Validation guide for HP StorageWorks Continuous Access EVA 2.x with VMware ESX Server 2.5.x

Executive summary

The purpose of the testing described in this paper was to validate VMware ESX Server 2.5.x with an HP Enterprise Virtual Array (EVA) 5000 and HP StorageWorks Continuous Access EVA 2.0.

This validation provides assurance that HP StorageWorks subsystems, HP ProLiant servers, integrated management software, and offerings from HP Services can combine to form a proven foundation for a virtualized environment using ESX Server software.

ESX Server provides the tools needed to virtualize server resources so that multiple operating systems and applications can share the same physical resources, allowing customers to reduce costs, improve resource efficiency, and enjoy the benefits of an Adaptive Enterprise.

Overview

The overall objective of the testing is to exercise areas of HP StorageWorks Continuous Access EVA 2.0 in an HP lab environment with an HP ProLiant DL580 cluster running VMware ESX Server 2.5.x and connected to an HP Enterprise Virtual Array (EVA) 5000.

Test environment

HP created a test environment so that HP StorageWorks Continuous Access EVA 2.0 could be validated with VMware ESX Server 2.5.x.

This section outlines the hardware and software components deployed in the test environment and identifies the specific software revisions that were qualified.

Hardware

The hardware configuration used during testing featured the following components:

- Two HP StorageWorks Enterprise Virtual Array 5000 (EVA5000) Model 2C2D-C storage arrays, each with:
  - HSV110 storage controller with VCS 3.025, or later, firmware
  - Eight (or 16[1]) 34 GB 15,000 rpm hard drives with CR06F1 firmware
- Two HP ProLiant DL580 G3 servers, each with:
  - Two Intel® Xeon™ 3.0 GHz processors
  - 2 GB RAM
  - QLogic QLA2342 Fibre Channel Adapter/HP StorageWorks FCA2214DC Fibre Channel HBA
- Brocade switches 16L

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[1] For the secondary array

EVA5000 storage array

The EVA5000 array provides a high-performance, high-capacity, high-availability, virtual RAID storage solution for the high-end enterprise-class marketplace, removing the time, space, and cost boundaries of traditionally-architected storage.

The EVA5000 is designed for the data center where there is a critical need for improved storage utilization and scalability while meeting application-specific demands for consistently high transaction I/O capabilities and MB data rate performance, seamless capacity expansion, instantaneous replication, and simplified storage administration.

Software

The minimum software configuration used during testing featured the following components:

- VMware ESX Server 2.5.0 or 2.5.1
- HP StorageWorks Continuous Access 2.0
- HP StorageWorks Business Copy EVA
- QLogic QLA2342 Fibre Channel Adapter/HP StorageWorks FCA2214DC Fibre Channel HBA
  - Firmware: 3.025 or 3.028
  - BIOS: 1.34
  - Driver: 6.07.02

HP StorageWorks Continuous Access EVA

Continuous Access EVA, delivered in a cost-effective, easy-to-deploy package, is an array-based application that utilizes a powerful yet simple Graphical User Interface[2] to create, manage, and configure remote replication on a broad range of EVA storage solutions. Continuous Access EVA shares an integrated management interface – Replication Solutions Manager (RSM) – with HP StorageWorks Business Copy, offering a unique, unified replication management approach.

Providing the highest levels of data protection capabilities, Continuous Access EVA helps customers meet their mission-critical disaster recovery needs.

More information	
"*HP StorageWorks Continuous Access EVA planning guide*" – a good starting point; see also: "*HP StorageWorks Business Copy EVA administration guide*" and "*HP StorageWorks Replication Solutions Manager Installation and Administrator Guide*"	Refer to the HP StorageWorks Continuous Access EVA page under the **Technical documents** link
"*HP StorageWorks Continuous Access EVA Replication Performance Estimator*" – for performance estimates	Refer to the HP StorageWorks Continuous Access EVA page under the **Related information** link
"*HP StorageWorks SAN Design Reference Guide*" – note in particular the chapter on SAN Extension	Refer to the Manuals – HP StorageWorks SAN page

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[2] The Continuous Access EVA product includes a user interface; activation requires a license.

