Applications and Scope of Virtualization for Server Consolidation in iT Industry

Gurjit Singh Bhathal 1, Dr. G.N. Singh2

Abstract- Virtualization is a broad term that refers to the abstraction of computer resources. In simple and useful definition, “Virtualization is a technique for hiding the physical characteristics of computing resources from the way in which other systems, applications, or end users interact with those resources. This includes making a single physical resource (such as a server, an operating system or storage device) appear to function as multiple logical resources, or it can include making multiple physical resources appear as a single logical resource.” Platform virtualization: Platform virtualization is performed on a given hardware platform of host computer with virtual machine, which creates a simulated computer environment for its "guest" software. Resource virtualization: Resource virtualization is the virtualization of specific system resources, such as storage volumes, name spaces, and network resources. This paper will discuss their types, applications and advantages of virtualization technologies. It will also demonstrate the business problems.

Keywords- Virtualization, Virtual Machine, VMware.

I. INTRODUCTION

Virtualization has a long history, starting in the mainframe environment and arising from the need to provide isolation between users. The basic trend started with time-sharing systems (enabling multiple users to share a single expensive computer system), aided by innovations in operating system design to support the idea of processes that belong to a single user. The addition of user and supervisor modes on most commercially relevant processors meant that the operating system code could be protected from user programs, using a set of so-called "privileged" instructions reserved for the operating system software running in supervisor mode. Memory protection and, ultimately, virtual memory were invented so that separate address spaces could be assigned to different processes to share the system’s physical memory and ensure that its use by different applications was mutually segregated. These initial enhancements could all be accommodated within the operating system, until the day arrived when different users, or different applications on the same physical machine, wanted to run different operating systems. A number of important challenges are associated with the deployment and configuration of contemporary computing infrastructure. Given the variety of operating systems and their many

versions - including the often-specific configurations required accommodating the wide range of popular applications - it has become quite difficult to establish and manage such systems. This requirement could be satisfied only by supporting multiple VMs, each capable of running its own operating system. Significantly motivated by these challenges, but also owing to several other important opportunities it offers, virtualization has recently become again a principal focus for computer systems software. It enables a single computer to host multiple different operating system stacks, and it decreases server count and reduces overall system complexity. VMware is the most visible and early entrant in this space, but more recently XenSource, Parallels, and Microsoft have introduced virtualization solutions. Many of the major systems vendors, such as IBM, Sun, and Microsoft, have efforts under way to exploit virtualization. Virtualization appears to be far more than just another ephemeral marketplace trend. It is poised to deliver profound changes to the way that both enterprises and consumers use computer systems.

II. BUSINESS PROBLEMS

The IT industry has dramatically evolved over the last decade, allowing businesses to gain access to technology through inexpensive x86 server systems, as well as the applications and operating systems that run on this platform. However, the adoption rate has grown so rapidly that many customers today are forced to deal with the following issues:

1) Inefficient server Hardware Migration

The typical enterprise replaces servers every three years. Although replacing servers may seem like a straightforward process, it can be quite time-consuming, painful, and expensive. The main issue surrounding this is the fact that each operating system is tied directly to the hardware, thereby making it difficult to migrate to newer servers, also in some instances applications can be tied to a particular named instance of the operating system, as well as the hardware. Therefore, each infrastructure refresh cycle can be unattractive to the datacenter, operating systems and applications management teams.

2) Inefficient Application Server Deployment

Application servers are continually added to enhance the business; however, lead times for procuring the hardware and software, performing testing and development, and conducting proof-of-concept modeling, implementation, and end-user training can sometimes take months to complete. Although a number of server deployment technologies are available, they can be very expensive to purchase and
implement, which is why they are not more prevalent in businesses today.

3) High Availability Complexity

Due to the various application architectures and operating systems available, high availability can be difficult to implement. In general, we look at high availability as a series of measures undertaken to implement minimal to near real-time failover for a particular application within the data center. Implementing a highly-available infrastructure increases in complexity as the size of the data center grows, which is what makes it expensive to implement and maintain. Most customers do not need every system to be highly-available, but in general, systems that serve the network backbone, directory services, file and print sharing, email, enterprise applications etc. generally fall into the ‘high availability’ category. Determining the criticality of each application is the first step in creating a highly available infrastructure. This determination should be made by upper management (not IT) and incorporated into the enterprise’s Disaster Recovery Plan. Unfortunately, in almost every case it takes a major application outage to demonstrate the importance of high availability which can be avoided through regular planning and testing.

