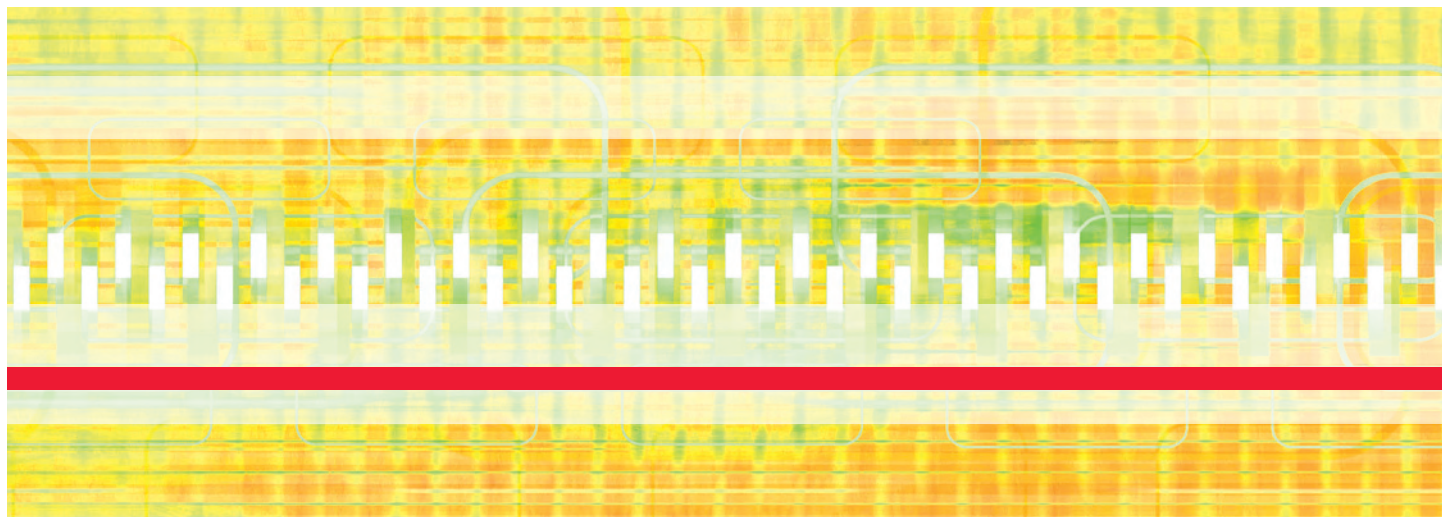


Hitachi Data Systems and VMware – The Power to Turbocharge VMware Environments



Server and Storage Virtualization

The quest to make the most use of IT assets through virtualization is not unique to the server or the storage side of today's business. Rather, server and storage virtualization architectures can — and do — work beautifully in tandem to jointly mask IT complexity, utilize new and legacy assets, effectively mobilize application resources and assign different IT classes of service to applications.

While some organizations struggle with choosing which virtualization technology to deploy — server virtualization or storage virtualization — savvy organizations have already come to realize that adopting either type of virtualization directly drives the need, applicability and benefits of the other. Virtualization, when applied from the top of the IT stack down to the bottom, effectively changes the playing field — making virtualized VMotion server environments work more smoothly.

This is especially true for business environments able to experience the many areas of technical affinity, complementary conceptual design and end-to-end benefits achieved by combining VMware Infrastructure 3 virtual server farms with a virtual storage pool offered by the Hitachi Universal Storage Platform™ V or Hitachi Universal Storage Platform VM controller-based storage virtualization platforms.

