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A Bubble to Burst in Future: Virtualization

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***Abstract*: Virtualization and Cloudification are the upcoming technologies that will drastically change IT World in the upcoming days. Virtualization and Cloudification deliver the full benefit of the World Wide Web and client server OS. The main objective of virtualization is to multiplex different virtual machines in the same hardware machine. Virtualization enables resources sharing /utilization (and allows businesses enterprises to coalesced their resources) which will leads to reduced IT cost and better performance and scalability of device. This paper will present an overview of virtualization along with cloudification (in cloud computing), types of virtualization, underlying technologies, architecture and the various security issues involved in the virtualization and how to overcome that.**

***Keywords*: Virtual Machine, Host machine, Hypervisor, IDE, Para-virtualization, Emulation, SaaS (Software as a Service), IaaS (Infrastructure as a Service).**

1. Introduction

In general virtualization means preparing/presenting a virtual environment of something that doesn't exist actually, (But in area of computer science, virtualization represent a virtual version of any OS or Network) little bit like Simulation. In other words, Virtualization is a technique, which allows to share a single physical instance of a resource or an application among multiple customers and organizations. Virtualization makes it possible to run any application on the user machine, independent of underlying hardware/Architecture of the machine. It means you can use/ work on any operating system like Unix/Linux/MAC or any software applications which is very expensive to buy or IDE like Net beans for coding. (You don't) there is no need to expand the device/computer memory for downloading the huge software files and to upgrade existing hardware components of your device. We can run multiple operating systems and applications simultaneously on the same machine. Virtualization works best with the cloudification because with the help of cloud computing one can store and access the data anywhere, anytime and on any machine. Without cloud computing we can't utilize capabilities of virtualization to the fullest.

- This technology was initially popularized in 1960's by IBM.
- 1990 VMware released its virtualization product: slow, based on x86 platform (no multi-core), expensive

Now, we have

1. VMware suite
2. MS virtual PC, Hypervisor
3. QEMU (Quick Emulator): open source
4. XEN
5. KVM

2. Virtualization vs. Cloud Computing

Virtualization changes the hardware-software relations and is one of the foundational elements of cloud computing technology that helps utilize cloud computing capabilities to the full. Unlike virtualization, cloud computing refers to the service that results from that change. It describes the delivery of shared computing resources, on-demand services through the Internet. Most of the confusion occurs because virtualization and cloud computing work together to provide different types of services, as is the case with private clouds.

The cloud often includes virtualization products as a part of their service package. The difference is that a true cloud provides the self-service feature, elasticity, automated management, scalability and pay-as-you-go service that is not inherent to the technology.

- Virtualization doesn't depend upon cloud computing environment while without virtualization cloud computing can't exist.
- Cloud computing works on IaaS (Infrastructure as a Service) while virtualization is based upon SaaS (Software as a Service).
- Shared computing resources like software and Hardware provide you a cloud computing environment while Virtualization comes into existence after Machine /Hardware manipulation.
- Cloud Computing provides you flexibility such as pay as you go, self-service, etc. while access to a virtualized environment won't allow you to such features.
- Cloud computing is good for selling your service/software to external users while Virtualization is best for setting up Data Center within the company network/infrastructure.
- Storage capacity is limitless in the Cloud network while in a Virtualization it is dependent upon Physical server capacity.
- Single machine failure won't impact the cloud infrastructure while in virtualization single node failure can impact 100s of virtual machines (If Physical Hardware/Machine is not configured in High Availability)

3. Components and working

Virtualization model consist of following components:

1) *Virtual machine:* Virtual machine are nothing but simply just like some data files that will be downloaded to host machine that will emulate desired environment.
2) *Host Machine:* a machine on which virtual machine is going to build up.
3) *Hypervisor:* It is virtualization software which provides isolation of software and underlying Hardware.

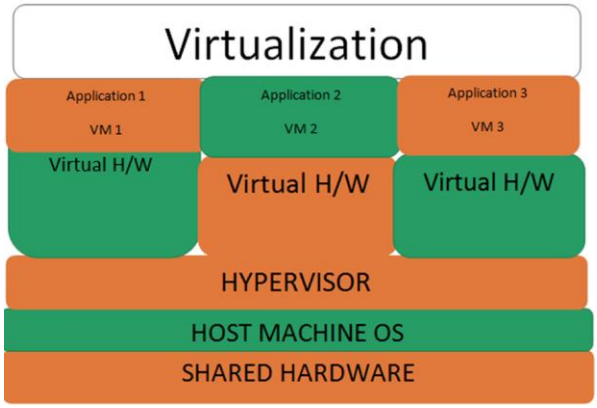

Fig. 1. Virtualization

As we know that virtualization is based on the concept of separating the operating system and applications from the underlying computer architecture. For this purpose "The virtualization software, also known as “the hypervisor" is used that provides the isolation btw the hardware and software. While working on virtual machine, several processes need hardware access to execute successfully. Here the role of hypervisor comes in play; hypervisor will provide an environment & fulfill the need of process and will act as a traditional OS for that particular process. Hypervisor sits between the software and underlying architecture and provides abstraction at various level like:

