Industry Trends and Technology Perspective Solutions Brief

"NetApp MultiStore™ Virtual Storage Server"
A look at MultiStore™ and how it addresses various requirements including storage consolidation, security, load-balancing and BC/DR

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This StorageIO Industry trends and perspectives solution brief looks at a storage virtualization capability that provides secure segmentation or isolation of different applications on a consolidated storage system while providing transparent failover to client applications. NetApp MultiStore™ complements virtualized and non-virtualized server environments while enabling routine data and storage management tasks including maintenance or application load-balancing in consolidated storage and server environments.
Introduction & Background
There are many different challenges facing IT data centers and businesses of all sizes that can benefit by leveraging some form of virtualization technology to enable consolidation or improve routine operational efficiency in a more cost effective manner.

Common IT data center challenges and activities include:

- Addressing data center and application performance bottlenecks along with changing workloads
- Securing applications and data from different user groups or customers in consolidated environments
- Manage more data being generated, stored, protected and retained for longer periods of time
- Support compliance or self-governance along with preservation of intellectual property (IP) data
- Sustain business and application growth while becoming more energy efficient
- Enable data and transaction integrity for business continuance (BC) and disaster recovery (DR)
- Consolidate servers, storage and applications to reduce complexity and contain management costs
- Transparently move or migrate data from old to new storage during technology replacement
- Boost resource utilization maximizing floor space, power and cooling capabilities to contain costs
- Enhance application service delivery in a cost effective and environmentally friendly manner

As a solution, IT data centers are increasingly looking to virtualization technology and techniques to address the above issues and activities. Using virtualization to consolidate servers and storage resources is a popular approach being used in many environments to boost resource utilization and contain costs. In addition to server virtualization, virtualization technology is also being applied to networking, I/O and storage. There are many aspects of data storage virtualization that address routine IT management and support tasks including data protection, maintenance and load-balancing for seasonal and project oriented transient application workloads.

There are several forms of storage virtualization, including aggregation or consolidation, to boost utilization. In addition to virtualization technologies to support server, storage and network consolidation, other approaches include emulation to facilitate integration of new technologies into your IT data infrastructure environment while minimizing or eliminating disruptions to software and procedures. Common forms of storage virtualization using emulation or abstraction include virtual tape libraries, virtual storage servers, virtual storage partitions and device emulation among others.

NetApp MultiStore™ – A Closer Look
Another storage virtualization approach, not to be confused with NetApp physical storage systems including the V-Series (formerly known as the gFilers), is NetApp MultiStore™. NetApp MultiStore is a licensable feature (by physical storage system) from NetApp built into the NetApp Data ONTAP storage software. MultiStore™ subdivides a NetApp physical storage system into multiple logical domains or virtual storage server partitions known as vfilers, each with their own unique identity, management and IP address.

As an example, in Figure-1, a NetApp storage system has been subdivided into three separate vfilers (A, B and C), each assigned to a different department, workgroup or application. Each vfiler and the storage assigned to it are isolated from other vfilers on the same physical storage system to protect data integrity and maintain application privacy in a shared consolidated storage environment. The vfilers function and appear to client application servers as a typical NetApp storage system for transparency even when a
vfiler is moved from one physical storage system to another. Another usage case for the vfilers would be to create separate vfilers to correspond to separate virtual machines in a VMware or other virtualized server environment to achieve similar storage consolidation benefits of server virtualization.

Co-existing with other NetApp technologies, MultiStore™ can be deployed in local, remote or various combined configurations to enable application needs ranging from load balancing for seasonal or project oriented applications, facilitating routine IT management tasks including maintenance, along with supporting data protection of local and remote storage servers including rapid restorer for BC and DR.

General capabilities and benefits of NetApp MultiStore™ include:

- Support server and storage consolidation without reconfiguring client or application server
- Virtual storage partitions, called vfilers, each with their own identity and IP access characteristics
- Securing or isolating different applications or customers on consolidated storage
- Transparent client access of data for BC and DR scenarios with no application changes
- Facilitate routine IT resource management operations including maintenance
- Load balancing to meet seasonal workload changes or transient projects and storage needs
- Enable tiered or delegated storage management models of virtual storage servers
- Improved storage and IT resource utilization to address energy efficiency concerns

The basic premise of MultiStore™ is to subdivide a physical NetApp storage system into multiple separate logical domains each individually managed with a separate IP address with its own personality or identity. On the surface MultiStore looks similar in concept to a virtualized server where multiple virtual machines each capable of hosting different operating systems and applications share common memory, processing and I/O capabilities. However, where MultiStore differs from a VMware or Virtual Iron or other hyper-visor based server virtualization solution is that MultiStore is a feature embedded in the standard NetApp storage operating system environment.

To be more precise, unlike server virtualization solutions where a hyper-visor creates separate virtual machines capable of running multiple instances of the same or different operating systems, MultiStore is implemented as a single instance of Data ONTAP that then creates separate virtual filers each with their
own identities. This is similar in approach to other enterprise class storage systems capable of creating virtual partitions or domains to subdivide storage resources while enabling finer grain allocation and management.

