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Virtualization in Cloud Computing

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Abstarct:

Virtualization makes it possible to create a virtual representation of anything, which may include computer resources, a virtual computer hardware platform, or storage devices.Cloud computing technology is one of the biggest milestones in leading us to next generation technology and booming up business and IT field. It helps to overcome the problems of data loss, accessing data whenever needed and data security. This technology is mainly service oriented and focuses on cost reduction, hardware reductionnaik and pay just for service concept. Virtualization in cloud computing is making a virtual image of the storage devices servers or network resources so that they can be used on multiple machines at the same time. There are four main types of cloud computing: private clouds, public clouds, hybrid clouds, and multiclouds. There are also three main types of cloud computing services: Infrastructure-as-a-Service (IaaS), Platforms-as-a-Service (PaaS), and Software-as-a-Service (SaaS). Cloud storage is the abstraction, pooling, and sharing of storage resources through the internet. Cloud storage is facilitated by IT environments known as clouds, which enable cloud computing.

Introduction:

Virtualization uses software to create an abstraction layer over computer hardware that allows the hardware elements of a single computer processors, memory, storage and more to be divided into multiple virtual computers, commonly called virtual machines (VMs).

Virtualization is the "creation of a virtual (rather than actual) version of something, such as a server, a desktop, a storage device, an operating system or network resources".In other words, Virtualization is a technique, which allows to share a single physical instance of a resource or an application among multiple customers and organizations. It does by assigning a logical name to a physical storage and providing a pointer to that physical resource when demanded.

The goal of virtualization is usually one of the following: higher levels of performance, scalability, reliability/availability, agility, or to create a unified security and management domain. This virtual view is constructed using excess processing power, memory, storage, or network bandwidth.

The benefits of server virtualizations are more efficient utilization of physical servers. More efficient utilization of power. Virtual machine creation: create virtual machine to customer's specifications for memory, CPU reservation, and disk space and supported OS.

Virtualization is technology that you can use to create virtual representations of servers, storage, networks, and other physical machines. Virtual software mimics the functions of physical hardware to run multiple virtual machines simultaneously on a single physical machine. Businesses use virtualization to use their hardware resources efficiently and get greater returns from their investment. It also powers cloud computing services that help organizations manage infrastructure more efficiently.

Virtualization example

Consider a company that needs servers for three functions:tore business email securely

1. Run a customer-facing application
2. Run internal business applications

Types of Virtualization:

1. Hardware Virtualization.
2. Operating system Virtualization.
3. Server Virtualization.
4. Storage Virtualization.

1) Hardware Virtualization:

When the virtual machine software or virtual machine manager *(VMM) is directly installed on the hardware system* is known as hardware virtualization. The main job of hypervisor is to control and monitoring the processor, memory and other hardware resources. After virtualization of hardware system we can install different operating system on it and run different applications on those OS.

Usage:

Hardware virtualization is mainly done for the server platforms, because controlling virtual machines is much easier than controlling a physical server.

2) Operating System Virtualization:

When the virtual machine software or virtual machine manager *(VMM) is installed on the Host operating system* instead of directly on the hardware system is known as operating system virtualization. Operating System Virtualization is mainly used for testing the applications on different platforms of OS.

3) Server Virtualization:

When the virtual machine software or virtual machine manager *(VMM) is directly installed on the Server system* is known as server virtualization. Server virtualization is done because a single physical server can be divided into multiple servers on the demand basis and for balancing the load.

4) Storage Virtualization:

Storage virtualization is the *process of grouping the physical storage from multiple network storage devices so that it looks like a single storage device*.Storage virtualization is also implemented by using software applications.Storage virtualization is mainly done for back-up and recovery purposes.

Virtualization Work in Cloud Computing:

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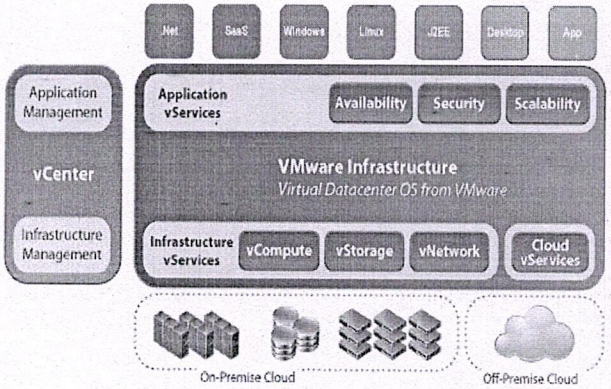
Virtual machines in the cloud that do the computation for SaaS applications as well as delivering them to users. If the cloud provider has a geographically distributed network edge, then the application will run closer to the user, resulting in faster performance.

Creation of a virtual machine over existing operating system and hardware is known as Hardware Virtualization. A Virtual machine provides an environment that is logically separated from the underlying hardware.

The machine on which the virtual machine is going to create is known as **Host Machine** and that virtual machine is referred as a **Guest Machine**

The main usage of Virtualization Technology is to provide the applications with the standard versions to their cloud users, suppose if the next version of that application is released, then cloud provider has to provide the latest version to their cloud users and practically it is possible because it is more expensive.

To overcome this problem we use basically virtualization technology, By using virtualization, all severs and the software application which are required by other cloud providers are maintained by the third party people, and the cloud providers has to pay the money on monthly or annual basis.



By using virtualization, you can interact with any hardware resource with greater flexibility. Physical servers consume electricity, take up storage space, and need maintenance. You are often limited by physical proximity and network design if you want to access them. Virtualization removes all these limitations by abstracting physical hardware functionality into software. You can manage, maintain, and use your hardware infrastructure like an application on the web.

