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DataCore SANsymphony – The Perfect Complement to Virtualized Server Infrastructure

THE NET NET

Server virtualization today is a hot topic. Enterprises everywhere are rapidly implementing virtualized servers in a quest for better resource utilization, simplified management, and a more flexible infrastructure. Over 85% of these virtualized servers use a SAN and a shared storage model. Unfortunately, server virtualization with shared storage exacerbates pre-existing storage management issues, and in many cases creates new challenges not present in a purely physical world. In particular, storage networks derived from point-to-point physical architectures and fixed, high-availability configurations often work to undermine the portability and flexibility promised by virtualized servers.

Forward looking enterprises have found that pairing storage virtualization with server virtualization offers a solution to these unique storage management challenges. DataCore, an early pioneer of the network storage virtualization product category, was one of the first storage virtualization providers to recognize the power of deploying storage virtualization in concert with server virtualization. As a result, its SANsymphony product is optimally tailored to address the critical challenges of managing storage in a virtualized environment. This product profile will detail the critical storage management challenges engendered by virtualized server infrastructure and then discuss how SANsymphony addresses these critical challenges.

The Storage Challenged Virtual Enterprise

From our research and surveys, server virtualization and server consolidation are at or near the top of mind for most CIOs and senior IT management. It is not hard to understand why. Virtualization enables IT to do more with less. Virtualization allows CIOs to better utilize existing infrastructure and gives IT managers the flexibility to adapt infrastructure to changing business demands. In short, server virtualization and server consolidation deliver the following value proposition:

- Improve server utilization from 5-15% to over 50%
- Reduce the number of physical servers under management dramatically, providing greater economies of scale in terms of administration
- Deliver higher performance with greater reliability
- Increase the overall flexibility of infrastructure by allowing IT to move virtual machines around to meet SLAs and improve performance

We'll look next at the storage challenges that confront virtualized enterprises.

Storage Challenge #1: Performance

Server virtualization vendors report that over 85% of their customers attach their virtual environments to SANs, which far exceeds the average server SAN attach rates in non-virtual enterprises. Enterprises attach their virtual server environments to SANs specifically to gain access to larger amounts of performance and capacity while retaining virtual server portability. Since this SAN attachment happens with devices that are high-performance virtual hosts with many virtual guests, the performance demands upon storage quickly reach a new level.

To make matters worse, traditional storage practices create complex physical SAN configurations in an attempt to focus I/O performance at I/O intensive applications. As a result, enterprises end up creating an environment that defeats the simplified management goal of server virtualization.

Storage Challenge #2: Capacity Management Exacerbated

Capacity management is a key storage challenge everywhere, but the SAN attachment of virtual servers draws more attention to the issue. Server virtualization demands large contiguous blocks of storage in order to work with and move virtual images. Storage is by nature a limited resource, and traditional storage environments hand out small chunks of capacity at a time in order to extract every bit of this limited resource from every pool of storage. Such an allocation practice works in opposition to the storage needs of virtual server environments, and makes many enterprises unable to meet storage demands.

Utilization further exacerbates the capacity management challenge. Traditional storage environments utilize 25% to 35% of their allocated space before running out of storage. Virtualization demands large amounts of capacity, but does nothing by itself to improve utilization. Consequently, storage for virtual systems generates allocation requests 4 times greater than utilized, and much of that space is expected to be contiguous.

Complicating the issue are the configuration limitations associated with physical channels and disk groups, which most SAN devices inevitably impose. Not only does a consciousness of physical restrictions invade the otherwise virtual environment, but the solution is often achieved only through over-allocation.

Traditional storage tools offer no fix for improving upon allocation and utilization of storage. Consequently, server virtualization needs only exacerbate the problem.

Challenge #3: Protecting Data

Server virtualization environments require highly available shared storage since many virtual machines (VMs) share a common server. This magnifies the business downtime impacts of a failure since "all the eggs are in a single basket". VM data structures therefore must not be only protected but they must be easily shared so that VMs can be rapidly failed over or redeployed to another server platform to maximize uptime.

Server virtualization also complicates the data backup practices. Off-hours backups can no longer run simultaneously because the performance demand on a single server supporting multiple virtual guests is simply too high. In response, storage managers look to array-based snapshot backups, specialized clients, mirror splits, or other approaches, but those possibilities are mired in management complexity, negative performance impacts, and possible up-time complications. Assuring that virtual guests are easily backed up with complete data integrity becomes nearly impossible. Meanwhile, mapping constantly changing virtual configurations to typically scripted and fixed back-up tasks, introduces a new challenge.

