All you need to know about

Virtualization in Cloud Computing

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Introduction

Virtualization in cloud computing primarily stems from the need to split up resources to make them more efficient and add security layers to silos of computing power. For instance, you can segment server capacities into small parts to allow for the distribution of the server's capabilities among several environments and users.

Essentially, it creates a virtual resource running on a layer abstract from physical hardware. Cloud computing is one of the more common use cases. Virtualization allows a computing environment to simultaneously run several independent systems also called virtual machines. These virtual machines (VMs) share the same physical IT infrastructure and are managed and coordinated by an additional software interface named hypervisor.

While this concept has existed for several decades, it has recently become the standard practice in IT infrastructure. And the global virtualization market is at around 40 to 60 billion US dollars and is expected to grow exponentially to nearly 120 billion US dollars within the next few years.

Almost any type of IT infrastructure can be virtualized, including servers, desktops, networks, storage, data, applications, data centers, CPUs, and GPUs. Accordingly, virtualization is the lynchpin of cloud computing, making it one of the most cost-effective, energy-saving, and hardware-reducing techniques.

The virtualization process in cloud computing is where a name is assigned to the physical storage and is available on demand. It also provides a virtual environment for memory, networking, and storage. There is a host machine and a guest machine. Virtualization may be considered synonymous with hardware virtualization as it plays a big part in delivering Infrastructure as a Service for cloud computing.

Virtualization in Cloud Computing
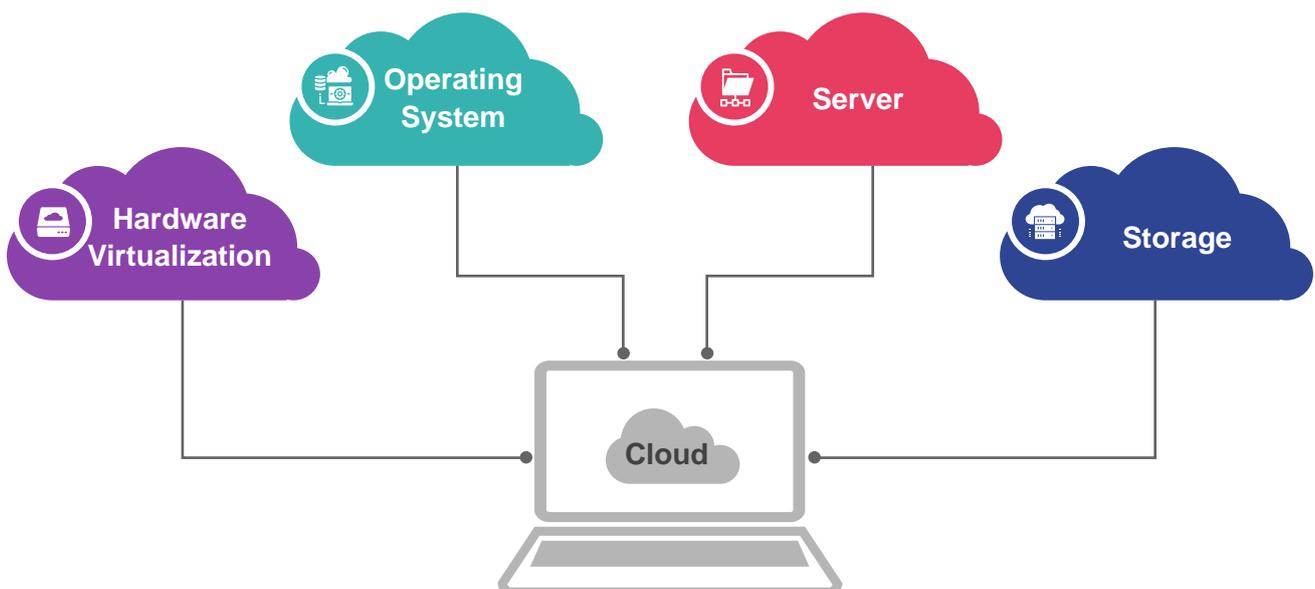
Typically, virtualization is hypervisor-based. It enables the separation of OS' and applications from the base-level hardware and permits host machines to run multiple virtual machines (VMs) as guests, sharing the physical resources. There are a few distinct characteristics of virtualization that we will discuss below.

Characteristics of virtualization

There are several characteristics of virtualization, such as sharing, emulation, isolation, and increased security.

Sharing

Enterprises can create separate computing environments within the same host. It reduces the number of active servers and reduces power consumption. While virtualization enables sharing of available physical resources, it also allows aggregation. Groups of individual hosts can be represented as a single virtual host. It aims at harnessing the physical resources of a homogenous group of machines to be viewed as one source.

