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Survey Paper On Different Virtualization TechnologyWith Its Merits And Demerits On Organization

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Abstract

A Virtualized System includes a new layer of software, the virtual machine monitor. The VMM's principal role is to arbitrate accesses to the underlying physical host platform's resources so that multiple operating systems (which are guests of the Virtual Machine Monitor) can share them. The VMM presents to each guest OS a set of virtual platform interfaces that constitute a virtual machine (VM). Once confined to specialized, proprietary, high-end server and mainframe systems, virtualization is now becoming more broadly available and is supported in off-the-shelf systems based on Intel architecture (IA) hardware. Virtualization technology provides hardware support for processor virtualization, enabling simplifications of virtual machine monitor software. Resulting VMMs can support a wider range of legacy and future operating systems while maintaining high performance.

Keywords – ***Virtualization, VMM, Intel Architecture, legacy OS***

I. INTRODUCTION

Virtualization is one of the hottest trends in information technology today. This is no accident. While a variety of technologies fall under the virtualization umbrella, all of them are changing the IT world in significant ways.

Virtualization is software technology which uses a physical resource such as a server and divides it up into virtual resources called virtual machines (VM's). Virtualization allows users to consolidate physical resources, simplify deployment and administration, and reduce power and cooling requirements. While virtualization technology is most popular in the server world, virtualization technology is also being used in data storage such as Storage Area Networks, and inside of operating systems such as Hyper-V (Hypervisor).

II. UNDERSTANDING VERTUALIZATION

To understand modern virtualization technologies, think first about a system without them. Imagine, for example, an application such as Microsoft Word running on a standalone desktop computer. The application is installed and runs directly on the OS, which in turn runs directly on the computer's hardware. The application's user interface is presented via a display that's directly attached to this machine. This simple scenario is familiar to anybody who's ever used Windows.

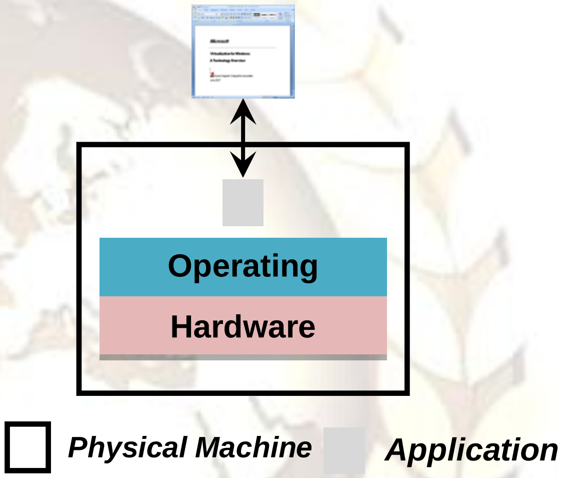

Figure – 1: A System without virtualization

But it's not the only choice. In fact, it's often not the best choice. Rather than locking these various parts together—the operating system to the hardware, the application to the operating system, and the user interface to the local machine—it's possible to loosen the direct reliance these parts have on each other.

Doing this means virtualizing aspects of this environment, something that can be done in various ways. The operating system can be decoupled from the physical hardware it runs on using *hardware virtualization*, for example, while *application virtualization* allows an analogous decoupling between the operating system and the applications that use it. Similarly, *presentation virtualization* allows separating an application's user interface from the physical machine the application runs on. All of these approaches to virtualization help make the links between components less rigid. This lets hardware and software be used in more diverse ways, and it also makes both easier to change. Given that most IT professionals spend most of their time working with what's already installed rather than rolling out new deployments, making their world more malleable is a good thing.

Each type of virtualization also brings other benefits specific to the problem it addresses. Understanding what these are requires knowing more about the technologies themselves. Accordingly, the next sections take a closer look at each one.

III. VIRTUALIZATION TECHNOLOGIES

A. Hardware Virtualization

For most IT people today, the word "virtualization" conjures up thoughts of running multiple operating systems on a single physical machine. This is hardware virtualization, and while it's not the only important kind of virtualization, it is unquestionably the most visible today.

The core idea of hardware virtualization is simple: Use software to create a *virtual machine (VM)* that emulates a physical computer. By providing multiple VMs at once, this approach allows running several operating systems simultaneously on a single physical machine.

