Unit 3

Cloud Virtualization technology

Introduction to Virtualization

Virtualization in Cloud Computing is making a virtual platform of server operating system and **storage** devices. This will help the user by providing multiple machines at the same time it also allows sharing a single physical instance of resource or an application to multiple users. Cloud Virtualizations also manage the workload by transforming traditional computing and make it more scalable, economical and efficient.

Virtualizations in Cloud Computing rapidly integrating the fundamental way of computing. One of the important features of virtualization is that it allows sharing of applications to multiple customers and companies.

Cloud Computing can also be known as services and application delivered to help the virtualized environment. This environment can be either **public** or **private**. With the help of virtualization, the customer can maximize the resources and reduces the physical system which is in need.

Types of Virtualization

- Operating System Virtualization
- Hardware Virtualization
- Server Virtualization
- Storage Virtualization

Operating System Virtualization

In **operating system virtualization** in Cloud Computing, the virtual machine software installs in the operating system of the host rather than directly on the hardware system.

The most important use of operating system virtualization is for testing the application on different platforms or operating system. Here, the software is present in the hardware, which allows different applications to run.

Server Virtualization

In **server virtualization** in Cloud Computing, the software directly installs on the server system and use for a single physical server can divide into many servers on the demand basis and

balance the load. Used in server platform as it is flexible to use Virtual Machine rather than physical machines. In hardware virtualizations, virtual machine software installs in the hardware system and then it is known as hardware virtualization.

It consists of a hypervisor which use to control and monitor the process, memory, and other hardware resources. After the completion of hardware virtualization process, the user can install the different operating system in it and with this platform different application can use.

Storage Virtualization

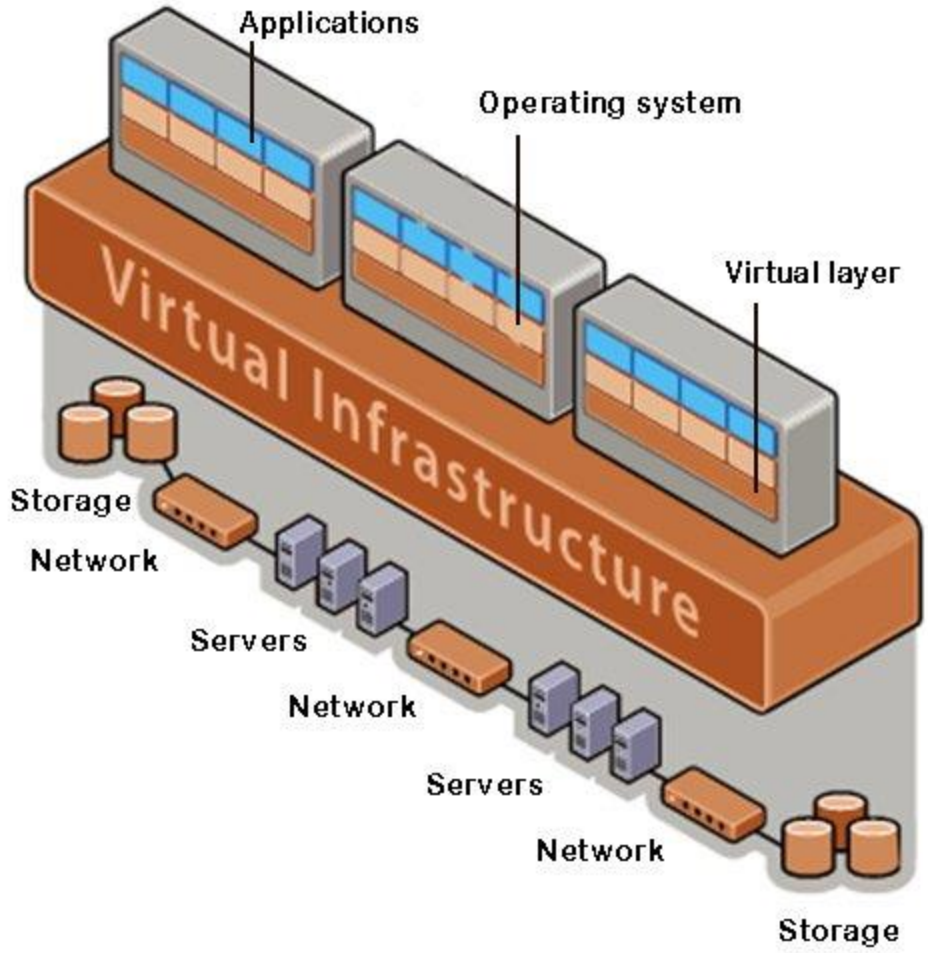
In **storage virtualization** in Cloud Computing, a grouping is done of physical storage which is from multiple network storage devices this is done so it looks like a single storage device.

