Enhancing Continuous Operations and Data Integrity for VMware vSphere Environments

Hitachi’s Next Generation VSP Storage in VMware Environments

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Executive Summary

Hitachi has been in the vanguard of infrastructure solution providers offering large enterprise-scale, storage system virtualization for the last ten years. With the announcement of the VSP G1000, Hitachi added Global Storage Virtualization – the ability to virtualize across metro and remote distances to its virtual storage platform. Hitachi now extends the functionality of these large virtualized storage systems—including Global Storage Virtualization—to a new series of unified storage arrays with the announcement of the next generation Hitachi VSP storage systems. With the announcement of its new series, Hitachi will now offer the same storage capabilities across the VSP family that now spans from entry to high-end storage systems.

Global Storage Virtualization extends virtualized storage services across multiple sites and disparate, heterogeneous physical storage systems under the control of its Storage Virtualization Operating System (SVOS). A key enabler is the implementation of active-active stretched cluster technology for storage systems that underpins a significant SVOS feature introduced in the VSP G1000—global active device (GAD). We have seen GAD to be of particular value in VMware environments where administrators still hesitate to virtualize critical business applications over a concern for their ability to maintain continuous application availability.

Here we review the highlights of the new models in the VSP family announcement and examine it in the context of using Hitachi’s SVOS-based systems in VMware environments for:

- **Non-disruptive Operations** for assured VMware-based application availability
- **Workload Mobility** for movement of VMs and associated applications among SVOS storage platforms
- **Non-disruptive Data Migration** between storage arrays running SVOS
- **Continuous Storage Infrastructure Platform for Cloud-based IT Services**—spanning the enterprise data center and a cloud services provider using large enterprise and modular storage arrays

The New VSP Storage Systems

Hitachi has announced the next iteration of its SVOS-based storage systems to join the VSP family.

Overall highlights from this announcement include:

- SVOS as the platform OS supporting external array storage virtualization, GAD, virtual storage machines, and other features previously only available on VSP enterprise-class systems
- Hitachi NAS capabilities that include hardware-accelerated file systems, dedicated NFS controllers, VM-level hardware snapshots/clones, and primary storage deduplication
• New “single pane of glass” management application for unified block and file storage management
• Hitachi Accelerated Flash (HAF) supports tiered flash (hybrid) or all flash storage (max. 1.8 PB) configurations
• Automated, active flash tiering via an enhancement to Hitachi Dynamic Tiering allows data to be promoted to a high performance tier immediately after an increase in load has been detected
• Approximately three times the performance and twice the throughput vs preceding HUS models
• 12 Gb/s SAS back-end and twice the number of front-end ports

Hitachi SVOS is now software-based storage technology that will allow for consistency across large and small VSP platforms. This means that SVOS can eliminate complex migrations, provide transparency for technology updates and extend the lifespan of the underlying storage system. To reduce complexity and create a foundation for automation also means that consolidated management is made easier and creates a base for hybrid (private/public) cloud infrastructures with an SVOS instance also located at a public cloud site.

Aspects of this announcement that will be of particular interest to IT administrators managing VMware environments include:

• Scale to support from 100-15,000 VMs and 100 million VM-level snapshots
• Datastores available as all-flash, tiered flash, or all-SAS configuration
• VMware vSphere Virtual Volumes (VVol) support (with later release in July 2015)
• Virtual Infrastructure Integrator software and vCenter plugin for managing backup and recovery of VMs leveraging VM-level array-snapshot capabilities.
• Ability to provision VMs in less than a minute and large (TB) VMs quickly
• VMware Horizon View Composer Array Integration feature (VCAI) allows a VMware ESXi host to offload the creation of VMware Horizon View linked clones to a platform’s native snapshot function. When used with Horizon View VDI, this feature allows for the performance of native snapshots of VDI desktops during provisioning as opposed to having the hypervisor perform them.

