Introduction to Distributed and Parallel Computing
CS-401

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Virtualization in Cloud Computing

- **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.

What is the concept behind the Virtualization?

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**

Types of 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.

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.

Usage:
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.

Usage:

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.

How does virtualization work in cloud computing?

Virtualization plays a very important role in the cloud computing technology, normally in the cloud computing, users share the data present in the clouds like application etc, but actually with the help of virtualization users shares the Infrastructure.

➢ 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.

Data Virtualization

➢ Data virtualization is the process of retrieve data from various resources without knowing its type and physical location where it is stored.

➢ It collects heterogeneous data from different resources and allows data users across the organization to access this data according to their work requirements.

➢ This heterogeneous data can be accessed using any application such as web portals, web services, E-commerce, Software as a Service (SaaS), and mobile application.

➢ We can use Data Virtualization in the field of **data integration, business intelligence,** and **cloud computing**.

Advantages of Data Virtualization

➢ It allows users to access the data without worrying about where it resides on the memory.

➢ It offers better customer satisfaction, retention, and revenue growth.

➢ It provides various security mechanism that allows users to safely store their personal and professional information.

➢ It reduces costs by removing data replication.

➢ It provides a user-friendly interface to develop customized views.

➢ It provides various simple and fast deployment resources.

➢ It increases business user efficiency by providing data in real-time.

➢ It is used to perform tasks such as data integration, business integration, Service-Oriented Architecture (SOA) data services, and enterprise search.

Disadvantage

➢ It creates availability issues because availability is maintained by third-party providers.

➢ It required a high implementation cost.

➢ It creates availability and scalability issues.

➢ Although it saves time during the implementation phase of virtualization it consumes more time to generate the appropriate result.

Uses of Data Virtualization

1. Analyze performance

Data virtualization is used to analyze the performance of the organization compared to previous years.

2. Search and discover interrelated data

Data Virtualization (DV) provides a mechanism to easily search the data which is similar and internally related to each other.

3. Agile Business Intelligence

It is one of the most common uses of Data Virtualization. It is used in agile reporting, real-time dashboards that require timely aggregation, analyze and present the relevant data from multiple resources. Both individuals and managers use this to monitor performance, which helps to make daily operational decision processes such as sales, support, finance, logistics, legal, and compliance.

4. Data Management

Data virtualization provides a secure centralized layer to search, discover, and govern the unified data and its relationships.

Data Virtualization Tools

1. Red Hat JBoss data virtualization

Red Hat Virtualization is the best choice for developers and those who are using microservices and containers. It is written in **Java**.

2. TIBCO data virtualization

TIBCO helps administrators and users to create a data virtualization platform for accessing multiple data sources and data sets. It provides a built-in **transformation** engine to combine non-relational and unstructured data sources.

3. Oracle data service integrator

It is a very popular and powerful data integrator tool that mainly works with Oracle products. It allows organizations to quickly develop and manage data services to access a single view of data.

Hardware Virtualization

➢ Previously, there was "one to one relationship" between physical servers and operating system. Low capacity of CPU, memory, and networking requirements were available. So, by using this model, the costs of doing business increased. The physical space, amount of power, and hardware required meant that costs were adding up.

➢ The **hypervisor** manages shared the physical resources of the hardware between the guest operating systems and host operating system. The physical resources become abstracted versions in standard formats regardless of the hardware platform. The abstracted hardware is represented as actual hardware. Then the virtualized operating system looks into these resources as they are physical entities.

➢ **Virtualization means abstraction**. Hardware virtualization is accomplished by abstracting the physical hardware layer by use of a hypervisor or VMM (Virtual Machine Monitor).

➢ When the virtual machine software or virtual machine manager (VMM) or hypervisor software is directly installed on the hardware system is known as hardware virtualization.

Usage of Hardware Virtualization

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

Advantages of Hardware Virtualization

The main benefits of hardware virtualization are more efficient resource utilization, lower overall costs as well as increased uptime and IT flexibility.

1) More Efficient Resource Utilization:

Physical resources can be shared among virtual machines. Although the unused resources can be allocated to a virtual machine and that can be used by other virtual machines if the need exists.

2) Lower Overall Costs Because Of Server Consolidation:

Now it is possible for multiple operating systems can co-exist on a single hardware platform, so that the number of servers, rack space, and power consumption drops significantly.

