

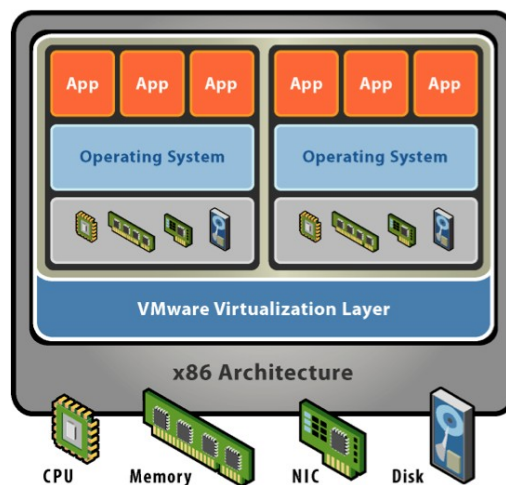
Definitive Logic: Introduction to Virtualization

Overview

Virtualization has developed into one of the IT industry's leading technologies and most important tools to increase efficiency, decrease costs and provide a high level of service to its users. With virtualization, an IT organization can achieve greater results more quickly and at a lower cost. To back up such claims it is important to understand not only the high level abilities of virtualization, but also the technology behind it. This is a rapidly growing industry that has made it their goal to take entire datacenters into a new realm.

What is Virtualization?

Virtualization is a general term that is characterized by the ability of a software platform to dissolve the one to one relationship between Operating Systems (OS) and hardware. In this paradigm, a virtualization platform, whether provided by VMWare, Microsoft, Red Hat or others, provides a hardware abstraction layer that enables an administrator full control over their hardware. All virtualization platforms allow for hardware resources to be dynamically distributed among multiple concurrently running Virtual Machines (VM). This intermediate layer provides the capability to create dedicated virtualized hardware components that are the building blocks for VMs. From these components, which include disk drives, memory, network interfaces and CPUs, a VM is allocated a view of the underlying hardware and is given exactly the necessary resources required to execute its task. Within a virtualized environment it is common to encounter a heterogeneous mixture of VMs including all versions and types of Operating Systems utilizing hot swappable virtual hardware to provide the agility, fault tolerance and efficiency that systems administrators crave.



Source: VMWare.com



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Benefits

The key concepts of virtualization although often complex can be applied to solve real world problems with ease. One of the most readily apparent benefits of virtualizing an environment is the ability to fully utilize hardware, and therefore reduce costs not only on hardware maintenance but also on datacenter operating costs. In a typical non virtualized environment there may be dozens of physical servers sitting idle, either because they are running a legacy rarely used application or perhaps because peak periods of performance are sporadic. With virtualization those systems can be migrated off multiple disparate and often archaic hardware systems onto modern efficient hardware that can run at a high utilization. In this way a single virtualized physical server running at 80% utilization may replace an entire rack of legacy hardware running at only 5% utilization. For new software systems, the concept is the same – a single new application server for example may require at peak utilization 4x4 3 GHz CPUs, but the majority of the time will be sitting idle. With shared dynamic resources, virtualization can reduce your initial hardware costs, maintenance and therefore Total Cost of Ownership by effectively utilizing hardware smarter.

In a virtualized environment with a SAN present a whole host of features become available that were only concepts a few years ago. One of the leaders in this area is VMWare VSphere 4 – which is described as a “Cloud Operating System.” This software platform is unique in that it pools and virtualizes entire sets of hardware. Instead of merely running your virtualized systems on a single physical server, VMWare VSphere has the capability to see the datacenter as a single entity and allocate resources across a heterogeneous mix of virtualized hardware. One of the most dramatic benefits of this approach is zero down time. When hardware fails, which is a fact of life, VMWare VSphere utilizes an included feature called VMotion to move, with zero down time a running VM from one physical server to another. This is possible because the SAN hosts the VM's disk and will stay static regardless of the execution environment. VMotion takes the current data in memory and copies it across the network to create an exact replica of the current execution state. This is done by taking a number of passes through the memory to pick up and copy changes with the final pass and cut over happening in within the limits of a TCP timeout. This combined with VMWare's ability to boot up fully configured cloned copies of operating systems and applications servers gives a datacenter the enviable positions of being able to scale on the fly.

With this technology it becomes possible to execute other advanced datacenter strategies such as disaster recovery, co-location, real time backups, environment duplication and isolation.

Architecture

Like many mature technologies virtualization has a vast array of options and features available, and often with competing strategies from different vendors. This discussion will focus on terms and architectures that are geared towards VMWare, however many of these features are available from



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other vendors.

