

Survey On Virtualization With Xen Hypervisor

Mr. Tejas P. Bhatt^{*1}, Asst. Prof. Pinal J. Patel^{#2}

** C.S.E. Department, Government College of Engineering, Gandhinagar
Gujarat Technology University, Gujarat, India.*

*# C.S.E. Department, Government College of Engineering, Gandhinagar
Gujarat Technology University, Gujarat, India*

Abstract

In the cloud computing, there is one virtual machine that can be created and put it out on the physical machine with providing the ideas using the hypervisors. So the virtualization technology has limited security capabilities in order to secure wide area environment such as the cloud. While consolidating physical to virtual machines using Xen hypervisor, we want to be able to deploy and manage virtual machines in the same way we manage and deploy physical machines. For operators and support people there should be no difference between virtual and physical installations. Therefore, the development of a robust security system requires changes in traditional virtualization architecture. So we want to provide security to the multiple operating systems.

Keywords: Virtualization, Xen Hypervisor, virtual machine

I. Introduction

A) What is Cloud Computing:-

Cloud computing is a computing paradigm in which tasks are assigned to a combination of connections, software and services accessed over a network. This network of servers and connections is collectively known as "the cloud." Computing at the scale of the cloud allows users to access supercomputer-level power. Using a thin client or other access point, like an iPhone, Blackberry or laptop, users can reach into the cloud for resources as they

need them. For this reason, cloud computing has also been described as "on-demand computing." The Internet is utilized as a vehicle but it is not the cloud. Google, Amazon, eBay, etc utilize cloud technologies to provide services via the Internet. The cloud technologies are an operating technology built on a vast number of computers that provide a service [1]. **Google** as a best example of cloud computing. What happens when you type and search something on Google? Have you ever thought about this? Does your PC go through all that information, sorts it out for you and display all the relevant results? No, it doesn't. Otherwise, you would wait much longer for a simple results page to display. A simple PC can't process all those billions of websites in a fraction of a second, like Google does. Your PC only serves as a messenger to tell Google what you are looking for. Everything else is done by some of Google's powerful computers located somewhere, Who Knows Where in the world. Exactly, that's a great example of how cloud computing is used [2].

B) What makes cloud computing different? [3]

1) It's managed:-

Most importantly, the service you use is provided by someone else and managed on your behalf. If you're using Google Documents, you don't have to worry about buying umpteen licenses for word-processing software or keeping them up-to-date. Nor do you have to worry about viruses that might affect your computer or about backing up the files you create. Google does all that for you. One basic principle of cloud computing is that you no longer need to worry how the service you're buying is provided: with

Web-based services, you simply concentrate on whatever your job is and leave the problem of providing dependable computing to someone else.

2) It's "on-demand":-

Cloud services are available on-demand and often bought on a "pay-as-you go" or subscription basis. So you typically buy cloud computing the same way you'd buy electricity, telephone services, or Internet access from a utility company. Sometimes cloud computing is free or paid-for in other ways (Hotmail is subsidized by advertising, for example). Just like electricity, you can buy as much or as little of a cloud computing service as you need from one day to the next. That's great if your needs vary unpredictably: it means you don't have to buy your own gigantic computer system and risk have it sitting there doing nothing.

3) It's public or private:-

Now we all have PCs on our desks, we're used to having complete control over our computer systems—and complete responsibility for them as well. Cloud computing changes all that. It comes in two basic flavors, public and private, which are the cloud equivalents of the Internet and Intranets. Web-based email and free services like the ones Google provides are the most familiar examples of public clouds. The world's biggest online retailer, Amazon, became the world's largest provider of public cloud computing in early 2006. When it found it was using only a fraction of its huge, global, computing power, it started renting out its spare capacity over the Net through a new entity called Amazon Web Services. Private cloud computing works in much the same way but you access the resources you use through secure network connections, much like an Intranet. Companies such as Amazon also let you use their publicly accessible cloud to make your own secure private cloud, known as a Virtual Private Cloud (VPC), using virtual private network (VPN) connections.

