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Virtualization Concept and Live Virtual Machine Migration

[1] Divya Kapil
[1] School of Computing, Graphic Era Hill University,Dehradun, India,

***Abstract*— Virtualization technology was invented to maximize the utilization of hardware resource by IBM in 1960s. Virtualization is the abstraction of the physical resources needed to complete a request and underlying hardware used to provide service. It splits up a physical machine into several virtual machines. A virtual machine can be defined as, "It is a software implementation of a computing environment in which an operating system or application can be installed and run. As hardware cost went down, the need for virtualization faded out. More recently, virtualization become important again to improve availability, security, cost reducing, reliability and flexibility. This paper describes Virtualization technology concept. And also a case study on live virtual machine migration is used to explain the points.**

***Keywords*— Virtualization, Virtual machine, Live virtual machine migration, cloud computing**

INTRODUCTION

Virtualization is logical representation of physical resources. By Virtualization technique resource limit can be removed. In 1960, IBM introduced virtualization technique to maximize the utilization of hardware resources. The expensive and powerful mainframe computers were underutilized. Virtualization is a technology which divides the resources of a computer into multiple execution environments by using one or more technologies such as hardware and software partitioning, time-sharing, partial or complete machine simulation, emulation. Virtualization software examples are VMware ESX / ESXi [1], Virtual PC [2], Xen [3], and Microsoft Hyper-V [4], KVM [5], Virtual-Box [6].
In the early 70's, increasing utilization and level of sharing of costly computing resources such as the mainframes is the main motivation for virtualization.

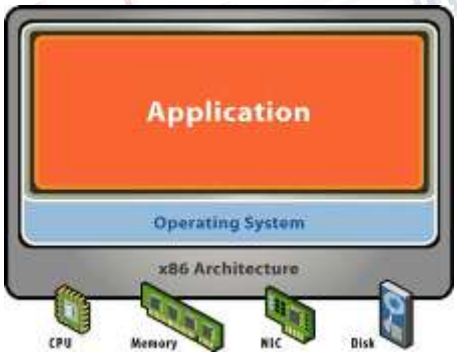

Figure 1 Conventional Architecture

Virtualization can be applied to either single resource or to a complete computing system, also known as Platform Virtualization; it allows multiple "Virtual Machines" in the same computing host.

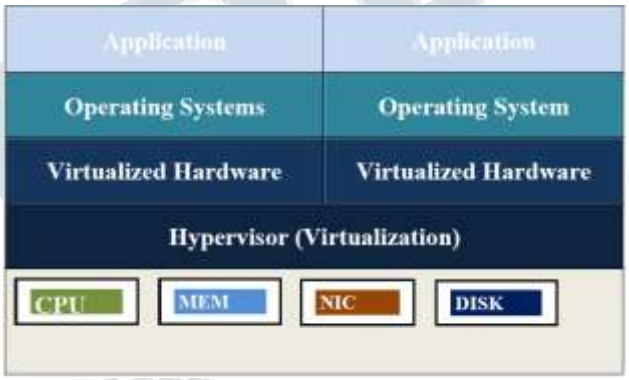

Figure 2 Virtualization Architecture

"A virtual machine (VM) is a software implementation of a computing environment in which an operating system or program can be installed and run".
Virtualization can run multiple operating systems simultaneously as shown in Fig. 2. A single physical machine can have many virtual machines in which isolated operating system instances run.

II. VIRTUALIZATION "KEY TECHNOLOGY" OF CLOUD COMPUTING

[A] Virtual Machine Monitor (VMM or Hypervisor):
Virtual machine monitor (VMM) (also called a hypervisor), which is a logical layer between underlying hardware and computational processes, and runs on the top of a given host. Some popular virtualization software are VMware ESX / ESXi, Virtual PC, Xen, KVM, and VirtualBox. Kinds of Server Virtualization: The physical server is called the host. The virtual servers are called guests. The virtual servers are like physical machines.
1. Full virtualization
2. Para-virtualization

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Full virtualization: It uses a special kind of software called a hypervisor. The hypervisor interacts directly with the physical server's CPU and disk.
Para-virtualization: Unlike the full virtualization, the guest servers in a para-virtualization system are aware of one another. A para-virtualization hypervisor doesn't need much processing power to manage the guest operating systems, because each OS is already aware of the demands the other operating systems are placing on the physical server.