It can implement with the help of software applications and storage virtualization is done for the backup and recovery process. It is a sharing of the physical storage from multiple storage devices.

How Virtualization Works?

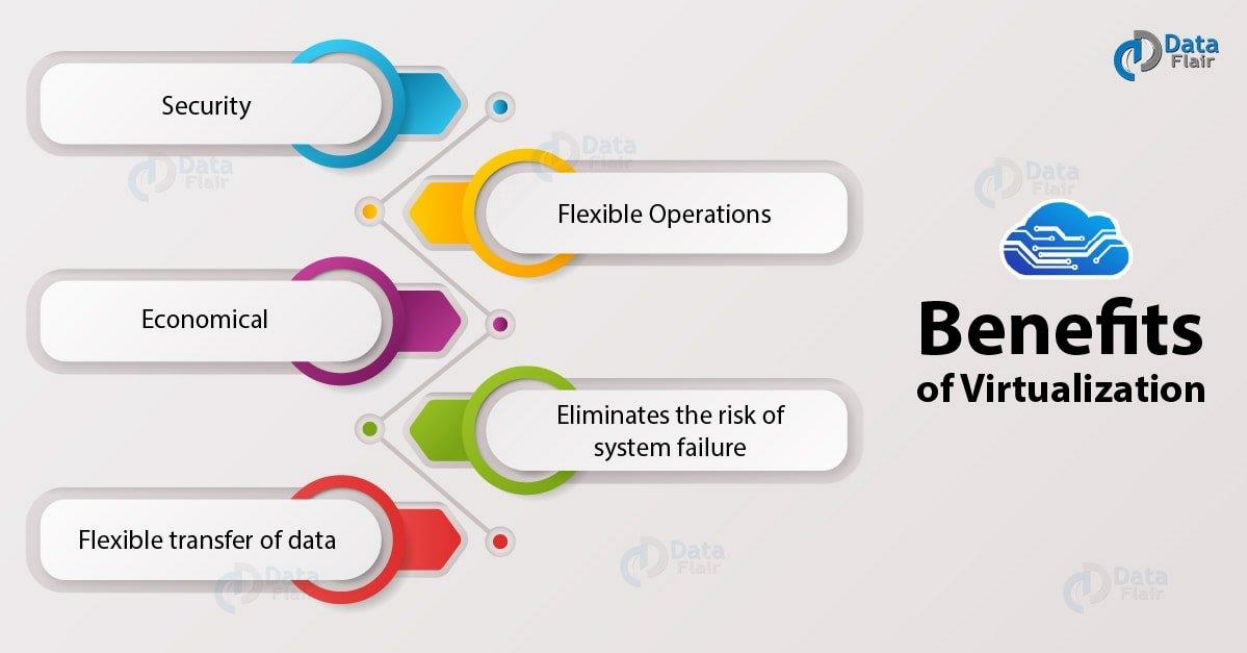
Virtualization in Cloud Computing is a process in which the user of cloud shares the data present in the cloud which can be application software etc. It provides a virtual environment in the cloud which can be software hardware or any other thing.

In virtualization, the server and the software application which are required by the **cloud providers** maintain by the third party and in this, the cloud provider please some amount to the third party. It is done because it will be costly if a new version of an application is released and it has to be introduced to the customers. It can be also explained in a way that with the help of Hypervisor which is software the cloud customer can access server. A hypervisor is connectivity between the server and the virtual environment and distributes the resources between different virtual environments.


Applications
Operating system
Virtual layer
Virtual Infrastructure
Storage
Network
Servers
Network
Servers
Network
Storage

Implementation Levels of Virtualization Structures

Benefits of virtualization



i. Security

During the process of virtualization **security** is one of the important concerns. The security can be provided with the help of firewalls, which will help to prevent unauthorized access and will keep the data confidential. Moreover, with the help of firewall and security, the data can protect from harmful viruses malware and other cyber threats. Encryption process also takes place with protocols which will protect the data from other threads. So, the customer can virtualize all the data store and can create a backup on a server in which the data can store.

ii. Flexible operations

With the help of a virtual network, the work of it professional is becoming more efficient and agile. The network switch implement today is very easy to use, flexible and saves time. With the help of virtualization in Cloud Computing, technical problems can solve in physical systems. It eliminates the problem of recovering the data from crashed or corrupted devices and hence saves time.

iii. Economical

Virtualization in **Cloud Computing**, save the cost for a physical system such as hardware and servers. It stores all the data in the virtual server, which are quite economical.