C) Characteristics of cloud computing: - [4]

- 1) On-demand Self-service: individuals can set themselves up without needing anyone's help;
- 2) Ubiquitous network access: available through standard Internet-enabled devices;
- 3) Location independent resource pooling: processing and storage demands are balanced across a common infrastructure with no particular resource assigned to any individual user;
- 4) Rapid elasticity: consumers can increase or decrease capacity at will;
- 5) Pay per use: consumers are charged fees based on their usage of a combination of computing power, bandwidth use and/or storage

D) Types of Cloud Computing:-[2]



1) Infrastructure as a Service (IaaS) is basically when you buy raw computing hardware to use over the net, usually servers, or online storage. You buy what you need and pay-as-you-go. The best and the most basic example of this type of cloud computing is buying a web hosting for your website. You pay monthly fee to a hosting company for the storage on their servers and to have them serve up files for your website from those servers.

2) Software as a Service (SaaS) is a case where you use the complete software application that's running on someone else's servers. The best example of this is Google Docs, which you can use for creating and storing text documents, presentations, spreadsheets and so on...

3) Platform as a Service (PaaS) is case where you create applications using web-based tools so they run on systems software and hardware provided by another company. As an example, consider a situation where you develop your own e-commerce website but have the whole thing, including the shopping cart, checkout, and payment mechanism running on a merchant's server.

E) The possible deployment models: [4]

- 1) Private cloud: The cloud infrastructure is owned or leased by a single organization and is operated solely for that organization.
- 2) Community cloud: The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations).
- 3) Public cloud: The cloud infrastructure is owned by an organization selling cloud services to the general public or to a large industry group.
- 4) Hybrid cloud: The cloud infrastructure is a composition of two or more clouds (internal, community, or public) that remain unique entities but are bound together by standardized or proprietary technology).

F) Advantages and disadvantages of cloud computing: - [3]

Advantages:-

- Lower upfront costs and reduced infrastructure costs.

- Easy to grow your applications.
- Scale up or down at short notice.
- Only pay for what you use.
- Everything managed under SLAs.
- Overall environmental benefit (lower carbon emissions) of many users efficiently sharing large systems.

management thought security, security and comfort accidents.

II. Virtualization

Introduction to virtual machine [8]

A virtual machine (VM) is a software implementation of a computing environment in which an operating system (OS) or program can be installed and run. The virtual machine typically emulates a physical computing environment, but requests for CPU, memory, hard disk, network and other hardware resources are managed by a virtualization layer which translates these requests to the underlying physical hardware. VMs are created within a virtualization layer, such as a hypervisor or a virtualization platform that runs on top of a client or server operating system. This operating system is known as the host OS. The virtualization layer can be used to create many individual, isolated VM environments. Typically, guest operating systems and programs are not aware that they are running on a virtual platform and, as long as the VM's virtual platform is supported, this software can be installed in the same way it would be deployed to physical server hardware.

For **example**, the guest OS might appear to have a physical hard disk attached to it, but actual I/O requests are translated by the virtualization layer so they actually occur against a file that is accessible by the host OS. Virtual machines can provide numerous advantages over the installation of OS's and software directly on physical hardware. Isolation ensures that applications and services that run within a VM cannot interfere with the host OS or other VMs. VMs can also be easily moved, copied, and reassigned between host servers to optimize hardware resource utilization. Administrators can also take advantage of virtual environments to simply backups, disaster recovery, new deployments and basic system administration tasks. The use of virtual machines also comes with several important management considerations, many of which can be addressed through general systems administration best practices and tools that are designed to managed VMs.

A virtual machine [11] takes the layered approach to its logical conclusion. It treats hardware and the operating system kernel as though they were all hardware. A virtual machine provides an interface identical to the underlying bare hardware. The operating system creates the illusion of multiple processes, each executing on its own processor with its own (virtual) memory.