Emulation

Emulation is the execution of multiple guest programs within an environment controlled by the virtualization layer. A whole new environment can be emulated to allow the execution of guest programs even if they are not present in the physical host.

Isolation

Guest programs with separate and isolated environments can be executed in the OS, application, etc. These guest programs perform by interacting with the abstraction layer that gives access to the underlying resources. The VM filters the guest activity and prevents operations that can harm the host.

Increased security

Virtualization increases the host's ability to control the execution of all the guest programs with greater transparency. Virtual manager machines filter and control the activity of guest programs and protect the execution environment.

With the above characteristics, virtualization in cloud computing also comes in different types. Below is a list, each one serving enterprises in different ways.

Major types of virtualization

OS virtualization

OS virtualizations enable multiple operating systems to be installed on a single server or workstation. A second OS can be installed on a subset or partition instead of the original OS being seen as a base-level system. Each of these OS' is separate and protected in a containerized manner. Enterprise can save costs on devices, space, electricity, etc., simply because they can run many OS' on one machine.
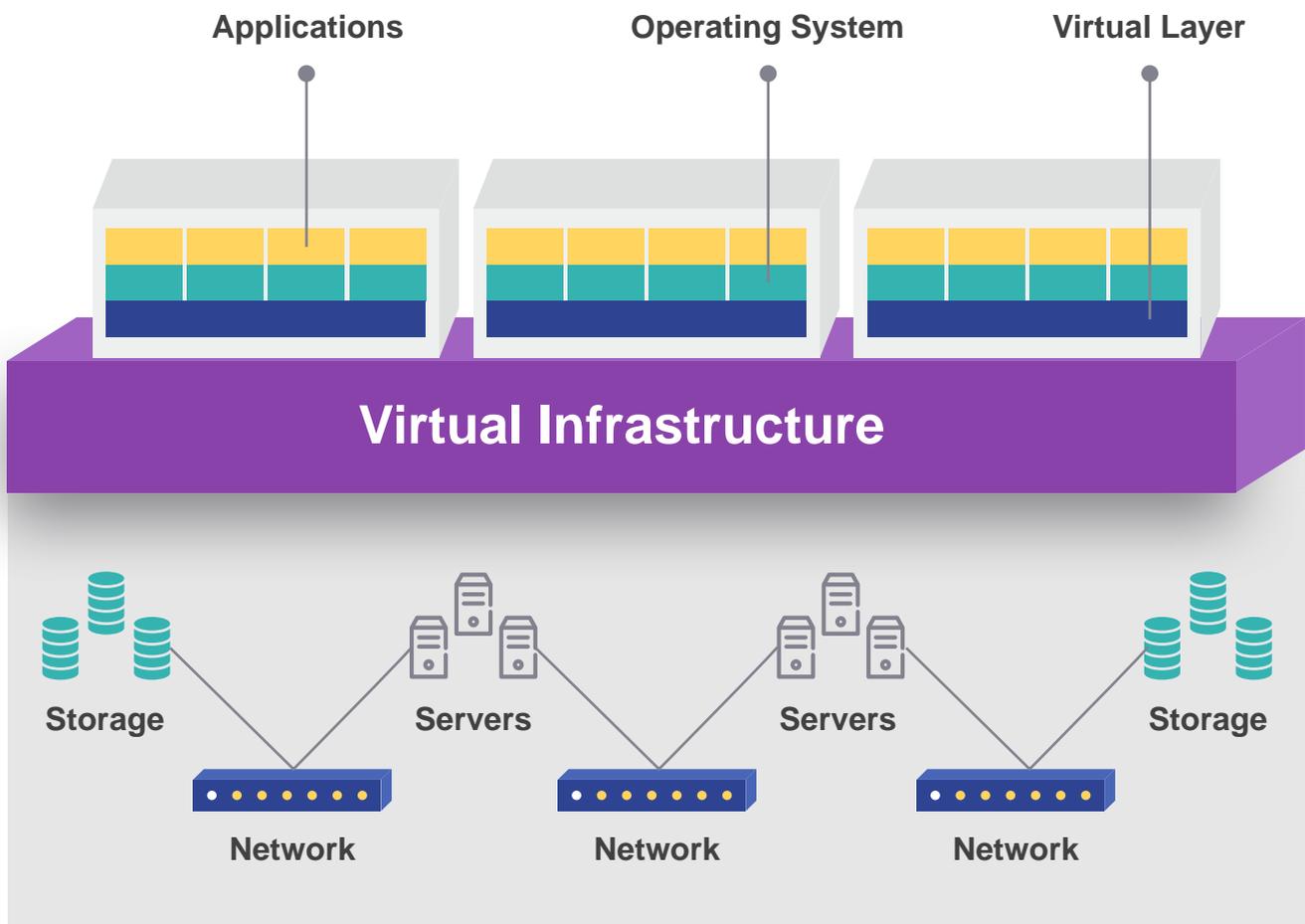
Network virtualization

Network virtualization is how you can run multiple virtual networks, each having a separate data plan and control. They coexist on top of the one physical network and can be managed by different parties. It offers a way to provision virtual networks, including routers, switches, firewalls, VPNs, etc.

