8. VIRTUALIZATION IN CLOUD COMPUTING

8.1 What is Virtualization?

In registering, the procedure of making something virtual as opposed to genuine is known as virtualization. It incorporates a virtual fittings stage. In any case it is not restricted to that alone. It likewise incorporates working frameworks, stockpiling gadgets and machine system assets.

The bases of virtualization lay in the 1960s centralized servers when it was a system for intelligently isolating the work applications and isolating them.

There are three separate sorts of virtualization as:

i. **Full virtualization:** It is a complete reenactment of the fittings to permit programming, which is a visitor working framework.

ii. **Partial virtualization:** In this sort, some yet not all the target activities are reenacted.

iii. **Para virtualization:** Here the equipment is not reenacted however the product and the visitor projects are executed in their spaces.

Virtualization permits numerous working frameworks to run simultaneously on a solitary machine.

Over the last ten years, the process has been one of the decentralization. Centralized servers were too expensive to acquire and maintain. Due to this, applications were moved to a large shared server and then to their own physical machines often using commodity hardware. This decentralization process also helps to maintain and upgrade the applications. Since a compromised system is isolated from other systems, it increased the security of the system.

Virtualization is a modification that lies in between centralization and decentralization. Under this process, instead of purchasing and maintaining an entire computer system for on application, each application is given its own operating system, and all the operating systems can function from a single hardware alone.
Virtualization separates the operating systems from the hardware, and so many useful tools become functional. Virtualization allows an operator to control the use of CPU of guest operating system, memory, storage and other resources so that the guest system only gets what is necessary for its function. This helps IT staff to maintain service levels that are required for specific applications. It also minimizes the use of storage and CPU in access by the guest operating system.

With the release of Xen 3.0, virtualization has attained some level of maturity that can be relied upon in complex situations. It must also be noted that in virtualization even the partitioning of a hard drive is virtualizes, it permits devices, human users and application to interact with the virtual resource as a single piece of a logical resources.

In the year of 2005, virtualization became very popular and the demand increased greater than expected. Now, there are three areas, which are advancing rapidly due to virtualization.

- **Network virtualization:** It is a strategy for incorporating accessible assets in a system by part up the current transfer speed into channels. Each one channel is autonomous and can be allocated or reassigned to a specific server or gadget progressively.

  Virtualization, in this manner, rearranges the procedure of the system by making it less intricate and sensible.

- **Storage virtualization:** When the physical storage is pooled from multiple network devices into a single storage device in appearance to manage the functions centrally, it is called storage virtualization. This process is used in SANs.

- **Server virtualization:** It is the process where the server resources are masked and hidden from server users for obvious reasons. The positive aspect of this is the user does not have to worry about the complex details nor does the user have to worry about maintaining the server. In fact, it leaves room for expanding the processes.

Virtualization can sum up as the IT enterprise that includes automatic computing in which the IT environment can maintain itself based on perceived activity. Utility computing is seemed to be power of the computer processing where the client only
pays when it is used and not otherwise. Scalability is the most important task of virtualization today. The enormous proportion of scalability that is provided by virtualization is indeed a benefit to the IT enterprise.

Since virtualization continues to demonstrate tangible benefits, everyone broadens the value of virtualization in the market, increasing the demand. Lesser power consumption is an additional feature of the process. Most of the companies up to now have tested the process of virtualization based solely on the testing of the applications thus far. Virtualization allows developers to working on a single system to write codes that run in many different environments. Once the process of application development smoothest, the server farms also run smoothly without interruptions or breakdowns.

Besides the cost saving aspect of virtualization, it also enhances a business’s agility and speed to process the applications. Businesses that employ work load processing, partitioning, clustering and other virtualization techniques are in a better position to respond to the required speed. Resource utilization is the key word in the IT industry today, and means of cost cutting are a priority which is why the different segments of virtualization as well as the costing is greatly reduced. This has been achieved by collecting different resource pools and putting them together in a process of integration.