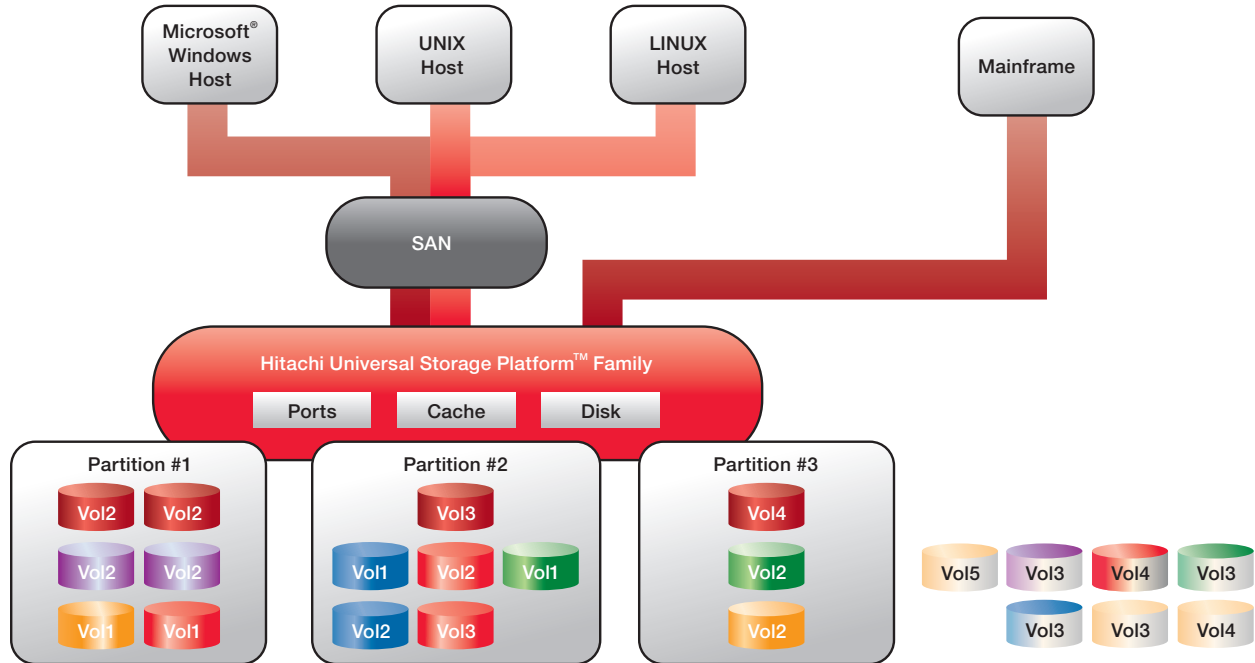
What can the two virtualization platforms achieve better together? Here are just a few examples:

- Seamless VM migrations, replication and remote recovery with minimal use of server CPUs
- Quick provisioning and assignment of just the virtual resources — from server memory cache to virtual storage ports and partitions — needed to support different classes of IT service and their related applications

- Integration of even legacy, heterogeneous servers and storage behind a simplified, virtual layer that now extends the value of the solutions' enterprise-class functions and services
- Robust policy-based management of IT assets, including streamlined departmental or centralized administration, in-depth functionality surrounding service-oriented chargeback and detailed service level agreements (SLA)

Hitachi virtualization uniquely complements VMware capabilities by masking the underlying heterogeneous storage infrastructure. Hitachi storage allocation policies provide the storage mix that delivers the desired quality of service (QoS) — automatically and without intervention.

Hitachi Virtual Storage Machine



Just as VMware virtual machines allow unique assignment of server resources to each guest, Hitachi Virtual Storage Machine technology offers the ability to assign and partition heterogeneous storage resources — in the form of virtual ports, storage controller cache and disk capacity — to each application or guest.

Hitachi Storage: The Best Match for VMware Environments

Hitachi Data Systems offers the exact mix of VMware-certified, 100 percent interoperable storage and storage services needed to meet — and exceed — the needs of even the most robust VMware environments.

Given the fact that both VMware and Hitachi Data Systems solutions are architected for virtualization, they have a high affinity out of the box. The parallels in their conceptual designs are especially striking.