Challenge #4: Data Migration

Data movement challenges plague most storage environments, but major data migrations bring those challenges to the surface. At the root of the problem are incompatibilities between storage subsystems, complex SAN configurations, and many storage infrastructure dependencies. As virtualization increases the number of SAN clients, complexity and dependencies increase, making data migration even more complex. As a result, the virtual computing promise of a flexible infrastructure is lost.

Challenge #5: Managing Large Scale

Large enterprise storage network environments are very complex, with larger configurations incorporating many hundreds of devices. With the introduction of server virtualization, the number of SAN attached devices rapidly increases, and consistently managing devices within specific virtual namespaces or areas of the enterprise becomes much more challenging. Many management tools become unwieldy, tedious, and inefficient when applied to a much larger environment and may result in administrators making more configuration or operational errors. Most management tools are unable to understand the requirements of large virtual namespaces, and are unable to standardize and automate key storage operations, such as: provisioning large numbers of similarly configured volumes, automating allocations, and sub-dividing large storage environments into more easily managed sub-sections.

Deploying many systems and doing it quickly is a key benefit of server virtualization. However, individually assigning, provisioning, and managing storage for each individual system remains a time intensive task.

Storage Virtualization to the Rescue

These storage challenges surrounding traditional storage management stand in the way of many of the promised benefits of server virtualization, and result in an infrastructure that is:

- More complex
- Less effective in utilizing capacity
- More difficult to protect
- Less adaptable

Fortunately, storage virtualization offers a compelling solution to address these additional management complexities.

Storage virtualization simplifies storage infrastructure while making it more flexible. But some solutions stand out in how fully they encompass storage management issues specific to virtualization. Next we'll look at one solution, DataCore's SANsymphony, and assess how it addresses virtual computing challenges for storage infrastructure.

Focus on SANsymphony

Founded in 1998, DataCore Software is one of the pioneers of network-based storage virtualization. Today, DataCore has thousands of customers and has emerged as a leader in providing storage virtualization solutions to enterprise customers.

The foundation of DataCore's enterprise storage virtualization product, SANsymphony (SSY), is custom software layer running on top of Microsoft Windows Server operating system. DataCore does this with a software microkernel that interfaces with the Microsoft Windows operating system at a very low level, bypassing other user space applications and processes to reserve committed levels of memory and processor.

This approach allows DataCore to make use of a widely interoperable, cost-effective platform with one of the best deterministic I/O subsystems on the market. Following a software installation, a SANsymphony Windows Server becomes a dedicated, high performance Storage Domain Server (SDS). SDS virtualizes a wide range of storage by sitting in-line between hosts and storage. DataCore then combines any number and configuration of SDSs into a Storage Domain and load balances I/O across SDSs to scale performance.

With the Windows-based benefits of wide interoperability and cost-effectiveness, DataCore has been able to focus more of their efforts on rapidly maturing their product and adding innovative feature-function to the software. Consequently, today, DataCore has a broad feature set that is hard to match as compared to their competitors. Altogether, this combination of the Windows Operating System, industry standard hardware, and DataCore software promises to deliver a mature, easily managed, highly scalable, and feature rich solution.

