# Virtualization is More than Virtual Machine Software

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## OVERVIEW

It is clear to those who have explored the topic of virtualization technology that it encompasses far more than just virtual machine software, such as VMware ESX Server, XenSource XenEnterprise or Microsoft Virtual Server. Over the last 30 years, virtualization technology has been developed to enhance how individuals access computing solutions, how applications are developed and deployed, how they are processed, where and how they are stored, how systems communicate with one another, and, of course, how an extended system environment can be made both secure and manageable. This broad view is very important if an organization hopes to make optimal use of this technology.

Somewhere along the way, many in the industry have come to believe that virtualization is merely the use of virtual machine software. This rather narrow view of virtualization is based upon the view that the whole purpose of virtualization is to encapsulate an operating system and a whole stack of software enabling an application or Web service to run. Virtual machine software then makes it possible for one or more of these "capsules" to run simultaneously on a single machine.

While this viewpoint is useful if the goals were only consolidating an existing application portfolio onto a smaller number of systems, cost reduction, cost avoidance or making it easier to deploy systems for new tasks, it is not as useful if the organization is seeking higher levels of performance, greater levels of scalability, greater agility, high levels of reliability and availability or being able to manage their physical and virtual resources in a uniform way. Virtual machine software, after all, is only one of five virtual processing functions. Virtual processing is one of seven layers of virtualization technology. Decision makers must work with a broader view of virtualization technology.

The Kusnetzky Group believes this state of affairs can be attributed to the marketing prowess of a small number of suppliers of virtual machine software rather than virtualization really being such a limited concept. This paper will examine a useful model of virtualization technology and present what each type of virtualization can do for an organization. Future papers in this series will focus on other aspects of virtualization.

## WHAT IS VIRTUALIZATION?

Virtualization is a way to abstract applications and their underlying components away from the hardware supporting them and present a logical view of these resources. This logical view may be strikingly different than the physical view. The goal usually is one of the following: higher levels of performance, scalability, reliability/availability, agility or to create a unified security and management domain.

## GRAND HISTORY OF VIRTUALIZATION

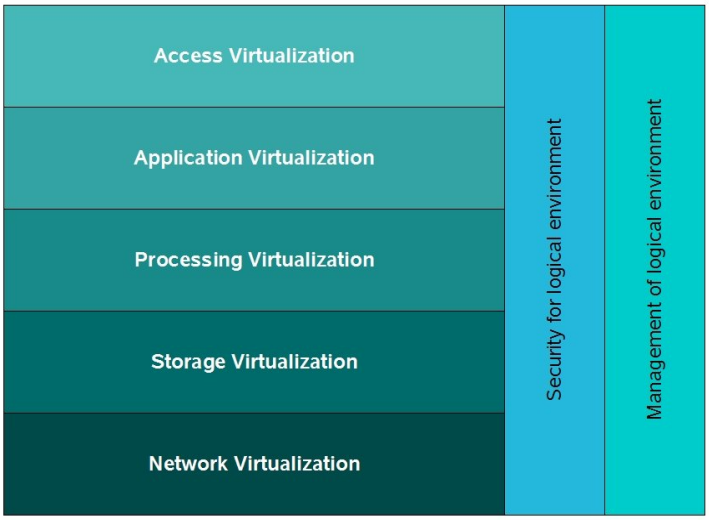
Although some would claim that virtualization is something new and exciting, it is really an established set of technologies that have been steadily evolving for well over 30 years. Mainframe and midrange system suppliers have been offering

virtualization technology, making it possible for many computing resources, such as storage, networking, user access, application development and deployment and processing itself to live in a logical world that is not limited to the constraints of the underlying physical system.

Industry advancements have demonstrated that each layer of a computing environment can experience benefits from virtualization technology. Access mechanisms, application development and deployment frameworks, data management, operating systems, storage management and even networking technology have all been enhanced through the careful application of this concept.

As in other areas of technology, it has been repeatedly shown that no single tool, in this case type of virtualization, is a panacea for all problems.

## KUSNETZKY GROUP'S MODEL OF VIRTUALIZATION TECHNOLOGY

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The Kusnetzky Group has developed a model that describes each of the layers of virtualization technology in use today. Each of these layers allows solutions to exist in a logical or virtual world rather than having to live within the physical constraints of the underlying systems. If one reviewed all of the IT solutions in use in an organization's datacenter, it is likely that all of these layers of technology would be found. Let's consider each of these layers of technology in turn.

### *ACCESS VIRTUALIZATION*

Access virtualization includes hardware and software technology that allows nearly any device to access any application without either having to know too much about the other. The application sees a device it's used to working with. The device sees an application it knows how to display. In some cases, special purpose hardware is used on each side of the network connection to increase performance, allow many users to share a single client system or allow a single individual to see multiple displays. Functions such as terminal services and presentation managers would be found in this layer.

### *APPLICATION VIRTUALIZATION*

Application virtualization includes software technology allowing applications to run on many different operating systems and hardware platforms. This usually means that the application has been written to use an application framework. It also means that applications running on the same system that do not use this framework would not experience the benefits of application virtualization. This layer of technology makes it possible to restart an application in case of a failure, start another instance of an application if the application is not meeting service level objectives, or provide workload balancing among multiple instances of an application to achieve high levels of scalability.

