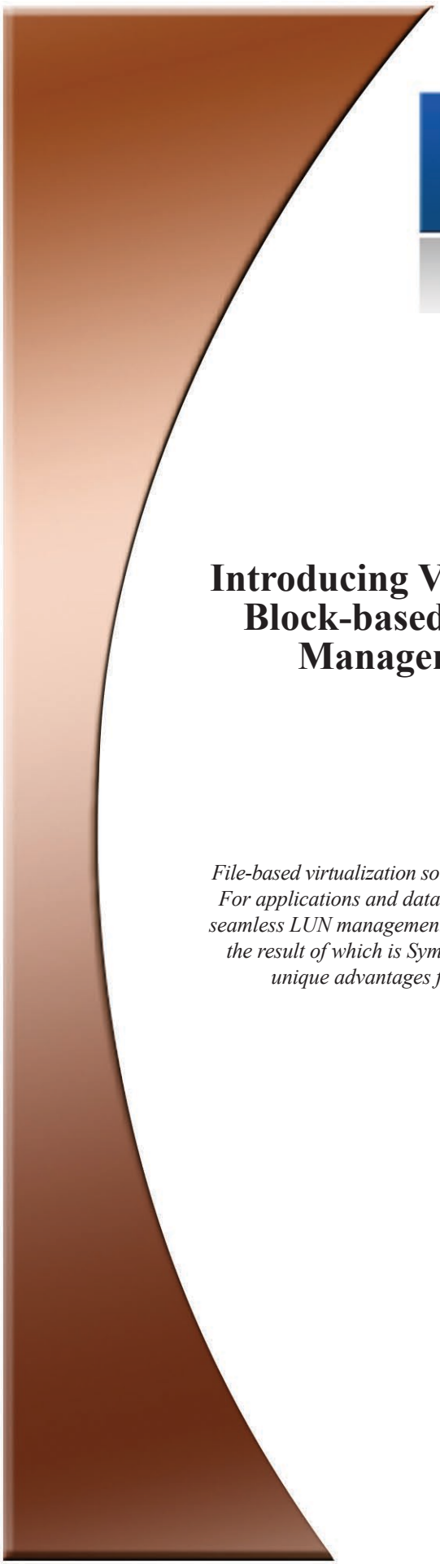

Symantec Corporation

Introducing Veritas Virtual Infrastructure from Symantec: Block-based Virtualization Built on Enterprise Storage Management for Your Enterprise Infrastructure

Abstract

File-based virtualization solutions, like VMware ESX Server, are best suited to low-impact file, print and web services. For applications and databases, you need a block-based virtualization system designed for high performance and seamless LUN management. Symantec's expertise in volume management has been focused on solving this problem, the result of which is Symantec's new VxVI solution. Solving this problem from the Volume Manager layer offers unique advantages for expanding the useful deployments of virtualization in enterprise environments.

November 2008

By

DCIG LLC
7511 Madison Street
Omaha NE 68127

402.884.9594

Introducing Veritas Virtual Infrastructure from Symantec: Block-based Virtualization Built on Enterprise Storage Management for Your Enterprise Infrastructure

Table of Contents

Introducing Veritas Virtual Infrastructure from Symantec: Block-based Virtualization Built on Enterprise Storage Management for Your Enterprise Infrastructure

Executive Summary

VMware is the predominant platform that many companies are initially using for server virtualization. While VMware does not result in performance or configuration problems for many of the initial application servers that companies seek to virtualize (file, print and web servers), many application servers do not fit so neatly into the VMware virtualization model. This forces companies to postpone – possibly permanently – the virtualization of these servers and delay the energy, hardware and space savings that virtualization delivers.

There are two possible technical reasons that prompt companies to postpone the virtualization of some of their servers: application performance requirements and/or the inability to manage their new virtual infrastructure. High performance servers with strict service level agreements (SLAs) need access to network and storage resources as application demands dictate. While they can do that now using current tools, once the environment is virtualized using VMware, these tools do not work as they did prior to virtualization. Further, if application problems should occur, once an environment is virtualized using VMware, it extremely difficult to isolate, monitor and correct the source of the problem.