VMware ESX Server

ESX Server provides virtual infrastructure software for partitioning, consolidating, and managing systems in mission-critical environments. ESX Server and VMware Virtual Infrastructure Nodes combine to deliver a highly scalable virtual machine platform with advanced resource management capabilities – a platform that can be managed by VMware VirtualCenter.

More information	
ESX Server	http://www.vmware.com/support/resources/esx_resources.html
VirtualCenter	http://www.vmware.com/support/resources/vc_resources.html

Software versions tested

Table 1 lists the software combinations tested by HP.

Table 1: Software combinations tested by HP and those not tested but expected to work

| VMware ESX Server	HBA firmware	Comments
2.5.0	VCS 3.025	Tested and supported combination
2.5.1	VCS 3.028	Tested and supported combination
2.5.0	VCS 3.028	Not tested but expected to work
2.5.1	VCS 3.025	Not tested but expected to work
2.5.x	VCS 3.020	Not tested; however, since VCS 3.025 and 3.028 are considered to be patches for VCS 3.020, this combination is expected to work

Note:
As a best practice, HP recommends deploying the latest supported software combination.

Tested configuration

Figure 1 provides an outline of the test configuration, with an HP ProLiant 580 G3 server cluster (Hosts A and B), each with dual HBAs configured through four switches, W, X, Y, and Z.

Two EVA5000 arrays (primary and secondary) are configured in a dual-fabric, No Single Point of Failure (NSOPF) environment. In this configuration, one port from each HBA is attached to each fabric; in this way, if there is a problem on one fabric, replication continues on the other.

Figure 1: Test configuration
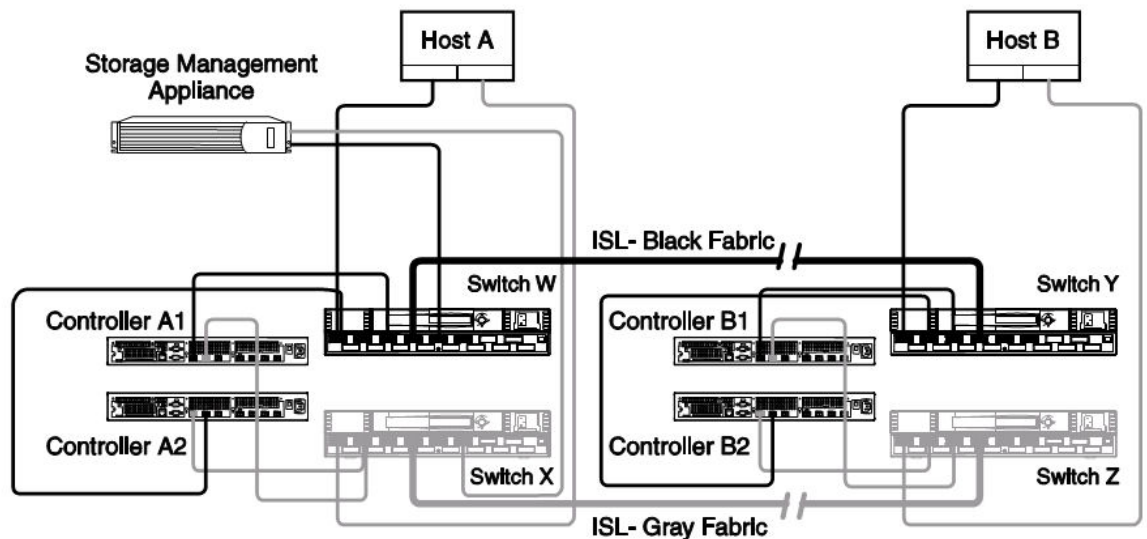
Prior to the testing, HP ensured the following:

- The HP ProLiant DL580 G3 servers and the EVA5000 storage array were configured correctly
- Continuous Access EVA was activated and configured with the appropriate Data Replication (DR) groups[3]

HP made no changes to ESX Server to optimize support for the EVA5000 storage array.

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[3] A DR group is a named group of virtual disks selected from one or more disk groups. Members of the DR group can remotely replicate to the same destination, fail over together, share a log (DR group log disk), and preserve write order within the group.

Testing

The objective of the testing carried out by HP was to validate VMware ESX 2.5.x with an EVA storage array and Continuous Access EVA 2.0. The test methodology was based on an internal VMware SAN qualification test plan and procedures.

