

Applications of Server Virtualization Technology

Shrithi H H¹, Vanamala C.K²

¹M. Tech CNE, Department of Information Science & Engineering,
The National Institute of Engineering,
Manandavady Road, Mysore-570008, INDIA

²Assistant Professor, Department of Information Science & Engineering,
The National Institute of Engineering,
Manandavady Road, Mysore-570008, INDIA

Abstract- High performance and efficient servers are the backbone of any solid IT infrastructure. Servers are often under-utilized in their computing capacity by the applications hosted on them. Unpredictable demands due to peak hour usage, and a need for dynamic allocation of computing resources in a server farm, necessitate the use of server virtualization technology. The technology can improve the utilization rate of server greatly and lower the investment of hardware, and meanwhile reduce the cost of operation and maintenance effectively.

Key words: Virtualization, VM

I. INTRODUCTION

High performance and efficient servers are the backbone of any solid IT infrastructure. With the gradual improvement of the system, it is necessary to introduce application servers constantly in order to meet the growing needs, which will lead to the rapid expansion of the servers and we must face complicated software and hardware management and maintenance work. The problems of server management are as follows. Section 2 discusses for the need for server virtualization. Section 3 gives an idea on server virtualization. Section 4 lists out applications of server virtualization.

II. NEED FOR SERVER VIRTUALIZATION

A. The Low Level of Maintenance and Management but High Cost

This is caused by the increase in the number of servers, operating and maintenance costs continue to rise, including the purchase and set up hardware devices, power and cooling requirements, daily monitoring and maintenance, etc. Application environment is very complex, and applications are often developed by different platforms, it requires a lot of manual and material resources for maintenance. If the server system has problems, it will lead to paralysis of applications. In addition, systems also need to stop running when they are upgraded, and it will cause applications disruption.

B. The Percentage of Resource Utilization Is Low

The server which is deployed currently only carries a single service, and most of the server utilization rate is only about 20%. These servers take a lot of data center space and resource to run, which makes the hardware configuration of high servers could not demonstrate their superiority.

C. The Poor Compatibility

Because the number of servers which could support the applications increases year by year, how to make full use of existing old equipment which means protecting the original investment becomes increasingly important. However, the original application platform usually installs older version of the operating system; the introduction of many new hardware devices is no longer available for this operating system support, and how to transport application services between old equipment and new equipment is becoming a problem to IT maintenance staff. In response to these problems, to fully enhance the utilization of server hardware, rather than spend a lot of money to buy a new server is a more ideal solution. Introducing the virtualization technology into the management server, and you can integrate a variety of server resource and save unnecessary expenses, also provide high reliable and high available application services.

III. SERVER VIRTUALIZATION

Virtualization is the ability of a computer to run multiple guests, or virtual machines, such that each guest is unaware of others, and thinks that it has the whole computer systems to itself. This technology was invented about 5 decades ago for mainframes to be able to support multiple users running different tasks, isolated from each other in memory.

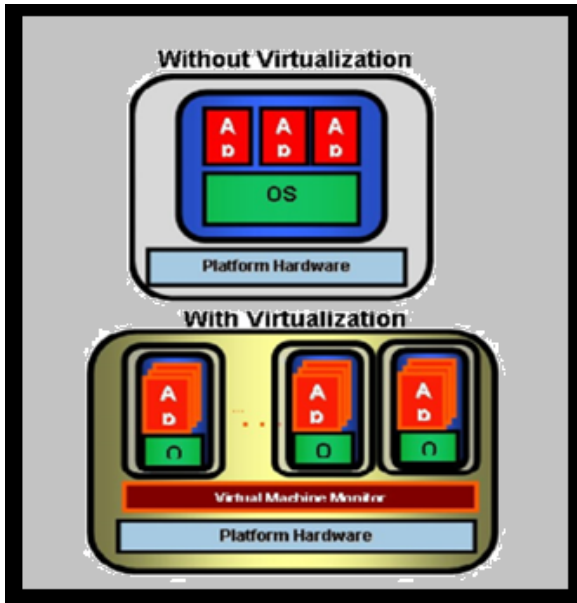


Figure 1: Comparison of non-virtualized vs. virtualization Hardware-Software stack

In figure 1, a layer of software called VMM (virtual machine monitor) support multiple machine instances, isolated in memory and hard disk is partitioned. A view of virtual CPU and other hardware resources is presented to each guest OS in turn, and the guest state is saved between context switching. This technology has several application for servers, such as consolidation, load balancing and failover reliability.

