SNIA SSF Virtualization Demonstration

IBM TotalStorage® SAN Volume Controller

IBM Systems Group -TotalStorage Software

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Executive Overview

The term "virtualization" is a very popular and confusing term these days. It is used by server vendors, fabric vendors, storage vendors, and storage software vendors to describe a wide range of functions intended to simplify the management of IT installations. Almost all vendors seem to use this term, but no two vendors can agree on its meaning.

The SNIA Supported Solutions Forum (SSF) decided to focus on storage virtualization and create a demonstration that would, first, educate the audience on the meaning of storage virtualization, and, second, allow the participating vendors the opportunity to show their virtualization products side-by-side with those of their competitors. The environment utilized for this demonstration was the SSF's multi-vendor switch interoperability infrastructure. In this environment, the virtualization products interoperate with storage from several major storage vendors, thus promoting multi-vendor interoperability – one of the SSF's primary goals.

This demonstration required an intense level of cooperation and diligent effort among all of the participating vendors. None of these virtualization products had ever been tested in such a rich multi-vendor environment before. The vendors learned a great deal from this activity, and are taking this knowledge back to their engineering labs to help improve the interoperability capabilities of their products.

This demonstration was first staged at the SNIA Technology Center in Colorado Springs in September, then brought here to the fall Storage Networking World (SNW) in Orlando, Florida. The participating vendors includes: Cisco, EMC, Fujitsu-Softek, HDS, HP, IBM, QLogic, Sun, Troika Networks, McDATA, and MaXXan.

The purpose of this white paper is to document the vendor-specific portion of the SNIA SSF Virtualization demonstration. Each vendor has authored its own white paper based on a common template. The specifics of the environment, a brief product description, the product setup and configuration, the tests performed, and the results of the testing are covered herein. Also included, where appropriate, are the surprises found along the way that will be taken back to the lab to help improve the products.

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Product-Specific Overview

The purpose of this white paper is to document the results of the SNIA SSF Virtualization demonstration as they relate to the IBM TotalStorage SAN Volume Controller (SVC). It is intended to demonstrate the coexistence of the SVC with other vendor's products. It is further intended to showcase some of the advanced features of the SVC

This paper specifically describes the configuration and testing for the SVC in the SSF's multi-vendor switch interoperability SAN environment. It documents the tests performed and the results achieved.

All testing was pre-staged at the SNIA Technology Center in Colorado Springs, CO, during the week of September 22-26, 2003, and then taken to the fall Storage Networking World (SNW) in Orlando to show in the Interoperability and Solutions Demo lab.

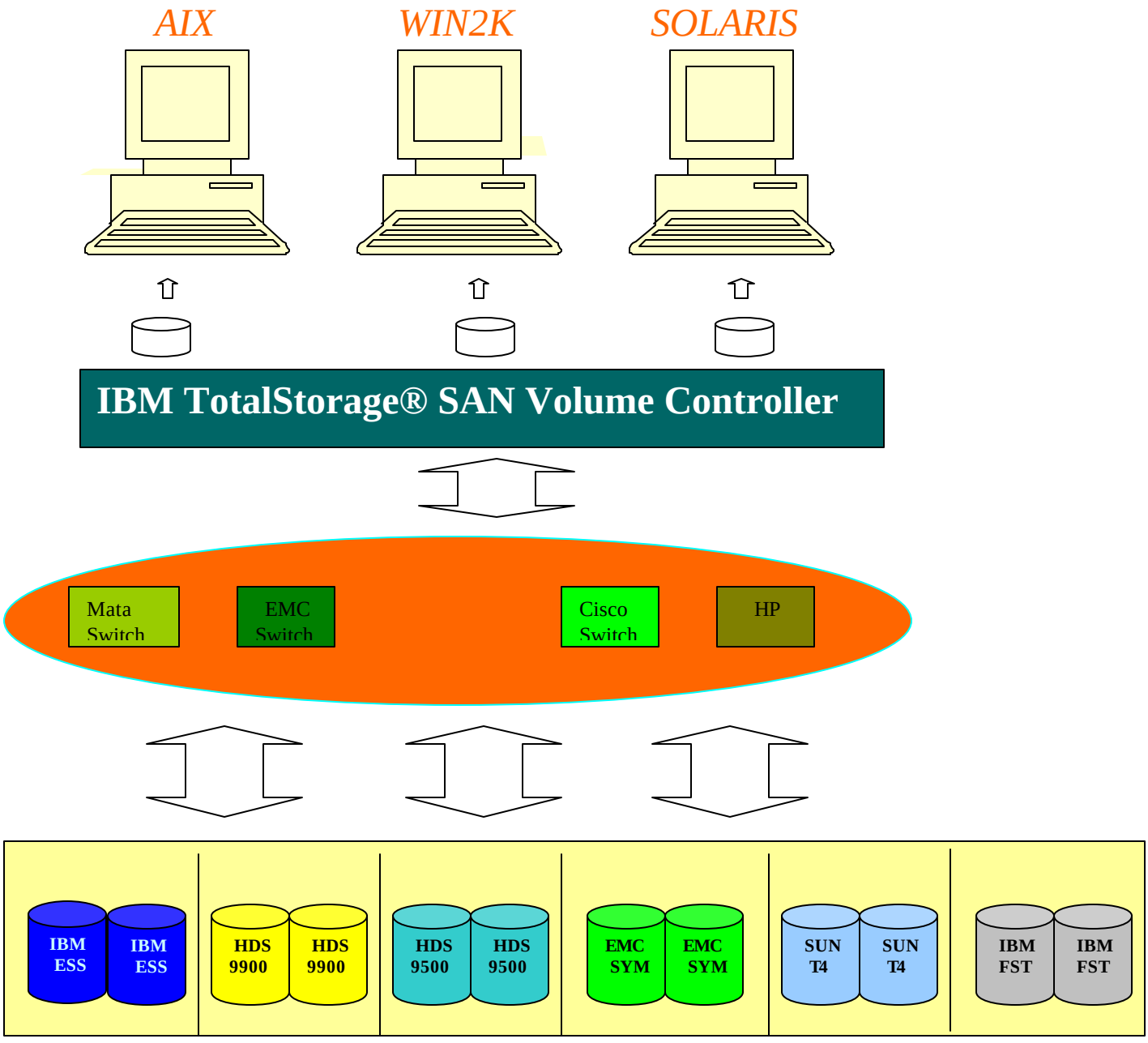
The IBM Team involved in this activity was Dan O'Hare, Pankaj Tandon, Hemanth Kalluri and Phil Mills.

