

# HP storage qualification and system verification test results with Xsigo VP780 I/O Director



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## Executive summary

This paper describes the results of testing conducted to qualify the Xsigo VP780 I/O Director against a broad range of HP storage and server solutions.

Test results were compiled over a period of four weeks at HP's Partner Technology Access Center in Cupertino, California, in accordance with a test plan that was jointly created by HP and Xsigo Systems technical representatives. Elements of the test plan included:

- **Breadth:** 47 separate tests comprising hardware/software combinations drawn from multiple HP industry standard ProLiant servers, c-Class BladeSystem components, StorageWorks Arrays, and different operating system environments including Microsoft® Windows® Server 2003 and Red Hat Enterprise Linux (RHEL).
- **Stress:** Continuous 72 hour testing operations utilizing various stress conditions.
- **All phases of operation:** Testing across all standard operating conditions including installation, management, and maintenance.
- **Scalability:** Scalability and performance testing designed to simulate the most demanding enterprise environments.

### Target audience:

The information contained in this white paper is intended for solutions architects, engineers, and project managers involved in the planning and deployment of I/O virtualization solution with Xsigo VP780 I/O Director on HP platforms. Audience should be familiar with I/O virtualization and interoperability testing.

This white paper describes testing performed in August 2007.

## Summary of results

The Xsigo VP780 successfully passed all tests outlined in the joint Xsigo/HP test plan, verifying broad interoperability, functionality to specification, and full data integrity. Xsigo successfully completed the criteria outlined by HP's Developer and Solution Partner Program (DSPP), and DSPP Technology Access Program (DTAP).

**Table 1.** Overview of Results

Device Tested	Results
<b>HP StorageWorks Arrays</b>	
Modular Smart Array 1000 (MSA1000)	PASSED
Enterprise Virtual Array 8000 (EVA8000) (similar results are expected with new EVA8100/6100/4100)	PASSED
<b>Multi-Path Software</b>	
HP StorageWorks Secure Path	PASSED
Linux Device Mapper	PASSED
<b>HP StorageWorks SAN Switch</b>	

Device Tested	Results
4/16 SAN Switch	PASSED
4/32 SAN Switch	PASSED
<b>HP ProLiant Servers</b>	
DL380	PASSED
DL585	PASSED
BL460c server blade (with BladeSystem c7000 Enclosure)	PASSED

**Table 2.** HP ProLiant DL380 Host Server

Storage Device Tested	Operating Environment Tested	Results
MSA1000	Red Hat Enterprise Linux 4 U4 (x86/x86_64) Red Hat Enterprise Linux 5 (x86/x86_64) Microsoft Windows Server 2003 with SP2 Windows Server 2003 x64 Edition with SP2	PASSED
EVA8000	Red Hat Enterprise Linux 4 U4 (x86/x86_64) Red Hat Enterprise Linux 5 (x86/x86_64) Windows Server 2003 with SP2 Windows Server 2003 x64 Edition with SP2	PASSED

**Table 3.** HP ProLiant DL585 Host Server

Storage Device Tested	Operating Environment Tested	Results
MSA1000	Red Hat Enterprise Linux 4 U4 (x86/x86_64) Red Hat Enterprise Linux 5 (x86_64) Windows Server 2003 with SP2 Windows Server 2003 x64 Edition with SP2	PASSED
EVA8000	Red Hat Enterprise Linux 4 U4 (x86/x86_64) Red Hat Enterprise Linux 5 (x86_64) Windows Server 2003 with SP2 Windows Server 2003 x64 Edition with SP2	PASSED

**Table 4.** HP ProLiant BL460c Server Blade

Storage Device Tested	Operating Environment Tested	Results
MSA1000	Red Hat Enterprise Linux 4 U4 (x86/x86_64)	PASSED
	Red Hat Enterprise Linux 5 (x86_64)	
	Windows Server 2003 with SP2	
	Windows Server 2003 x64 Edition with SP2	
EVA8000	Red Hat Enterprise Linux 4 U4 (x86/x86_64)	PASSED
	Red Hat Enterprise Linux 5 (x86_64)	
	Windows Server 2003 with SP2	
	Windows Server 2003 x64 Edition with SP2	

