

Automated Tiered Storage for VMware

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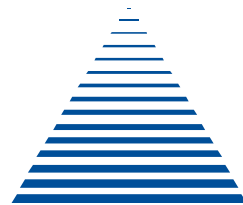
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Introduction

As server virtualization projects move from early stages of deployment to advanced stages involving more critical and demanding applications on more virtualized server clusters IT administrators are increasingly challenged to ensure performance, application availability, and cost efficiency. When each application has its own dedicated server, service delivery issues can be managed on an application-by-application, server-by-server basis. However, when multiple applications are running on virtualized server clusters, one must take a more holistic view to assuring the productivity of primary business application users.

Developing a holistic approach to management of the virtual server environment should be a goal of IT management teams, especially as existing, early stage deployments will likely continue to grow in scale and number. We see at least two essential ways to do this:

1. Begin by breaking down a strictly silo'd management style where server, network and storage administrators narrowly focus on their own administrative domains.
2. Embrace technologies that enable a more holistic management style.

This paper takes a look at how storage virtualization followed by storage tiering help enable this holistic operational goal.

Storage Virtualization - Unifying the Storage Environment

Virtualizing storage can be highly complementary to virtualizing the server environment. In fact, storage virtualization can help mask the differences and incompatibilities among different storage arrays, presenting them as a contiguous storage pool to VMware.

Furthermore, with the right storage virtualization platform, contiguous storage pooling can be extended to both new and existing arrays from like and unlike vendors, which not only provides investment protection but can also help organizations better absorb the costs of a growing VMware environment while maintaining consistency and predictability over performance, data protection, and new server or application deployments.

Finally, we note that VMware is increasingly advancing the ways that virtualized storage can be integrated with VMware environments. This can be seen in the introduction of VMware APIs for Array Integration (VAAI) delivered with vSphere 4.1 and most recently with the introduction of VMware APIs for Storage Integration (VASA) in vSphere 5.0.

Hitachi Unifies VMware Storage with it's Virtualized Storage Platform (VSP)

Hitachi can help organizations unify their storage environment using storage virtualization by leveraging the Hitachi Virtualized Storage Platform (VSP) to improve the efficiency, resiliency and scale of their VMware environments.

The Hitachi VSP is an integrated subsystem consisting of virtualized storage controllers and Hitachi disk arrays that can be composed of FC, SAS or SATA disk. The VSP also supports attachment of third-party storage and can be scaled to support larger VMware environments in which storage virtualization, performance, and ability to add capacity non-disruptively are required. With the VSP Hitachi offers a suite of storage and data management tools that function across native Hitachi storage and any third-party storage arrays attached to and virtualized by the VSP. Hitachi also provides tools and professional services for implementing an automated tiered storage environment for VMware deployments.

Hitachi Automates Tiered Storage for VMware

One of the many holistic management tools enabled by storage virtualization and the creation of storage pools is automated tiered storage. Hitachi enables organizations to create tiers – i.e., high performance, lower capacity FC and SAS disk to higher capacity, lower performance SATA disk – to meet the different characteristics of their data. For example:

- “Heavy-hitter” data sets can be allocated to high performance FC/SAS arrays (RAID 0, 10, 50) to assure optimal storage performance. As these data sets become less active, they can then be moved to higher-capacity SATA disk (RAID 6) to make room for other data sets that have become more active. Doing so helps to assure that currently active, high value data is always on high value storage.
- “Dormant” data sets can be allocated to SATA arrays and/or legacy FC arrays to maximize storage cost efficiency. If these data sets become active, they can be promoted to a higher performance tier.

In order to implement automated tiered storage, VMware administrators need to be able to map VMware data stores to VMs and workloads, and automatically identify unused storage capacity within the virtual storage pool. A new API now included in VAAI with the release of vSphere 5 called UNMAP will aid in this process when integrated with the VSP. In addition, the migration of data objects between tiers can be performed non-disruptively by the VSP in order to preserve business application availability and user productivity.

Hitachi Tiered Storage Manager is one such tool. It allocates volumes to the most appropriate storage tier¹ by enabling automated bi-directional migration of data objects to maximize storage efficiency and performance as needed under these common scenarios:

¹ Hitachi Tiered Storage Manager allows users to build tiers of Hitachi storage, not tiers of heterogeneous storage.

