

What is cloud Computing?

Cloud computing is a means to access data and programs on remote server through internet instead of computer's hard drive or local server. Cloud computing is also referred to as **internet-based computing**, it is a technology where the resource is provided through internet to the server.

Some operations that can be performed via cloud computing are:

- Storage, backup & recovery of data
- Delivery of software on demand
- Development of new applications & services
- Streaming videos and audio

How does cloud computing work?

→ helps users easily access computing resources like storage and processing over internet rather than local hardwares.

- Infrastructure: Cloud computing depends on remote network servers

- On-demand access: users can access cloud services on demand and can scale up or down for physical hardware.

What is virtualization?

Initially developed during the mainframe era, it allows multiple operating systems and applications to run on the same hardware simultaneously, enhancing hardware utilization and flexibility. This process involves using specialized software to create virtual environments for applications, storage, memory, and networking.

In cloud computing, virtualization is crucial as it enables multiple customers and organizations to share a single physical instance of a resource, reducing costs and enhancing efficiency. It supports Infrastructure-as-a-Service (IaaS) solutions and offers benefits such as resource allocation flexibility, enhanced development productivity, cost savings, remote access, scalability, high availability, and disaster recovery. However, it also involves high initial investments, a need for skilled staff, and potential data security risks.

Key terms include:

- Host Machine: The physical machine hosting the virtual machines.
- Guest Machine: The virtual machines created on the host.

Benefits of Virtualization

- **Efficient resource allocation**
- **Enhanced development productivity**
- **Reduced IT infrastructure costs**
- **Remote access and scalability**
- **High availability and disaster recovery**
- **Pay-per-use IT infrastructure**
- **Ability to run multiple operating systems**

Drawbacks of Virtualization

- **High initial investment**
- **Need for skilled staff**
- **Potential data security risks**

Characteristics of Virtualization

- **Increased Security:** Secure execution environments.
- **Managed Execution:** Features like sharing, aggregation, emulation, and isolation.

Types of Virtualization

- 1 **Application Virtualization:** Remote access to applications.
- 2 **Network Virtualization:** Multiple virtual networks on one physical network.
- 3 **Desktop Virtualization:** Remote access to desktops.
- 4 **Storage Virtualization:** Managing storage from multiple sources as a single repository.
- 5 **Server Virtualization:** Dividing a physical server into multiple virtual servers.
- 6 **Data Virtualization:** Managing data from various sources in a single place for easy access.

Uses of Virtualization

- **Data integration**
- **Business integration**
- **Service-oriented architecture data services**
- **Organizational data search**

Virtualization is essential for modern cloud computing, offering numerous benefits and a few challenges, making it a vital technology for efficient IT infrastructure management.

What is Virtual Machine?

Virtual Machine abstracts the hardware of our personal computer such as CPU, disk drives, memory, NIC (Network Interface Card), etc, into many different execution environments as per our requirements.. For example, VirtualBox. When we run different processes on an operating system, it creates an illusion that each process is running on a different processor having its own virtual memory, with the help of CPU scheduling and virtual-memory techniques. There are additional features of a process that cannot be provided by the hardware alone like system calls and a file system. The virtual machine approach does not provide these additional functionalities but it only provides an interface that is the same as basic hardware. Each process is provided with a virtual copy of the underlying computer system. We can create a virtual machine for several reasons, all of which are fundamentally related to the ability to share the same basic hardware yet also support different execution environments, i.e., different operating systems simultaneously. The main drawback of the virtual-machine approach involves disk systems. Let us suppose that the physical machine has only three disk drives but wants to support seven virtual machines. It cannot allocate a disk drive to each virtual machine, because virtual-machine software itself will need substantial disk space to provide virtual memory and spooling. The solution is to provide virtual disks. After which they can run any of the operating systems or software packages that are available on the underlying machine. The virtual-machine software is concerned with multi-programming multiple virtual machines onto a physical machine, but it does not need to consider any user-support software. This arrangement can provide a useful way to divide the problem of designing a multi-user interactive system, into two smaller pieces.

Hypervisor 5

A hypervisor is a form of virtualization software used in Cloud hosting to divide and allocate the resources on various pieces of hardware. The program which provides partitioning, isolation, or abstraction is called a virtualization hypervisor. The hypervisor is a hardware virtualization technique that allows multiple guest operating systems (OS) to run on a single host system at the same time. A hypervisor is sometimes also called a virtual machine manager(VMM).

Types of Hypervisor –

TYPE-1 Hypervisor:

The hypervisor runs directly on the underlying host system. It is also known as a “Native Hypervisor” or “Bare metal hypervisor”. It does not require any base server operating system. It has direct access to hardware resources. Examples of Type 1 hypervisors include VMware ESXi, Citrix XenServer, and Microsoft Hyper-V hypervisor.

Pros & Cons of Type-1 Hypervisor

Pros: Such kinds of hypervisors are very efficient because they have direct access to the physical hardware resources(like Cpu, Memory, Network, and Physical storage). This causes the empowerment of the security because there is nothing any kind of the third party resource so that attacker couldn't compromise with anything.

Cons: One problem with Type-1 hypervisors is that they usually need a dedicated separate machine to perform their operation and to instruct different VMs and control the host hardware resources.

TYPE-2 Hypervisor:

A Host operating system runs on the underlying host system. It is also known as ‘Hosted Hypervisor’. Such kind of hypervisors doesn’t run directly over the underlying hardware rather they run as an application in a Host system(physical machine). Basically, the software is installed on an operating system. Hypervisor asks the operating system to make hardware calls. An example of a Type 2 hypervisor includes VMware Player or Parallels Desktop. Hosted hypervisors are often found on endpoints like PCs. The type-2 hypervisor is very useful for engineers, and security analysts (for checking malware, or malicious source code and newly developed applications).

Pros & Cons of Type-2 Hypervisor:

Pros: Such kind of hypervisors allows quick and easy access to a guest Operating System alongside the host machine running. These hypervisors usually come with additional useful features for guest machines. Such tools enhance the coordination between the host machine and the guest machine.

Cons: Here there is no direct access to the physical hardware resources so the efficiency of these hypervisors lags in performance as compared to the type-1 hypervisors, and potential security risks are also there an attacker can compromise the security weakness if there is access to the host operating system so he can also access the guest operating system.