In most cases 5% to 25% of the server capacity is utilized by most businesses. Costs are greatly used when the underutilized capacity is in x86 servers in the data centre. The saving is not only one-time savings but an ongoing one.

The virtualization technology changes the way a data center is run, administered and operated. A host of solutions appears with virtualization. It is no longer just a server consolidation, but it provides the kind of flexibility that is hard to imagine unless one is using the process. The live migration capabilities make a network administrator’s life much easier and possibly more productive also. It reduces the physical requirements of the data center, but it can also compund the complexities of the servers, but this can be easily managed by using cross platform facilities.

8.2 Virtualization Theory
As a society moves increasingly towards the virtual processes leaving behind the traditional way of using physical mechanisms to deal with different processes, the
environment is becoming more and more useful in many areas of functioning. Distance learning, electronic commerce, social networking sites and some other application-related sites are amenable to this process.

The virtualization theory deals with the virtualization technology which is used to build virtual networks (VN). Virtualization is not just about Ipsec burrows. It covers an extensive variety of parcels in switches and switches, and convention expansions that coordinate to give rationality to VNs in imparted base.

The hypothesis of virtualization has three fundamental areas:

i) **Devices**: How the movement is kept up and differentiated inside to a gadget. What are the primitives utilized for layers 2, 3 and 4?

ii) **Data way**: How is movement detachment implemented in a system way? What are the instruments to keep up the detachment in a system way?

iii) **Control plane**: Due to the way that the information way manufactures an overlay topology, for these progressions are required to course conventions to a capacity.

It is accordingly, paramount to comprehend the engineering before utilizing it.

**8.3 Network Device Virtualization**

One of the peculiarities of the Virtual Network is that it gives private correspondence way between the parts of a gathering of imparted foundation. This offers climb to two essentials in the system base as:

i) **Traffic from one gathering is never blended with an alternate:**

For sending and accepting over imparted connections, burrows (huge numbers of which are acquired from VPN arrangements) can promise information detachment. System gadgets need to uphold information detachment in the inward memory.

ii) **Each VN has a different location space:**

This necessity is gotten from the way that the VNs offer the same qualities as the physical system. Two of the most fundamental parts of the system are the location space and sending.
8.4 The Process of the Virtualization Theory

The virtualization theory seeks to explain whether processes are suitable for migration to a virtual environment. It is a general theory that extends to the processes that integrate the process of virtualization and the features that enable such an operation to take place. The main idea of defining virtualization as a theory is to explain the process, the technology and understand it before it can be used in separating tasks from a shared infrastructure.

The process virtualization theory seeks to explain whether processes are suitable for migration into the virtual environment or not.

Virtualization can be divided into four levels as:

- Emulation
- Full virtualization
- Para virtualization
- Operating System level virtualization

i. **Emulation:** This technique allows conversion of commands and instructions by using software. Some complex commands take a lot of effort to emulate correctly. In this method, kernel's drivers are not used in the host or the guest. This is an important feature because it makes the software more secure, more portable and the theory allows for running an emulator without first installing it.

ii. **Para virtualization:** This technique allows the execution of normal commands on real CPU without any translation. The risky commands that can take a host system down are not allowed to run as it is pre-translated to keep the environment error free. Para virtualization must have good integration between the host and the guest.

iii. **Full virtualization:** This method uses hot kernels. It allows the execution of normal commands without any translation to run on real CPU. The risky commands that can take a host system down are not allowed to run as it is pre-translated. It required a single architecture on both host and guest.

iv. **Operating level system virtualization:** This method offers the tightest integration between the host and the guest systems by providing a single,
unified and heavily modified kernel that works as both guest and host kernel at the same time.