Synergistic Architectures: Virtual Machines Meet Virtual Storage Machines

VMware environments are accustomed to assigning resources and policy to various virtual machines residing on their physical server hardware. With the Hitachi Universal Storage Platform V or Universal Storage Platform VM, environments can now take advantage of analogous benefits in the form of virtual storage machines and the Hitachi

virtualized storage architecture. These benefits include:

- **Control over resources and the environment.** Offering the capability to partition dedicated storage system cache, ports, security access and virtual storage capacities, Hitachi storage functionality gives organizations an easy way to dedicate and secure storage resources for specific applications and VMware guests.
- **Security and secure multitenancy.** Just as VMware virtual machines are isolated from other virtual machines, Hitachi virtualized storage is also isolated from other virtual storage machines.
- **Flexible administration.** Both virtual machines and Hitachi Virtual Storage Machines can have their own administrator or a central administrator for all.
- **Dedicated users.** Users can be dedicated to a particular virtual machines (in the case of VMware) or a particular Hitachi Virtual Storage Machine.

- **Uniquely assigned addressing.** With VMware, applications can be assigned particular ranges of virtual server “addresses.” Likewise, with Hitachi virtualized storage, applications can be assigned particular ranges of storage (LUN) addresses, such as LUN 0.
- **Department level metering and chargeback.** VMware virtual machines are designed to track their utilization of resources from the physical server and offer the potential to charge back a particular department for usage, if desired. Similarly, Hitachi storage architecture is able to granularly track actual resource utilization in many ways to also provide robust chargeback functionality.
- **Mobility — in policy and at the command line.** Virtual machines allow guests ready mobility among server platforms and operating systems. With the Hitachi Universal Storage Platform V or Hitachi Universal Storage Platform VM, organizations can benefit from ready mobility of

their data among heterogeneous storage devices, between mainframe and open systems, and between different tiers of underlying storage.

- **Provisioning.** Just as VMware's virtual machines allow server resources to be added transparently and nondisruptively, so, too, does the Hitachi Universal Storage Platform enable new and legacy storage resources from various vendors to be added transparently and nondisruptively. In addition, Hitachi Thin Provisioning, a unique feature to the Hitachi line of virtual storage, saves storage costs and can defer future acquisitions of storage capacity — all while ensuring each application has just the storage it needs.
- **Consistency of behavior.** Organizations using VMware have come to expect the company's virtual machines to operate consistently — regardless of the underlying physical server platform on which they run. Similarly, the Hitachi virtual storage layer ensures that Hitachi Virtual Storage Machines also behave consistently, regardless of the underlying storage hardware on which they are housed.
- **Isolation.** One great benefit of the use of virtual machines in VMware is their ability to isolate the environment and enable effective development, testing or software as a service (SaaS) efforts. Similarly, Hitachi Virtual Storage Machines also isolate the environment and effectively support similar efforts.

Other Hitachi Features that Turbocharge VMware Environments

Beyond the synergistic and parallel virtualization designs found in the VMware and Hitachi architectures, Hitachi boasts a number of unique features that can drive VMware environments to achieve greater benefits surrounding asset utilization, application mobility and flexible mastery of the environment.

Beyond SANs: Virtualizing Heterogeneous, Third-party Storage and Multiple Storage Architectures

Where many competing storage virtualization vendors stop at virtualizing storage with their own homogeneous line of storage systems or only devices within their own Fibre Channel-based storage area network (SAN), Hitachi Data Systems goes farther. The Hitachi Universal Storage Platform V or Universal Storage Platform VM allows VMware environments the option to manage one or more virtual pools of storage, “tiered” into various classes of service and all built on a wide range of externally attached vendor storage systems.

Instead of dealing with isolated silos of storage, legacy storage systems and storage from different vendors can now be united under the common, simplified virtualization layer of the Hitachi Universal Storage Platform. Expanding beyond just support for SAN environments, Hitachi virtualization technology also supports virtualizing storage systems based on SAN architectures, network attached storage (NAS) and even direct attached storage (DAS). Offering consistent manageability across and among these connection types, Hitachi Data Systems offers unparalleled flexibility to match VMware virtual machines and applications to exactly the right storage type.

