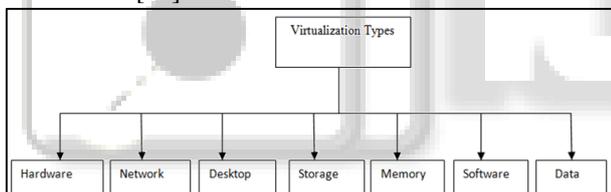


Fig. 3: Types of virtualization

##### A. Hardware Virtualization

It is also called server virtualization. Hardware virtualization is the abstraction of computing resources from the software that uses those resources. Hardware virtualization installs a hypervisor or VMM which acts as a communication barrier between the software and the underlying hardware. After installation of hypervisor, the software relies upon virtual processors rather than physical one. Subcategories of hardware virtualization are as follows [13]

- 1) Full Virtualization: The actual hardware is completely simulated to allow software to run an unmodified guest operating system.
- 2) Para Virtualization: Hardware is not simulated in this category, but offers a special API that can be used by modifying the guest operating system. This is possible only if the source code of the guest OS is available. The source code of the guest OS is modified for calling VMM APIs then it is recompiled and used.
- 3) Partial Virtualization: Entire hardware is not simulated in partial virtualization. It means that the entire operating

system cannot run in the virtual environment. Each virtual machine has its own address space.

##### B. Network Virtualization

Network virtualization means monitoring and managing a computer network as a single managerial unit from centralized software. It provides network optimization such as (data transfer rate, reliability, flexibility, scalability and security).

Many network administrative tasks may be automated using network virtualization. This is beneficial for those networks which experience a rapid and unpredictable increase of usage.

Subcategories of network virtualization are as follows:

- 1) Internal network virtualization: It provides network like functionality to a single system.
- 2) External network virtualization: It combines many networks or parts of networks into a single virtual unit.

##### C. Desktop Virtualization

It provides the work ease and security. One can access resources remotely; a user is able to work from any location and on any system. It provides the facility for employees to work from home or on the way. It also protects private and sensitive data from being lost or stolen by keeping it protected on central servers.

##### D. Storage Virtualization

In this type of virtualization, several network storage resources are present as a single storage device for convenient and more proficient management of these resources. It provides various advantages as follows:

- Better storage management in a diverse IT environment
- Easy updates, improved availability
- Automated management
- Reduced downtime
- Improved storage utilization
- Automated management

##### E. Memory Virtualization

It introduces a way to separate the memory from the server to provide a distributed, shared or networked function. It increases performance by providing better memory capacity without any addition to the main memory. That's why a section of the disk drive is used as an extension of the main memory.

##### F. Software Virtualization

It provides the ability to the main computer to create and run one or more virtual machines. It is used to facilitate a complete computer system in order to permit a guest OS to run. For instance letting Windows to run as a guest that is natively running Linux (or vice versa, running Linux as a guest on windows).

##### G. Data Virtualization

Without any technical information, you can easily operate data and know how it is formatted or where it is actually located. It decreases the data errors and workload [14]

## V. BENEFITS OF VIRTUALIZATION

The advantages of switching to a virtual environment are plentiful, saving your money and time while providing much greater business continuity and the ability to recover from disaster.

### A. Reduced expenses

For organizations with less than 1,000 employees, up to 40 percent of an IT budget are spent on hardware. Purchasing multiple servers is often a good portion of this cost. Virtualizing needs fewer servers and extends the lifetime of existing hardware. This also means reduced energy costs.

### B. Easier disaster recovery and backup

Disasters are fast and unpredictable. In seconds cyber-attacks, floods, power outages, theft and even snow storms can destroy data essential to your business. Virtualization makes recovery much faster and accurate, with less manpower and a fraction of the equipment.

### C. Improved business continuity

With an increase of the mobile workforce, having good business continuity is necessary. Without it, files become unreachable, work goes undone, employees are less productive and processes are slowed. Virtualization gives employees access to files and softwares and allows multiple people to access the same information for more continuity.

## VI. DRAWBACKS OF VIRTUALIZATION

The disadvantages of virtualization are mostly those that arrive with any technology change. With vigilant planning and skilled implementation, all of these drawbacks can be overcome [10]

### A. Upfront costs

The investment in the virtualization software and possibly additional hardware might be essential to make the virtualization possible. This depends on your current network. Many businesses have adequate capacity to hold the virtualization without investing a lot of money.

### B. Less expertise in virtualization

To implement and manage a virtualized environment, IT staff with expertise in virtualization is required. On the user side a typical virtual environment will run similarly to the non-virtual environment. There are some applications that do not adjust well in the virtualized environment; this is something that the IT staff will need to be aware of.

## VII. CONCLUSION

Virtualization is continuously gaining popularity due to its productivity, efficiency, security and cost advantages. For many businesses comparing the advantages to the disadvantages, moving to a virtual environment is always beneficial. Even if the drawbacks present some challenges, these can be overcome with an expert IT team or by outsourcing the virtualization process to a Managed IT Services provider. Virtualization provides an easy way to set up new virtual servers so you don't have to manage a lot of them. This paper discussed cloud computing basics, virtualization in cloud computing, various types of

virtualization, advantages and disadvantages of virtualization.

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