HP exercised the following Continuous Access EVA 2.0 functionality:

- Installation and setup
- Tools
- Host Bus Adapter (HBA) failover
- Path failure test

- Device management
- Fabric and device discovery
- HBA limitations
- Storage connectivity and basic functionality

- Unplanned failover of Host A to Host B
- Planned failover of Host A to Host B
- Storage process failover

HP did not intend this test menu to be exhaustive but rather serve as a framework that exercised the majority of Continuous Access EVA features.

The following sections describe sample tests.

Installation and setup

HP configured the storage array as follows:

- Two boot-from-SAN disks: x0a (Host A) and x0b (Host B)
- Five Vdisks: x1 – x5
- Four guest operating systems installed on x1
- Four logical disks created on each Vdisk:
  - x1a.vmdk – x1d.vmdk
  - x2a.vmdk – x2d.vmdk
  - x3a.vmdk – x3d.vmdk
  - x4a.vmdk – x4d.vmdk
  - x5a.vmdk – x5d.vmdk
- Four logical disks presented to each guest operating system:
  - VM1: x2a.vmdk x3a.vmdk x4a.vmdk x5a.vmdk
  - VM2: x2b.vmdk x3b.vmdk x4b.vmdk x5b.vmdk
  - VM3: x2c.vmdk x3c.vmdk x4c.vmdk x5c.vmdk
  - VM4: x2d.vmdk x3d.vmdk x4d.vmdk x5d.vmdk

Figure 2 shows the array configuration.

Figure 2: Array configuration, showing two boot-from-SAN disks and five Vdisks configured with 20 logical disks
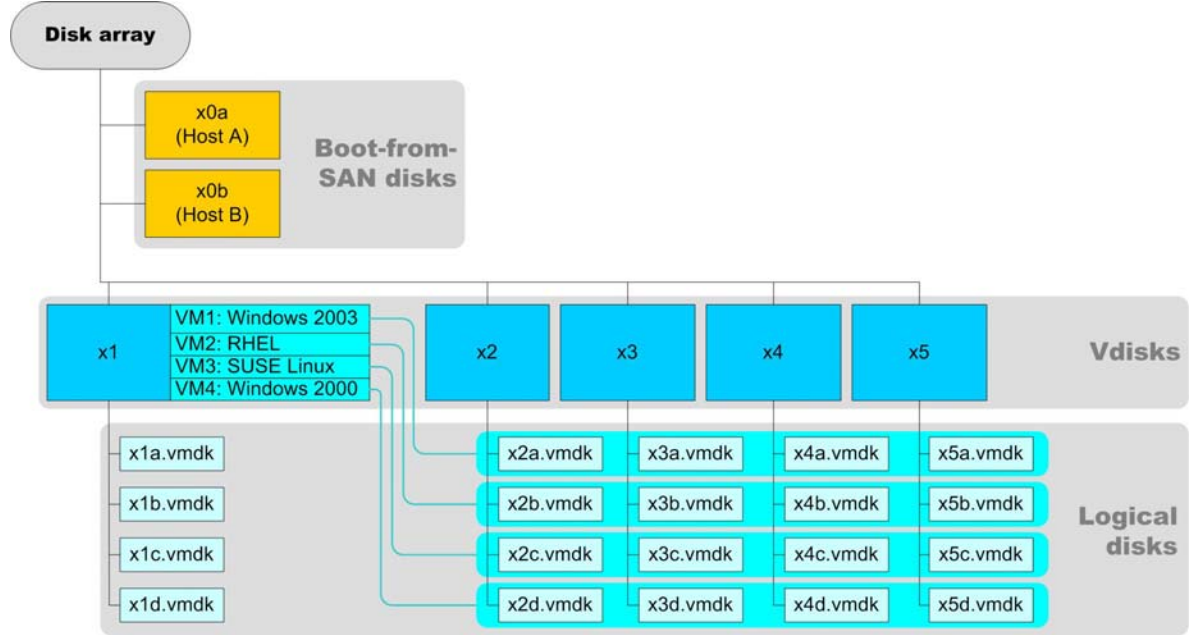
As shown in Figure 2, each VMware server had its own boot-from-SAN disk, which belonged to a unique DR group; in addition, five Vdisks were configured. One Vdisk (x1) hosted the following virtual machines (VMs):

- VM1: Microsoft® Windows® Server 2003, Enterprise Edition
- VM2: Red Hat Enterprise Linux Advanced Server 3.0, update 4, or later
- VM3: SUSE LINUX Enterprise Server 9
- VM4: Microsoft Windows Server 2000 Advanced Server

Four logical disks were presented to each VM.

