

Simplifying VMware Storage Management

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CAPEX, OPEX and Flexible Application Services Delivery to Business Users

VMware has been deployed typically to reduce the number of servers managed by centralized IT and the corresponding expenses that can balloon out of control when servers have a one-to-one relationship with applications. The result is server sprawl. We now see that VMware deployments can address at least three major business-related IT requirements:

The desire to deliver a flexible services delivery experience

Business application users and CIOs alike are increasingly interested in applications delivered via the cloud. In order to compete with external clouds, internal IT must be responsive, flexible and services-oriented to deliver the cloud user experience. VMware has the potential to deliver a services-oriented application environment. But a services-oriented delivery model will require tighter integration between the storage layer and the rest of the application delivery “stack.”

The need to control CAPEX and OPEX expenditures and more efficiently manage supporting infrastructure growth

To date, VMware has been typically implemented to reduce or at least control IT CAPEX and OPEX expenditures. It has been hugely successful in eliminating overly redundant server capacity (CAPEX) and the bloated management, maintenance, and energy costs (OPEX) associated with the single-server-per-application delivery model. On the storage side, however, we have seen the supporting VMware storage architecture requiring ever increasing amounts of storage capacity and additional management personnel to just keep pace with a quickly growing VMware environment, thus reversing some of the benefits realized from virtualizing servers.

The enhancement of enterprise’s security and risk management profile resulting from business continuance/disaster recovery capabilities that are built into VMware

VMware, through the implementation of facilities like VMotion, also has the potential to vastly improve the enterprise’s position with regard to risk management by making it much more efficient and cost-effective than it has been the case in the past. The storage environment must integrate seamlessly with these and other VMware functions to make its business continuance and disaster recovery capabilities even more effective¹.

While it is clear that the storage architecture supporting the VMware business user environment must reflect the above requirement. It is also becoming increasingly the case that, as VMware environments scale to include the business critical applications, the automation of selectable management functions to control lower tier apps or the ability to automate repetitive management functions can also be of great benefit.

¹ See EGI Solution Brief entitled “VADP Advances VMware-based Data Protection.”

The Benefits of a Holistic Management Approach for IT

As VMware deployments scale upward, taking on an increasing number of applications and application users, IT administrators need a more automated approach to managing VMware environments. We note that the impact of VMware on IT management groups—once divided along the line of server, network and storage administration—has been to force greater management consolidation and collaboration. Server administrators are becoming more “storage aware,” for example. The selected automation of storage management functions for example can make it easier for all members of the VM management team to manage the VMware storage environment without having deeper expertise in storage management.

Therefore, it follows that storage and data management applications need to approach the VMware management environment with the understanding that the tools will likely be used by IT professionals that are increasingly holistic in their views of the VMware operational environment. Finding storage management tools that are integrated with server, network, and VMware management tools—most notably, VMware vCenter—will deliver this view to VMware administrators. Automation of management functions will make it easier for the virtual environment administrator to manage more efficiently and reduce the risk of error that could result in an outage.

Second, reducing the number of manually implemented tasks through storage management automation will reduce management overhead and allow IT administrators to devote more time to managing and adding new applications to the VMware environment.

Finally, we have noticed that managing virtual machines (VMs) often requires new management policies and processes for dealing with routine issues or tasks, such as outages, help desk support, and deployment of upgrades and new software releases, etc. VMware storage-focused reporting mechanisms and tools are also required so that IT administrators can effectively resolve issues that will inevitably arise between IT administrators and user groups, and among different management groups within the IT organization.

Automated Management in vSphere 5

VMware vSphere Storage APIs for Storage Awareness (VASA)

Both medium scale modular and large high performance storage arrays offer a range of high value features and functions. Depending on the application, the mix of the most relevant features required for a particular VM running a high value business application will vary. Array based automated management will be more important for some of these VMs while performance features may dominate others. The process of manually assigning and provisioning storage features and functions to VMs can be time consuming and error prone even on the first iteration. But continually monitoring and optimizing storage for each VM as the virtual server environment grows adds back a layer of management complexity that virtualization was supposed to do away with in the first place.

VASA takes a major step toward automating the VM-to-storage provisioning process. VASA introduces APIs that, when implemented by a storage vendor at the array level, can be used to communicate arrays available features and functions to vSphere. vSphere, using policy established by IT administrators, can

automate the assignment to VMs to storage that is optimized for each VM. As time goes on, vSphere will determine if the storage assigned to a VM is responding adequately to the usually growing needs of the VM. If not, the VM is migrated to available storage that does fit the required profile.