4) Disaster Recovery Complexity

Disaster Recovery planning has been a major focus for customers in light of recent terrorism activity and power grid failures, as well as the various natural disasters involving tropical storms, tornadoes, and hurricanes over the last decade. However, there are very few enterprises that have implemented disaster recovery procedures as well as a regular testing program. We look at Disaster Recovery as a series of measures undertaken to implement minimal to near real-time failover for a particular application outside the data center involving a hot or cold site. Similar to a highly-available infrastructure, creating a Disaster Recovery site increases in complexity as the size of the data center grows, which makes it incredibly expensive to implement and maintain. Businesses sometimes maintain multiple sites for Disaster Recovery, and in some cases, duplicate the entire infrastructure to avoid any recovery difficulties during large-scale recoveries. Some implement multiple storage area networks and replicate between sites asynchronously or synchronously, which can be very expensive and problematic due to network latencies and distance limitations. Other technologies used in these types of scenarios are geographically dispersed clusters, with nodes in multiple data-centers, giving customers the ability to fail over applications to different data centers at the push of a button. This is a very challenging technology to implement correctly, and in many cases is very expensive and difficult to maintain.

III. DIFFERENT APPLICATIONS AND MODELS

1) Actual Physical Computing Model

Implementing a physical server with an operating system for each application is the most universally deployed server strategy. This strategy isolates the application and prevents any other applications from consuming resources, thereby enhancing application stability and ensuring a consistent end-user experience. However, this physical model actually accounts for the problems associated with server utilization and proliferation.

![Before Virtualization](image1)

**Application**

![Virtual Computing Model](image2)

**Before Virtualization:**

Fig.1. Normal used Architecture of System.

2) Virtual Computing Model

In contrast to the physical model, the Virtual Computing Model increases server utilization while consolidating multiple workloads or server instances on a single physical system.

![After Virtualization](image3)

**Application**

![Virtual Computing Model](image4)

**After Virtualization:**

Fig.2. Virtual Architecture using software layer.

3) Server Virtual Computing Model

Over the last few years, a number of software and hardware vendors have entered the server virtualization space with a common mission of creating hardware independence, increasing utilization, and developing solutions to ease the migration to a real-time enterprise. In order to properly understand virtualization, let’s take a look at two of the most common computing models today. Virtual machines are used to consolidate many physical servers into fewer servers, which in turn host virtual machines. Each physical server is reflected as a virtual machine “guest” residing on a
virtual machine host system. This is also known as Physical-to-Virtual or 'P2V' transformation.

Fig.3. Server Consolidation on one Physical System.

4) Disaster recovery Simplicity

A virtual infrastructure eases the disaster recovery process. Since each virtual machine is independent from the physical hardware, and is encapsulated to a single file, virtual machines can be copied via SAN replication to another data center and can run on completely different hardware. This generally requires a high bandwidth connection between sites, but an alternative approach can also involve the traditional method of tape restoration. Figure 11 below illustrates how SAN replication can copy a virtualized environment from one site to another, thereby cloning the entire production environment in real time. Virtual machines can be used as "hot standby" environments for physical production servers. This changes the classical "backup-and-restore" philosophy, by providing backup images that can "boot" into live virtual machines, capable of taking over workload for a production server experiencing an outage.

Fig.4. Disaster Recovery Architecture in a Virtual Environment by VMware

IV. CONCLUSION

The use of virtualization portends many further opportunities for security and manageability on the client. The examples presented here only begin to illustrate the ways in which virtualization can be applied. Virtualization represents a basic change in the architecture of both systems software and the data center. It offers some important opportunities for cost savings and efficiency in computing infrastructure, and for centralized administration and management of that infrastructure for both servers and clients. We expect it to change the development, testing, and delivery of software fundamentally, with some immediate application in the commercial and enterprise context.

V. REFERENCES

1) Mendel Rosenblum, Chief Scientist, VMware Inc
2) Dr. Dobb's Journal August 2000 By Jason Nieh and Ozgur Can Leonard
3) From Wikipedia, the free encyclopedia
4) Simon Crosby, XenSource and David Brown, Sun Microsyst