Demonstration Environment

Test environment

The test was in a heterogeneous environment, with a wide mix of storage controllers, SAN switches, and host platforms from multiple companies. Each set of vendor's equipment was then interconnected with the other vendors' equipment to test multi-vendor interoperability.

SAN Topology



Hardware and Software

IBM provided the following hardware and software to be included in the virtualization demonstration with the other vendors. This equipment will also be deployed at Storage Networking World (October 27-30, 2003).

- ? IBM TotalStorage Enterprise Storage Server® (ESS), model F20
  - ✍ Microcode level 2.1.1.279
- ? IBM TotalStorage FAStT, model 700
  - ✍ Microcode level 8.2
- ? IBM TotalStorage SAN Volume Controller (SVC)
  - ✍ 2x 2145-4F2 Storage Engines
  - ✍ 2x UPS power supplies
  - ✍ Software - Version 1, Release 1, Modification 0
- ? IBM RS6000®, model 7025-F80
  - ✍ IBM AIX® 5.1 Maintenance Level 03
  - ✍ IBM 6227 HBA w/ IBM device driver v5.1.0.35
  - ✍ IBM Subsystem Device Driver (SDD) multipathing driver v1.4
- ? IBM xSeries®, model 330
  - ✍ Microsoft® Windows® 2000, Service pack 3
  - ✍ Qlogic QLA2310 HBA with QLogic device driver
  - ✍ IBM Subsystem Device Driver (SDD) multipathing driver v1.4
- ? SUN Sparc Ultra 10
  - ✍ SUN Solaris 8
  - ✍ JNI FCE 6460 HBA with device driver v5.2
  - ✍ IBM Subsystem Device Driver (SDD) multipathing driver v1.4

Virtualization Product Description

IBM TotalStorage Virtualization Family

The Virtualization Family is focused on improving storage utilization, storage management productivity and application availability. It is designed to move and centralize three key elements of storage management in your storage network – volume (or block storage) management, file system management and device management.

The IBM TotalStorage Virtualization Family is designed to:

- ? Help reduce storage management complexity and costs while improving data availability
- ? Create a single pool of volumes for applications by virtualizing the attached storage
- ? Centralize management of storage volumes
- ? Enhance storage administrator productivity
- ? Improve storage resource utilization
- ? Reduce or eliminate downtime for planned outages, maintenance and backups
- ? Offer a single, cost-effective set of advanced copy services
- ? Enable virtualization of storage, one of the core attributes in building an on-demand operating environment to support an effective e-business on demand initiative.

IBM TotalStorage SAN Volume Controller

The IBM TotalStorage SAN Volume Controller combines hardware, software and services into an integrated solution designed to centralize storage volume management and improve storage resource utilization to enable businesses to adapt quickly and dynamically to their variable environments. It can be particularly beneficial to a company that already have midrange to high-end storage area networks (SANs), and is designed to incorporate easily into existing SAN environments.