And, the fact that storage can be “profiled” from the standpoint of vSphere is an important concept in this discussion. IT administrators can automate the provisioning of storage to VMs using vSphere 5 Storage Profiles—characteristics of a storage device that is available to a given VM.

There are a growing number management processes that will benefit as a result of VMware’s continuing commitment to VMware/storage integration:

Performance Management—A VM will remain on a given class of storage as defined in the profile as long as it meets predetermined performance requirements. If not steps are taken like moving the VM via vMotion to a different class of storage (see Storage DRS below) to bring storage for that VM back into compliance with performance requirements.

Automated VM Allocation via Storage Distributed Resource Scheduler (DRS)—Storage DRS determines the optimal placement of a VM using vSphere’s knowledge (via VASA-derived information) of available disk space and current I/O load (IOPs and I/O latency). DRS determines initial placement of the VM, after which it continually monitors the VM’s performance requirements against actual conditions. Other capabilities include the creation of storage clusters for the aggregation of multiple storage devices under Storage DRS as well as creating rules regarding the sharing of storage resources by VMs.

VMware vCenter Site Recovery Manager 5

VMware vCenter Site Recovery Manager 5 (SRM 5) includes a newly introduced replication and automatic failback functions. The intent is to provide VMware administrators with automated and more reliable disaster recovery capabilities.

VMware vSphere Replication

VMware vSphere Replication in SRM is a hypervisor-based data replication function that VMware administrators can use to manage replication at the VM level from the vCenter console. Storage in this environment does not have to be homogeneous. Replication in SRM will also support storage based replication product from VMware partners like HDS. Now VMware administrators will be able to choose the most appropriate replication strategy for a given application or circumstance. However, Evaluator Group continues to believe that, for performance reasons, mid-scale to larger enterprise VMware administrators will opt for storage-based replication. This has historically been the case when storage administrators have been given this choice.

Fully Automated Failback and Planned Migration

Under SRM 5, VMware administrators can automate a site recovery and migration process. SRM 5 will automatically recover all applications with limited or no manual intervention by including a new automatic failback capability that can automatically reverse replication between primary and secondary sites. VMware administrators can automatically failback to the primary site when the disaster condition is resolved. This capability can dramatically improve Recovery Time Objectives (RTO) depending on the environment.

SRM 5's Planned Migration function allows VMware administrators to perform an application-consistent migration of VMs to another site by executing a staged shutdown of protected VMs at the primary site, synchronize data between primary and secondary sites, the recover the VM at the secondary site. This capability can be used to automate planned migrations and execute load balancing over geographic distance.

Hitachi and VMware vSphere Integration

Today, VMware administrators are faced with many choices and alternatives when it comes to selecting tools to manage VMware storage. Hitachi, for example, offers a variety of storage technologies and storage management solutions that can help IT administrations simplify management processes across IT administrative groups using VMware.

Mapping Hitachi Storage Management Tools to VMware

	Ease of Provisioning	Ease of Management/ Troubleshooting	Continuous Optimization (cost + performance)
Server Admin (VMware Tools)	CapacityIQ Lifecycle Manager VMware High Availability and VMware Fault Tolerance Configuration Manager App Speed (optional)	Application Discovery Manager Distributed Resource Scheduling	Chargeback
Storage Admin (Hitachi Tools)	Symmetric Active-Active Controllers (Hitachi hardware) Hitachi Dynamic Provisioning Hitachi Device Manager*	Hitachi Tiered Storage Manager* Hitachi Tuning Manager*	Hitachi Command Director*

*Part of Hitachi Command Suite

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With these tools, storage administrators, or any administrator with permission to access storage management functions via VMware vCenter, can:

- Use Hitachi Command Director to centralize reporting and management for Hitachi Command Suite products, including Hitachi Device Manager, Hitachi Tuning Manager, and Hitachi Tiered Storage Manager. This product can be used to define and establish service levels for applications running in the VMware environment.