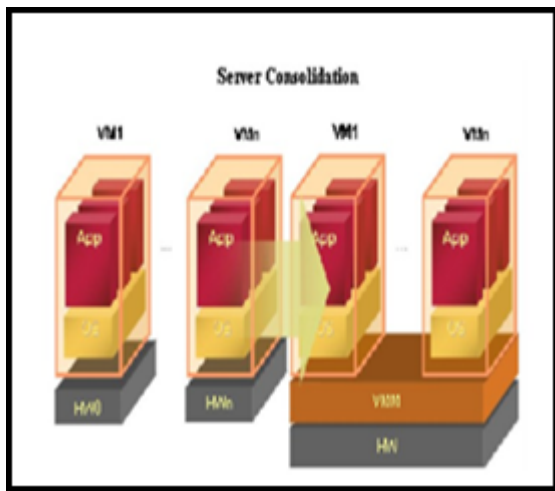


Figure 2: Consolidation enables multiple VMs to run on the same server hardware

In server virtualization, server consolidation refers to the practice of taking OS and application stacks running on several physical servers, with each OS and its apps contained within a virtual server, and then multiple virtual servers running on a single physical server as shown in figure 2. This practice allows better utilization of hardware resources and thereby allow more isolated applications to run in a given server farm infrastructure. The downside is

that if a consolidates server crashes for any reason then all machines running on it will be affected.

Load balancing refers to the ability of an IT manager to take a virtual machine running on a physical server, and move it to another server without stopping it. This becomes possible because a virtual machine is nothing but a large binary file in the memory, with no direct references to the underlying hardware. It can be paused and copied to the memory of another identical physical server, especially if the first servers need to be brought down for regular maintenance or is slowing down due to too many tasks. VMware has a tool Vmotion to aid in such a load balancing tasks.

Failover reliability refers to the ability of preserving the state of a virtual machine and replicating it on another physical server, using memory mirroring or other suitable techniques, in case the first machine suffers failure.

However, it should be noted that the VMM in above applications occupy the ring0 of the CPU, traditionally reserved for OS with privileged calls, and thus it pushes the OS to run in ring1, also known as ring compression. Thus OS is no longer able to make privileged kernel calls, and the VMM traps these to replace them with an equivalent code. This technique for Software virtualization is generally known as Binary Translation.

IV. APPLICATIONS OF SERVER VIRTUALIZATION TECHNOLOGY

A. Digital Forensics Education

Educators in digital forensics struggle with the desire to provide their students with realistic learning environments while protecting production systems from undesirable and potentially illegal interference. Virtualization technology can be used to create realistic learning environments for digital forensics that reduce cost and space requirements while saving students and instructors time. To support the digital forensics data collection and analysis effort there are many tools available, ranging from enterprise level commercial offerings such as Encase and FTK, to Linux distributions such as the Helix live CD [6] which includes many forensically oriented open-source tools.

The application of theoretical concepts has been shown to be an important factor in ensuring that students fully grasp a subject, in addition a providing practical experience that can allow a student to more easily transition to a real work environment. However, actually providing high quality practical exercises for students is not an easy task. For educators seeking to provide such an experience in digital forensics, there are several goals for the learning environment which can be challenging to attain in the traditional computing lab environments, such as:

Virtualization can be used to address many of the challenges faced by educators attempting to provide their students with high quality digital forensics experience including the following:

- Creating an interesting scenario at the host level. Although virtualization does not remove the need to create interesting systems, the resulting virtual machines then exist as a small collection of files in a directory on the host system. VMs can be archived or deployed by simply copying the files (or in the enterprise level products through the use of templating and cloning functionality)
- Creating an interesting network environment. Virtual machines can connect to physical networks in the same manner that physical hosts can, allowing them to participate in exercises based on a physical network. However, multiple VMs running on a physical host can also be connected to a virtual network, allowing realistic networking exercises to be conducted in a completely isolated virtual environment.
- Making the exercise available to students. Deployment of VMs generally means making a few files available to the physical host. Although the files that comprise the VM can be large (depending on the VM configuration), one or more carefully configured VMs can commonly be stored on a CD or DVD, and made available for use by students anywhere that the associated virtualization software is available. Free software that provides sufficient capabilities for students to run most exercises is available from all of the major vendors.
- Resetting the exercise systems for subsequent groups. Restoring a known state for a virtual machine requires nothing more than restoring a file, which can either be done manually, or more commonly, can be accomplished in essentially zero time from within the virtualization software. This allows exercises to be configured to one of multiple known states with almost no delay.

B. Public security Bureau and Fire service department

The information center of the public security bureau and fire service department include fire monitoring systems, e-mail management systems, file storage systems, office automation applications, and departments website presentation systems. These systems using server virtualization technology, make reasonable integration of existing hardware resources, and build a unified virtualization platform to complete the construction of business systems.