8.5 VMDK File (Virtual Machine Disk) Structure
VMware developed a file format for its virtual appliance products known as VMDK or Virtual Machine Disk. Earlier, it was an exclusive format but was not an open format. The entire virtual hard disk drives that are used in virtual machines are contained in this format. Some examples are VMware Workstations, Virtual Box, etc. VMDK comes in various sizes with a maximum of 2 TB, but the newer VMware vSpace 5.5 released in September 2013 comes with a 62 TB capacity.

The working of the virtual machines is same as that of the physical machines since they also write on the physical memory only. In the VMDK format, it just mimics the operations of the physical disks. They are stored on the host computer or other storage device and appear as a regular one to the guest operating system. All the VMware provides support for all the VMDK file formats.

VMDK files are either stored on the local storage or else network connected storage by the Data center platforms. On the other hand, VMDK files are stored normally on VMFS partitions for large file storage and also can be stored on NAS partitions.

8.5.1 Layout Basics
There are two key characteristics to describe the virtual disks.

i) Backing up the data using virtual disk can be stored in either a single big file or different smaller files.

ii) Whatever space that the virtual disk’s files might need can be allocated when the virtual desk is under creation. So in this way proper memory management is possible since it is small at first and later the memory keeps on increasing.

The VMware virtual disks contain a descriptor file which describes the data layout in the virtual disk. The virtual disk contains the following links in the chain:

Link A, which is the base link.

Link B, which is the delta link 1.
Link C, which is the delta link 2.

*Extents that make up a link:*

The region of physical storage that is used in a virtual disk was small earlier but keeps growing is known as an “Extent” as:

Extent 0 + Extent 1+ Extent 2 + Extent 3

### 8.5.2 The Descriptor File

Contents of the descriptor file are not case sensitive. Files beginning with symbol # are comments and are ignored by the VMware program that opens the disk. Following is an example of coding:

```plaintext
% cat disk.vmdk

# diskdescriptorFile

version=1

CID=ffffffffe

parentCID=ffffffff

createType="TwoGbmaxExtentSparse"

#extent description

RW4192256 Sparse “test –s001.vmdk“

RW4192256 Sparse “test – s002.vmdk”

RW2101248 Sparse “test-s003.vmdk.”

# data base

#DDB

ddb. adapterType=”ide”

ddb.geomerty.sectors = “63”

ddb.geometry.heads =”16”
```
Next is the Header which gives the description of the version CID if a link has a parent or if a link does not have a parent.

In the case of a base disk with a delta link the parent link has not changed since the time the delta link was created. If the parent link has changed the delta link must be invalidated.

The bottom most links was not modified between the times when the virtual machine was suspended and the time it was resumed or between the time you took a snapshot of the virtual machine and the time take for you to revert back to the snapshot.

Parent CID shows the content ID of the parent link.

Create type shows the type of virtual disk.

To give the full format of the VMDK structure it has:

Image types
-2GbMaxExtentFlat
-2GbMaxExtent Sparse
-MonolithicFlat
-MonolithicSparse

Descriptor File (details already given above)
Extent data File Types
There are multiple types of extent data files.
-RAW extent data file or device
-VMDK Sparse extent data file
-COWD sparse extent data file

8.6 Advantages and Disadvantages of Machine Being a File

- Advantages
• Multiple users can access the files simultaneously. This is the most advantageous in small workstations where there is not much disk space available.
• Large number of programs maintained in a private disk can be accessed by the user.
• Easy administration with a single server and being distributed throughout the network.
• There are very fewer numbers of copies or duplicates, and so it is easier on the network and also for the memory.
• There is fewer numbers of programs working in the backup as well considering the huge amount of the geographical area covered.
• Since the files are all at a single location, the backup process is very simple.
• Administration becomes simple since the centralized files on a single server are easy to maintain.
• It can be accessed by all the users immediately.
• Money-saving techniques, fewer devices, less money.
• It is cheaper to get site licenses than buying all the licenses required for running all the application.
• IMs and emails can be used by network communicators.
• Easy data backups since everything is stored in file servers.