- Use Hitachi Tuning Manager to monitor entire I/O paths between individual VMs and storage, and to obtain historical trending and predictive analysis to forecast storage requirements to meet required service levels.
- Use Hitachi Device Manager to improve disk utilization, gain better control of storage assets and automate storage management processes.
- Provision RAID-group-based storage as needed from pooled resources using Hitachi Dynamic Provisioning. LUNs are allocated from these pools and data is automatically striped across all disks in the pool.
- Automatically balance varying workloads across all VMs serviced by a Hitachi array, eliminating the need to constantly monitor and reconfigure around bottlenecks.
- Reduce administrative time normally associated with VM-to-storage path provisioning and setup and some of the trial-and-error and resulting down time risk associated with this process.
- Improve disk utilization using Hitachi Dynamic Provisioning (HDP). HDP enables administrators to allocate the right amount of storage required without operational disruption and without wasting capacity by over-provisioning, and Hitachi Symmetric Active-Active Load Balancing Controllers automatically distribute workloads across all data paths between VMs and storage to assure predictable performance under continuously variable load conditions.

HDS and SRM 5

VMware has taken a holistic approach to data resilience by supporting the integration of its automated application failover and data recovery facility (SRM) with solutions from outside storage vendors. SRM allows vCenter administrators to automate the failover and recovery of virtual machines using data replication features supplied by participating storage vendors including HDS. And with SRM 5, a vCenter administrator can automate a VM recovery by restoring a VM image directly using a supported storage array-based replica without having to coordinate the process with an array-based management console.

The values to IT administrators of vCenter SRM integration with the supporting storage environment are twofold:

1. The number of manual, error-prone tasks associated with VM recovery is greatly reduced if not eliminated.
2. The ability to deliver cost effective disaster recovery and business continuance capabilities to the enterprise by IT administrators is greatly enhanced because the solution leverages functionality already built-in to VMware and supporting storage arrays.

Hitachi Storage Replication Adapter, available at no additional charge from VMware, provides management integration of Hitachi TrueCopy, Hitachi TrueCopy Extended Distance, and Hitachi Universal Replicator with SRM such that a vCenter administrator using SRM can manage Hitachi's synchronous and asynchronous data replication solutions between Hitachi storage arrays supporting VMware-based applications. This adapter is offered for Hitachi VSP and AMS 2000 Series. The functionality delivered in SRM 5 is presently supported for the synchronous versions of Hitachi Universal Replicator and TrueCopy with the adapter.

As we have previously noted, Hitachi's VSP supports attachment and virtualization of third party arrays. VMware administrators can therefore use the VSP's controller to extend the new vCenter 5 data resilience features to these arrays.

Conclusion

We have no doubt that VMware, when implemented and managed effectively, offers a fluid and flexible application delivery environment that can serve as the foundation of an enterprise-internal, cloud-like services delivery model. However, while changing application user requirements may be easier for IT to respond to with VMware than without it, the fact that new VMs can be turned-on in minutes could allow management complexity to run rampant. Taking a holistic approach by integrating storage management with the overall VMware management regime, for example, will enable a cloud-like user experience while keeping a lid on management complexity.

We mentioned earlier that once stove-piped management groups were consolidating and collaborating with one another. What these new VMware operational management teams now require is end-to-end visibility of the VMware environment that includes alerting and reporting functions that can be understood and acted upon by potentially any member of the group. Hitachi Device Manager, Hitachi Tuning Manager and Hitachi Command Director are storage resource management tools that offer VMware hypervisor-specific views to quickly deliver these alerting and reporting functions analysis. They also offer a way to deliver a consolidated reporting environment to all VMware administrators that shows utilization, performance against SLAs/SLOs, and the rate of data growth so that business owners and/or VMware administrators can audit their resource usage and better plan for the future.

Finally, following last year's announcement of the first three primitives in vStorage APIs for Array Integration (VAAI) in vSphere 4.1 VMware has announced the availability VASA as well as two more VAAI primitives. VASA represents a major step forward in the automation of vSphere environments, VAAI is a set of mechanisms that allow processing for certain data-related services—copying data when creating a new VM, for example—to be offloaded from the ESX host to a VAAI-supported storage array, such as the Hitachi VSP and Hitachi Adaptable Modular Storage 2000 series². The intent of these APIs is to streamline the functioning and manageability of the VMware environment and speed-up delivery of storage-supported services to storage specialists and VMware administrators alike. Hitachi's support of VAAI will certainly result in a simplification of ESX server-to-storage management.

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² See EGI Solution Brief entitled "Meeting the Performance Requirements for Virtualized Tier One Applications" for more information.