Note:
Since only a single path is presented from ESX Server to the virtual machines, there is no need to install multi-path drivers (such as HP StorageWorks Secure Path) on the guest operating systems.

HP successfully installed all VMs on the host servers, as shown in Figure 3.

Note:
HP recommends noting any special settings required within the test environment to deploy the ESX Server kernel and VMs.

Figure 3: ESX Server screen showing four virtual machines
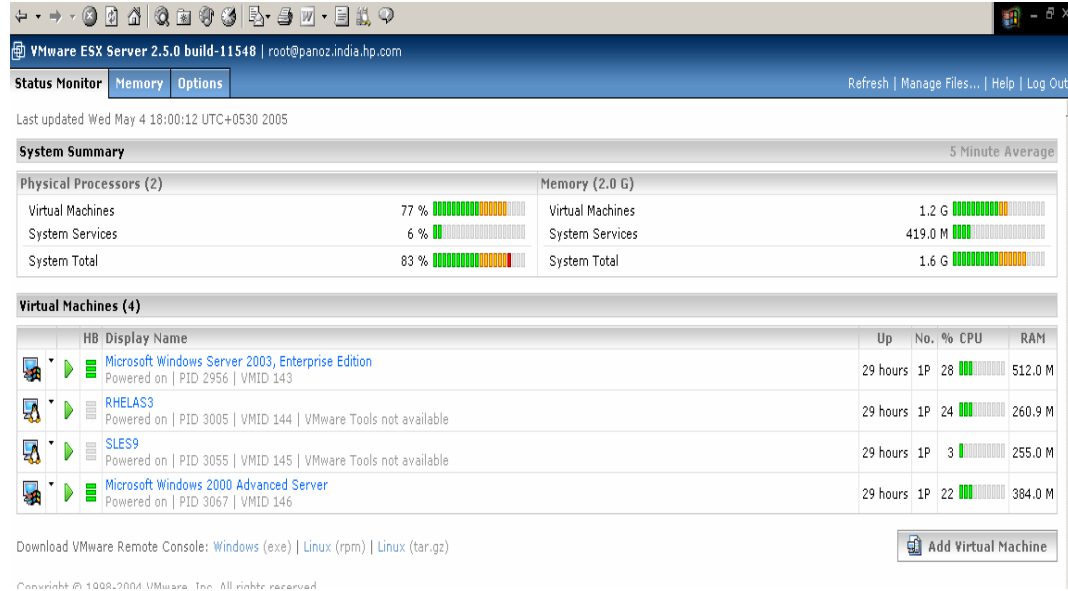
After installing the VMs, HP performed the path failure test.

Path failure test

HP carried out path failure tests with each VM.

For each path shown in Figure 1 (for example: Host A to Switch W, Host A to Switch X, or Controller A1 to Switch W), HP performed the following sequence of events:

1. Disconnect or disable the connection.
2. Monitor the failover.
3. Restore the connection.

HP ran an I/O load generator (IOMETER, for example) on each VM to exercise the path between that VM and the storage array. The load was a mix of random read and writes, each 8 KB in size.

HP verified that I/O was not interrupted when paths failed and were restored. None of the VMs lost access to the storage array.

Failover test

HP carried out a series of failover tests: a) a planned failover of Host A to Host B, b) an unplanned failover of Host B back to Host A, and c) HBA failover.

Planned failover of Host A to Host B

1. On Host A, gracefully shut down each of the VMs, and then Host A itself.
2. Following the standard storage failover procedures provided in the Continuous Access EVA administration guide, failover each of the two DR groups.
3. Present all four Vdisks to Host B.
4. Boot Host B using the failed-over boot disk.
5. Boot each VM.
6. Verify that all Vdisks are recognized, first at the VMware kernel level and then by each VM.

Unplanned failover of Host B back to Host A

1. Crash Host B (by unplugging the power cord from the server).
2. Following the standard storage failover procedures provided in the Continuous Access EVA administration guide, failover each of the two DR groups.
3. Present all four Vdisks to Host A.
4. Boot Hosts A and B and each of the VMs.
5. Verify that all Vdisks are recognized by Hosts A and B, first at the VMware kernel level and then by each VM.