3) Increased Uptime Because Of Advanced Hardware Virtualization Features:

The modern hypervisors provide highly orchestrated operations that maximize the abstraction of the hardware and help to ensure the maximum uptime. These functions help to migrate a running virtual machine from one host to another dynamically, as well as maintain a running copy of virtual machine on another physical host in case the primary host fails.

Software Virtualization

➢ Managing applications and distribution becomes a typical task for IT departments. Installation mechanism differs from application to application. Some programs require certain helper applications or frameworks and these applications may have conflict with existing applications.

➢ **Software virtualization** is just like a virtualization but *able to abstract the software installation procedure and create virtual software installations*.

➢ **Virtualized software** is an application that will be "installed" into its own self-contained unit.

➢ Example of software virtualization is *VMware software, virtual box* etc.

Advantages of Software Virtualization

1) Client Deployments Become Easier:

Copying a file to a workstation or linking a file in a network then we can easily install virtual software.

2) Easy to manage:

To manage updates becomes a simpler task. You need to update at one place and deploy the updated virtual application to the all clients.

3) Software Migration:

Without software virtualization, moving from one software platform to another platform takes much time for deploying and impact on end user systems. With the help of virtualized software environment the migration becomes easier.

Server Virtualization

Server Virtualization is the process of dividing a physical server into several virtual servers, called **virtual private servers**. Each virtual private server can run independently.

The concept of Server Virtualization widely used in the <u>IT</u> infrastructure to minimizes the costs by increasing the utilization of existing resources.

Types of Server Virtualization

1. Hypervisor

In the Server Virtualization, Hypervisor plays an important role. It is a layer between the <u>operating system</u> (OS) and <u>hardware</u>. There are two types of hypervisors.

•Type 1 hypervisor (also known as bare metal or native hypervisors)

•Type 2 hypervisor (also known as hosted or Embedded hypervisors)

The hypervisor is mainly used to perform various tasks such as allocate physical hardware resources (CPU, RAM, etc.) to several smaller independent virtual machines, called **"guest"** on the host machine.

2. Full Virtualization

Full Virtualization uses a **hypervisor** to directly communicate with the <u>CPU</u> and physical server. It provides the best isolation and security mechanism to the virtual machines.

Storage Virtualization

➢ As we know that, there has been a strong link between the physical host and the locally installed storage devices. However, that paradigm has been changing drastically, almost local storage is no longer needed. As the technology progressing, more advanced storage devices are coming to the market that provide more functionality, and obsolete the local storage.

➢ Storage virtualization is a major component for storage servers, in the form of functional RAID levels and controllers. Operating systems and applications with device can access the disks directly by themselves for writing. The controllers configure the local storage in RAID groups and present the storage to the operating system depending upon the configuration. However, the storage is abstracted and the controller is determining how to write the data or retrieve the requested data for the operating system.