It reduces the wastage, decreases the electricity bills along with the maintenance cost. Due to this, the business can run multiple operating system and apps in a particular server.

iv. Eliminates the risk of system failure

While performing some task there are chances that the system might crash down at the wrong time. This failure can cause damage to the company but the virtualizations help you to perform the same task in multiple devices at the same time.

The data can store in the cloud it can retrieve anytime and with the help of any device. Moreover, there is two working server side by side which makes the data accessible every time. Even if a server crashes with the help of the second server the customer can access the data.

v. Flexible transfer of data

The data can transfer to the virtual server and retrieve anytime. The customers or cloud provider don't have to waste time finding out hard drives to find data. With the help of virtualization, it will very easy to locate the required data and transfer them to the allotted authorities.

This transfer of data has no limit and can transfer to a long distance with the minimum charge possible. Additional storage can also provide and the cost will be as low as possible.

Server virtualization

Server virtualization is a partition of physical servers into multiple virtual servers. Here, each virtual server is running its own operating system and applications. It can be said that server **virtualization in cloud computing** is the masking of server resources. The server is familiar with the identity of individual physical servers. The single physical server is divided into multiple isolated virtual servers, with the help of software. Today, the companies contain a large number of servers but don't use them. This result as, the waste of expensive servers. We can use server virtualization in IT infrastructure, this can reduce cost by increasing the utilization of existing servers. Server virtualization generally benefits from small to medium scale applications.

Server Virtualization allows us to use resources efficiently. With the help of server virtualization, you can eliminate the major cost of hardware. This virtualization in Cloud Computing can divide

the workload to the multiple servers and all these virtual servers are capable of performing a dedicated task.

One of the reasons for choosing server virtualization is that a person can move the workload between virtual machine according to the load.

Server virtualization helps to address issues at a time. This is done with the help of specially designed software, an administrator which can convert a single physical server into virtual machines.

The single virtual server acts like an independent physical device which can manage and operate its own operating system. Earlier the scientists created virtual machines on supercomputers for decades and now it is an interesting topic.

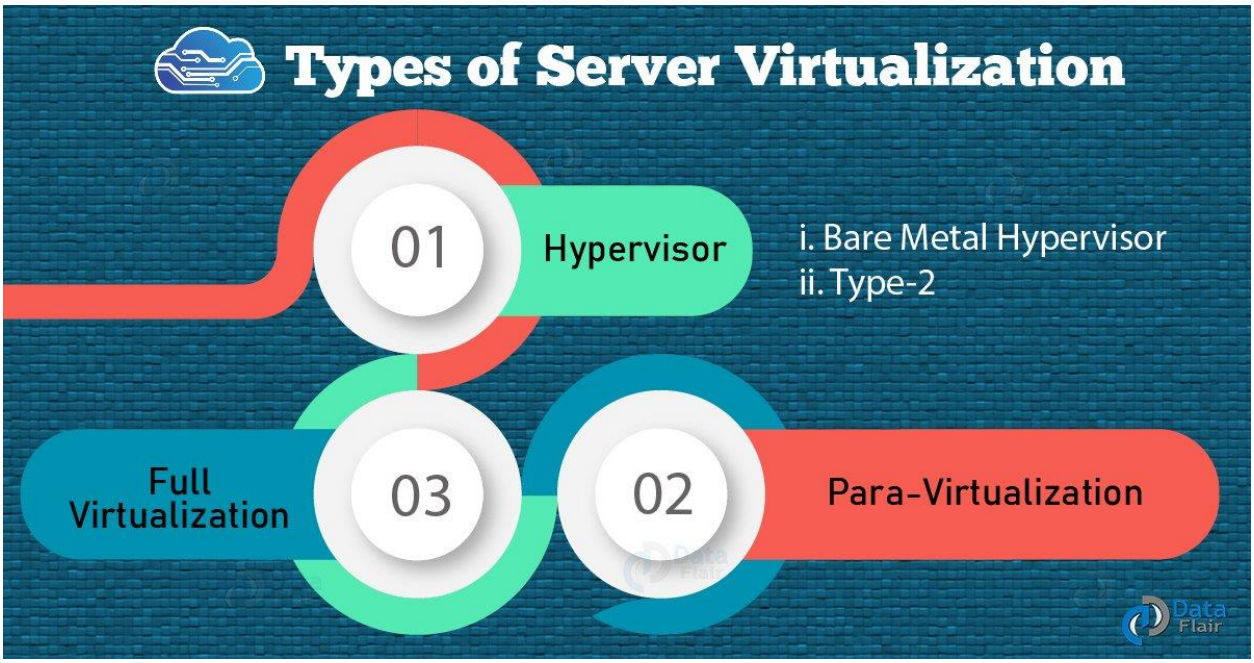
Lucid is the basic principle of working of the server virtualization. Each virtual server performs like a unique physical device, which is capable to run its own operating system. Here software which is specially designed for this purpose is used.