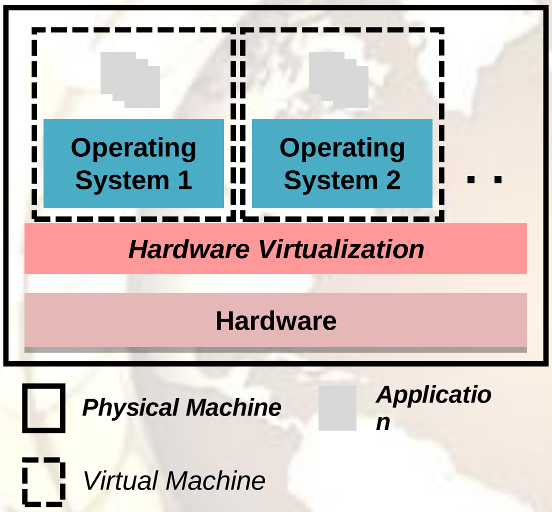

Figure – 2: Hardware virtualization

When used on client machines, this approach is often called *desktop* virtualization, while using it on server systems is known as *server* virtualization. Desktop virtualization can be useful in a variety of situations. One of the most common is to deal with incompatibility between applications and desktop operating systems. For example, suppose a user running Windows Vista needs to use an application that runs only on Windows XP with Service Pack 2. By creating a VM that runs this older operating system, then installing the application in that VM, this problem can be solved.

Server virtualization also makes restoring failed systems easier. VMs are stored as files, and so restoring a failed system can be as simple as copying its file onto a new machine. Since VMs can have different hardware configurations from the physical machine on which they're running, this approach also allows restoring a failed system onto any available machine. There's no requirement to use a physically identical system.

Hardware virtualization can be accomplished in various ways, and so Microsoft offers several different technologies that address this area.

They include the following:

1.) Hyper-V (Windows Server 2008)
2.) Virtual Desktop Infrastructure (VDI)
3.) Virtual PC 2007
4.) MS Enterprise Desktop Virtualization (MED-V)

B. Presentation Virtualization

Much of the software people use most is designed to both run and present its user interface on the same machine. The applications in Microsoft Office are one common example, but there are plenty of others. While accepting this default is fine much of the time, it's not without some downside. For example, organizations that manage many desktop machines must make sure that any sensitive data on those desktops is kept secure. They're also obliged to spend significant amounts of time and money managing the applications resident on those machines. Letting an application execute on a remote server, yet display its user interface locally Presentation virtualization can help.

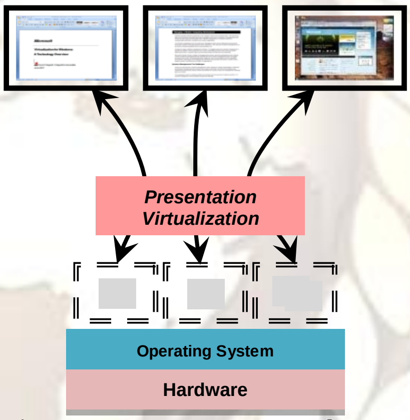

Figure – 3: Presentationvirtualization

This approach allows creating *virtual sessions*, each interacting with a remote desktop system. The applications executing in those sessions rely on presentation virtualization to project their user interfaces remotely. Each session might run only a single application, or it might present its user with a complete desktop offering multiple applications. In either case, several virtual sessions can use the same installed copy of an application.

Running applications on a shared server like this offers several benefits, including the following:

1.) Data can be centralized.
2.) The cost of managing applications can be significantly reduced.
3.) Organizations need no longer worry about incompatibilities between an application and a desktop operating system.
4.) Presentation virtualization can improve performance.

Microsoft's presentation virtualization technology is Windows Terminal Services. First released for Windows NT 4, it's now a standard part of Windows Server 2008. Terminal Services lets an ordinary Windows desktop application run on a shared server machine yet present its user interface on a remote system, such as a desktop computer or thin client. While remote interfaces haven't always been viewed through the lens of virtualization, this perspective can provide a useful way to think about this widely used technology.

C. Application Virtualization

Virtualization provides an abstracted view of some computing resource. Rather than run directly on a physical computer, for example, hardware virtualization lets an operating system run on a software abstraction of a machine. Similarly, presentation virtualization lets an application's user interface be abstracted to a remote device. In both cases, virtualization loosens an otherwise tight bond between components.

Another bond that can benefit from more abstraction is the connection between an application and the operating system it runs on. Every application depends on its operating system for a range of services, including memory allocation, device drivers, and much more. Incompatibilities between an application and its operating system can be addressed by either hardware virtualization or presentation virtualization, as described earlier. But what about incompatibilities between two applications installed on the same instance of an operating system? Applications commonly share various things with other applications on their system, yet this sharing can be problematic. For example, one application might require a specific version of a dynamic link library (DLL) to function, while another application on that system might require a different version of the same DLL. Installing both applications leads to what's commonly known as *DLL hell*, where one of them overwrites the version required by the other. To avoid this, organizations often perform extensive testing before installing a new application, an approach that's workable but time-consuming and expensive.