Application virtualization

Application virtualization is when virtual applications are kept separated from the physical infrastructure. They are not run directly on the physical infrastructure. Instead, they are run through the virtualization layer that acts as though delivering physical resources of the device to an application. It is common to use virtualization tools in combination with virtual applications. These applications can also be run on virtual environments that are different from the base-level OS.

Administrative virtualization

Administrative virtualization involves managing actress and permissions for devices and servers. It is more relevant in data centers and separates admin roles through a virtual layer. It helps separate users and defines privileges from underlying files.

Storage virtualization

Virtual storage in cloud computing is one of the most common practices. It helps separate storage infrastructure from the underlying physical resources. For instance, the physical storage is pooled as a virtual resource, and the virtual storage gets allocated and used. It allows for a simpler transfer process, centralized management, and more efficient storage.

Server virtualization

Server virtualization is related to server power and processing capabilities. Each virtual server can be run independent of the others, and the applications could be drawing resources from any server. The physical server is divided into different virtual servers by changing the ID number.

Desktop virtualization

Desktop virtualization is ideal for workforces when they are mobile and working from remote locations or changing their locations frequently. These desktops can be accessed through the cloud, and data can be accessed or transferred through the virtual desktop.

With the different types of virtualization available, it is easy to understand why managing the virtual infrastructure is essential when it comes to deriving its benefits. Using the appropriate tools is also key to tapping into these benefits.

Key benefits of virtualization in cloud computing

Virtualization offers many benefits for enterprises, including reduced costs, increased agility, flexibility, and scalability. It also enables enterprises to use their physical hardware resources more efficiently. Other benefits are reduced downtime, increased productivity, centralized data management, etc.

Let's look at a few of the benefits of virtualization:

Reduced IT expenses

One of the most significant benefits of virtualization is reduced IT costs. For instance, a non-virtualized environment is inefficient because it sits idle when not in use and consumes power.

However, that single physical server transforms into many virtual machines in a virtualized environment. These VMs can have different operating systems running different applications while still hosted on a single physical server. When you consolidate the applications onto a virtualized environment, you consume fewer physical customers, making it a more cost-effective approach.

Reduced downtime and enhanced resiliency in disaster recovery situations

When a disaster strikes the physical server, you need someone to replace or fix it. These fixes can take hours or even days. It is much easier to provision and deploy in a virtualized environment, as you can clone or replicate the virtual machine that's been affected. The recovery process would also take mere minutes instead of hours to set up a new physical server. Therefore, a virtualized environment enhances the environment's resiliency and improves business continuity, with little to no downtime.

Increased efficiency and productivity

Virtualized environment means far fewer servers, leaving your IT teams free of time-consuming maintenance efforts managing the physical hardware and IT infrastructure. You will be able to install, update, and maintain the environment across all VMs in a virtual environment on the server instead of the more tedious process of applying updates to servers, one at a time. With less time spent on maintaining the environment, enterprises can enhance the team's efficiency and productivity.

Control independence and DevOps

Since the virtualized environment is segmented into VMs, developers can quickly create a virtual machine without impacting the production environment. It is ideal for developers and testers as they can clone the virtual machine in no time and run a test on the environment.

For instance, if a new software patch has been released, you can clone the virtual machine, apply the latest software update, and test the environment, before drawing it into the production application, increasing the speed and agility of the application.

Protection against failure

Using virtualization in cloud computing ensures that the rest won't be affected even if one part of the system fails. It is because virtualized infrastructure is separated into containers. Therefore, if you are testing a program or even different kinds of software, you would be doing it inside a VM that protects the rest of the environment from application crashes, bugs, or viruses.

Smooth transfer of machines or data

An upside to virtualization is that you can transfer data between servers without searching through different physical hard drives or data centers. With virtualized storage ad desktops, entire machines can be moved from place to place without shifting physical infrastructure, saving time, money, and energy.

Security

Each VM is in its own container. So, a malicious file or malware will be restricted to the container if it gains access. VMs and infrastructure are well separated from the rest of the system, making it harder for viruses to spread throughout the environment.

This is true in the case of virtualization with cloud computing because of the strong encryption protocols. Backups of machines and data are created in virtualized systems keeping them safe until you need to restore them.