1. Removal of special hardware and utility requirements.
2. Effective management of resources.
3. Increased employee productivity as a result of better accessibility.
4. Reduced risk of data loss, as data is backed up across multiple storage locations.

4. Types of Virtualization

A. Network Virtualization

Let’s see how is network virtualization used in cloud computing. It refers to the management and monitoring of a computer network as a single managerial entity from a single software-based administrator’s console. It is intended to allow network optimization of data transfer rates, scalability, reliability, flexibility, and security. It also automates many network administrative tasks. Network virtualization is specifically useful for networks that experience a huge, rapid, and unpredictable traffic increase. Network virtualization, provides a facility to create virtual networks—logical switches, routers, firewalls, load balancer, Virtual Private Network (VPN), and workload security within days or even in weeks. The intended result of network virtualization provides improved network productivity and efficiency.

Two categories:

- *Internal:* Provide network like functionality to a single system.
- *External:* Combine many networks, or parts of networks into a virtual unit.

B. Storage Virtualization

Multiple physical storage devices are grouped together, which then appear as a single storage device. This provides various advantages such as homogenization of storage across storage devices of multiple capacity and speeds, reduced downtime, load balancing and better optimization of performance and speed. Partitioning your hard drive into multiple partitions is an example of this virtualization. Storage virtualization is the process of grouping the physical storage from multiple network storage devices so that it looks like a single storage device. It enhances performance by providing greater memory capacity without any addition to the main memory Subtypes:

- *Block Virtualization:* Multiple storage devices are consolidated into one.
- *File Virtualization:* Storage system grants access to files that are stored over multiple hosts.

C. Hardware Virtualization

Hardware virtualization also known as hardware-assisted virtualization or server virtualization runs on the concept that an individual independent segment of hardware or a physical server, may be made up of multiple smaller hardware segments or servers, essentially consolidating multiple physical servers into virtual servers that run on a single primary physical server. Each small server can host a virtual machine, but the entire cluster of servers is treated as a single device by any process requesting the hardware. The hardware resource allotment is done by the hypervisor. The main advantages include increased processing power as a result of maximized hardware utilization and application uptime. Here software are run independent of underlying hardware. The basic idea is to combine many small physical servers into one large physical server, so that the processor can be used more effectively.

Subtypes:

- Full Virtualization – Guest software does not require any modifications since the underlying hardware is fully simulated.
- Emulation Virtualization – The virtual machine simulates the hardware and becomes independent of it. The guest operating system does not require any modifications.
- Para-virtualization – the hardware is not simulated and the guest software run their own isolated domains.

D. Software Virtualization

It provides the ability to the main computer to run and create one or more virtual environments. It is used to enable a complete computer system in order to allow a guest OS to run. For instance, letting Linux to run as a guest that is natively running a Microsoft Windows OS (or vice versa, running Windows as a guest on Linux).

Types:

- Operating system
- Application virtualization
- Service virtualization

E. Memory Virtualization

Physical memory across different servers is aggregated into a single virtualized memory pool. It provides the benefit of an enlarged contiguous working memory. You may already be familiar with this, as some OS such as Microsoft Windows OS allows a portion of your storage disk to serve as an extension of your RAM.

Subtypes:

- Application level control: Applications running on connected computers directly connect to the memory pool through an API or the file system.

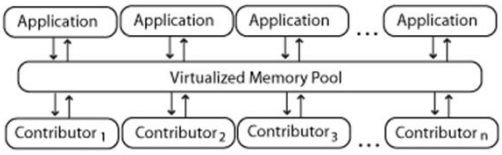

Fig. 2. Application level control

- Operating system level control: Access to the memory pool is provided through an operating system. The operating system first connects to the memory pool, and makes that pooled memory available to applications.