➤ **Disadvantages**
• Security issues arise with sharing of the program. It requires different programs.
• Integrity problems make it essential for explicit programming.
• Access anomalies mean multiple users can access the same file. So sensitive files pose a risk here.
• Some related data from an isolated file when required can pose an issue if the data resides in different isolated files.
• Handling certain queries can be difficult.
• Then there is the question of data redundancy.
• Possibilities if data inconsistency is always there.
• There is also a high risk of data duplication.
• There is a lack of standardized control over the organization of the data files.
• There is also an inconsistency over the structure of the files because of the different types of data in the files.
• Even though a onetime expense, purchasing the servers and cables is a very costly affair.
• There are many complications when managing a huge network.
• If a server breaks down, all the files in it are inaccessible.
• Viruses can easily attack multiples PCs.
• There is the large amount of hacking that takes place in case of WANs.
• To minimize these issues, complicated procedures are required, which are again expensive.

8.7 CPU Virtualization
Virtualization of the hardware is known as CPU Virtualization. This is where any hardware platform that can be controlled by the user or a guest software over a virtual machine on a platform, virtually. This is not limited to guest software but also several operating systems. The software works as if it is the local system itself but with some limitations. The local system resources are managed at a restrictive level. The guests are restricted to using some specific peripheral devices or native devices with restricted hardware use.

Virtualization causes penalties in both reduction in performance and also the resources required to run the hypervisor of the virtual machine compared to the native one. There are reasons for CPU virtualizations.

Many small servers are replaced by one large physical server for improved utilization of the hardware in case of server consolidation. This is very much cost effective since it saves on energy and cooling systems. Furthermore, the virtual machine can be much easily controlled and configured remotely.

A new virtual machine can be provisioned without purchasing new hardware.

Virtual machines cannot only be relocated but help in rapid disaster recovery because the CPU is virtualized.
8.8 X86 Virtualization

This alludes to fittings virtualization about x86 construction modeling. It permits numerous working frameworks to all the while impart the x86 processor. In ensured mode of x86 structural engineering, the working framework Kernel runs at a higher benefit, for example, ring0 and applications at a lower benefit, for example, ring3. In programming based virtualization, the host OS has immediate access to fittings while the visitor OS has restricted access to the equipment.

One approach that is utilized as a part of programming based virtualization is to beat this limit by the procedure usually known as ring de-benefits. This is fundamentally running the visitor programming at a ring higher than Zero.

Virtualization of the secured mode is conceivable due to emulating three systems.

i) Binary interpretation: It is utilized to revamp regarding ring 3 guidelines and certain ring 0 directions, for example, POPF that would come up short noiselessly or act diversely when run at a ring higher than 0. This would make the trap and copy difficult to attain. To enhance execution, the fundamental squares need to be joined in an intelligible manner to identify their utilization of pages by the visitor OS or even changing toward oneself code.

ii) Shadow page tables: various key information structures utilized by a processor need to be shadowed. Since most working frameworks use paged virtual memory and conceding the visitor OS, immediate access to the memory would mean the loss of the control by the virtualization director. A portion of the x86mmu needs to be copied in programming for the visitor OS utilizing a method called shadow page tables.

iii) I/O gadget imitating: Unsupported gadgets and the visitor OS must be imitated by a gadget emulator that runs in the host OS.

8.9 Memory over Commitment

For every running virtual machine, the organized and systematic memory of the virtual machine is reserved for virtualization of overheads.

Due to the management of the memory techniques of the ESxi host, the virtual machines will be able to use more memory compared to the other physical machines. Over commitment makes proper sense because some of the virtual machines are
loaded lightly compared to heavy load machines whose relative levels of activity vary from time to time.