As companies look to virtualize the mission critical, performance intensive segment of their server infrastructure, it is imperative that the settings found in their current physical environment carry over into their new virtual environment. Veritas Virtual Infrastructure (VxVI) from Symantec now makes this possible. Using VxVI, companies can preserve these settings as they virtualize these servers while also preserving the centralized storage management capabilities that Symantec delivers and to which enterprise customers are already accustomed. In so doing, companies can immediately realize the energy, hardware and space saving that they are seeking from server virtualization without putting their infrastructure at risk.

Introducing Veritas Virtual Infrastructure from Symantec: Block-Based Virtualization Built on Enterprise Storage Management for Your Enterprise Infrastructure

The Green Light for Server Virtualization

Any company that takes the time to look at the benefits of server virtualization likes what they see and hear. Drastic reductions in the number of physical servers; smaller data center footprints; lower heating and cooling costs; increased efficiencies in IT operations; and, improved time-to-implementation for new applications and services. All of these factors combine to make server virtualization a winning proposition in almost every corporate environment. Because of this, more companies giving server virtualization the green light to go forward in their data center environments.

Server Virtualization's Green Lights

Data Center Infrastructure	*IT Staffing*
• *Fewer physical servers*	• *Increase focus on application optimization*
• *Fewer network cables & connections*	• *Manage more virtual servers per IT staff*
• *Reduced storage capacity*	• *More options to dynamically provision resources (CPU, memory, storage)*
• *Saves power, heating and cooling*	• *Reduced time to setup/configure servers*
• *Smaller data center footprint*	• *Less hardware to heat, cool and manage*

Analysts generally agree that worldwide about 90% of enterprise companies use server virtualization in some way within their organization, though many still use it in a more limited role. It is estimated that enterprise companies have virtualized less than 10% of their physical servers while small and midsize businesses (SMBs) have virtualized at most 3% of their physical servers. This means that most companies, regardless of their size, have yet to implement server virtualization on a large scale and realize its full benefits.

But as the benefits of server virtualization become more clear to companies, it is less clear what choices in server virtualization that companies have available to them. VMware is commonly associated with server virtualization and is the software that many companies may think of first when the topic of server virtualization surfaces. But VMware is not the only choice available to companies to virtualize their servers. Depending on the application server, other virtualization platforms may present themselves as more viable options.

File-Based Virtualization Methods are for Simplified Server Workloads

VMware ESX server is the predominant platform that companies use initially for server virtualization. The ESX server creates a virtual infrastructure by aggregating the physical resources (CPU, memory, network resources and storage) assigned to that ESX server into one common pool. The ESX server can then dynamically redistribute these resources to the virtual machines (VMs) that it hosts as they need these resources. When the ESX server assigns storage resources to a specific VM, it creates a virtual machine disk (VMDK) file that contains that VM's operating system and associated data and/or applications. The creation of this VMDK file is done using a file-based virtualization method.

How VMware Manages Storage Using VMDK Files

A VMware Virtual Machine Disk Format (VMDK) file encapsulates all of the information about a virtual server or desktop in a single file. The VMDK file specifically captures information that is on the virtual machine's assigned hard drive as well as information about the disk storage assigned to each virtual machine (VM). One or more VMDK files may be associated with a specific virtual machine (VM) and there are three ways VMware manages storage using the VMDK file:

- It can specify and allocate the maximum amount of disk storage space that an individual VM can access.
- It can sparsely or thinly provision disk storage space in 2 GB extents. As each 2 GB extent fills up, a new 2 GB extent is allocated.
- It can map a VM to raw disk storage or partitions. Used this way, it stores information about the raw partitions that the VM can access.

Using file-based virtualization does not create a problem for many of the application servers that companies initially seek to virtualize. Companies almost universally start by virtualizing physical servers that represent their least valuable and complex applications. This makes sense because those servers present the least amount of risk to the company in case something should go wrong as the organization begins to understand virtualization. Though not all-inclusive, common servers to virtualize at this stage include Windows or Linux application servers that use direct attached storage (DAS) or networked attached storage (NAS) for their storage needs; or file, print and web servers with simple applications. These servers are particularly good candidates to virtualize using VMware because they are:

- Not mission critical. File, print and web servers along with departmental application servers are important to day-to-day business operations but are typically not 24x7 applications. Outages (planned or unplanned) on these servers may create user frustration but do not result in financial penalties or a cessation in business operations. These are also highly redundant systems so if something goes wrong with one, there is typically another available in the environment to pick up the load until the problem is fixed.