[B] Types of Hypervisor
1. Type-1(Bare-metal)
2. Type-2 (Hosted)

Type 1 (or native, bare metal) hypervisors run directly on the host's hardware to control the hardware and to manage guest operating systems. A guest operating system thus runs on another level above the hypervisor.

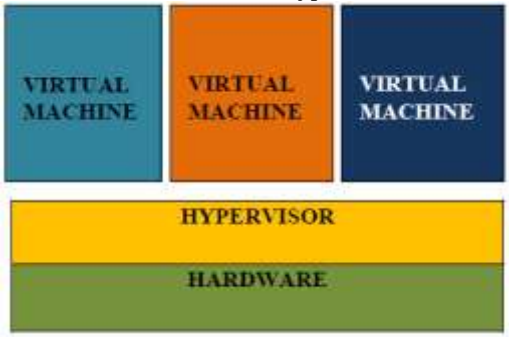

Figure 3 Bare-Metal Virtualization

Type 2 (or hosted) hypervisors run within a conventional operating system environment. With the hypervisor layer as a distinct second software level, guest operating systems run at the third level above the hardware. VMware Workstation and VirtualBox are examples of Type 2 hypervisors.

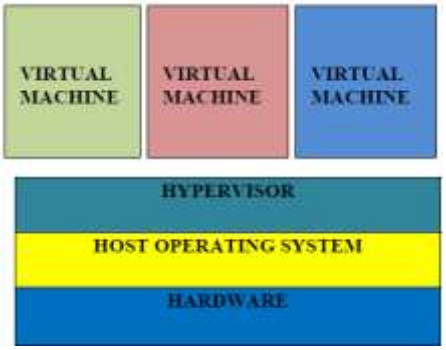

Figure 4 Hosted Virtualization

III. LIVE VIRTUAL MACHINE MIGRATION

Virtualization technology allows multiple operating systems run simultaneously on the same physical machine. Virtualization provides migration of virtual machines from one physical host to another physical host. Virtual machine migration can be used to avoid process level migration problems because VMM avoids Residual Dependencies.

The migration techniques can be classified as:

[A] Static: The static techniques include static migration and cold migration. In static migration, the virtual machine is completely shut down through the operating system. In cold migration the virtual machine is paused, suspended, or frozen in its current execution state.

[B] Dynamic: Dynamic migration, also known as live migration, transfers memory pages from the source and target hosts as the virtual machine continues executing.

[A] Reasons of virtual machine migration
1. Consolidation of virtual machines
2. Load Balancing
3. Energy saving
4. Online system maintenance
5. Fault Management
6. Proactive maintenance

1. Consolidation of virtual machines
Consolidation of virtual machines is very useful for energy optimization in cloud computing environments. We can power on only those physical machines that are hosting virtual machines, and shut down idle servers for energy saving. To reduce energy consumption, we need to reduce the idle power wasted by underutilized servers. Table 1 shows

1.	User Idleness	The user is not actively engaging the VM
2.	Server Capacity	The server has sufficient resources to accommodate the VM
3.	VM Idleness	The VM can execute on the server with sufficient autonomy from the desktop, such that the desktop can sleep and save energy.

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Table 1: Reasons for consolidation

2. Load Balancing
The load balancing determines how to divide work among available machines. Load balancing is essentially a resource management and a scheduling problem. Goals of Load Balancing
i. Fault tolerance in case of system failure
ii. To maintain the system stability
iii. For future modification in the system

3. Energy saving
Data canter's consume enormous amounts of electrical power resulting in high operational costs and carbon dioxide emissions. VMs can be consolidated to save the energy. Live migrations of virtual machines are one of the way to save energy.

4. Online maintenance
To improve system's reliability and availability a system must be connected with the clients and the up gradation and maintenance of the system is also necessary task so for this all VMs are migrated away without disconnecting.

5. Fault Management
To ensure an availability of the computing resources, there is a need for an effective fault management framework.

6. Proactive maintenance: Live virtual machine can replace the failure virtual machine by moving to new physical machine. Disaster recovery is other important feature of live migration.

[B] Performance Metrics
Live virtual machine migration has the capability of migrating a running VM from one physical host to another physical host over LAN or WAN. There are many performance metrics for live virtual machine migration which are shown in table 2.