An administrator which is present in the software can convert one physical server into multiple servers. So these multiple servers are enough to use all the machines processing power.

CPU works with multiple processors that provides the ability to run several complicated tasks with ease. Here, the virtual server specially dedicates only to a particular task to perform better. There are many servers which use only a small part of their overall capability.

Types of Server Virtualization

There are 3 types of server virtualization in cloud computing:



Hypervisor

A Hypervisor is a layer between the **operating system** and hardware. The hypervisor is the reason behind the successful running of multiple operating systems.

It can also perform tasks such as handling queues, dispatching and returning the hardware request. Host operating system works on the top of the hypervisor, we use it to administer and manage the virtual machines.

Para-Virtualization

In Para-virtualization model, simulation in trapping overhead in software virtualizations. It is based on the hypervisor and the guest operating system and modified entry compiled for installing it in a virtual machine.

After the modification, the overall performance is increased as the guest operating system communicates directly with the hypervisor.

Full Virtualization

Full virtualizations can emulate the underlying **hardware**. It is quite similar to Para-virtualization. Here, machine operation used by the operating system which is further used to perform input-output or modify the system status.

The unmodified operating system can run on the top of the hypervisor. This is possible because of the operations, which are emulated in the software and the status codes are returned with what the real hardware would deliver.

Types of Hypervisor

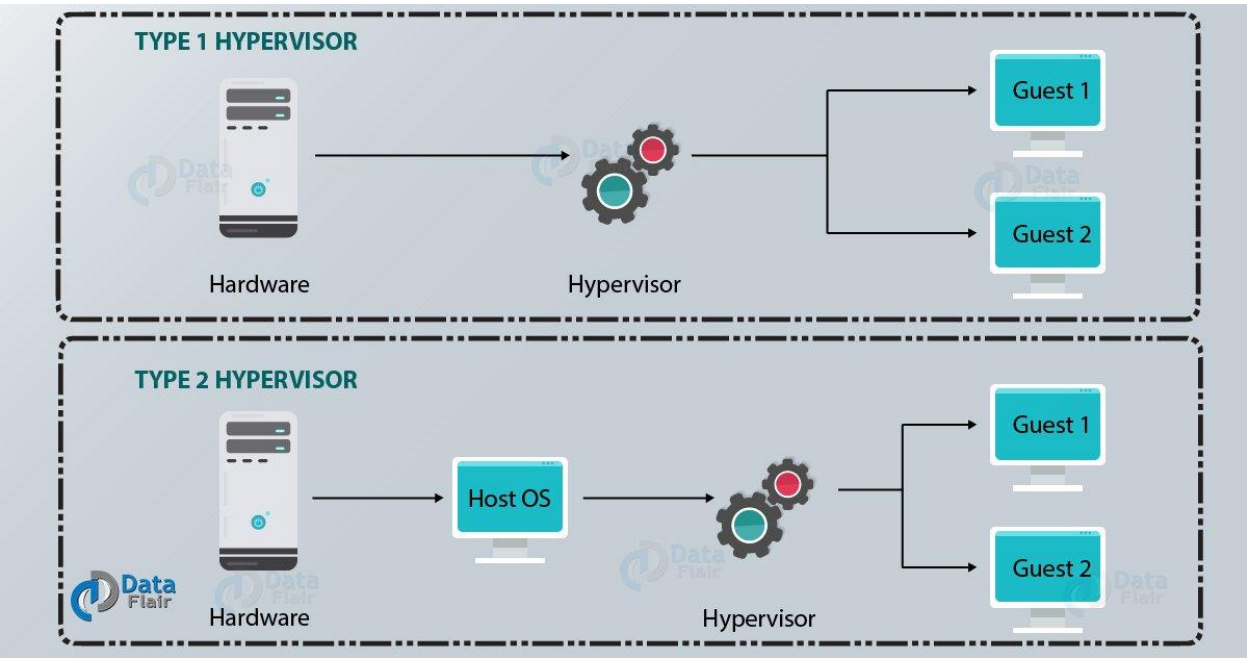
The hypervisor uses to enable server virtualization in Cloud Computing. There are two types of hypervisor such as-