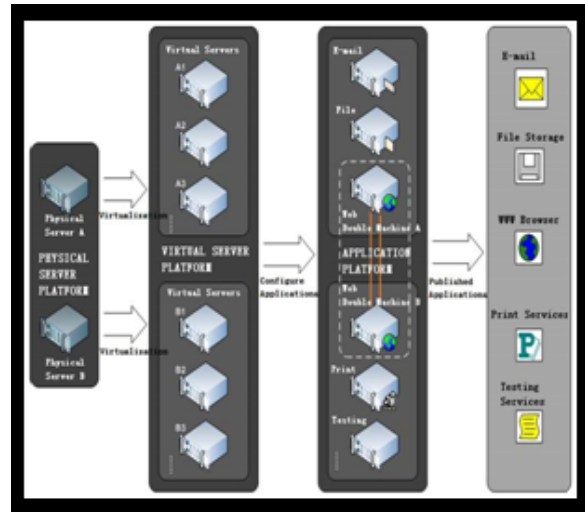


Figure 3. Server virtualization

1 Application Results

By using this visual platform to manage whole hardware resource of application system, the information system of public security bureau and fire service department has the following advantages:

- Hardware resources are fully used. By using this server virtualization platform, two servers will be divided into multiple virtual servers, and each of them keeps independent and is installed different operating systems for different applications.
- Operating consumption is reduced. After the integration of virtualization platform, this technology brings significant savings effects including server power consumption, rack space consumption, power consumption of machine rooms' air-conditionings, and so on; at the same time it declines the number of physical servers, making maintenance and operations of the whole hardware system easier than before [2].
- Improve the security of overall system. Without additional investment of hardware, the virtual platform could provide some application modes such as load balancing and hot standby system for duplicated engine. Thus, the security and the continuity of all application systems are increased to unprecedented levels [2].
- System flexibility is high. According to the different needs of application systems, virtualization server platform allows administrators to adjust resources condition of virtual server; at the same time virtual server could design consolidated server template, so that it is straight-forward to divide template and set up virtual server, which makes the work of upgrading the system become very convenient. Supports dynamic migration of virtual servers.

Virtual server could complete the migration between physical servers within only a few seconds, and application will not be interrupted. The advantage of virtualization platform is independent of physical hardware. Whether the server is damaged or down for maintenance, virtual server can be dynamically moved to safeguard the continuity of the application [2].

- Reducing downtime. Virtualization platform supports dynamic migration of virtual servers. Virtual servers could complete the migration between physical servers within only a few seconds, and application will not be interrupted. The advantage of application platform is independent of physical hardware. Whether the server is damaged or down for maintenance, virtual server can be dynamically moved to safeguard the continuity of the application [2].

V. CONCLUSION

Server virtualization technology is the core of the dynamic resource scheduling, disaster recovery is an effective solution. For server consolidation is the best solution for operating system virtualization, because the operating system server virtualization has a lower loss, so can significantly improve server utilization.

Application of server virtualization technology in the information center of the public security bureau and fire service department shows that it can improve the

utilization rate of server greatly, reduce management problems, and lower the maintenance costs.

Virtualization can provide several advantages to digital forensics educators, and can be applied to provide students with high-quality practical experience with digital forensics topics in a manner which makes efficient use of hardware resources and the time of experts who can share the burden of creating meaningful exercises. In addition, the creation of a remotely accessible virtualized laboratory can allow students to have access to resources from across campus, across the nation, or across the planet, at a time and place that fits their requirements and schedules. As the virtualization field continues to evolve, new tools and approaches are likely to expand the current capabilities leading to better opportunities for virtualization to benefit digital forensics curricula.

REFERENCES

- [1]. Application of Server Virtualization Technology in Enterprise Information, Xianmin Wei, Computer and Communication Engineering School, Weifang University
- [2]. Application of Server Virtualization Technology Based on Citrix XenServer in the Information Center of the Public Security Bureau and Fire Service Department, Jiaxin Wang, Lianhe Yang#2, Miao Yu, Shuai Wang ,School of Computer Science and Software Engineering, Tianjin, Polytechnic University, Tianjin, China
- [3]. Applications of Virtualization to Digital Forensics Education, Brian Hay, Department of Computer Science, University of Alaska Fairbanks
- [4]. Applications of Virtualization for Server Management and Security, Naresh K. Sehgal, Staff Architect, Enterprise Software Technology, Intel Technology India Pvt. Ltd., Bangalore, India