HBA failover

1. Power off Controller A1.
2. Verify that all I/O migrates to Controller A2
3. Power on Controller A1
4. Power off Controller A2
5. Verify that all I/O migrates to Controller A1

HP successfully performed all failover tests.

Best practices

While performing the tests described in this white paper, HP identified the following best practices:

- With the VMware server running, breaking a Fibre Channel cable connection from the active[4] HBA caused I/O traffic to switch to the passive HBA. The server continued to run; however, it could not later be re-booted.
  Boot capability was restored by using the QLogic Fast!Util tool to re-bind the boot LUNs to the passive HBA.

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[4] The active HBA is the HBA through which the server was initially booted.

- HP identified an issue with earlier versions of the HBA BIOS: when rebooting the VMware server, an attempt to invoke the **Fast!Util** utility[5] by depressing **Ctrl Q** caused a **PCI Configuration Error.** As a result, HP recommends upgrading to version 1.34, available at http://h20000.www2.hp.com/bizsupport/TechSupport/SoftwareDescription.jsp?locale=en_US&lang=English+%28US%29&pnameOID=315892&prodSeriesId=315890&prodTypeId=12169&basePartNum=COL4498&locBasepartNum=co-15253-1&os=Microsoft+Windows+2000&tech=Firmware++Storage+Fibre+Channel.

- An unplanned failover (caused by powering off and re-booting both host servers, for example) disabled the networking component of the Windows Server 2003 virtual machine. HP was required to log in to this machine and re-enable networking.

- Booting from SAN requires the selection of a) the lowest-numbered HBA with a visible LUN, and b) the lowest-numbered (lowest target ID) Service Processor (SP) with an attached LUN. You must specify the SP/LUN combination that is first seen in a scan from the HBA.
  If your storage array is an active-passive type, the selected SP must also be the preferred (active) path to the boot LUN.
  If you are not sure which SP has the lowest target ID or which has the preferred connection to the boot LUN, use your storage array management software to ascertain this information.
  Note that the World Wide Port Name (WWPN) sequence does not necessarily correspond to the target ID sequence.

- In a test[6] that created and deleted new partitions from existing LUNs, HP noted that virtual machines had to be shut down before LUNs could be added or removed; indeed, VMs must be shut down to accomplish any virtual hardware change.
  After creating or deleting a partition, the virtual machine could not be booted unless all configured virtual disks were present.
  Furthermore, it was not possible to partition virtual disks into more than four volumes, which constitutes a Virtual Mirror File System (VMFS) violation with the following message:

  "Disks are limited to 4 physical volumes. If you want to have more than 4 volumes, you should create 3 physical volumes, one extended partition and 2 or more logical volumes."

- The HBA queue depth selection parameter can only be set while loading the HBA module for QLogic.

- Re-booting a VMware server after the active HBA had failed resulted in a major error. HP was required to use the QLogic Fast!Util tool to map the appropriate LUN changes.

- When adding LUNs to – or removing them from – a storage array, perform a rescan to make the LUNs presentable.

- When unpresenting LUNs on a storage array, there must be no ongoing I/O traffic.

- Avoid LUN thrashing by assigning separate virtual disks to each VM rather than consolidating multiple virtual disks for a single physical machine.

Summary

The tests run by HP successfully validated HP StorageWorks Continuous Access EVA 2.x with WMware ESX 2.5.x. The specific configurations validated were as follows:

- ESX 2.5.0 with Continuous Access EVA 2.1 and VCS 3.025
- ESX 2.5.1 with Continuous Access EVA 2.2 and VCS 3.028

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[5] Required to configure the bindings between the SAN LUN's and the HBA
[6] Not described in this white paper

For more information

HP StorageWorks Continuous Access EVA	http://h18006.www1.hp.com/products/storage/software/conaccesseva/
HP StorageWorks EVA5000	http://h18006.www1.hp.com/products/storageworks/enterprise/index.html
VMware ESX Server	http://www.vmware.com/products/server/esx_features.html
	http://www.vmware.com/support/resources/esx_resources.html
VMware VirtualCenter	http://www.vmware.com/support/resources/vc_resources.html

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