Eco-friendly (organizational and environmental)

A direct benefit to your enterprise and the natural environment is the opportunity to cut down on the number of physical servers. With fewer physical servers, less power is consumed, benefiting in two ways:

- It reduces expenses for the organization.
- It helps reduce the carbon footprint of the data center.

The above benefits are only a few, albeit some of the most important. Additionally, virtualization in cloud computing also streamlines operations and processes. It enables a centralized management process to help the enterprise, and IT operate seamlessly. Virtual networks are easier to manage. The business focus can be on resource management and capacity building in a holistic manner - no more time spent on repairs, installations, patches, and maintenance of physical infrastructure. With backups and recovery also faster and easier, the workforce can take the business forward with zero hassles.

Conclusion

Using cloud-based virtualization solutions covering public and private cloud services and hybrid cloud services provide efficient use of the physical hardware, in turn improving the business ROI. In short, virtualization helps drive higher capacity utilization and reduced costs, making it worth the investment.
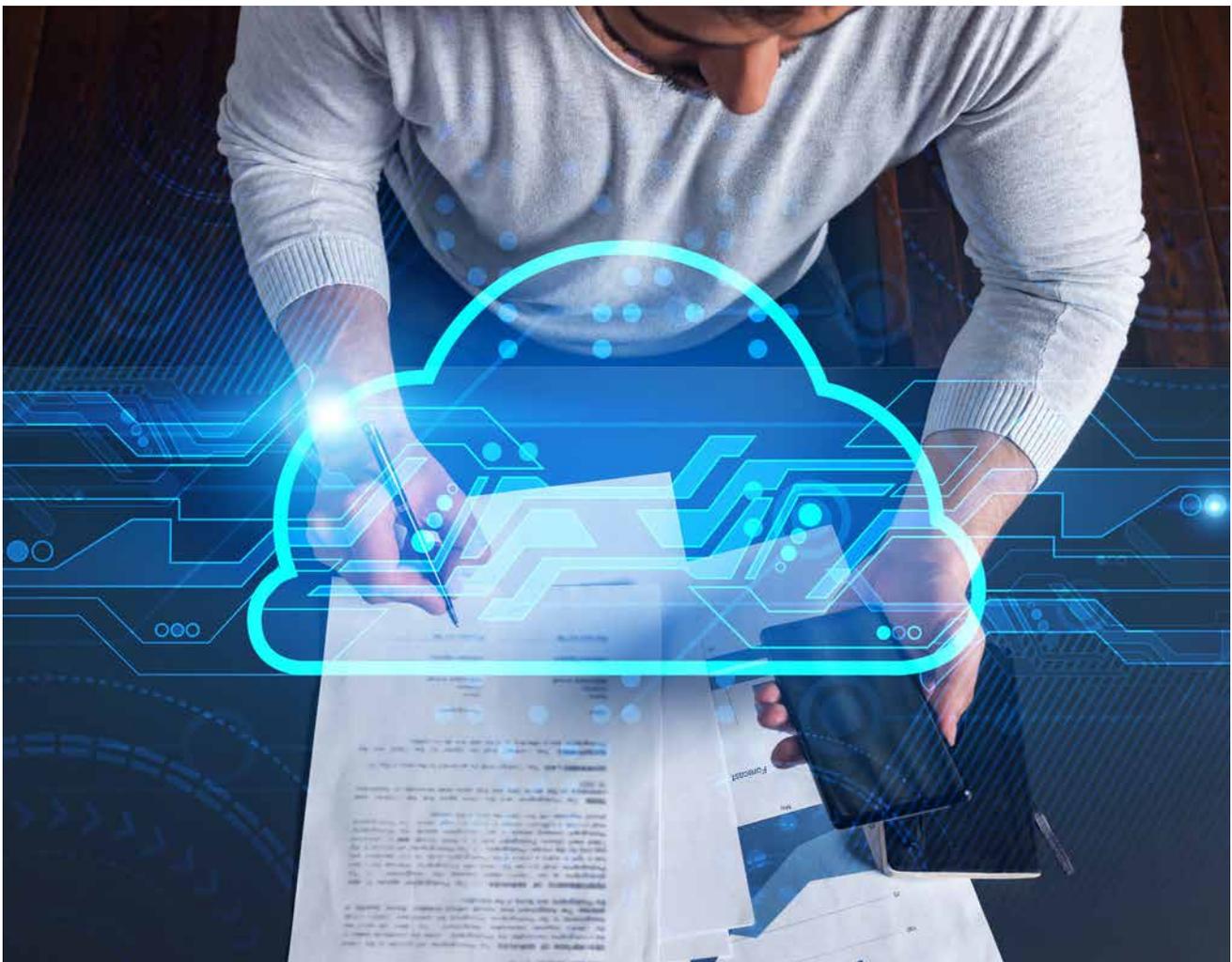
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