The movement of memory utilization that is the ESxi host normally transfers memory from the idle machine to the virtual machine which constantly needs more memory. The reservations or the parameter of shares is very important to allocate memory to virtual machines. This particular memory is always available to the rest of the virtual machines when the current one is not in use. Another added point is the availability of the memory compression. The memory compression on ESxi hosts is enabled by default to improve the performance of the virtual machine when it is over committed.

8.10 Memory Sharing

A lot of work loads represent various opportunities for sharing the memory beyond the virtual machines. Less memory is consumed along with the sharing of memory and workload as it consists of multiple virtual machines. It would not consume less if it were running on the physical machines.

Due to this particular reason, the system can support over commitment at a higher level. The sharing of the amount of memory saved depends on the features of the work load. The workload of ample of identical virtual machines can release up to thirty percent of memory or more were as a more extensive workload might result in saving the memory of at least five percent.

Figure 8.1 ESxi Mapping of Memory
In the above figure 8.1, the boxes are representing pages, and the arrows are guiding the myriad memory mapping. The arrows from the virtual guest memory to physical guest memory represent the maintaining of the map by the page table in the operating guest system. (The mapping of linking the linear memory to the virtual memory for x86 architecture processor is not available). The arrows linking the machine memory to the guest physical memory shows the maintaining of the map done by VMM. The dashed arrow shows the mapping and linking of the machine memory to the guest virtual memory. They are also maintained by VMM. The shadow table mapping is utilized for the underlying processor who runs the virtual machines.

Due to the increasing level of the memory mappings which is introduced by virtualization, ESxi is quite effective in managing the memory beyond all virtual machines. A few of the virtual memory are mapped in order to share the pages or for those pages which are swapped out or unmapped.

A host is the one who manages the performance of the virtual memory without the complete knowledge of the guest operating system and without interfering with the management of the own memory system of the guest operating system.

**8.11 Consideration of the Performance**

While using the hardware assistance, it is necessary to eliminate the overhead just for the purpose of software memory virtualization. Particularly, the elimination due to the hardware assistance of the overhead is extremely necessary to keep the shadow page tables at par with the guest page tables. While using the TLB miss latency hardware assistance is higher resulting in a debate regarding the benefits of the workload by primarily using the hardware assistance. All this depends upon the overheads that are the cause of memory virtualization while using the software memory virtualization. If there is a small amount of involvement in the workload regarding the page table activity which is mapping the memory, process creation or context switches and significant overheads are not caused by software virtualization. A huge amount of page table activity along with the workloads is very much likely to prove beneficial for the hardware assistance.

Memory virtualization is beneficial for the saving and consolidation of costs. It has challenged the normal way of thinking by people. It has changed the way IT normally
manages applications. Businesses and data centre services. Virtualization is nothing but the abstraction of the IT resources which separates the physical boundaries from its functions. Memory virtualization’s greatest benefit is lesser servers, multiple applications, one main frame and all that are running simultaneously on one mainframe along with a higher capacity of the storage of network.

Memory is essential in all digital machines. Each of them has physical memory and a logic which manipulates the 1s and the 0s. Memory complements logic, which is why the performance gains are essential businesses, which put in the memory and more of its capacity. This memory virtualization presents a direction to decouple memory from a server who provides a distributed function and from a processor. It is a virtualized memory which is shared among multiple machines. It is of utmost importance to remember that storage and memory are not same. Memory virtualization focuses on the performance of application and also focuses on the direct point with the end users. The CPU directly and actively uses data by extracting it from the memory. It is applied in:

a. Extending memory by exceeding the physical server’s capacity.

b. Implementing the shared memory for grid or clustered computing environment.

c. Enabling Real Time Infrastructure and cloud computing in the data center.

**8.12 Extending Memory**

A data set application is normally larger when compared with the available physical memory present in the server. Today, single server memory capacity can range from 1GB to more than 64GB. The memory is the most essential resource of that CPU with which it is connected.