Application virtualization solves this problem by creating application-specific copies of all shared resources, as Figure 4 illustrates. The problematic things an application might share with other applications on its system—registry entries, specific DLLs, and more—are instead packaged with it, creating a *virtual application*. When a virtual application is deployed, it uses its own copy of these shared resources.

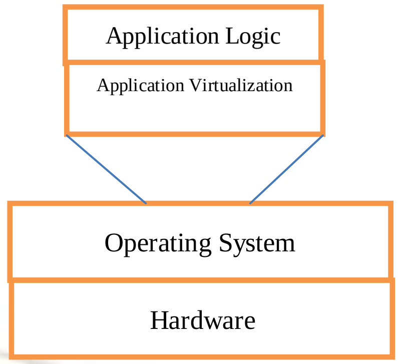

Figure – 4: Applicationvirtualization

Application virtualization makes deployment significantly easier. Since applications no longer compete for DLL versions or other shared aspects of their environment, there's no need to test new applications for conflicts with existing applications before they're rolled out. And as Figure 4 suggests, these virtual applications can run alongside ordinary applications—not everything needs to be virtualized.

D. Other VirtualizationTechnology

This overview looks at three kinds of virtualization: hardware, presentation, and application. Similar kinds of abstraction are also used in other contexts, however. Among the most important are,

1.) Memory Virtualization

- The term ***memory virtualization*** decouples volatile random access memory (RAM) resources from individual systems in the data center, and then aggregates those resources into a virtualized memory pool available to any computer in the cluster. The memory pool is accessed by the operating system or applications running on top of the operating system. The distributed memory pool can then be utilized as a high-speed cache, a messaging layer, or a large, shared memory resource for a CPU or a GPU application.
- *Memory virtualization* allows networked, and therefore distributed, servers to share a pool of memory to overcome physical memory limitations, a common bottleneck in software performance.

2.) Network Virtualization

- The term ***network virtualization*** is used to describe a number of different things. Perhaps the most common is the idea of a virtual private network (VPN). VPNs abstract the notion of a network connection, allowing a remote user to access an organization's internal network just as if she were physically attached to that network. VPNs are a widely implemented idea, and they can use various technologies. In the Microsoft world, the primary VPN technologies today are Internet Security and Acceleration (ISA) Server 2006 and Internet Application Gateway 2007.

3.) Storage Virtualization

- The term ***storage virtualization*** is also used quite broadly. In a general sense, it means providing a logical, abstracted view of physical storage devices, and so anything other than a locally attached disk drive might be viewed in this light.
- A simple example is folder redirection in Windows, which lets the information in a folder be stored on any network-accessible drive. Much more powerful (and more complex) approaches also fit into this category, including storage area networks (SANs) and others. However it's done, the benefits of storage virtualization are analogous to those of every other kind of virtualization: more abstraction and less direct coupling between components.

4.) Database Virtualization

- ***Database virtualization*** is the decoupling of the database layer, which lies between the storage and application layers within the application stack. Virtualization at the database layer allows hardware resources to be extended to allow for better sharing resources between applications and users, masking of the physical location and configuration of a database from querying programs, as well as enable more scalable computing.

A. Virtual Data Partitioning
B. Horizontal Data Partitioning

- **Advantages** :-

C. Added flexibility and agility for existing computing infrastructure.
D. Enhanced database performance.
E. Pooling and sharing computing resources.
F. Simplification of administration and management.
G. Increased fault tolerance.

IV. Understanding Virtualization Use Cases

Virtualization is useful in a number of scenarios. They range from simple and straightforward to complex and transformational. Understanding how you want to use virtualization is critical; because that will dictate which virtualization solution is most appropriate for you. This chapter goes over some of the main uses of virtualization.

- **Server Consolidation :-**

The first application of virtualization is usually server consolidation. In fact, server consolidation is what most people think of when they consider virtualization. *Server consolidation* refers to taking separate server instances and migrating them into virtual machines running on a single server. To be technically correct, consolidation is also the act of taking a number of separate servers and migrating them onto fewer servers, with multiple virtual machines running on each server.