Disadvantages:-

- Higher ongoing operating costs.
- Greater dependency on service providers.
- Risk of being locked into proprietary or vendor-recommended systems? How easily can you migrate to another system or service provider if you need to?
- What happens if your supplier suddenly decides to stop supporting a product or system you've come to depend on?
- Potential privacy and security risks of putting valuable data on someone else's system in an unknown location?
- Dependency on a reliable Internet connection.

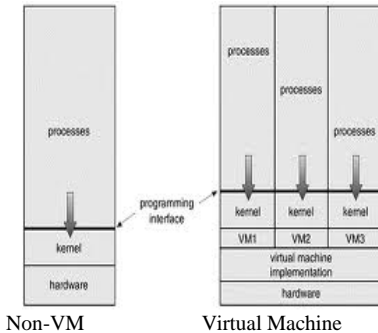
G) *There are some Security issues in cloud computing as follows: [7]*

- 1) Program Availability: You can only realize the value of thought handling when your team relationship and data transfer use age meet your little needs. The thought must be available whenever you need it. If not, the effects are no different than a denial-of-service damage.
- 2) Cloud Organization Viability: Because thought solutions are relatively new to the organization business, there are questions about their balance and investment. This concern improves when a business needs homeowners to use unique joins, creating tenant lock-in.
- 3) Disaster Renewal and Business Continuity: Home entrepreneurs and clients need confidence that their features and solutions will continue if the thought provider's technology environment is subject to a problem.
- 4) Security Incidents: The Company must inform homeowners and clients of any security abuse. Home entrepreneurs or clients may need company support to respond to analyse or research results. Also, a business may not offer sufficient support to homeowners or clients for fixing research.
- 5) Transparency: When a thought company does not present details of its own inner policy or technology, homeowners or clients must believe in the provider's security claims. Home entrepreneurs and clients may still need some exposure by solutions as to how they

The resources of the physical computer are shared to create the virtual machines.

1. CPU scheduling can create the appearance that users have their own processor.
2. Spooling and a file system can provide virtual card readers and virtual line printers.
3. A normal user time-sharing terminal serves as the virtual machine operator's console.

System Models



Advantage of Virtual machine: - [9]

The key benefits of virtual machine technology are:

1) Isolation, 2) standardization, 3) consolidation, 4) ease of testing, and 5) mobility.

1) Isolation:

One of the key reasons to employ virtualization is to isolate applications from each other. Running everything on one machine would be great if it all worked, but many times it results in undesirable interactions or even outright conflicts. The cause often is software problems or business requirements, such as the need for isolated security. Virtual machines allow you to isolate each application (or group of applications) in its own sandbox environment. The virtual machines can run on the same physical machine (simplifying IT hardware management), yet appear as independent machines to the software you are running. For all intents and purposes—except performance, the virtual machines are independent machines. If one virtual machine goes down due to application or operating system error, the others continue running, providing services your business needs to function smoothly.

2) Standardization:

Another key benefit virtual machines provide is standardization. The hardware that is presented to the guest operating system is uniform for the most part, usually with the CPU being the only component that is "pass-through" in the sense that the guest sees what is on the host. A standardized hardware platform reduces support costs and increases the share of IT resources that

you can devote to accomplishing goals that give your business a competitive advantage. The host machines can be different (as indeed they often are when hardware is acquired at different times), but the virtual machines will appear to be the same across all of them.

3) Consolidation:

Virtual machines also increase utilization and promote consolidation. Consolidation of servers results in easier management and decreased hardware costs. The drawback of consolidation is increased susceptibility to hardware failures and increased impact from those failures. However, the risk and negative impact can be mitigated with failover setups where virtual machines on two different physical machines monitor each other with each one ready to take over for the other.

Using virtual machines should not require more physical machines and usually will result in fewer physical machines. This is a great boon because setting up and maintaining physical hardware is messy and time-consuming. On top of that, physical servers consume power. With electricity rising in cost, power savings translate into larger and larger financial savings.