- Low performance. The hardware on many of these servers provides significantly more capacity (CPU, memory, network and storage) than the application it hosts actually uses. By virtualizing these servers using VMware and one powerful server, companies can share the hardware resources of the physical server between the VMs it hosts while still meeting the application's requirements.

- Minimally managed now. These application servers are already primarily managed using the "set it and forget it" principle. Administrators only tend to these machines should something go wrong (failed hardware component) or if they need to apply a maintenance patch or upgrade the software. Companies can perpetuates this model using VMware while lowering management, hardware and energy costs.

This combination of factors provides clear-cut reasons as to why it makes technical and financial sense to virtualize these types of servers using VMware. The only problem with trying to extrapolate VMware's file-based virtualization approach to include all servers is that not all corporate servers fall so neatly under this umbrella of simplified server workloads.

High-end application servers are the most obvious example of servers possessing characteristics that preclude companies from using VMware's file-based virtualization method to virtualize them. These servers often load balance I/O loads across multiple network paths to disk, or access or share storage capacity with other servers for failover which are technical features that VMware currently does not support.

Though these technical features may be added over time by VMware, what slows this down is the position that VMware is now taking with other software providers. These other software providers seek to provide this needed functionality for the VMware's ESX operating system, but they cannot because VMware has kept their system closed. A closed system is proprietary and can only be changed by the offering vendor, which is VMware in this case. To add the functionality that is needed to virtualize high-end application servers, other software providers need access to VMware's underlying Application Program Interfaces (APIs). At this point, not all of VMware's APIs are equally shared or documented, including some of the APIs that software providers need to deliver the type of functionality required.

This position puts software providers and the companies that plan to implement VMware at the mercy of VMware until such a time that VMware decides to release the functionality themselves or open their APIs. When or whether this will occur is difficult to forecast. Companies who need to virtualize high-end servers are essentially out of luck until VMware makes this a priority. If and when VMware does offer such functionality, it is unknown how well the first software release would perform under high-end application loads or how companies would monitor or manage these systems in the short and long term.

File-based Virtualization Hits a Brick Wall: Enterprise Storage Management

Even assuming VMware does satisfactorily address these current technical issues, the larger question that looms is whether a file-based storage management platform such as is offered by VMware is equal to the task of supporting enterprise storage management. Dynamic storage layouts (RAID 0, 1, 10); mirroring across different storage enclosures or arrays; dynamic online storage growth for virtual servers; and, advanced SAN multi-pathing and load-balancing functions are currently found and used in existing block-based storage management implementations. These capabilities are not currently found among the storage management features available in VMware.

File-based virtualization uses VMDK files as its method of storage management which causes host volume managers on VMs to loose the granularity of control and visibility into the underlying storage infrastructure that high-end application servers require. Instead the VMware hypervisor give administrators two options to create and assign storage to individual VMs:

1. Storage (any combination of DAS, NAS or SAN) is discovered and managed by the underlying VMware ESX hypervisor using its logical volume manager (LVM). The LVM aggregates and virtualizes this storage to create a virtual pool of storage that administrators can then provision to individual VMs. The administrator then creates new virtual LUNs from this virtualized pool of storage and assigns them to specific VMs. The VMDK file tracks which virtual LUNs are associated with each VM.

2. The VMware ESX server also provides an option called raw device mapping (RDM) that maps specific LUNs to specific VMs. Using this option administrators can manually create a 1:1 mapping from within the ESX hypervisor from a LUN to an individual VM. This is done to support limited application clustering configurations and array based snapshot technology. As in the first scenario, a VMDK file is created (known as an RDM VMDK file) that tracks what VM is associated with what LUN.

The problem that emerges is that creating a new file-based virtual infrastructure requires companies to create new storage management policies and procedures for the dynamic allocation and discovery of the storage by the OS and application. As external storage is provisioned to each ESX server, companies now need two steps to manage storage. The ESX LVM first needs to discover and add the new storage to its storage pool. Then administrators need to re-provision this new storage to individual VMs which, in turn, need their volume manager to discover and provision this newly assigned virtual storage to each of their hosted applications.