A Virtual Machine (VM) can typically require Tier 1 storage, but not always. Migrating it to a lower tier frees-up Tier 1 storage space for VMs that do need Tier 1 performance.

High performance (Tier 1) storage is typically used to support the deployment of new VMs. However, over time, VMware administrators come to an understanding, using a number of differing methods, that a particular VM does not exhibit I/O activity that would warrant maintaining the VM on Tier 1 storage and conclude that it can be moved to a lower tier to free up space on costly high-performance storage for VMs that actually do need the performance. What's more, concluding that a VM should be migrated can take a considerable amount of time. During that time Tier 1 storage is wasted on a low-activity or temporarily dormant VM.

Hitachi Tiered Storage Manager automates the migration of data from Hitachi VSP Tier 1 storage to Tier 2 AMS 2000 or third party arrays managed by the VSP by automatically identifying the source data on Tier 1, identifying the free capacity on the lower tier, and then moving the data volumes among tiers without disrupting application availability. Application performance as experienced by the user will likely remain unchanged if the number of IOPs it generates remains the same.

Application performance is degraded because a VM's storage is allocated to lower-tier disk. Migrating it to Tier 1 will improve application performance and meet required service levels.

It is often the case that an inactive VM can suddenly "come back to life." These sudden demands for increased storage performance can be expected when for example, VMs associated with the creation of quarter-end and year-end financial statements become active. It can also happen on a more permanent basis when more users are added to an application. The quicker the response to these spikes in demand, the better it is for the relationship between VMware administrators and application user groups.

Here, the process described runs the same way except that data is migrated automatically from the AMS 2000 and/or third party array tier to the higher-performance Hitachi VSP storage tier. In this case, users should notice an immediate improvement in application performance once the movement is complete.

Application performance requirements are both cyclical and predictable. Automating migrations improves VMware management efficiency.

As mentioned above, VMware administrators are well aware of cyclical changes in I/O demand relating to predictable business cycle changes and periodic reporting requirements. Using Hitachi Tiered Storage Manager, bidirectional VM migrations can be scheduled in advance thereby relieving administrators of the need to repetitively initiate these processes. This saves administrative time and reduces exposure to errors.

Other Hitachi controller-based tools are also required to implement Hitachi's automated tiered storage in a VMware environment. These include Hitachi Device Manager to map and manage the VM-to-

storage connections (both logical and physical), Hitachi Tuning Manager to monitor I/O activity, and Hitachi Dynamic Provisioning to add granularity to the types of data objects that are migrated.

Hitachi Dynamic Tiering

As a result of the way in which Hitachi has engineered and implemented storage virtualization, the VSP can extend its native automated tiering functionality to additional Hitachi arrays as well as third party arrays. Tiering can be applied at the sub-LUN level (block) or object level (file) using SSD (SLC Flash), SAS, SATA, and virtualized third party storage as separately definable tiers. A maximum of three tiers (tiers 0, 1, and 2) can be configured and can be defined by RAID group and drive speed. The minimum level of granularity for block-level tiering is a 42 MB “page”. The minimum level of granularity for file-level tiering is a single file. Volumes may be migrated among tiers without disruption as well as well using Hitachi data migration tools.

Data is written to the highest performance tier first as defined by the user. As it becomes less active it is successively migrated to the lower performance tier(s). If activity increases, it will be promoted back to successively higher performance tiers. Movement can be controlled by time of day in cycles of between one and twenty-four hours.

Conclusion

Virtualizing storage delivers a more holistic view of the storage environment supporting a VMware deployment. The benefits of this view include:

- Increased awareness of how I/O performance is directly related to VM-based application performance, and more cost-efficient management of a VMware deployment.
- Enhanced ability to respond to storage-related performance and availability issues.

As a result, VMware administrators can feel more confident when moving critical applications to virtualized servers because they understand how to respond quickly to changing requirements and meet the expectations of application users.

In addition, knowing that the storage environment is being managed at maximum efficiency means that VMware administrators can more accurately plan for and cost-justify additional storage requirements. Hitachi’s Tiered Storage Manager and Hitachi Dynamic Tiering allow Hitachi customers to derive maximum efficiency from both new and legacy storage arrays.

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