Extending Enterprise-class “Thin Provisioning” to All Attached Storage

Some companies may already be aware of the storage practice of thin provisioning. This allows storage systems to allocate a large portion of virtual storage capacity to an application or guest, yet only use a fraction of the physical capacity currently required. Offering savings in both up-front capacity additions and a “green” factor that minimizes the amount of disk capacity in use, the practice works amazing well in a Hitachi Data Systems virtualization world. With Hitachi, VMware customers can now extend enterprise-class Hitachi Dynamic Provisioning functionality to all externally attached storage — another example of the entire suite of enterprise-level storage services

now available to external storage, even to less performance-conscious storage tiers. With Hitachi Dynamic Provisioning software, an application's or guest's initial storage requirements need no longer be an obstacle requiring such steep investments in storage.

Providing Rapid, Policy-based Data Mobility and Migration — without Disruption

Solutions like VMware Vmotion offer ready application mobility for virtual machines. Hitachi Data Systems also offers integrated and complementary, nondisruptive storage-based data migration technologies to different classes or tiers of storage — all offering a common management interface, and a common look and feel for administrators. With the help of Hitachi HiCommand® Tiered Storage Manager software, organizations can further offload server processing through rapid, storage-based migration of data subsets within virtual machines, as well as migration of entire virtual machines or VMFS infrastructures. This transparent, nondisruptive data migration functionality can move data between tiers without disrupting production environments, applications or VMware guests. The functionality is especially useful for hardware technology refreshes or application migration activities, such as migrations and upgrades to newer Microsoft® Exchange versions, migrations to different tiers of storage, and other enterprise-focused applications.

Offering Best-in-class Protection and Replication of Virtual Machine Infrastructures

Organizations wanting to reduce the CPU and I/O workload load on their servers can now match the power and simplicity of their VMware high availability environments with rapid, storage-based data protection and recovery services. For fast, local replication without disruption to production applications, Hitachi ShadowImage® Heterogeneous Replication software and Hitachi Copy-on-Write Snapshot software are built to easily handle the growing copies of applications and data found in a VMware environment. Offering rapid, nondisruptive snapshots of

data sets in the background — without strain to server resources — these solutions are especially useful for rapid disk-based backup and recovery, and the changing needs of a development or testing team. Unique “boot from SAN” capabilities in the Hitachi virtualization platform also allow VMware environments to boot a device independent of its hard drive — a potential time-saving factor for many disaster recovery efforts.

Supporting Mixed Host Environments

When organizations choose to virtualize their storage and gain further virtualization benefits throughout the IT stack, many face a dilemma: What should they do about their combined host environments that might consist of both mainframe and open systems applications? Hitachi Data Systems virtualization technology is unique in its ability to leverage both open and mainframe systems, in either a standalone or mixed environment. Most storage virtualization platforms only support open systems environments. This offers further utilization and pooling of storage resources — without sacrificing important QoS and security features needed to host storage for specific applications or hosts.

You've Chosen VMware. Now Choose Hitachi Data Systems.

Committed to working closely together to integrate and pass along the benefits of end-to-end virtualization and utilization to their joint customers, VMware and Hitachi Data Systems are not just partners in the way they think, but also in the results consistently touted by their virtualization customers.

Learn how Hitachi Data Systems can extend the savings and simplicity of virtualized VMware environments down to the storage side of your IT infrastructure. Experience the enhanced utilization, mobility and mastery that ensues when you combine server virtualization from VMware with storage virtualization from Hitachi Data Systems.

To learn more about the benefits of a combined VMware/Hitachi Data Systems virtual world, please contact your local Hitachi Data Systems representative or go to: <http://www.hds.com/partners/alliance-partners/vmware.html>

Fully Certified and Interoperable

Building on its leadership in storage virtualization, Hitachi Data Systems also became the first storage vendor to obtain full VMware certification for its Universal Storage Platform when used in conjunction with VMware Infrastructure 3. Obtaining the first certification under VMware's external storage virtualization hardware certification program, the Hitachi Universal Storage Platform virtualized storage architecture remains fully tested

for interoperability and ultimate support with VMware. A wide range of Hitachi storage solutions, including Hitachi Adaptable Modular Storage and Hitachi Workgroup Modular Storage systems, are also fully supported for interoperability and integration with VMware environments — thanks to the collective and continuous testing efforts of both VMware and Hitachi Data Systems, a VMware technology alliance partner.

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BP-007-A DG March 2008