i. Bare Metal Hypervisor

The Bare-metal hypervisor is installed directly on the top of the host hardware. It manages all the hardware resources which are installed inside the tin. The hardware resource is further allocated to the virtual machine. VMware vSphere ESXi is an example of the bare metal hypervisor.

ii. Type-2

The second type of hypervisor runs directly on the top of the conventional operating system. Type 2 hypervisor has some architecture limitation. They are quite popular in a nonproduction environment and VMware Workstation for VirtualBox is the example of type-2.



However, another problem which arises is that the larger the computer network the more complex a server will be.

We can use the virtual server for web service as web hosting services to the customers at very low cost. In web hosting, there is no need for a separate computer as a single web server provides an ample amount of virtual servers which are sufficient enough to handle the whole work.

Why Server Virtualization?

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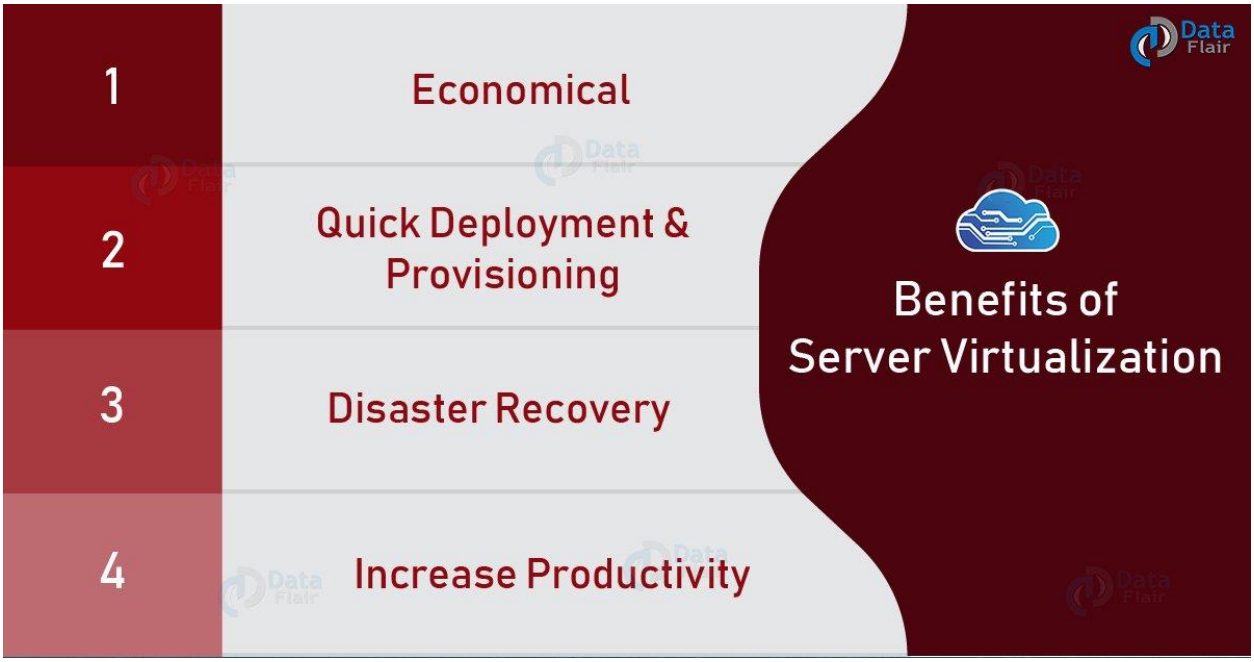
Server Virtualization Benefits



i. Economical

This is one of the major benefits of server virtualization because it can divide a single server into multiple virtual servers which eliminate the cost of physical hardware. Moreover, the applications are no longer in need of their own server as each virtual machine on the server operates them.

ii. Quick Deployment and Provisioning

Within minutes, you can perform the provisioning and deployment process. Here, Server Virtualization allows replicating an existing virtual machine.

iii. Disaster Recovery

A data virtually move from one server to another, quickly and safely. You can store the data anywhere and retrieved from anywhere, this process consumes less time and downtime will be very less.

iv. Increase Productivity

If the physical servers are less in amount then it will be easy for them to maintain. In addition, there are many tools available for making provision and convert services as efficiently as possible. So, this was all about Server Virtualization in Cloud Computing. Hope you liked our explanation.