New Hitachi VSP Storage System Details

• Three new models: G200 (2U), G400 (4U), and G600 (4U). All models will run the SVOS OS. An additional high-end model (G800) will be available later in 2015.
• The new models will be unified (file plus block) via integration with the 4000 line.
• Support for global active device and Hitachi Dynamic Tiering active flash will be available later in 2015
• The first release of the new management platform will be available in early 2015. Additional capabilities will be added later in 2015.
• Highly efficient utilization of storage capacity for VMware virtual server and VDI environments
• VMware-specific software plug-ins and adapters include:
  o VMware vStorage APIs for Array Integration (VAAI)
  o Site Recovery Manager (SRM) Adapter for block and file
  o Hitachi Virtual Infrastructure Integrator 3.0 vSphere Data Protection Solution
  o Hitachi Storage Management Pack for VMware vCenter (block)
  o Storage Management Pack for vRealize Operations Management Suite
  o Storage Connector for vRealize Orchestrator
  o Hitachi Storage Provider for VMware vCenter (VASA)

These add value to existing VMware software plug-ins and adapters including:

Hitachi Storage Management Pack for vRealize Operations Manager—provides a unified comprehensive view of Hitachi storage components for storage resource optimization. The adapter also comes pre-loaded with dashboards for storage performance, capacity and top consumers for Hitachi Storage arrays.

Hitachi Storage Connector for VMware vCenter Orchestrator—an Orchestrator plug-in that facilitates automation and orchestration of storage management operations. It is based on version 5.5 of the vCenter Orchestrator Plug-in SDK and provides several built-in workflows and actions that can be used by an administrator to automate higher-level workflows. Major workflow categories that are automated include storage configuration, provisioning, LUN, FS and VM snapshot backup, and VM recovery.

**Active-Active Stretched Clusters—Hitachi’s Global Active Device (GAD)**

In addition to the VMware-specific features mentioned above, there were capabilities introduced in SVOS with the previous VSP G1000 announcement that are significant for IT administrators managing VMware environments. One of them is Hitachi’s global active device (GAD). To understand GAD, it is important to first understand the concept of Hitachi’s virtual storage machines that were introduced with the first release of the VSP. Virtual storage machines are loosely comparable to server-based Virtual Machines (VMs).
Figure 1. Comparing Server-based Virtual Machines (VMs) to Hitachi’s Virtual Storage Machines (VSMs)

VSMs can be thought of as virtual machines that are used to apply software defined storage services across heterogeneous physical storage resources. These include:

- Automated tiered storage (Hitachi Dynamic Tiering)
- Thin provisioning (Hitachi Dynamic Provisioning)
- Storage resource pooling
- Secure multi-tenancy
- Data replication (snapshots and clone copies with Hitachi ThinImage, ShadowImage, TrueCopy, and Universal Replicator)

Data migration and remote replication are attributes of each VSM and can be extended across all physical storage—HDS and third party arrays—attached to SVOS controllers. A single VSM can also span metro distances.
When used in conjunction with VSMs, GAD sets up cross-mirrored volumes between two SVOS-based systems that accept read/write I/Os on both sides and are continuously updated (see Figure 3 below). If a disk controller failure occurs at the main site, a reserve controller at the remote site automatically takes over and accepts read/write I/Os. Conversely, if a controller failure occurs at the remote site, the main site controller automatically takes over. A quorum controller that is external to either system is used to determine the operational controller when a failure occurs.

GAD assures that an active and up to date storage volume is available to a production application in spite of the loss of a virtualized controller. In addition, the use of active-active stretch clustering can also be used for non-disruptive workload migration and non-disruptive data migration without requiring the use of a separate system between VSPs.
Figure 3. Volume mirroring using Hitachi GAD to assure data volume availability

Implications for Improving VMware Environments

As mentioned, Evaluator Group believes that Hitachi’s implementation of active-active stretched clusters as GAD has significant implications for VMware administrators. These include:

Non-disruptive Operations—The assurance of continuous availability for critical business applications running in a VMware environment

Workload Mobility—Movement of a primary or secondary application VM to another location to balance the current workload, or to take the primary application server temporarily off-line for technology updates

Non-disruptive Data Migration—The ability to non-disruptively migrate data in when performing technology updates and scaling-out VMware environments

Implementation of Hybrid Cloud—Hitachi GAD-enabled active-active stretched clusters that span the enterprise data center and a cloud services provider

Non-disruptive VMware Operations

Currently with VMware, failure of access to data (storage array or FC link failure for example) requires application interruption and failover using SRM to another copy of data, potentially at a second site. Hitachi’s SVOS-based Virtual Storage Machines can now provide active-active stretched clusters over
metro distances. Multi-path software allows application access to replicated data from the shortest path. Therefore, to activate a failover locally or between metro distance sites, vMotion only has to move virtual machine compute because the data is already at the failover target. As a result, overhead and delays for Storage vMotion data movement are eliminated. VM high availability is now a continuous operation with access to data, assuring critical business application availability and integrity.