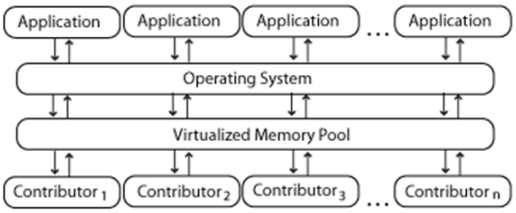

Fig. 3. Operating system level control

5. Various Security Issues and Solutions

A. Network monitoring with cloud computing

Current network defenses are based on physical networks. In the virtualized environment, the network is no longer physical; its configuration can actually change dynamically, which makes network monitoring difficult. To fix this problem, you must have software products (available from companies such as VMWare, IBM, Hewlett-Packard, and CA) that can monitor virtual networks and, ultimately, dynamic virtual networks.

B. Hypervisors and cloud computing security

Just as an OS attack is possible, a hacker can take control of a hypervisor. If the hacker gains control of the hypervisor, he gains control of everything that it controls; therefore, he could do a lot of damage.

C. Configuration and change management

The simple act of changing configurations or patching the software on virtual machines becomes much more complex if the software is locked away in virtual images; in the virtual world, you no longer have a fixed static address to update the configuration.

D. Perimeter security in the cloud

Providing perimeter security, such as firewalls, in a virtual environment is a little more complicated than in a normal network because some virtual servers are outside a firewall. This will be the responsibility of the service provider.

6. Security Solutions

The following are tactics that, if followed, can help mitigate potential threats to virtual environments without the need for burdensome, expensive processes and solutions that simply aren't an option for many organizations.

- *Separation:*

Establish how and where to separate development, test and production virtual machines.

- *Process enforcement:*

Enable IT-specific processes via self-service portals to increase efficiency and simplify management.

- *Sprawl management:*

Actively manage the virtual environment in terms of what is being used, what's needed and what's not.

- *Complete stack management:*

Focus on end-to-end connections within the virtual environment.

- *Built-in auditing:*

Leverage tools to automate security checks, balances and processes wherever possible.

- *Patching:*

Implement a patch maintenance and management process and schedule to make sure patches are up-to-date for both online and offline virtual machines.

7. Conclusion

Virtualization lets you easily outsource your hardware and eliminate any energy costs associated with its operation. Although it may not work for everyone, however the efficiency, security and cost advantages are considerable for you to consider employing it as part of your operations. But whatever type of virtualization you may need, always look for service providers that provide straightforward tools to manage your resources and monitor usage, so that you don't have to spend a lot of time managing your virtual servers and virtualization can

indeed be efficient for you. There are also some security threats that come along with this Technology, but with a knowledge of the primary security risks associated with virtualization and a commitment to following best practices that will mitigate those risks, it's possible for any organization to find a balance between taking advantage of the benefits of virtualization and maintaining the highest levels of security.

References

[1] https://www.slideshare.net/chandraniraychowdhury/virtualization-basics-36408017
[2] https://www.slideshare.net/sasisatyam/introduction-to-virtualization-14723491
[3] https://www.slideshare.net/markanamehul/virtualization-in-cloud-computing-ppt
[4] https://www.slideshare.net/idatapath/virtalization-101-everything-you-need-to-know-to-get-started-with-vmware
[5] https://www.slideshare.net/sasisatyam/introduction-to-virtualization-14723491
[6] https://www.slideshare.net/MangeshG1/virtualization-presentation-17769050
[7] https://profsandhu.com/cs6393_s14/csur_virt_2013.pdf
[8] https://searchservervirtualization.techtarget.com/tip/Virtualization-challenges-Security-storage-and-VM-sprawl
[9] https://searchcloudsecurity.techtarget.com/tip/Top-virtualization-security-risks-and-how-to-prevent-them
[10] http://techgenix.com/virtualization-risks/
[11] https://pediaa.com/what-is-the-difference-between-full-virtualization-and-paravirtualization-in-cloud/
[12] https://www.researchgate.net/publication/307905618_AN_OVERVIEW_OF_VIRTUALIZATION_CLOUD_COMPUTING
[13] https://www.golinuxhub.com/2014/07/comparison-type-1-vs-type-2-hypervisor.html
[14] https://www.globalknowledge.com/us-en/resources/resource-library/articles/virtualization-for-newbies-five-types-of-virtualization/
[15] https://www.educba.com/cloud-computing-vs-virtualization/
[16] https://www.redhat.com/en/topics/cloud-computing/cloud-vs-virtualization.
[17] https://blog.resellerclub.com/what-is-the-difference-between-virtualization-and-cloud-computing/
[18] VMware.com
[19] Microsoft.com
[20] SANS.org
[21] Gartner.com
[22] Trendmicro.com
[23] Symantec.com
[24] http://www.Securiteam.com/cves/2007/CVE-2007-1877
[25] htmlhttp://www.Securiteam.com/cves/2007/CVE