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A Review on Cloud Virtualization

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Abstract:

Virtualization is a method that allows many users as well as organisations to share a single physical instance of a resource or application. It accomplishes this by giving a physical storage a logical name and delivering a reference to that physical resource when needed. Cloud computing on the other hand is a virtualization-based technology which the user can use to develop and configure software programs over an internet connection. The purpose of this paper is to study how virtualization works in cloud computing and the different types of virtualization available in cloud computing.

Keywords — **Cloud Computing, Virtualization, Applications, Virtual Machines.**

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I. INTRODUCTION

Cloud computing is the on-demand, pay-as-you-go distribution of IT services through the Internet. Cloud-based storage allows you to store files to a remote database rather than maintaining them on a proprietary hard drive or local storage device. As long as a device has internet connectivity, it has access to the data as well as the software applications needed to run it[1].

Virtualization is a technique that utilises software to build an abstraction layer over computer hardware, allowing a single computer's hardware to be split into numerous virtual machines. It lets the user make the most of a physical machine's capabilities by distributing them among several users or settings. Hence it can be considered as running multiple operating systems at the same time on the same machine. Applications running on top of the virtualized machine may appear to be running on their own dedicated computer, complete with their own API, libraries, and other software distinct from the host machine[2]. Virtual machines lower costs and improve scalability and performance while also providing a secure environment.

Cloud computing is the integration of many hardware devices, whereas virtualization is a technology that virtualizes your hardware into several computers. A user receives dedicated hardware under virtualization, but with cloud computing, many hardware units offer a single login environment for the user.

In cloud computing, virtualization refers to the creation of a virtual platform for the server operating system and storage devices. This will benefit the user by offering multiple computers while also allowing several users to share a single physical instance of a resource or application. Cloud virtualization changes traditional computing to make it more scalable, cost-effective, and efficient by managing the workloads . One of the most essential benefits of virtualization is that it allows numerous consumers and organizations to share software.

Although cloud technology necessitates the idea of virtualization, there is a fundamental difference between the two words. Cloud computing is built on the basis of virtualization. Virtualization is a type of technology that may be thought of as software that can modify hardware. Cloud computing, on the other hand, is a service that is the result of the manipulated hardware.

II. VIRTUALIZATION LEVELS

The fundamental purpose of the virtualization application layer is to convert the actual hardware of a host system into virtual resources that can only be utilised by virtual machines. This may be done at many levels of operation. The instruction set architecture (ISA) level, application level, library support level, operating system level, and hardware level are all common virtualization levels.

A. Instruction Set Architecture (ISA) Level

Virtualization in the ISA layer is accomplished using ISA emulation. This is useful for running large amounts of legacy code that was developed for various hardware configurations. These programs operate on any ISA-based virtual computer[3]. With this, binary programs that previously required extra layers to execute on x86 computers may now run without them. It can be modified to work on an x64 system as well.

B. Hardware Abstraction Level (HAL)

Virtualization at the hardware level is done on top of the bare metal. On one side, this method creates a virtual hardware environment for a virtual machine. The process, on the other hand, uses virtualization to handle the underlying hardware. Virtualizing a computer's resources, such as CPUs, memory, and I/O devices, is the approach[3]. The goal is to increase the hardware usage rate for numerous users at the same time. This is most commonly found in cloud-based infrastructure.

C. Operating System Level

This virtualization approach establishes an abstract layer between the applications and the operating system. OS-level virtualization produces separate containers on a single physical server, allowing OS instances to access data center hardware and applications. The containers act as though they were real servers. OS-level virtualization is widely used to allocate hardware resources among a large number of mutually distrusting users in virtual hosting environments.

D. Library Level

Instead of using the OS's long system calls, most programmes use APIs provided by user-level libraries[4]. As most systems have well-documented APIs, such an interface may be virtualized as well. By using API hooks to manage the communication channel between programs and the rest of the system, virtualization with library interfaces is feasible.

E. Application Level

When only one application has to be virtualized, application-level virtualization is employed, and it is the final of the virtualization implementation levels in cloud computing. Applications run as a single process on a computer's operating system. As a result, it's also known as process virtualization. It's typically beneficial when using high-level languages to operate virtual machines. It enables the smooth execution of high-level language applications compiled for usage in the virtual machine's application level.

III. TYPES OF VIRTUALIZATION IN CLOUD COMPUTING

When discussing virtualization strategies in cloud computing, there are six methodologies that may be considered:

A. Storage Virtualization

Storage virtualization is a collection of technologies that work together to provide an abstraction layer

between logical and physical storage systems. In this case a virtual storage system manages a group of servers. The servers are unaware of where their data is kept. It allows the user to manage and use storage from various sources as if it were a single repository. Despite modifications, breakdowns, and variations in the underlying equipment, storage virtualization software ensures smooth operations, constant performance, and a continuing array of advanced functions[5].