Using virtualization technology, the SAN Volume Controller is designed to create a pool of managed disks from attached storage subsystems, which can then be mapped to a set of virtual disks for use by host server applications.

The SAN Volume Controller is comprised of a highly available cluster of nodes. Uninterruptible Power Supplies (UPSs) help protect the cluster against data loss in a power outage.

Architecture

In a conventional SAN, the LUNs that are defined within the storage subsystem are directly presented to the host or hosts. Symmetrical virtualization, otherwise known as block aggregation or in-band virtualization, essentially means having an appliance in the data path that can take physical storage from one or more storage subsystems, and offer it to hosts in the form of a "virtual" disk. The SNIA Block Aggregation Model specifies that block aggregation can be performed within hosts (servers), in the storage network (storage routers, storage controllers) or in storage devices (intelligent disk arrays).

While each of these approaches has pros and cons and all are available in various forms from various vendors, we have chosen to develop our latest block aggregation product (IBM TotalStorage SAN Volume Controller) within the storage network.

Capabilities

- ? Designed to help increase storage administrator productivity by allowing administrators to manage, add and migrate physical disks non-disruptively from an application server point of view.
- ? Designed to provide a common platform for advanced functions, including FlashCopy and Remote Copy.
- ? Designed to provide read and write caching for performance

Product Setup and Configuration

The setup and configuration of the SAN environment for use with the SAN Volume Controller includes the following steps.

1. Connect the 2-node SAN Volume Controller to the SAN fabric

   The eight (8) fibre channel ports of the 2-node SAN Volume Controller cluster are connected to the fibre channel switch. For this demonstration, the SAN Volume Controller cluster will be connected to the multi-vendor Switch Interop Infrastructure provided by the SSF.

   Each node of the SAN Volume Controller has a total of four (4) fibre channel ports, provided by two (2) fibre channel dual ported host bus adapters (HBAs).

2. Zone the fibre channel switch

   For this demonstration, all of the storage products, hosts, and SVC were connected to the multi-vendor Switch Interop Infrastructure provided by the SSF.

   a. Zone all storage products and the SAN Volume Controller cluster into a single back-end zone.
   b. Zone all server products and the SAN Volume Controller cluster into a single front-end zone. Zone all of the SAN Volume Controller ports into a single zone. This is used to communicate between the nodes of the SVC cluster.

3. Create the SAN Volume Controller cluster

4. Create the host objects on the SAN Volume Controller

   Define the SVC *host objects* for each of the following using the host's World Wide Port Names (WWPN):

   a. IBM RS6000 (AIX 51-03)
   b. IBM xSeries model 330 (Windows 2000 SP3)
   c. SUN Sparc Ultra 10 (Solaris 8)

5. Initiate auto-discovery of the storage product LUNs which will be used as the *managed disks.*

   The SAN Volume Controller will poll all of the storage products in the same back-end zone to determine the storage units that are available for use. For this demonstration, the following storage products will be used.

a. IBM ESS F20
b. IBM FAStT 700
c. Hitachi Data Systems 9900
d. Hitachi Data Systems 9500
e. SUN Microsystems T4
f. EMC Symmetrix 8000
g. Hewlett Packard (XP-128)

6. Use the SAN Volume Controller to create a "storage pool" made up of storage capacity provided by the set of heterogeneous attached storage products.

   Assigning the *managed disks* that were discovered into a single *Managed Disk Group*.

7. Carve storage from the storage pool, for use by the individual hosts

   Create the individual *Virtual Disks of specific sizes by* striping data across all of the *managed disks* within *the managed disk group* using storage from the heterogeneous set of storage products.

8. Assign that virtual storage to the individual host servers.

   Map each *Virtual Disk* to the specific *host objects so* that each host can use that storage.

9. Configure the virtual storage for use via the host appropriate storage management tasks. This virtualized storage is now ready for use by the host applications, all managed by the SAN Volume Controller.

Virtualization Functions Tested

During this demonstration, there will be two main activities:

1. Carry out the set-up and configuration
    a. Creating the SVC cluster
    b. Set up the environment, including zoning and working with the hosts and storage products.
    c. Set up the storage virtualization using the SAN Volume Controller using storage capability striped across the attached heterogeneous storage.
2. Exercise the virtualized storage using host applications:
    a. AIX : Use DB2® 7.2 to perform I/O against a database that resides on the virtualized storage.
    b. Windows 2000: Play an MPEG video that resides on the virtualized storage while using some of the SAN Volume Controller advanced capabilities to migrate the data non-disruptively and to use FlashCopy® to make an instantaneous copy of the data. Monitor the I/O activity using the IOMETER tool.
    c. Solaris: carry out I/O activity while monitoring it with the IOMETER tool.