1.	Preparation Time	Time when migration has started and transferring the VM's state to the target node.
2.	Downtime	The time during which the migrating VM's is not executing. It includes the transfer of processor state.
3.	Resume Time	This is the time between resuming the VM's execution at the target and the end of migration. In this time, all dependencies of the source are eliminated.
4.	Pages Transferred	This is the total amount of memory pages transferred..
5.	Total Migration Time	his is the total time of all the above times from start to finish.
6.	Application Degradation	This is the extent to which migration slows down the applications executing within the VM.

Table 2 Performance Metrics of live virtual machine migration

[C] Live Virtual Machine Migration Technologies
Two major VM migration technologies are VMotion and Xen Motion respectively supported by two major virtualization vendors-VMware [7] and Citrix [8]. Though both VMotion and XenMotion mainly use pre-copy approach to transfer data their underlying VM memory allocation mechanism and data transferring protocol could be quite different. Such diversities result in different performance quality under the same network condition.

1. VMotion
VMware [7] VMotion enables the live migration of running virtual machines from one physical server to another with zero downtime, continuous service availability, and complete transaction integrity. It is transparent to users.

2. XenMotion
With XenMotion [9], virtual machines can be moved from server to server without service interruption for zero-downtime

[D] Live Virtual Machine Migration Techniques in cloud environment
Svard et al. [10] proposed a method dynamic page transfer reordering which dynamically adapt the transfer order of memory pages to reduce the total migration time.
Bose et al. [11] proposed a technique which combines VM replication with VM scheduling To minimize the migration latencies
Svard et al. [12] implemented a live migration algorithm

based on delta compression which is a modification to the KVM hypervisor.
To reduce the consumption of bandwidth and cloud resources, Celesti et al. [13] focus on the dynamic VM allocation and propose a "Composed Image Cloning" (CIC) methodology.

IV. CONCLUSION AND FUTURE WORK

Live virtual machine migration is new technology that has many benefits. In this paper we have discussed virtualization basic concept and live virtual machine migration parameters and technologies. We also discussed some live virtual machine migration techniques in cloud environment. There is no specific performance model of migration, during migration performance of virtual machine degrades. There is one more important issue which should be concerned, that is security when one virtual machine is migrated from one host to another host. In future we plan to propose performance model based on research gap.

REFERENCES

[1] "VMWare ESX/ESXi," Available: http://www. vmware.com/ products/ vsphere /esx -and- esx/, [April 15, 2013]

[2] "Windows Virtual PC," Available: http://www.microsoft.com/ windows/virtualpc/, [April 15, 2013]

[3] "Xen Hypervisor," Available: http:// www. xen. org/ products/ xenhyp.html, [April 15, 2013]

[4] "Hyper-V Server," Available: http: //www. microsoft. com/ server cloud/ hyper-vserver/, [April 15, 2013]

[5] "Kernel-based Virtual Machine," Available: http://www.inux-kvm.org, [April 15, 2013]

[6] "VirtualBox," Available: http://www.virtualbox.org, [April 15, 2013] IEEE Trans. Electron Devices, vol. ED-11, pp. 34-39, Jan. 1959.

[7] http://WWW.vmware.com

[8] Xen, "Xen Hypervisor.", (2012), [online]. Available: http://www.xen.org/products/xenhyp.html [Nov 1, 2012].

[9] https:// www. citrix. com/ blogs/ 2008/ 09/15/ helloxenmotion/

[10] J. T. P. Svard, B. Hudzia, and E. Elmroth, "High performance live migration through dynamic page transfer reordering and compression," in 3rd IEEE International Conference on Cloud Computing Technology and Science (CloudCom 2011), 2011, pp. 542-548.

[11] S. Kumar Bose, S. Brock, R. Skeoch, N. Shaikh, and S. Rao, "Optimizing live migration of virtual machines across wide area networks using integrated replication and scheduling," in IEEE International Systems Conference, 2011, pp. 97-102.

[12] r. S. Petter, H. Benoit, T. Johan, and E. Erik, "Evaluation of delta compression techniques for efficient live migration of large virtual machines," in 7th ACM SIG-PLAN/SIGOPS international conference on Virtual execution environments Newport Beach. vol. 46 California, USA, 2011, pp. 111-120.

[13] A. Celesti, F. Tusa, M. Villari, and A. Puliafito, "Improving Virtual Machine Migration in Federated Cloud Environments," in Second International Conference on Evolving Internet (INTERNET), 2010, pp. 61-67.