**Figure 4.** VSP failover for non-disruptive VMware operations that is based only on the need to move VMs. ① VSP’s concurrent data mirroring capability (metro distance) makes data immediately available at Site B. ② vMotion moves VMs. ③ Multi-path software allows application access to replicated data from the shortest path.

**Workload Mobility**

In order to balance a processing workload during peak usage periods, VMware administrators often move an application to a second server to balance the workload. vMotion is used to move the VM and application(s). Now with either large or modular systems at two sites, SVOS’ concurrent data mirroring capability (metro distance) makes the VM’s data immediately available to the migrated VM at the second server. Data access can be automatically switched to the alternate server via the VSP’s multi-pathing capability. The workload is migrated without application interruption. This process could also be used to take a VMware server temporarily off line for routine maintenance and updates.
Figure 5. Two-site, non-disruptive workload mobility using SVOS storage systems for data mobility. ① vMotion is used to move the VM and application(s). ② VSP’s concurrent data mirroring capability (metro distance) makes the VM’s data immediately available to the migrated VM at the second server. ③ Data access is automatically switched to the alternate server via the VSP’s multi-pathing capability.

Non-disruptive data migration

In cases where another SVOS system is installed and brought online when the primary system has critical application volumes in use, data volumes can be migrated to the newly installed system without disruption to normal operations and while maintaining data protection during the migration. Two capabilities unique to SVOS allow this to happen:

1. Snapshots and replicated copies created by Hitachi ShadowCopy and ThinImage will be migrated as well so there is no lapse in data protection supported by these facilities.
2. VSM maps the secondary site serial number, model, and device number to the VM after it is moved so that its applications will not have to be restarted after the move.

This capability is also supported for third party arrays attached to SVOS controllers.
Figure 6. Non-disruptive data migration without lapse in data protection using VSP ① Data volumes and associated snapshots and clone copies are migrated from VSP A to VSP B using a VSM. ② Data access is switched to HUS B.

A VSP could also be located at a central site at a central site with one or more VSP systems at a remote/satellite sites. This configuration has multiple applications beyond data migration including disaster recovery and hybrid cloud instantiation (see below).

Hybrid Cloud

Tying together two SVOS systems can be used as a bridge between the enterprise data center and a cloud services provider that supports data replication and migration. In addition, SVOS with VSMs offers a number of storage-based data management attributes that will be of particular interest to cloud services providers as well as enterprise IT organizations undergoing a transformation to a cloud services model. VSMs are easily applied to the requirement for secure multi-tenancy. And, the non-disruptive failover, workload and data migration capabilities can support hybrid cloud with active-active stretched clusters between the SVOS user and service provider.

Evaluator Group Assessment

Using VMware vMotion in conjunction with Storage vMotion addresses some of the challenges associated with assuring continuous application availability. However, issues remain. Currently with
VMware, when a failure occurs, there can be performance impacts if data needs to be migrated. Hitachi’s implementation of active-active stretched cluster technology at the virtualized storage controller level improves application performance in these situations. Using VSP G1000 systems at the primary and smaller VSP systems at failover locations for example, the VMware administrator need only move the VM to the secondary location. By virtue of the fact that SVOS systems continuously mirror data-application data and data copies between locations, the data belonging to the VM in motion is already at the failover site. This also removes the possibility of disruption or delays as the result of an unexpected activation of vMotion. The ability to have VSP at a central site and one or more VSP systems at remote/satellite sites can also be used in applications requiring non-disruptive data mobility/migration and failover capability among sites.

An added benefit from SVOS falls into the realm of software defined storage. It is designed for modular hardware architectures, allowing for the incremental addition of storage, processing, and networking resources while retaining the original system platform. Because VSMs define the resources dedicated to VMs and to the VMware environment, the underlying hardware can change without disruption. This effectively extends the useful life of SVOS systems to five-seven years and reduces the impact of periodic storage hardware upgrades to the critical application environment.

For many enterprise VMware users, more than 70% of applications and workloads have been migrated to virtual machines. The more challenging applications are those regarded as business critical. The need to assure their stability, recoverability, and data integrity has been an inhibitor to virtualizing them. Now, the VSP Next Generation storage systems address these issues.

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