4) Ease of Testing:

Virtual machines let you test scenarios easily. Most virtual machine software today provides snapshot and rollback capabilities. This means you can stop a virtual machine, create a snapshot, perform more operations in the virtual machine, and then roll back again and again until you have finished your testing. This is very handy for software development, but it is also useful for system administration. Admins can snapshot a system and install some software or make some configuration changes that they suspect may destabilize the system. If the software installs or changes work, then the admin can commit the updates. If the updates damage or destroy the system, the admin can roll them back.

5) Mobility:

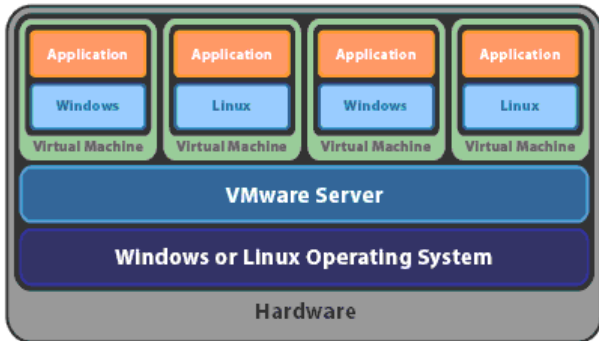
Virtual machines are easy to move between physical machines. Most of the virtual machine software on the market today stores a whole disk in the guest environment as a single file in the host environment. Transferring the virtual machine to another physical machine is as easy as moving the virtual disk file and some configuration files to the other physical machine. Deploying another copy of a virtual machine is the same as transferring a virtual machine, except that instead of moving the files, you copy them. Multiple deployments of a single virtual machine are much easier to achieve than multiple deployments of an operating system on a physical machine.

Virtualization on Cloud

Virtualization (or virtualisation) is the creation of a virtual (rather than actual) version of something, such as a

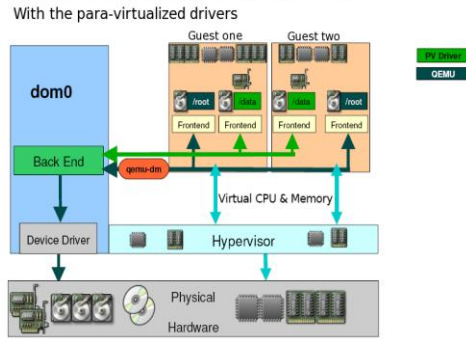
hardware platform, operating system (OS), storage device, or network resources. A virtual machine is subjectively a complete machine (or very close), but objectively merely a set of files and running programs on an actual, physical machine.[5] The virtualization platform is built on a business-ready architecture. Use software such as VMware vSphere to transform or “virtualize” the hardware resources of computer—including the CPU, RAM, hard disk and network controller—to create a fully functional virtual machine that can run its own operating system and applications just like a “real” computer. Each virtual machine contains a complete system, eliminating potential conflicts. VMware virtualization works by inserting a thin layer of software directly on the computer hardware or on a host operating system. This contains a virtual machine monitor or “hypervisor” that allocates hardware resources dynamically and transparently. Multiple operating systems run concurrently on a single physical computer and share hardware resources with each other. By encapsulating an entire machine, including CPU, memory, operating system, and network devices, a virtual machine is completely compatible with all standard x86 operating systems, applications, and device drivers. You can safely run several operating systems and applications at the same time on a single computer, with each having access to the resources it needs when it needs them. [10]

A) Types of Virtualization:- [12][13]



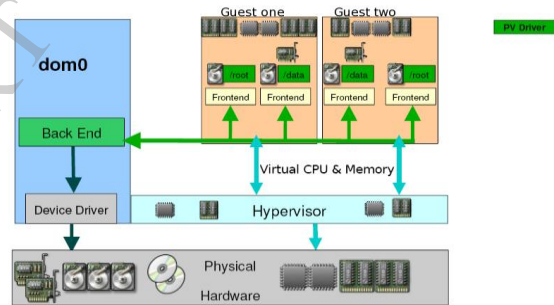
- 1) Native virtualization (or full virtualization) is where a type-2 hypervisor is used to partially allow access to the hardware and partially to simulate hardware in order to allow you to load a full operating system. This is used by emulation packages like VMware Server, Workstation, Virtual PC, and Virtual Server.