Then there are the larger questions of how to manage tiers of storage using a file-based virtualization method and how to support path management. Though VMware can virtualize DAS, NAS and SAN attached storage and then aggregate it or do a raw device mapping, the ESX LVM possesses no insight into what tier of disk is presented to it so it cannot pass along any information when it presents a LUN to the VM's volume manager. As such, the VM volume manager needs to treat all LUNs presented to it as the same tier of disk even though the virtual LUN presented by the ESX virtual infrastructure may consist of one or more different underlying tiers of storage with different availability and performance characteristics.

Using the RDM option partially addresses this problem but it requires manual setup and is a one-off configuration. This creates another level of storage management complexity as companies must track what LUNs are configured as RDM files and directly accessed by virtual or physical machines and which LUNs are assigned to and managed by the VMware ESX LVM.

sMost application servers now use multiple paths (two or more) to attach storage systems to deliver heightened availability, failover and performance for the application. Again, when these application servers are virtualized using VMware, no matter which way this storage is provisioned to these servers (virtual storage pool or raw device mapping), VMware also virtualizes the VM's paths to storage. As such, companies are put in a position where they must use VMware's path management with its more limited options.

Virtualizing high-end application servers using VMware's file-based storage management approach strips away a number of the benefits to which high-end application servers have grown accustomed. While companies need to consolidate and virtualize these application servers, they will pay a price in a loss in end-to-end visibility of their infrastructure along with a loss in the granularity of control that they need to deliver on corporate SLAs. In the world of high-end application management, these losses in infrastructure visibility and control are unacceptable.

Enterprise Storage Management Prerequisites

Maintaining these levels of visibility and control requires the use of server virtualization technology that preserves existing enterprise storage management techniques. Enterprise companies will virtualize their mid and high end application servers to lower costs and improve efficiencies but they cannot risk loosing visibility into their block-based infrastructure to do so. This dictates that companies select server virtualization software that does not sacrifice their existing methods of block-based storage management. These prerequisites for block-based storage management in a server virtualization product include:

- ***Preserve path management.*** All server virtualization technology, whether it uses file- or block-based storage management, will need to virtualize network paths at some level. The difference is that when using block-based storage management, virtualized servers can map and manage paths to storage volumes without loosing any of their current functionality, such as path failover or load balancing across multiple paths.

- ***Preserve application failover settings.*** Applications that failover on physical servers depend upon that server's volume manager to detect specific changes in the environment and initiate the application failover. However if and when application failovers occur, applications still need current path management and storage access preserved when the failover occurs. Block-based storage management ensures these settings stay in place on virtualized servers

- ***Preserve volume management.*** The need to manage storage volumes does not dissipate after servers or their storage is virtualized. Whether at the hypervisor level or on an individual VM, the need to centrally manage volumes and the aggregation, assignment, concatenation and usage of LUNs becomes more acute once server virtualization is put in place. Using block-based storage management, this can occur centrally and at the appropriate level.

- ***Manage multiple tiers of storage.*** Most enterprise companies have gone to a multi-tiered storage infrastructure. File-based storage management treats all storage as one tier and puts it into one group. Using block-based storage management, companies can create pools of storage and manage each tier according to its unique availability, connectivity and performance characteristics.

- ***Control data placement on a granular level.*** Not all applications or all data associated with a specific application has the same availability or performance characteristics. Using block-based management, companies can control what tiers of storage are presented to what virtual machines, clearly identify and label them as such and place the data on the appropriate tier of storage.

- ***Provide mechanism to migrate data.*** Data migrations have many aspects to it. All, some or only one volume may require a migration from one storage platform to another. Companies also need to monitor and account for fluctuations in application performance and availability as well as the progress of the migration to ensure that the migration occurs uninterrupted. Current block-based storage management already provide many of these advanced options to ensure applications remain available and online while data migrations complete uninterrupted.

Introducing Veritas Virtual Infrastructure from Symantec: Block-based Virtualization Built on Enterprise Storage Management

In response to this corporate need to maintain existing block-based storage management techniques as they virtualize high-end application servers, Symantec has introduced Veritas Virtual Infrastructure (VxVI). VxVI represents the logical next step for the Veritas Storage Foundation software by extending its support beyond physical servers into the realm of x86 virtual servers. By using VxVI when companies virtualize their physical servers, the same benefits that they derive now from block-based storage management carry over into the virtual environment.