- **Development and Testing Environments :-**

By using*virtualization*, a developer or tester can replicate a distributed environment containing several systems on a single piece of hardware. This negates having a bunch of servers sitting around for the occasional use of developers or testers. Virtualization is also useful in test and development environments in another way. One of the side effects of exercising software is that early versions often crash and damage not only the application, but also the underlying operating system as well as other applications in the software stack. To recover, it's necessary to reinstall all the software. Again, this is areal drag on productivity.

- **Quality of Service :-**

IT organizations must focus on the quality of service they deliver — how well they keep software infrastructures available and performing well.

Fortunately, virtualization, when properly managed, can help improve quality of service because it removes hardware dependence. By virtualizing systems, it is possible to quickly respond to failures of all types: hardware, network, even virtualization software itself. It can also be used to pre-emptively avoid failure by moving workloads off a system that is showing signs of problems (memory, disk, and so on).

Given the demands on IT organizations to continuously improve their operations in order to achieve business goals, it's incumbent upon them to explore how virtualization can help improve quality of service.

Companies run many applications that they consider *mission critical*, which is a fancy term meaning that the company relies on these applications for a fundamental part of their business.

- **Simple Failover :-**

The hypervisor (Hyper – V) is constantly monitoring each virtual machine's status, so it's relatively straightforward to configure it to start a new instance of a virtual machine should it notice a previously running virtual machine is no longer present. Because all the hypervisor has to do is start a new virtual machine based on the VM's image, the outage duration of a virtual machine may be mere seconds. Obviously, this is a huge improvement over the minutes to days durations typical of non-virtualized system restores.

- **High Availability :-**

***High availability* (HA)** extends the concept of simple failover to incorporate an additional hardware server. Instead of crashed virtual machine being started on the same piece of hardware, it is started on a different server, thereby avoiding the problem of a hardware-precluding virtualization failover.

HA provides an extra layer of failover protection at the cost of additional virtualization software complexity

- **Clustering :-**

Clustering is designed to ensure that no data is lost in the event of a software or hardware failure. Clustering has typically been offered by application vendors as an add-on to their base product, with some attendant drawbacks like extra expense, redundant solutions, and infrastructure complexity.

Part of the extra expense reflects the fact that you need extra hardware standing by, with the mirrored system on standby, ready to take over should the primary system fail. You don't need to be a genius to recognize that buying a second set of hardware makes clustering significantly more expensive. However, if you've got millions of U.S. dollars' worth of transactions occurring on your system, keeping a redundant server ready may be a worthwhile investment. And techniques exist that can allow you to run other work on the stand-by server until it is needed.

- **Data Mirroring :-**

All of the qualities of service mechanisms we've discussed thus far address how to keep virtual machines up and running. But what about data? After all, applications inside virtual machines are useless without data — so clearly it's important to ensure data availability as part of an overall quality of service strategy.

One way of keeping data available is to mirror it. As the name implies, mirroring data means that data in one place is reflected to another, ensuring that they are exact copies of oneanother.

Mirroring enables real-time consistency between two data stores. This makes it possible to immediately shift between one system and another by attaching the second system to the mirrored data.

Mirroring achieves this real-time consistency by feeding a constant stream of data changes — whether additions, updates, or deletions — from one location to another.

- **Data Replication :-**

Data replication is a second service oriented toward improving data quality of service. Unlike mirroring, which focuses on keeping copies of data consistent in real-time, replication addresses the need to keep complete copies of data available so that they can be used for system rebuild purposes.

Replicationis typically accomplished by sending copies of data to a centralized storage location, enabling an organization to be certain that it has copies of critical data security stored in case of a need to recover some specific data assets.

Again, efficiency in operation is vital for replication — just because the data is being moved to storage location doesn't mean that keeping the data flowing efficiently isn't important.

Smart replication software keeps up-to-the-minute changes flowing to the central location, thereby ensuring that an IT organization can quickly locate data assets and use them to rebuild a failed system.

V. RETHINKINGVIRTUALIZATION IN BUSINESS TERMS

[INTEL VERTUALIZATION TECHNOLOGY BRIEF]

- Realizing the general value of the virtualized operating model, Intel addressed virtualization at the foundation - the chip level - where they could simultaneously eliminate the need for modifications to the hosted operating systems and provide better performance. The resulting Intel® Virtualization Technology (Intel® VT) not only provides a consistent approach, but also opens the door for wider use of virtualization concepts such as Real-Time System.
- In simple terms, Intel VT adds new instructions, registers and interrupts management that can be used by VMM software to manage virtual environments. These new capabilities can be used to create a VMM that requires no changes to the hosted operating systems. Consequently, legacy systems are well supported and the VMM is not dependent on operating system version, update or patches.
- End users begin to realize the benefits from Intel VT after the suppliers of virtualization software modify their products to use the new capabilities. Intel has involved the virtualization community in the specification and development
- Process and work is underway to utilize Intel VT in commercial products. For example, Microsoft has committed to ongoing support of Intel VT in Windows Servers, and the open source VMM, Xen 3.0, supports Intel VT.
- Intel VT becomes especially attractive when considered in concert with Intel's Dual-Core technology to provide enhanced performance and concurrency of multiple environments to enhance real-time capabilities. Further advances such as Quad-Core will provide additional capabilities.