Xen Full Virtualization Architecture



- 2) Para virtualization is where the guest operating systems run on the hypervisor, allowing for higher performance and efficiency. For more technical information and videos on this topic, visit VMware’s Technology Preview for Transparent Virtualization. Examples of par virtualization are Microsoft Hyper-V and VMware ESX Server.

Xen Para-virtualization Architecture



dom0=the host or host operating system.

Virtualization is a wide range of application and elements technology that creates Unique Gadgets (VMs) - an abstraction of the elements that allows just one system to act as if it were many devices[7].

Without VMs: A personal OS functions all elements resources.

With VMs: Several OS, each handling its own exclusive system, talk about elements resources.

III. Xen Hypervisor [16]

Xen virtualization, a thin software layer known as the Xen hypervisor is inserted between the server's hardware and the operating system. This provides an abstraction layer that allows each physical server to run one or more "virtual servers", effectively decoupling the operating

system and its applications from the underlying physical server.

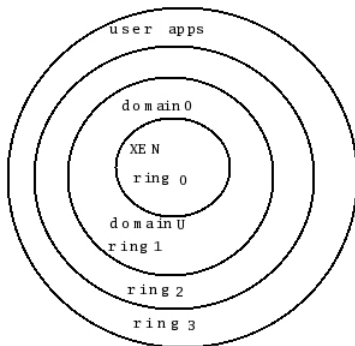
The Xen hypervisor is a unique open source technology, developed collaboratively by the Xen community and engineers at over 50 of the most innovative data center solution vendors, including AMD, Cisco, Dell, Fujitsu, HP, IBM, Intel, Mellanox, Network Appliance, Novell, Red Hat, Samsung, SGI, Sun, Unisys, Veritas, Voltaire, and Citrix.

Xen powers public clouds such as Amazon Web Services, Rackspace Public Cloud and many others. Examples of Xen based server products include Huawei UVP, Oracle VM and XenServer. Examples of client products and appliances include QubesOS, XenClient and Netscaler.

In Xen, a "hypervisor" runs in ring 0, while guest OSes run in ring 1 and applications run in ring 3. The x64/64 is a little different in this respect: both guest kernel and applications run in ring 3.

Xen itself is called a hypervisor because it operates at a higher privilege level than the supervisor code of the guest operating systems that it hosts.

At boot time, Xen is loaded into memory in ring 0. It starts a patched kernel in ring 1; this is called domain 0. From this domain you can create other domains, destroy them, perform migrations of domains, set parameters to a domain and more. The domains you create also run their kernels in ring 1. User applications run in ring 3. See Figure below, illustrating the x86 protection rings in Xen. [17]



The Xen community has created a number of open source solutions for specific purposes:

- 1) The Xen Hypervisor is the open source standard for hardware virtualization and the foundation for all solutions hosted on Xen.org.
- 2) The Xen Cloud Platform is an enterprise-ready virtualization platform based on the Xen Hypervisor, adding a host of extra functionality and integrations for cloud, storage and networking solutions.
- 3) Xen ARM is a Xen based Hypervisor that targets embedded and mobile devices on the ARM architecture.

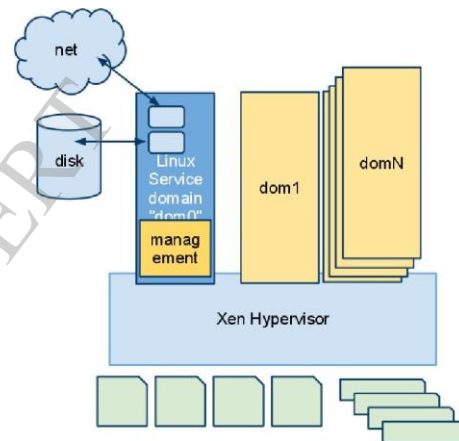
A) Xen Comparison with others:-[15]

- 1) Xen separates the hypervisor execution from management OS, management stack, device drivers, and guests (components)
- 2) Components are interchangeable – choose the best OS to support your needs
- 3) Strong isolation between all components – assisted with modern hardware and domains can restart without taking out full system
- 4) Scalability