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CONTINGENCY SITE

REMOTE MIRRORING

IP

PRIMARY SITE

DataCore SANSymphony
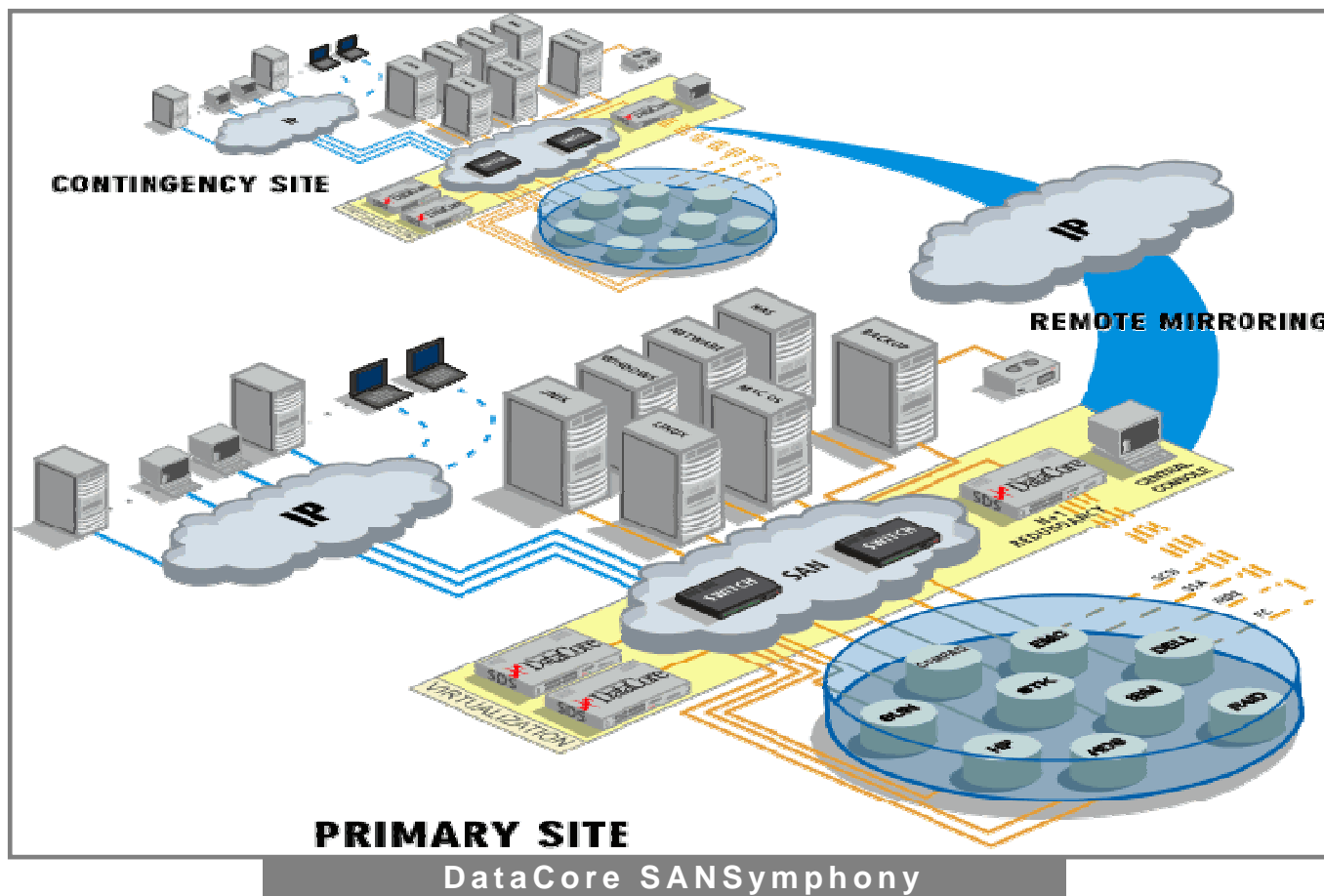
DataCore & the Storage Challenges of a Virtualized Server Infrastructure

We'll look next at how SANsymphony meets the key challenges confronting a virtualized enterprise.

Challenge #1: SANsymphony Optimizes Performance

Storage virtualization aggregates underlying storage systems and distributes performance demands across previously scattered enterprise storage. As a result, excessive demands upon single storage systems are balanced across multiple arrays. SS6 provides several unique capabilities beyond performance aggregation.

First, SSY optimizes performance by intercepting and tuning I/O between hosts and storage. Each SDS uses system memory as a performance cache and shapes I/O on both the disk side and the client side to extract maximum storage performance. In most cases, disk I/Os are directly satisfied by the SSY node. SDSs support up to 16GB of memory per node today with plans to expand that capability in the latter part of 2007 as 64 bit systems become more common. Because

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CPU and memory technology on standard servers tends to be one to two technology generations ahead of custom hardware solutions, SSY shows some of the highest channel utilization rates and lowest cache response latencies in the industry, as well as allowing for continuous technology refresh if required.

Second, SSY aggregates SDS nodes together for both availability and performance using an N+1 any-to-any failover architecture that also pools SDSs performance cache. Incremental nodes add to virtualization fabric bandwidth and also add to the virtualization fabric performance cache.

Finally, SSY provides a Quality of Service (QoS) policy engine to prioritize queuing and servicing of transactions against performance-constrained storage. While the CPU/memory and channel architecture of SSY allows for broad connectivity, QoS policy assures that custom priorities are maintained for high-value applications even as their physical location changes.

SSY meets the performance demands of virtual enterprises by pooling together the performance capabilities of scattered storage; enhancing the performance of storage networks; and controlling the performance demands of hosts.

Challenge #2: SANsymphony Virtualizes Capacity

Storage virtualization pools storage and allows the allocation of space across the boundaries of single physical arrays. A pool creates more contiguous space for allocation and eliminates stranded pockets of capacity.