Application virtualization allows an organization to efficiently break down the silos of computing and view all of their industry standard systems as a pool of resources that can be orchestrated dynamically to meet service level objectives, respond to planned or unplanned outages or even to consolidate workloads onto a smaller number of physical systems so that systems may be shut down to reduce power consumption and heat production. It also makes it possible for multiple previously incompatible applications or several versions of a single application to run simultaneously on the same physical system.

### *PROCESSING VIRTUALIZATION*

Processing virtualization includes hardware and software technology that hides physical hardware configuration from system services, operating systems or applications. This type of Virtualization technology ranges from the ability to make one physical system appear to be many or many systems appear to be a single computing resource. Usually this type of technology is deployed to achieve goals ranging from high levels of performance, scalability, reliability/availability, agility or consolidation of multiple environments onto a single system. Different types of processing virtualization are needed to achieve these goals.

Processing virtualization makes it possible for organizations to start multiple instances of applications and balance monolithic workloads across them for scalability or availability, segment tasks to run across multiple machines to improve overall performance or encapsulate entire workloads so that multiple workloads (operating system, network management software, storage management software, data management software, application framework software and the applications themselves) may execute on a single physical machine.

This layer of virtualization technology supports grid computing, single system image clustering, HA/failover clustering, client virtualization, server virtualization and operating system partitioning/virtualization.

Some in the industry would even extend the role of virtual machine software, such as a hypervisor, to being the replacement for all operating systems. While virtual machine software makes it possible for a single physical system to run multiple virtual machines, each of those applications in the virtual machines is still working with an operating system.

Another important point is that there are many types of computing including, real time process control, hand held computing, desktop computing all the way up to massively parallel servers. It's clear that a real time operating system or executive that's perfect for an intelligent microwave oven simply isn't the right choice for a midrange system running jobs for multiple thousands of people. One processing approach isn't appropriate for all purposes.

### *STORAGE VIRTUALIZATION*

Storage virtualization includes hardware and software technology that hides where storage systems are and what type of device is actually supporting applications and data. This technology also makes it possible for many systems to share the same storage devices without knowing that others are also accessing them. This technology also makes it possible to take a snapshot of a live system so that it can be backed up without hindering online or transactional applications.

Storage virtualization makes it possible for many different physical systems to share a single storage resource to reduce the costs of purchasing physical storage for each system or for this storage resource to be replicated several times in different datacenters to facilitate disaster recovery.

This type of virtualization is very important for organizations developing disaster recovery plans. This technology makes it possible for systems to access different storage subsystems without forcing the administration staff to reconfigure all of the network storage configuration settings.

### *NETWORK VIRTUALIZATION*

Network virtualization includes hardware and software technology that presents a view of the network that differs from the physical view. So, a personal computer may be allowed to only see systems it is allowed to access. Another common use is making multiple network links appear to be a single link.

Network virtualization makes it possible for many workloads to share the same network environment securely. Clients may be allowed to only see servers they're allowed to access. Servers may only see clients they support.

This type of virtualization is another very important tool for organizations developing disaster recovery plans. This technology makes it possible for systems to be run in a disaster recovery center without having to reconfigure all of the network settings.

### *MANAGEMENT OF VIRTUALIZED ENVIRONMENTS AND SECURITY*

Two of the most important layers of virtualization are the layers that manage and make secure all of the other layers of virtualization technology. This software technology makes it possible for multiple systems to be provisioned and managed as if they were a single computing resource. Without this layer of technology, organizations would face greater complexity and costs in a virtual environment than they did when they were using only physical systems.

The adoption of all of the layers of virtualization increases the importance of a management framework that allows the organization to:

- discover all of their virtual resources,
- create new virtual environments,
- provision newly created virtual environments,
- query and destroy unneeded virtual resources and
- Administer physical and virtual resources so as to meet service level objectives.

All of this must be possible without requiring the administrative and operational staff to be aware of the complexities of where these resources reside, whether they're physical or virtual resources and understand where these resources actually reside or how they all fit together.

### SUMMARY

Decision-makers face the imperative to develop a clear understanding of the organization's needs as well as an understanding of all of the virtualization technology currently available in order to develop a sound architecture for adoption of this technology. Without these things, an organization is very likely to waste time and money on a patchwork quilt of incompatible point solutions.

Organizations that deploy a single type of virtualization, such as virtual machine software, and use it to the exclusion of other forms of virtualization, it is likely to discover that their datacenter will be less efficient, less reliable and not perform up to their expectations. Complex environments, such as an organizational datacenter are likely to deploy all of these layers of virtualization in some form or another.

These organizations soon learn that it is unwise to replace a physical sprawl with a much more difficult to understand and manage virtual sprawl.

Future documents in this series will examine each of these layers of virtualization in more detail and make recommendations on their use. One of these documents will address the false notion that virtual machine software is the appropriate replacement for all other forms of processing virtualization and operating systems.