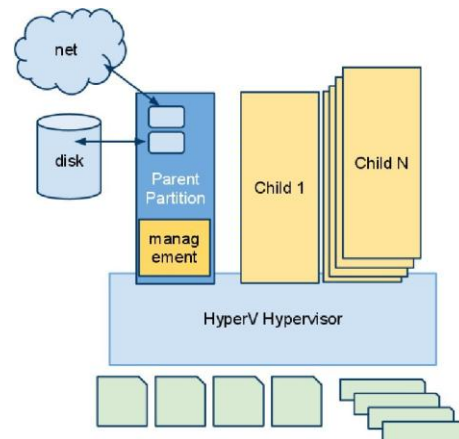
B) Different Hypervisor Architecture Diagrams:- [15]

1) Xen Architecture:-

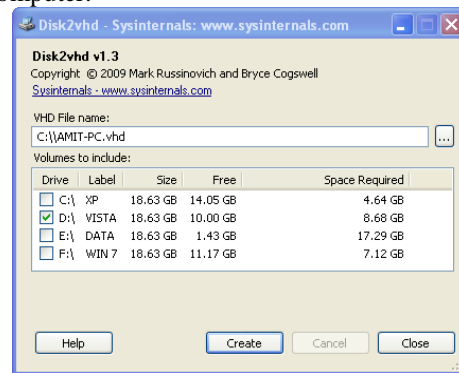
Linux Service domain “Domain0” can be Solaris, BSD, etc.



Hyper-V Architecture:-



- The application will show you the available drives in your computer.



- Select the drive which you want to migrate as a virtual machine. In this case, i would want to create a virtual machine for my Vista installation, hence i have selected the D drive.
- Specify the path where you want to save the virtual hard drive (vhd) file. The file would be of large size and almost equal to the size of the operating system drive.
- Hit the Create button. It would take some time to create the vhd file (mine took 25 minutes).

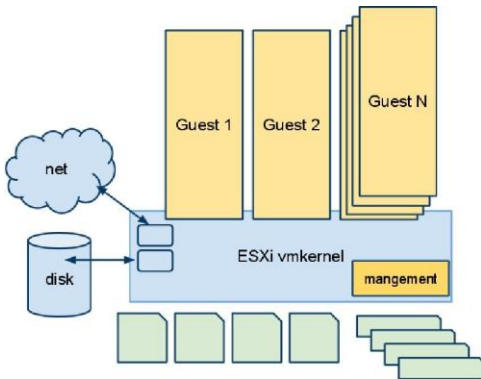
The software will clone a virtual hard disk of the drive selected and save it in specified location. After the vhd file has been created, you can use any virtualization software to mount the virtual hard disk and run the operating system as a virtual machine.

For **example**: I mounted the virtual hard disk on Microsoft Virtual PC and ran Windows Vista as a virtual machine under Windows xp. The software can convert the chosen hard drive into a vhd file, even if it is under use.

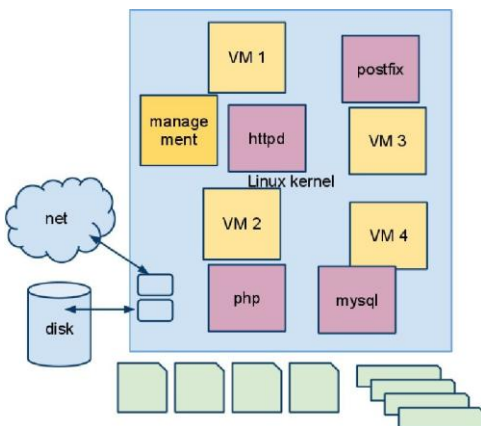
F) Steps for Creating the Virtual Machine: - [7]

- From the Applications menu, select System Tools and then Virtual Machine Manager.
- From the File menu, select new machine.
- Enter the name of the new virtual system and then click forward.
- Enter the location of your install media. Location of the kick start file is optional. Then click forward.
- Install either to a physical disk partition or install to a virtual file system within a file.
- Select memory to allocate the guest and the number of virtual CPUs then click forward.
- Select Forward to open a console and the files start to install.
- Finish the creation virtual machine in centos.