Virtualization example

Consider a company that needs servers for three functions:

1. Store business email securely
2. Run a customer-facing application
3. Run internal business applications

Each of these functions has different configuration requirements:

- The email application requires more storage capacity and a Windows operating system.
- The customer-facing application requires a Linux operating system and high processing power to handle large volumes of website traffic.
- The internal business application requires iOS and more internal memory (RAM).

To meet these requirements, the company sets up three different dedicated physical servers for each application. The company must make a high initial investment and perform ongoing maintenance and upgrades for one machine at a time. The company also cannot optimize its computing capacity. It pays 100% of the servers' maintenance costs but uses only a fraction of their storage and processing capacities.

Efficient hardware use

With virtualization, the company creates three digital servers, or virtual machines, on a single physical server. It specifies the operating system requirements for the virtual machines and can use them like the physical servers. However, the company now has less hardware and fewer related expenses.

Infrastructure as a service

The company can go one step further and use a cloud instance or virtual machine from a cloud computing provider such as AWS. AWS manages all the underlying hardware, and the company can request server resources with varying configurations. All the applications run on these virtual servers without the users noticing any difference. Server management also becomes easier for the company's IT team.

To properly understand Kernel-based Virtual Machine (KVM), you first need to understand some basic concepts in *virtualization*. Virtualization is a process that allows a computer to share its hardware resources with multiple digitally separated environments. Each virtualized environment runs within its allocated resources, such as memory, processing power, and storage. With virtualization, organizations can switch between different operating systems on the same server without rebooting.

Virtual machines and hypervisors are two important concepts in virtualization.

Virtual machine

A *virtual machine* is a software-defined computer that runs on a physical computer with a separate operating system and computing resources. The physical computer is called the *host machine* and virtual machines are *guest machines*. Multiple virtual machines can run on a single physical machine. Virtual machines are abstracted from the computer hardware by a hypervisor.

Hypervisor

The *hypervisor* is a software component that manages multiple virtual machines in a computer. It ensures that each virtual machine gets the allocated resources and does not interfere with the operation of other virtual machines. There are two types of hypervisors.

Type 1 hypervisor

A type 1 hypervisor, or bare-metal hypervisor, is a hypervisor program installed directly on the computer's hardware instead of the operating system. Therefore, type 1 hypervisors have better performance and are commonly used by enterprise applications. KVM uses the type 1 hypervisor to host multiple virtual machines on the Linux operating system.

Type 2 hypervisor

Also known as a hosted hypervisor, the type 2 hypervisor is installed on an operating system. Type 2 hypervisors are suitable for end-user computing.

Virtualization provides several benefits to any organization:

Efficient resource use

Virtualization improves hardware resources used in your data center. For example, instead of running one server on one computer system, you can create a virtual server pool on the same computer system by using and returning servers to the pool as required. Having fewer underlying physical servers frees up space in your data center and saves money on electricity, generators, and cooling appliances.

Automated IT management

Now that physical computers are virtual, you can manage them by using software tools. Administrators create deployment and configuration programs to define virtual machine templates. You can duplicate your infrastructure repeatedly and consistently and avoid error-prone manual configurations.

Faster disaster recovery

When events such as natural disasters or cyberattacks negatively affect business operations, regaining access to IT infrastructure and replacing or fixing a physical server can take hours or even days. By contrast, the process takes minutes with virtualized environments. This prompt response significantly improves resiliency and facilitates business continuity so that operations can continue as scheduled.

How does virtualization work?

Virtualization uses specialized software, called a hypervisor, to create several cloud instances or virtual machines on one physical computer.

Cloud instances or virtual machines

After you install virtualization software on your computer, you can create one or more virtual machines. You can access the virtual machines in the same way that you access other applications on your computer. Your computer is called the host, and the virtual machine is called the guest. Several guests can run on the host. Each guest has its own operating system, which can be the same or different from the host operating system.

From the user's perspective, the virtual machine operates like a typical server. It has settings, configurations, and installed applications. Computing resources, such as central processing units (CPUs), Random Access Memory (RAM), and storage appear the same as on a physical server. You can also configure and update the guest operating systems and their applications as necessary without affecting the host operating system.

Application virtualization

Application virtualization pulls out the functions of applications to run on operating

systems other than the operating systems for which they were designed. For example, users can run a Microsoft Windows application on a Linux machine without changing the machine configuration. To achieve application virtualization, follow these practices:

- Application streaming – Users stream the application from a remote server, so it runs only on the end user's device when needed.
- Server-based application virtualization – Users can access the remote application from their browser or client interface without installing it.

Desktop virtualization

Most organizations have nontechnical staff that use desktop operating systems to run common business applications. For instance, you might have the following staff:

- A customer service team that requires a desktop computer with Windows 10 and customer-relationship management software
- A marketing team that requires Windows Vista for sales applications

You can use desktop virtualization to run these different desktop operating systems on virtual machines, which your teams can access remotely. This type of virtualization makes desktop management efficient and secure, saving money on desktop hardware. The following are types of desktop virtualization.

Local application virtualization – The application code is shipped with its own environment to run on all operating systems without changes.

Conclusion

Mainly Virtualization means, running multiple operating systems on a single machine but sharing all the hardware resources. And it helps us to provide the pool of IT resources so that we can share these IT resources in order get benefits in the business.

Virtualization is the fundamental technology powering cloud computing. It separates computing environments from the physical infrastructure, thereby enabling multiple operating systems and applications to run simultaneously on a single machine.

Cloud computing is the delivery of computing resources over the internet. It offers cost savings, scalability, high performance, economies of scale, and more. For many companies, a cloud migration is directly related to data and IT modernization.

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