Load balancing

Cloud load balancing is defined as the method of splitting workloads and computing properties in a cloud computing. It enables enterprise to manage workload demands or application demands by distributing resources among numerous computers, networks or servers. Cloud load balancing includes holding the circulation of workload traffic and demands that exist over the Internet.

As the traffic on the internet growing rapidly, which is about 100% annually of the present traffic? Hence, the workload on the server growing so fast which leads to the overloading of servers mainly for popular web server. There are two elementary solutions to overcome the problem of overloading on the servers-

- First is a single-server solution in which the server is upgraded to a higher performance server. However, the new server may also be overloaded soon, demanding another upgrade. Moreover, the upgrading process is arduous and expensive.
- Second is a multiple-server solution in which a scalable service system on a cluster of servers is built. That's why it is more cost effective as well as more scalable to build a server cluster system for network services.

Load balancing is beneficial with almost any type of service, like HTTP, SMTP, DNS, FTP, and POP/IMAP. It also raises reliability through redundancy. The balancing service is provided

by a dedicated hardware device or program. Cloud-based server's farms can attain more precise scalability and availability using server load balancing.

Load balancing solutions can be categorized into two types –

1. **Software-based load balancers:** Software-based load balancers run on standard hardware (desktop, PCs) and standard operating systems.
2. **Hardware-based load balancer:** Hardware-based load balancers are dedicated boxes which include Application Specific Integrated Circuits (ASICs) adapted for a particular use. ASICs allows high speed promoting of network traffic and are frequently used for transport-level load balancing because hardware-based load balancing is faster in comparison to software solution.

Major Examples of Load Balancers –

1. **Direct Routing Requesting Dispatching Technique:** This approach of request dispatching is like to the one implemented in IBM's Net Dispatcher. A real server and load balancer share the virtual IP address. In this, load balancer takes an interface constructed with the virtual IP address that accepts request packets and it directly routes the packet to the selected servers.
2. **Dispatcher-Based Load Balancing Cluster:** A dispatcher does smart load balancing by utilizing server availability, workload, capability and other user-defined criteria to regulate where to send a TCP/IP request. The dispatcher module of a load balancer can split HTTP requests among various nodes in a cluster. The dispatcher splits the load among many servers in a cluster so the services of various nodes seem like a virtual service on an only IP address; consumers interrelate as if it were a solo server, without having an information about the back-end infrastructure.
3. **Linux Virtual Load Balancer:** It is an open source enhanced load balancing solution used to build extremely scalable and extremely available network services such as HTTP, POP3, FTP, SMTP, media and caching and Voice Over Internet Protocol (VoIP). It is simple and powerful product made for load balancing and fail-over. The load balancer itself is the primary entry point of server cluster systems and can execute Internet Protocol Virtual Server (IPVS), which implements transport-layer load balancing in the Linux kernel also known as Layer-4 switching.

Infrastructure requirement for virtualization

A virtual infrastructure allows us to utilize the IT capabilities of physical resources as software that can be used across multiple platforms. These resources are shared across multiple virtual machines (VMs) and applications for maximum efficiency, creating a virtual infrastructure.

Our business needs are the driving force behind dynamically mapping the physical resources of our infrastructure to applications — even as those needs evolve and change. This resource optimization drives greater flexibility in the organization and results in lower capital and operational costs. For example, aggregating our x86 servers along with network and storage into a unified pool of IT resources that can be utilized by the applications when and where they're needed.

- Bare-metal hypervisors to enable full virtualization of each x86 computer
- Virtual infrastructure services such as resource management and consolidated backup to optimize available resources among virtual machines
- Automation solutions that provide special capabilities to optimize a particular IT process such as provisioning or disaster recovery

Decouple our software environment from its underlying hardware to aggregate multiple servers, storage infrastructure and networks into shared pools of resources. Then dynamically deliver those resources, securely and reliably, to applications as needed. This pioneering approach lets our customers use building blocks of inexpensive industry-standard servers to build a self-optimizing data center and deliver high levels of utilization, availability, automation and flexibility.