Test Results

The following is a summary of test results:

1. Setup and configuration of the environment

    a. Connect the SAN Volume Controller to the SAN fabric
    Results: *Successful*

    b. Zone the fibre channel switch
    Results: *Successful*

    c. Create the SAN Volume Controller cluster
    Results: *Successful*

    d. Create the host objects on the SAN Volume Controller

        i. IBM RS6000
        Results: *Successful*

        ii. IBM xSeries
        Results: *Successful*

        iii. SUN Sparc Ultra 10
        Results: *Successful*

    e. Automatically discover the *managed disks* from the storage products

        i. IBM ESS F20
        Results: *Successful*

        ii. IBM FAStT 700
        Results: *Successful*

        iii. Hitachi Data Systems 9900
        Results: *Successful*

        iv. Hitachi Data Systems 9500
        Results: *Successful*

        v. SUN Microsystems T4
        Results: *Successful, but required some additional configuration steps to successfully have the SVC and SUN T4 work together.*

        vi. EMC Symmetrix 8000
        Results: *Successful*

        vii. Hewlett Packard
        Results: *Not attempted. This storage product was not available at the time of the test.*

    f. Create the *Managed Disk Group* with the SAN Volume Controller using the *managed disks* from the heterogeneous attached storage products
    Results: *Successful*

g. Create the *Virtual Disk* with the SAN Volume Controller.
Results: *Successful*

h. Assign the *Virtual Disk*s to the individual host servers
Results: *Successful*

i. Host servers configured in the virtual disks provided by the SAN Volume Controller
Results: *Successful*

2. Actively exercise that virtualized storage using host applications:

   a. AIX/DB2 Tests

      i. Load the DB2 database with 25GB of data
      Results: *Successful*

      ii. Start a Virtual Disk migration to another Managed Disk Group while the database is online and the application is actively reading/writing to that database
      Results: *Successful*

      iii. Quiesce the database and perform FlashCopy to create an instantaneous copy of that database. Resume activity to the database.
      Results: *Successful*

      iv. Bring the Virtual Disk that contains the FlashCopy of the database online to demonstrate that a point-in-time copy was made.
      Results: *Successful*

   b. Windows 2000 Tests

      i. Play the MPEG video stored on the Virtual Disk provided by the SAN Volume Controller. Run the IOMETER performance tool to gather measurements.
      Results: *Successful*

      ii. Start a Virtual Disk migration to another Managed Disk Group while playing the MPEG video.
      Results: *Successful*
      Note: no disruption or interruption in the video stream was noted at the start nor during the migration process!

      iii. Create an instantaneous copy of the MPEG video using FlashCopy while the video was playing. Assign the Virtual Disk containing the copy to the host, and demonstrate that a complete copy was made by playing the video.
      Results: *Successful*

      iv. Increase the size of the Virtual Disk by 2GB while the MPEG video was being played.
      Results: *Successful*

   c. Solaris Tests

      i. Run I/O activity against the Virtual Disk while measuring the performance with IOMETER.
      Results: *Successful*

ii. Start a Virtual Disk migration to another Managed Disk Group while I/O activity is being carried out on it. Measure the performance with IOMETER.
Results: *Successful*

Surprises

Describe any surprises here

- A positive "surprise" was that we were able to successfully virtualize storage from a number of products that are not yet on the supported product list for the IBM TotalStorage SAN Volume Controller.

Conclusions

This was a very successful demonstration for these virtualization products, switches, and storage products working well together.

In particular, the IBM TotalStorage SAN Volume Controller was able to successfully discover and use the complete set of heterogeneous storage products that were present during the pre-staging test at the SNIA Technology Center in Colorado Springs, CO.

Plus IBM was able to demonstrate several of the SAN Volume Controller's advanced functions. These included making an instantaneous copy of the host data using the SAN Volume Controller's FlashCopy function. It was also possible to demonstrate non-disruptive data migration to different disk storage.

Learn more about the IBM TotalStorage Virtualization Family at http://www.ibm.com/totalstorage/virtualization.

Learn more about the IBM TotalStorage SAN Volume Controller at http://www.storage.ibm.com/software/virtualization/svc

Disclaimer

This virtualization demonstration showed great potential for multi-vendor interoperability with the IBM SAN Volume Controller. However, we must point out that this was just a demonstration IBM currently plans to continue participating in events such as this one and work with other vendors to formally support SAN Volume Controller interoperation with different storage products. For the current detailed list of which products are supported, please review the Supported Hardware List and Supported Software Levels on the SVC product website at http://www.ibm.com/storage/support/2145.

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