With the use of memory virtualization, the whole working data set can be loaded totally into the memory so that it is easy for the working data to get accessed directly, even without using the disk. It extends consistently by showing improvement in the performance for the end users.

**8.13 Implementation of the Shared Memory**

Memory virtualization is quite effective in enhancing the possibility to deliver high service levels, which are indeed cost effective. By decoupling the physical resources
and channeling those across the network can prove to be provisioned on demand that too with a usage based model of payment.

In the shared mode of resources, services and application are used, and so more memory is required. This memory is shared and is distributed as a network resource which is available. Multiple terabytes of memory is present to all applications. Machines which have a higher end have around 2X invested in memory other than in the storage or CPU. Along with the memory virtualization, ROI is extremely significant and immediate.

8.14 VMS File System

The VMS files system has been ample of features along with the support of the record of ACLs, IO, stream and file versioning. This user and application interface of the file system is the RMS. These are correctly organized into the directories. It contains a list of each and every file which was earlier in the directory. A session is attached to the directory by the VMS on the default disk which is attached with the users ID. It is called the new home directory. Each user ID contains a home directory. This home directory has certain files and several other directories, which are known as the sub directories. These sub directories also contain several files and more sub directories. The same type of file unit is referred when the subject of the sub directory is talked about. The structuring method of the file enables the grouping set processes of the related files which are located in the directories. The basic file structures of directory looks are explained in the following section.

8.14.1 Directory File Structure

The directory at which you are working at all the time is your default directory. The directory file structure in figure 8.2 is as explained below:
i) Creating a directory

Use DIRECTORY command or DCL CREATE.

ii) How to change the default directory?

In order to move from a particular directory to another in the structure of a file, then use the command DCL SET DEFAULT. Whenever the command default is sued, the directory changes to that directory which is specified. It is extremely important to mention a path name to the target directory. This path name always follows a path which is unbroken from the initial level directory which goes down to the target sub directory.

iii) Using the DIRECTORY FILE STRUCTURE, as the example: The command blow specifies the complete path name of the sub directory SUBDIRC:

$ SET DEFAULT

When this command is executed, then SUBDIRC eventually becomes the default directory.
If you still have doubts regarding your location in the structure of the file, then simply use the command DC SHOW DEFAULT to see your default directory. By keeping the track of the default directory, it will help you to keep a track of your files. As an example, certain programs write output files directly to the default directory.

iv) Files

Files are certain documents, which contain different types of data, program output or programming statements. Under VMS, many files can be opened with a lot of editors with the help of EVE and EDT editors. The utility of text processing is SAS text editor or TPU editor. Irrespective of the editor in use, every file should have a unique and different name in that directory.

8.14.2 Storage Virtualization

It is a term or a concept which is widely used in computer science. These systems may use virtualization as a tool which enables better functionality and a lot of advanced features that too within and across the storage systems. Another name for the storage system is a disk array or a storage array or even a fitter. This storage system specially uses software and hardware along with the disk drives in order to provide a very reliable storage for computing and processing. The storage systems are quite complex in their structure. This is due to the provision of storage capacity and data protection as well, which will indeed include the aspect of the security of the data.

Disk drives are the sole elements of the storage systems. There are even other special embedded software and hardware, which come within the storage system. There are basically two types of the storage systems. The first one being the Bock access and the other one is the File access.

The Block access can be delivered and channeled over the fiber channels, SAS, FICON, iSCSI and other protocols. The file access can be provided by using CIFS or NFS protocol.

In the systems of storage, two main types of virtualizations will occur.

*Piece virtualization* will happen on the off chance that it is alluded to the reflection of the rationale stockpiling which originates from the physical stockpiling so it can be
gotten to without any respect to the physical structure and capacity. This division allows a more prominent adaptability to those overseers who deal with the stockpiling for the end clients. The record virtualization addresses those NAS challenges just by killing the conditions among the area of the physical documents put away and the information which is gotten to a distinctive document levels. In these cases, opportunities are accommodated server merging and for capacity utilization. It even gives the movement of the continuous document.