Data security and application isolation are maintained by creating a separate vfiler with its own unique identity and access controls for different applications or consolidated storage server instances. Client and application servers see each MultiStore virtual storage partition as a unique or separate file and data server. Each MultiStore™ vfiler instance protects data that it is responsible for by enforcing access to a specific virtual server or by the master root administration vfiler0. Even when two different applications’ data are stored on the same physical disk, the data can only be accessed via the virtual storage server responsible for that data thereby preventing trespassing by other virtual servers and applications consolidated to the same physical server.

The number of available MultiStore™ vfilers available per physical storage system will vary based on a number of factors including application workload or activity, specific performance requirements, amount of memory and I/O processing capabilities of specific NetApp storage system model along with local and wide area network bandwidth capabilities or constraints among others.

For flexibility, subordinated or tiered storage management can be assigned to each virtual filer having its own management functions that are a subset of the physical or root storage system. This flexibility enables different applications’ virtual storage servers to be managed separately and by different personnel all under the supervision of a super user of vfiler0. This tiered management approach lends itself well to managed service providers or other large scale environments that need flexibility with security for their hosted applications and data. Another use for MultiStore™ tiered storage management capability is to assign management of storage systems and their data on a project basis. When the project is completed, the data and associated virtual storage system can be archived until needed in the future.

**When and where to use MultiStore**

On a local basis MultiStore™ can be used to secure different applications or projects consolidated on a common storage system. When needed, a MultiStore™ virtual filer (vfiler) can be moved transparently to another physical storage system to support planned load balancing or increases in workload such as a project ramping up or seasonal activity. Additional MultiStore™ usage scenarios include:

- Compliment server consolidation by creating separate vfilers per virtual machine for data security
- Facilitate routine eminence of proactively shifting applications’ data without client access changes
- Support data movement during technology upgrades or replacements with seamless access by clients
- Enable local or wide area disaster recovery or business continuance (DR/BC) including multi-site DR
- Migrate vfilers from remote to central sites when and where needed or on a per project basis
- Migrate vfilers and applications across different physical servers for load balancing
- Application, user and customer isolation in co-located or managed service environments
- Autonomous or tiered management of consolidated applications and workloads
- Leverage scaling capabilities of large NetApp storage systems to meet consolidation needs

Primary tenants of virtualization including enabling transparency, emulation, and abstraction in addition to aggregation or pooling of resources. For example, masking complexity and eliminating host applications or clients from having to know psychically where data is actually being stored or if the location changes. A fundamental feature of MultiStore™ enables virtual storage systems or vfilers to be
moved to different physical systems locally or remotely transparently without having to reconfigure client application servers and the mount points they use for accessing data.

StorageIO perspective on MultiStore

NetApp MultiStore™ is an enabling technology that IT organizations of all sizes can utilize to address BC/DR needs locally along with distributed including remote office branch office (ROBO) storage needs. The flexibility of MultiStore™ lends itself to transparent BC/DR eliminating the need to make client-side reconfiguration changes to access recovered storage. MultiStore™ also works well as an operational tool. From an operational standpoint, MultiStore™ can be used to transparently move virtual storage systems or vfilers between different physical NetApp storage systems for load balancing, seasonal application needs or to facilitate maintenance in virtualized server and storage environments.

As flexible and enabling as MultiStore™ is, there are some scenarios where other approaches would be more applicable. MultiStore™ can be used to transparently migrate vfilers for load balancing, however, in some cases for more performance, a larger storage system or some other form of performance acceleration would be required. Currently, MultiStore™ supports NFS, CIFS and iSCSI based IP storage; consequently, deployments into consolidated Fibre Channel based scenarios would not make sense until such support is added sometime in the future. Since MultiStore™ only requires a single instance of Data ONTAP storage software to support multiple vfilers; operational management efficiency can be achieved from reducing the number of instances of Data ONTAP to manage when storage is consolidated. Unlike a virtual server environment where different operating system versions may be installed for testing purposes, MultiStore™ is not targeted or positioned as a vehicle for testing new versions of Data ONTAP. However, MultiStore™ can be used to support multiple virtual filers for application development, testing and Q&A activities or hosting activities in managed service environments.

Closing Comments

While there is a common affinity for MultiStore™ and virtualized consolidated server environments, there are many additional scenarios including supporting routine IT resource management tasks such as server and storage maintenance as well as disaster recovery and business continuance. As IT organizations consolidate server, storage and networking resources to boost utilization, MultiStore™ should be used in consolidated storage scenarios to securely isolate different applications or customer’s data on consolidated storage systems.

The above capabilities of MultiStore™ can be used to facilitate robust data protection and data integrity of consolidated server and storage environments. Exiting NetApp environments and customers if you are not already using or aware of MultiStore™, have your NetApp representative or business partner explore with you how and where the technology can be used to address various storage and data infrastructure resource management tasks while supporting both central and distributed environments.

About the author

Greg Schulz is founder of the Server and StorageIO Group, an independent IT industry advisory consultancy and research firm. Greg is also author of the books The Green and Virtual Data Center (CRC), Resilient Storage Network: Designing Flexible Scalable Data Infrastructures (Elsevier) and coming summer 2011 Cloud and Virtual Data Storage Networking (CRC). Learn more at www.storageio.com, www.storageioblog.com or on twitter @storageio.

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