The largest benefit of using VxVI as companies move ahead with virtualizing their high-end server is that companies can non-disruptively continue supporting their existing storage management practices. Retaining block-based storage management as servers are virtualized is more consistent with how real world enterprise storage management is done now, so there is no learning curve or hidden "gotcha's" as companies come up to speed on managing storage for the virtual servers. The downsides of file-based storage management become more apparent when used with high-end applications because file-based introduces one more stop in the storage path without providing a corresponding increase in benefits.

Other specific storage management benefits that block-based storage management based on VxVI provides over file-based storage management include:

- ***Mapping specific storage volumes to specific VMs.*** VxVI provides companies a better understanding of what virtual servers are using what specific storage volumes as well as what data and applications reside on the volumes assigned to the individual VMs.

- S***hare specific storage system volume among many VMs.*** Current principles for sharing volumes that Veritas Storage Foundation currently uses carry over into this new virtual server environment. In this way, companies can have confidence that their current application failover and clustering configurations will work once they are virtualized.

- ***No prerequisite to treat certain LUNs differently at hypervisor level.*** VxVI gives companies the option to provision LUNs to individual virtual servers in any format – raw, sliced or concatenated – and dynamically reconfigure if application requirements change. Using VxVI, companies do not need to set up separate policies or configurations to manage certain types of LUNs.

- ***Dynamic provisioning of new storage.*** Administrators can automatically extend volumes at either the hypervisor level or on individual VMs as new storage is allocated. VxVI provides companies a common, consistent way to do this storage provisioning at either level.

- ***Path management software functions as before.*** Using VxVI, companies can continue using the same dynamic path management tools that they previously used in the physical server environment since each VM is presented storage volumes that it recognizes and knows will respond to existing path management commands. This facilitates the detection of problems in the path wherever the errors may occur so path failover and load balancing may take place.

- ***Centralized management of both server virtualization and storage management.*** The starting, stopping, creation and destruction of VMs are done through the same console as the storage is managed. Storage can seamlessly be provisioned just as a new VM is created. Additionally the integration of space-optimized snapshots enables effective boot-image management. Multiple VMs can boot from the same volume and when VMs are provisioned from a template, the storage management integration can take a space-optimized snap and enable a new VM to share the boot volume but enable driver changes unique to the new application on the new VM.

VxVI can offer these benefits because mid & high-end application servers are virtualized using Citrix XenServer, not VMware ESX server. XenServer differs in a critical way from ESX in that its hypervisor recognizes and manages storage system LUNs in a block-based format even after they are presented. Preserving the LUNs in a block-based format, XenServer facilitates the introduction of VxVI at both the hypervisor level and VM level so as to provide a consistent way to manage and provision storage on the entire virtualized server, to include storage management at the VM and hypervisor levels.

Enterprise Virtualization for Your Enterprise Infrastructure

Companies are right to give the green light to server virtualization but that does not mean they need to use, or should use, the same server virtualization software to virtualize all of their physical servers. The VMware ESX server that many companies now use provides them with a technical and cost-effective means to virtualize many of their file, print and web servers. However, virtualizing mid & high-end as well as test and development servers that possess more complex high availability and performance requirements compels companies to consider different criteria to select the appropriate server virtualization solution.

VxVI and its complete integration with Citrix XenServer fills the gap that VMware leaves for companies seeking to virtualize their enterprise application servers and who recognize the need to keep their existing block-based storage management practices in place. XenServer's retention of block-based management in its architecture allows companies to preserve their existing storage management disciplines and roll them into their new virtualized server infrastructure through the implementation of VxVI.

VxVI eliminates the need for companies to adopt work-arounds or push the limits of VMware when virtualizing their high-end application servers. VMware ESX in its current release does not adequately address the availability, management and performance demands of high-end application servers. Furthermore, VMware's reluctance to share its APIs with third party software developers suggests that this functionality is not going to become available anytime soon.

In the face of this server virtualization dilemma confronting companies with high-end application servers, Citrix and Symantec have stepped forward to provide a server virtualization solution that companies can turn to now. Citrix provides the credibility that enterprise companies need to justify virtualizing their enterprise application servers on a platform other than VMware. As the same time, XenServer's use of block-based virtualization facilitates the introduction of Symantec's VxVI in the virtualized server environment and all of the storage management benefits that go with it. This pairing of Citrix and Symantec gives companies their first real server virtualization product that they can count on to deliver the enterprise virtualization that they need with the enterprise storage management features to go along with it.