8.14.3 Network Virtualization

- In processing, the methodology of programming and the equipment system assets and their usefulness into sole programming is based element of system. It additionally includes stage virtualization together with the asset virtualization. The system virtualization can even be inside virtualized when it is important to join numerous parts or systems of those system suppliers like the usefulness to a percentage of the product compartments on a solitary level.

Outside virtualization is a blend of any systems or parts of those systems into only one virtualized unit. The principle parts of the system virtualization are:

- Network hardware that is the interface cards or adaptor and switches
- Network elements like the load balancers and the firewalls
- Networks like VLANs or the containers like VMS
- Network storage device
- M2M elements of the network such as the telecom or SLR devices
- Network media like Fiber channel and Ethernet
- Network mobile elements like laptops, phones, tablets, etc.

8.15 Cloud Platform Architectures

Some of the platforms are explained in the following sections.

8.15.1 Understanding Windows Azure Platform Architecture

i) The Windows Azure Developer Portal

Windows Azure is actually a flexible and an open cloud platform, which helps users to deploy, create and even manage applications in less time across the international network of different types of datacenters managed by Microsoft. In fact, Windows Azure platform provides people with a reliable, intuitive and a powerful platform to
create different types of services and web applications. Major portions of this platform will include:

- Windows Azure, which acts as a service or an effective operating system.
- SQL Azure known as the completely functional database of the entire cloud
- AppFabric, as a consumable online service capable of providing federated access control and secured connectivity to perform different types of activities or applications

ii) Creating and running Projects in the Azure Development Platform

Azure Cloud Fabric and its storage services never give support to debugging operations or cloud-based development. Because of this software-development kit or SDK of Azure platform gives clones on-premises in the form of suitable DF, i.e. Development Fabric and even DS, i.e. Development Storage Applications. In addition, the kit can easily install program or windows Azure SDK menu, along with huge collection of libraries and sample applications. All these libraries and sample applications belong to wrapper classes for assuring about the simplification of various types of application programs.

iii) Using Azure Application Templates for Visual Studio 2008

Downloading of Windows Azure Tools for different types of Visual Studios will obviously add template node of Cloud Service into the dialog of New Project. If you choose for double-clicking of the cloud-service node, you would likely open dialog for New Cloud Service Project. In this way, opening of the dialog allows for addition of Worker Roles as ASP. NET Web Roles and CGI Web Roles, in to the big projects. Specifically, Visual Studio 2008 will display a completely new project comprise of two additional Worker Roles and Web Roles. Other than this, SDK of Windows Azure has added its potential or ability to include more than one roles of every type into the Cloud Service.

iv) Taking advantage of Auxiliary Cloud Services

The platform of Windows Azure has incorporated three different sets of auxiliary services, which include Live Services, .NET Services and SQL Azure Database.

v) Deploying Application and Services to the Azure Cloud
Windows Azure Platform provides the ease to deploy different types of applications created by the help of Development Storage along with Fabric and Azure or cloud services. Majority of cloud-based services and applications require persisted state, access to data and even blobs, tables and queues. Most of the high-scale applications involve scalable data. Whenever you choose to design a data-intensive application, your designed application will incorporate codes to enable for importing of data from various types of traditional sources, including online databases, on-premises, web pages, image files, productivity, application documents and several other types of data towards Azure Storage Services.