Virtualization has two distinct architectures – Hosted and Hypervisor. The former architecture describes an environment where virtualization technology is installed onto an existing Operating System. This technology, while older and not nearly as efficient, is still a viable solution for small virtual environments, and desktop installations. The latter, Hypervisor architecture is often referred to as “bare-metal” and like the name states installs the virtualization layer directly onto the hardware. In effect your Operating System is the virtualization platform. The Hypervisor's direct access to the hardware resources rather than operating through another software layer enables a significant performance improvement over the Hosted architecture. Of course the differences do not end with the installation method, but rather change the method of interaction between the virtualization platform and hardware, which is highly important for resources such as the CPU. Although this is only a brief introduction to these terms, what is important to comprehend is that virtualization takes full responsibility for managing hardware resources and the VM's interaction with them. For example the CPUs of a system can either be dedicated to a single VM or shared amongst a pool of resources to be dynamically allocated to VMs that require temporarily increased processing power. The same holds true for memory, networking and device IO. For example, VMWare has a Virtual Machine Monitor (VMM) dedicated to each VM which is responsible for managing all the resources that VM needs to effectively operate. The VMM, which runs between the Hypervisor and the VM runs a separate isolated hardware abstraction instance that mimics all the functionality of the real underlying hardware. In this way, the VMM can monitor, partition and schedule resources between itself and other VMMs.

Industry Leaders

At this time VMWare is the de facto leader in virtualization software, however there are other vendors to consider depending on your approach and budget. Some such as Microsoft's Hyper-V are gaining ground both in terms of market share and technology, but still cannot match the broad feature set of VMWare. Other options include Citrix Xen server, Red Hat Kernel-Based Virtual Machine(KVM), and Sun's Virtual Box. While there are open source options available, the advanced features that can take a single piece of physical hardware running a few VMs into a dynamic datacenter capable of moving VMs between physical hardware with zero downtime are only available as paid software.

Training and Information Resources

All vendors provide online documentation, often including samples, demos and their latest marketing information. We have listed here a few resources and training courses for some of the technologies that have been mentioned in this paper.

VMWare

VMWare - <http://www.vmware.com/>

VMWare VSphere 4 - <http://www.vmware.com/products/vsphere>



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VMWare VMotion - <http://www.vmware.com/products/vmotion/index.html>

VMWare Training - <http://mylearn.vmware.com/mgrreg/index.cfm>

VMWare Full Training List - http://mylearn.vmware.com/portals/www/search/catalogByTopic.cfm?ui=www_edu&category=catalog&pageName=Catalog%20by%20Category

Red Hat

Red Hat KVM - <http://www.redhat.com/virtualization/rhev/server/>

Red Hat KVM Training - https://www.redhat.com/courses/rh318_red_hat_enterprise_virtualization/

Microsoft

Microsoft Hyper-V - <http://www.microsoft.com/windowsserver2008/en/us/hyperv-main.aspx>

Microsoft Training - <http://www.microsoft.com/learning/en/us/training/virtualization.aspx>

Definitive Logic's Approach and Performance

Definitive Logic has been utilizing virtualization technology for many years to effectively drive down hardware costs, increase performance and respond quickly to our and our customers' needs. As a VMWare Certified VMWare Partner, we have dedicated considerable resources to understanding and implementing VMWare technologies. From our experiences we have developed a systematic approach to implementing a comprehensive enterprise level VMWare solution. Whether this is migrating an existing datacenter or developing a plan of action to support new applications we are prepared. Some of the important steps that we used in our past performance are as follows:

Understand

Our goal is to develop full understanding of intricacies and inter-workings of the current environment. Understanding does not stop at the hardware and software level – we strive to understand the short and long term strategic planning of our customers and to understand the requirements of working within an existing Enterprise Architecture. The goal of introducing virtualization to an environment is not to overthrow the status quo, but to support and provide all the necessary capabilities that an environment will need for years to come.

Baseline

Creating a baseline of the current working environment is a key aspect to meeting the expectations of our customers. Our approach includes a systematic documentation and metric based technique that will aim to uncover the high and low level details of the current execution state.

Identify Problem Areas

Over time an enterprise is prone to collecting a wide variety of Operating Systems, hardware types, configurations and software systems. Coupled with the security requirements of our customers, we often find a few key areas of concern: systems integration, undocumented configurations, archaic



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platforms – both hardware and software. Our approach is to identify the areas of concern early, bring them to the attention of stakeholders and work closely with them to find the best possible solution.

Identify Consolidation Areas

In addition to replicating the functionality of an environment, Definitive Logic always strives to exceed expectations in cost savings. A key area where this is possible is consolidation of similar and rarely used systems onto shared resource implementations. One of the advanced features of virtualization is the ability to configure either static or dynamic resource allocations. Dynamic allocation partitions a virtualized server past its max total physical resources, with the understanding that not all VMs will be running at their peak at any one time. One example of this area is batch processing and backup systems. In this case they may require exceptional resources for a few hours after close of business – this is where consolidation will have immediate returns.

Conclusion

Virtualization can provide significant benefits to an organization. In order to reap the maximum benefits, it is imperative to understand what virtualization is, who the key technology players are, and have a trusted partner that can provide a proven, rigorous approach to implementing virtualization for you. For additional information, please contact Nick Incontrera at nick.incontrera@definitivelogic.com or (703) 599-6266.