B. Network Virtualization

In cloud virtualization, network virtualization is a mechanism used to combine available resources in a network. This is done by dividing the network into several distinct channels. These channels can then be provided to a specific virtual machine without any delay or they can remain unassigned. The concept is that the technology hides the network's actual complexity by breaking it down into manageable chunks, similar to how a segmented hard drive makes it easier to handle information.

C. Application Virtualization

In cloud virtualization, application virtualization creates an abstract layer between the application and the operating system. Therefore, the software is independent of the operating system beneath it and operates in an encapsulated form. Aside from offering a measure of isolation, an application built for one OS can also run on another. Software virtualization allows users to make a duplicate of their existing configuration and data, which they may use to test new programs, software upgrades, and other scenarios without risking their genuine installation or data.

D. Desktop virtualization

Desktop virtualization is used to run several desktop operating systems from a single machine. It mainly falls into two types. The first type employs a hypervisor which allows several operating systems to be run on a single machine and this is known as locally hosted desktop virtualization. Virtual desktop infrastructure, or VDI, is the other type, which operates numerous VMs from a centralised server. This virtualization enables the user to simulate a workstation load unlike most types of virtualization where a server is simulated.

E. Data Virtualization

Data virtualization enables users to modify data with ease using an abstraction layer that separates the underlying data structure and database systems. Technical elements of data management are abstracted in support of broader elements that are directly connected to business objectives. It may be used to execute a variety of activities, including data integration, business integration, and data searching.

F. Server Virtualization

Server virtualization is the process of dividing a physical server into many virtual servers in order to increase the usability of server resources. In other words, it is the concealment of server resources such as the number and identity of processors, physical servers, and the operating system. The server administrator divides one physical server into many separate virtual servers using software. This approach is mostly utilized in web servers to lower the cost of online hosting. Multiple virtual servers can run on the same system or computer instead of needing a separate machine for each web server[6].

It's the separation of cloud computing resources from the program that makes use of them. It entails integrating virtual machine software with the physical components of the server. The hypervisor is the name given to this piece of software. The hypervisor is responsible for managing the shared physical hardware resources between the guest and host operating systems. The hypervisor's main job is to keep track of processes, manage memory, and regulate hardware. When hardware virtualization is done on server platforms, it is known as server virtualization.

The main types of hardware virtualization are:

1) Full Virtualization: Virtual machines of any type of OS supported by the hardware resources

beneath come under full virtualization. It is the most approved virtualization method, in which virtual machines reproduce the host machine's CPU capabilities. The test hardware is effectively cloned into the virtual environment. It enables very accurate simulations for testing software and applications, as well as the huge benefit of letting numerous users use the environment at the same time. VMware's hypervisors, KVM and Virtual Box from Oracle are examples of technologies that use full virtualization.

2) Para Virtualization: Unmodified software operates as a separate system upon a modified OS and offers an interface to VMs that are similar to their underlying hardware in para virtualization. It enables software to operate on virtual machines with different hardware than the underlying hardware. The multiple guest servers are aware of one another, which varies from Full Virtualization.

3) OS Level Virtualization: This virtualization divides a physical server and a single instance of the operating system into many separate partitions, each of which mimics an actual server. The OS kernel will run a single operating system and deliver the capabilities of that operating system to each partition.

IV. FUTURE SCOPE

The future of cloud computing has shifted dramatically in recent years. With the help of digital technologies, the world is now tightly connected to one another. One of the key causes for the shift in cloud computing's scope is because of this. The amount of jobs, technology, and research investments in cloud computing has risen as well.

Many firms are using virtualization technology to reduce expenses, reclaim control, and expand their infrastructure. The most important thing to keep in mind is that the logical (virtual) layer will be crucial in connecting the data centre to consumers and the cloud[7].

The more software-based infrastructure there is, the more ability will be required to deliver and meet the demands of so many businesses. Virtualization will play a key role in the future as enterprises seek greater agility, flexibility, and portability across their infrastructure, as well as more software defined environments, automation, and interaction with public clouds.

V. CONCLUSIONS

The main focus of this review paper is on cloud virtualization . Cloud computing is a popular strategy for sharing data and information via the internet, and virtualization is a popular technique used in cloud computing for sharing data and information. This paper presents five virtualization levels that boost scalability while also lowering the cost of cloud computing systems, and these technologies also improve the overall efficiency of cloud computing. This paper also compares the various methodologies used in cloud computing. Finally the paper discusses the future scope of virtualization in cloud computing.

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