The Hardware Virtualization Advantage:-

- Intel Virtualization Technology provides silicon based functionality that works together with compatible VMM software to improve upon software-only solutions. Because this virtualization hardware provides a new architecture upon which the operating system runs directly, it removes the binary translation. Thus it eliminates associated performance overhead and vastly simplifies the design of the

VMM, in turn allowing VMMs to be written to common standards and to be more robust.

- The advantage of increase supportability of the overall virtual machine solution.VMMs running under the Intel Virtualization Technology can be fully validated on the hardware, including certification that they execute directly using the architecture's full instruction set.
- Intel Virtualization Technology will provide the basis for a rich ecosystem of virtualization solutions that encompass both server and desktop environments.

VI. BUSINESS SURVEY

- Microsoft, Cisco, Oracle, EMC2 are market-leading innovative companies has adopted the virtualization technology by enabling the application as virtual applications hosted in virtual machines are secured across the network with heightened security, availability, and performance.
- There are no anymore security issues after adopting the pull of virtualization.
- I highlighted some related survey in below table based upon the company and its product and the nature of effect.

Most Valuable Leading Company				
Company	Product	Performance Status	Security Issues	Increased Benefit [In %]
Microsoft	SharePoint	+++	Yes	70%
	SQL Server	+++	None	50%
	Azure	++	None	up to 90%
Cisco	UCS [Unified Computing System]	+++	None	up to 73%
Oracle	Oracle [Database / Web logic applications]	+++	Yes	40%
EMC2	Storage Application Software	+++	None	60%

1) In above table I used the +++ strategy for its high better performance after adopting virtualization. And similarly (++) for better but not so much as compared to (+++) strategy.
2) There are basically no security issues in adopting virtualization technolgy but in some of the criteria I found security issues in some application even if after adopting virtualzation.
3) One main important factor I found is that company's annual income has been increased.

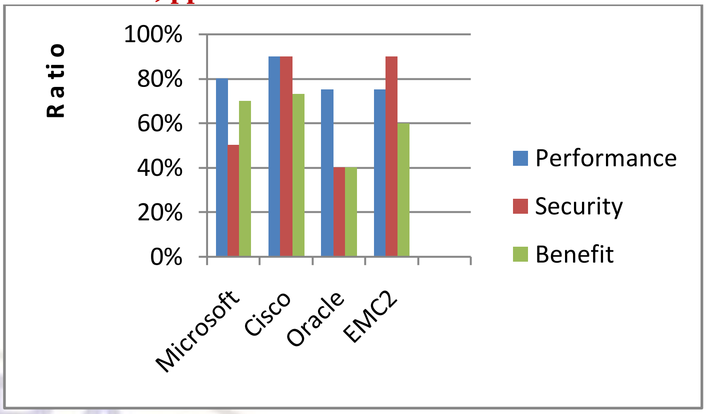

Figure – 5: Result

VII. PITFALLS TO AVOID

- In some cases it doesn't wait any type of protection.
- Don't skimp on training.
- Don't expose for legal issues.
- Don't imagine that virtualization is "Static".
- Don't skip the "Boring stuff". It's an overhead for cloud infrastructure.
- Don't Overlook the Organization.
- Don't Overlook the Hardware.
- Don't Overlook the Service Management.
- Be Prepared for Even More Virtualization in Future.

VIII. CONCLUSION

The pull of Virtualization is strong – the economics are too attractive to resist. And for most organizations, there's no reason to fight against this pull. Well-managed virtualization technologies can make their world better.

Virtualization technologies provide several important features that make it a powerful tool to use in a wide range of applications. These include but are not limited to server consolidation, application sandboxing, access to varieties of hardware and operating systems, testing, simple system administration and quality of service. All these features have made this technology extremely popular in academia and industry. A closer look reveals that although most of them have an operating environment similar to the end-user, they vary greatly in their architecture design, implementation and the level of abstraction at which they operate.

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