SSY provides a key capacity management feature beyond storage pooling: thin provisioning. Storage administrators use thin provisioning to allocate large volumes to a server, but the server only utilizes the space on disk that is actually occupied by data. The full volume size as allocated always appears present to the server, and as data grows SSY assigns more space without affecting the host system or requiring the storage manager to interact. SSY thin provisioning avoids the need to constantly provision more storage and sets virtual hosts free from the restrictions associated with hard space allocations.

We find that thin provisioning can typically drive utilization to 75% to 85% of capacity before purchasing additional storage, but the value of the flexibility and management simplification returned to a virtual environment will far exceed that benefit.

Challenge #3: SANsymphony Protects

Most storage virtualization solutions provide snapshot and data copy capabilities that allow enterprises to create duplicate data sets for backup, recovery, and even manual failover across different pools of storage. This facilitates backup, diminishes the performance impact of I/O intensive backup activity on primary storage, and provides near-line data for manual intervention and recovery in case of data disruption. SSY automates the creation, movement, and retention of snapshots and copies, reducing the administration for these tasks.

Further, SSY can create replicas and mirrors across homogeneous or heterogeneous underlying storage, and automates failover and recovery of mirrors or replicas - shielding virtual servers from failures at the storage device or array level. VMs continue to operate undisturbed since the mappings between servers and storage devices are dynamic, redundant, and not fixed physical relationships. In addition, SSY includes the ability for users to prioritize the recovery of storage on the basis of business priority levels versus waiting for a complete resynchronization of a specific array or the overall pool.

DataCore ventures one step further as well, with Traveller CPR. Traveller CPR continuously captures every storage transaction onto secondary storage, providing an Any-Point-In-Time (APIT) copy of enterprise data. Virtual server administrators can briefly bring virtual machines to a steady state, and then utilize that APIT copy to fully capture a recovery ready dataset with minimal administrator overhead and no impact on primary storage.

Altogether, DataCore's Traveller CPR, and SSY-based snapshot, mirror, and copy provides enterprises a selection of the best data protection functionality available in the market today.

Challenge #4: SANsymphony Non-Disruptively Migrates Data

It should be no surprise that SSY is a capable solution for migrating data across enterprise and virtual server infrastructures. SSY

virtual storage volumes are storage agnostic and retain their identity regardless of underlying storage. Furthermore, they can be presented to any server regardless of where that server resides in an FC or iSCSI network. Using this freedom and flexibility SSY makes "storage hot-swappable" in a virtualization fabric; this allows entire arrays and storage systems to be replaced or re-arranged without impact to normal operations.

Challenge #5: SANsymphony – Tuned for Macro-level Management

Thin-provisioning alleviates some of the repetitive storage administration typical in large storage environments, but SSY also uses group operations and the ability to logically partition and regulate resources in a SAN through the use of "Regions" and "SAN Domains" – independent virtual SANs or subnets. SSY group operations and the SSY management GUI automate a wide spectrum of storage tasks at a macro level and create economies of scale when managing a large environment. Some of these macro level capabilities include:

- Region configuration policies and rules
- Tools for creating and provisioning multiple host volumes simultaneously
- Ability to align virtual volume provisioning with different storage pools, auto-selecting disk resources without administrative interaction
- Ability to designate and manage multiple number and type of administrative staff per region or domain.

- Further abilities to structure volume characteristics such as protection and availability with rules and policies

Overall, SAN Domains and macro level group operations in conjunction with the automation capabilities of thin-provisioning represents a significant improvement on the tedium and potential confusion associated with complex storage networks.

Taneja Group Opinion

IT Managers are questioning their entire storage management approach as they're confronted with tough storage management challenges following their implementations of server virtualization. But truth be told, server virtualization isn't the only reason these managers should be looking at storage virtualization. In reality, major storage management challenges that have been flying under the radar for years are now getting noticed as server virtualization starts demanding high performing, flexible, and capacity-rich storage. Looking in on this struggle from the outside, wise consumers in non-virtualized enterprises might take this as a warning of complications to come even if they never plan to utilize server virtualization. But in virtual enterprises, the

challenges stemming from traditional storage management complicate the realization of the benefits promised by virtual computing.

DataCore's SANsymphony readily steps forward to meet the challenges created by a virtualized server infrastructure. Furthermore, SANsymphony does this with an impressive set of features and scalability, on top of the most common platform available today.

Based on our research, we believe that virtualization at both the server and storage layer become non-optional capabilities in the next generation data center. The data center of tomorrow must be able to scale on demand and be agile so that resources can be quickly commissioned and decommissioned as business demands dictate. If your organization is planning or already has made a significant commitment to server virtualization, we believe that you should also be evaluating and planning for a storage virtualization strategy. Enterprises can find one solution to their storage management troubles in SANsymphony.