VMware ESXI Architecture:-



KVM Architecture:-



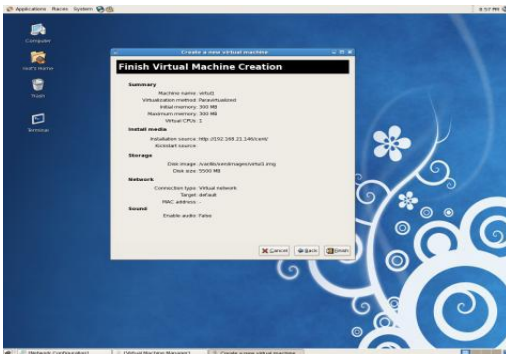
C) How to Convert your Existing Operating System into a Virtual Machine: - [14]

Microsoft has a free application named Disk2vhd, which can create a virtual machine of your existing operating system. The utility is a portable application and does not require any installation. You can run the virtual machine on any computer you want.

Following are the steps involved to create the virtual machine of your existing Windows operating system:

- Download the Zip file (751 Kb) and extract it. After that, just run the Disk2vhd.exe.

In the below screen shot there is virtual machine that can be display another virtual machine in the Centos



With Xen



IV. Future Work

We have done the above experiment for the creation of virtual machine and in which, we have to implement all kind of algorithm of encryption and decryption easily like AES, DES, and MD5.

In the future work, File or Folder level Encryption is an encryption system in which encrypted files, folders and disks are encrypted by features of the file system itself. With the use of these File Level Encryption is beneficial and some advantages implement the file level encryption. We have to do the file level encryption in the virtual machine with the use of AES algorithm and integrate the file level encryption in the cloud.

V. References

[1] Clouds and Software-as-a-Service (SaaS), Social Networks, Web 2.0 Tuesday, March 24, 2009 <http://4cloudcomputing.blogspot.in/2009/03/what-is-cloud-in-simple-terms.html>

[2] Dennis, Gnoted.com Powered by Word Press 2011 <http://gnoted.com/what-is-cloud-computing-simple-terms/>

[3] Chris Woodford. June 22, 2012. <http://www.explainthatstuff.com/cloud-computing-introduction.html>

[4] Maria Spínola September 6, 2009 <http://cloudcomputing.sys-con.com/node/1087426>

[5] Turban, E; King, D; Lee, J; Viehland, D (2008). "Chapter 19: Building E-Commerce Applications and Infrastructure". Electronic Commerce A Managerial Perspective. pp. 27.

[6] Farzad Sabahi "Secure Virtualization for Cloud Environment Using Hypervisor-based Technology" International Journal of Machine Learning and Computing, Vol. 2, No. 1, February 2012

[7] Ashish Maheta, Chirag Patel "Virtualization through Xen Hypervisor" International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622

[8] Anil Desai October 2011 Posted by: Margaret Rous <http://searchservervirtualization.techtarget.com/definition/virtual-machine>

[9] <http://www.devx.com/vmspecialreport/Article/30383>

[10] <http://www.vmware.com/virtualization/what-is-virtualization.html>

[11] [http://www.gitam.edu/eresource/comp/gvr\(os\)/3.4.htm](http://www.gitam.edu/eresource/comp/gvr(os)/3.4.htm)

[12] https://access.redhat.com/knowledge/docs/en-US/Red_Hat_Enterprise_Linux/5/html/Virtualization/glos.html

[13] <http://www.virtualizationadmin.com/faq/difference-between-emulation-native-virtualization-paravirtualization.html>

[14] <http://maketecheasier.com/create-virtual-machine-of-windows-os/2009/11/12>

[15] <http://www.xen.org/files/Marketing/WhyXen.pdf>

[16] <http://www.xen.org/>

[17] <http://www.linuxjournal.com/article/8540>