Difference between Cloud Computing and Grid Computing
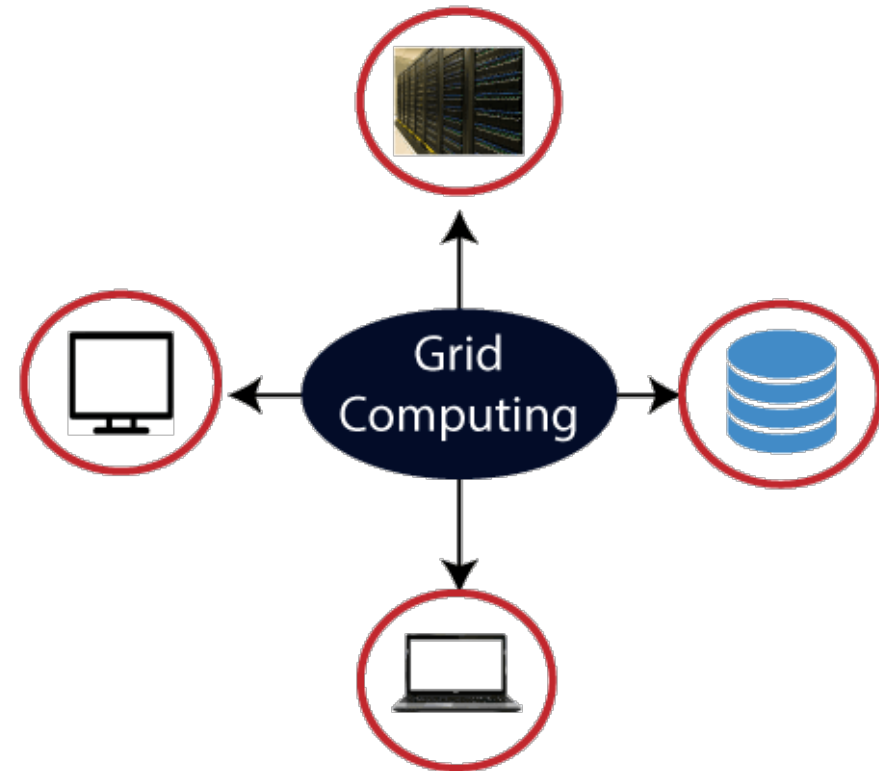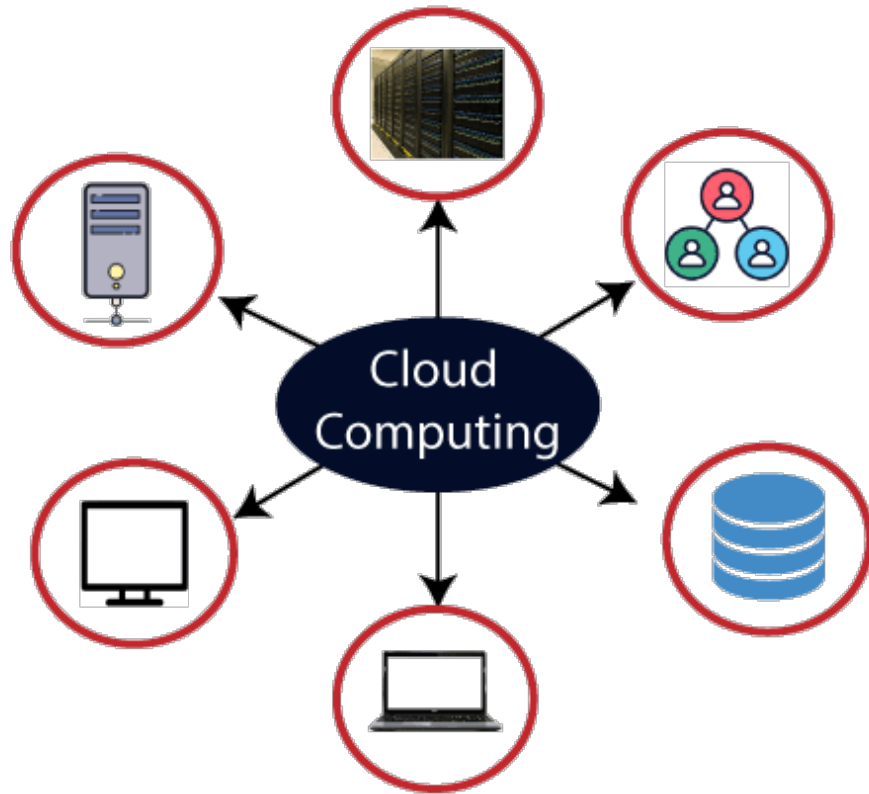
Cloud Computing	Grid Computing
Cloud Computing follows client-server computing architecture.	Grid computing follows a distributed computing architecture.
Scalability is high.	Scalability is normal.
Cloud Computing is more flexible than grid computing.	Grid Computing is less flexible than cloud computing.
Cloud operates as a centralized management system.	Grid operates as a decentralized management system.
In cloud computing, cloud servers are owned by infrastructure providers.	In Grid computing, grids are owned and managed by the organization.
Cloud computing uses services like Iaas, PaaS, and SaaS.	Grid computing uses systems like distributed computing, distributed information, and distributed pervasive.
Cloud Computing is Service-oriented.	Grid Computing is Application-oriented.
It is accessible through standard web protocols.	It is accessible through grid middleware.

Cloud Computing Application

Art	
Business	
Data Storage and Backup	
Education	
Entertainment	
Management	
Social	

Thanks & Cheers!!

Small aim is a crime; have great aim.
Bharat-Ratan A. P. J. Abdul Kalam