8.15.2 Analyzing the Windows Azure Operating System

Windows Azure is the operating system of a cloud layer which people can easily operate over different types of Window Service 2008, and its physical instances found in data centers of Microsoft. It is not needed here to gain knowledge about functionality of Azure operating system for deploying and development of services and applications into the Windows Azure Platform. However, if you possess a basic knowledge and understanding about the architecture of Azure software, you would expect to achieve highest possible performance, security and scalability.

i) The Lifecycle, Securing and Isolating Services and Data

Physical servers of data center to operate a customized and an advanced version of the Hyper-V technology of Microsoft. This technology possesses the capability to visualize varying physical instances for the delivery of clustered and runtime fabric referred as FC or Azure Fabric Controller. This type of controller possesses the capability to handle service or application deployment, balancing of load, replication of data or operating system and even resource management. Infrastructure of Windows Azure comprises of physical nodes provided by virtual machines and individual services operating on other servers.

IT managers have unveiled that threats related to privacy of data and security of network present outrageous risks related to survival and success of any organization. Because of this, the majority of professionals belonging to IT department have started focusing on security of perimeter to eliminate undesirable elements from the entire corporate network. For this, IT professionals are using stringent parameters of NAC, i.e. Network Access Control. IT professionals have been now able to prevent the
connection of organizations' intranet with the office workers connecting to the Internet. In this way, people have managed various network hacks and many surreptitious dialing up connections to a huge extent.

ii) Assuring Fabric Controller Availability
Azure Fabric Controller is one of the highly available failover clusters of different replicas operating on minimum five to a maximum seven different machines. Here, you can operate every machine over the simplified and the basic version of Azure Operating System.

iii) Virtualization of Windows Server for Azure
Main objective of the server virtualization is to enhance its utilization or usage, which is even less than 50 percent in between majority of data centers available during modern times. Professionals have also expected about the decrease of server utility due to the common usage of commodity server, while it is not for virtualization of server.

8.15.3 Microsoft Azure Platform as Service

i) Google App Engine
Google App Engine helps users to run their web applications over the infrastructure of Google. These applications are easy to scale, easy to build and easy to maintain according to the needs of growing data storage and traffic. With the availability of App Engine, you do not require servers for maintenance. Instead, you only have to upload your application, so that it gets prepared to serve or help your users.

ii) Google MapReduce / Yahoo Hadoop
USPTO has awarded Google an innovative patent of software method, which covers different principles of distributed MapReduce, which refers to a creative strategy to perform parallel processing activities. If Google's experts choose to enforce the awarded patent in the aggressive way, it would obviously have some significant implications for various types of projects based on open-source software using the technique along with the popular software framework of Hadoop used by Apache Foundations.
Reduce and maps were two different primitives of functional programs used in the software-development process since decades. Map operation helps users to apply suitable function to each item remains present in a proper sequence to return a sequence of similar size in combination with various types of processed values. Reduce or fold operation is responsible for accumulation of contents belonging to a proper sequence into only one return value by simply performing a suitable function to combine items within the sequence other than return values of former iteration.

MapReduce framework of Google roughly follows all these concepts. Here, you process a proper series of different date elements into the map operation and after this combine at the endpoint with reduction of operation to produce the actual output (Paul, 2010).

iii) Eucalyptus
Eucalyptus is the open-source platform to implement IaaS, i.e. Infrastructure as a Service in the both hybrid and private cloud computing environments. This platform is capable of pool together already existing virtualized infrastructure for the creation of various cloud resources for various service infrastructure, storage and network as services.

iv) Nimbus
Nimbus platform is capable of providing a well-integrated set of tools required to ensure scalability and reliability of on-demand resources. The main objective of this software is to allow users to move towards the cloud in a quick and an effortless way to automate and facilitate the complete process. Nimbus software platform also provides a bridge to help users in overlaying of some familiar concepts, including virtual clusters over resources provisioned within the cloud.

v) OpenStack
OpenStack is an international collaboration of cloud computing technologies. Developers are capable of producing ubiquitous open source platform of cloud computing for many private and public clouds. This type of project aims at the delivery of solution for all sort of clouds with massively scalable and simple implementation, which is rich in features. This type of technology comprises of a
proper series of some interrelated projects capable of deliver different components for a solution of cloud infrastructure (Rodriguez-Martinez, 2012).