## Test methodology

The HP storage qualification was divided into three distinct phases:

- **Phase one:** Single-path storage I/O
- **Phase two:** Multi-path storage I/O
- **Phase three:** Scalability

In each of the three phases Xsigo and HP performed a battery of tests, including:

- Virtual Host Bus Adapter (vHBA) installation and configuration
- Xsigo Fibre Channel I/O Module performance
- Name server registration
- Zone server registration and fabric zoning
- Storage array data path with no data corruption
- Quality of Service (QoS) applied to vHBAs
- Basic stress, scalability, and performance testing
- vHBA interoperability testing with the HP equipment listed previously

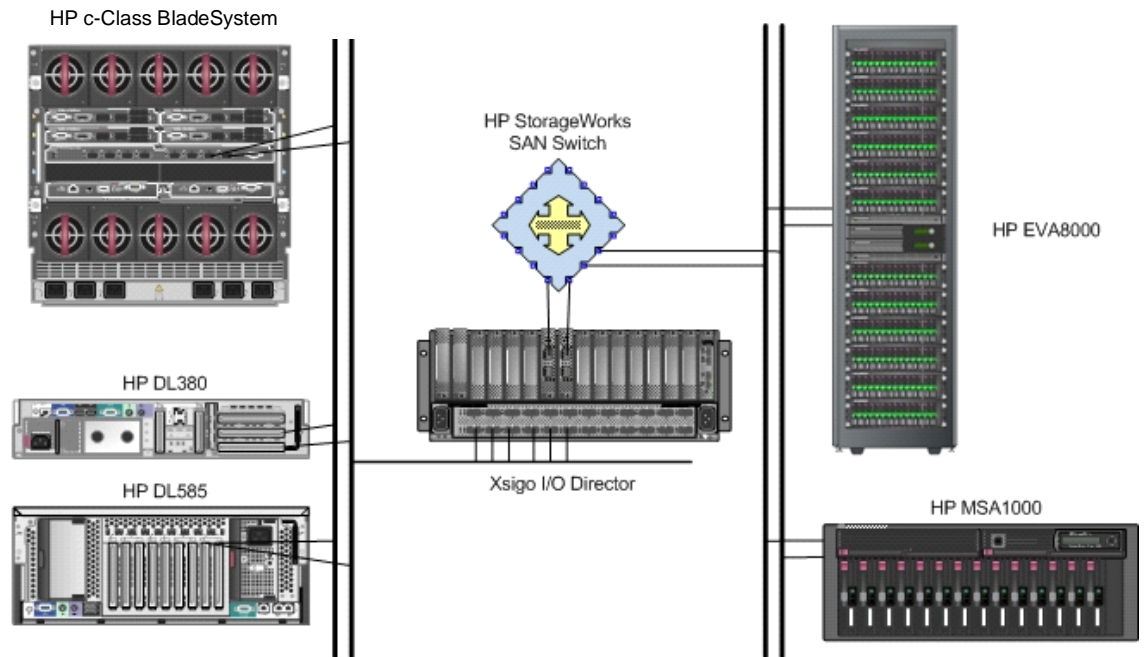
### Phase one: Single-path storage I/O

The Xsigo I/O Director was configured with a single Xsigo 4-Gigabit Fibre Channel I/O Module and connected via InfiniBand (IB) to a Host Channel Adapter (HCA) on an HP ProLiant server. The 4-Gigabit Fibre Channel module connected directly into an HP StorageWorks SAN Switch.

Three different HP ProLiant servers were used for the single and multi-path testing:

- HP ProLiant DL380
- HP ProLiant DL585
- HP ProLiant BL460c server blade

**Figure 1.** Single-Path Storage I/O Topology



In the case of HP BladeSystem, the Xsigo chassis was connected directly to a single HP c-Class BladeSystem enclosure via the HP 4X DDR IB Switch Module. Each switch module contains 16 downlinks to connect up to 16 server blades within a single enclosure, and 8 uplinks to connect to the InfiniBand fabric. Each server blade included a single-port HP 4X DDR InfiniBand PCI-Express Mezzanine HCA card running the OpenFabrics Enterprise Distribution (OFED) software.

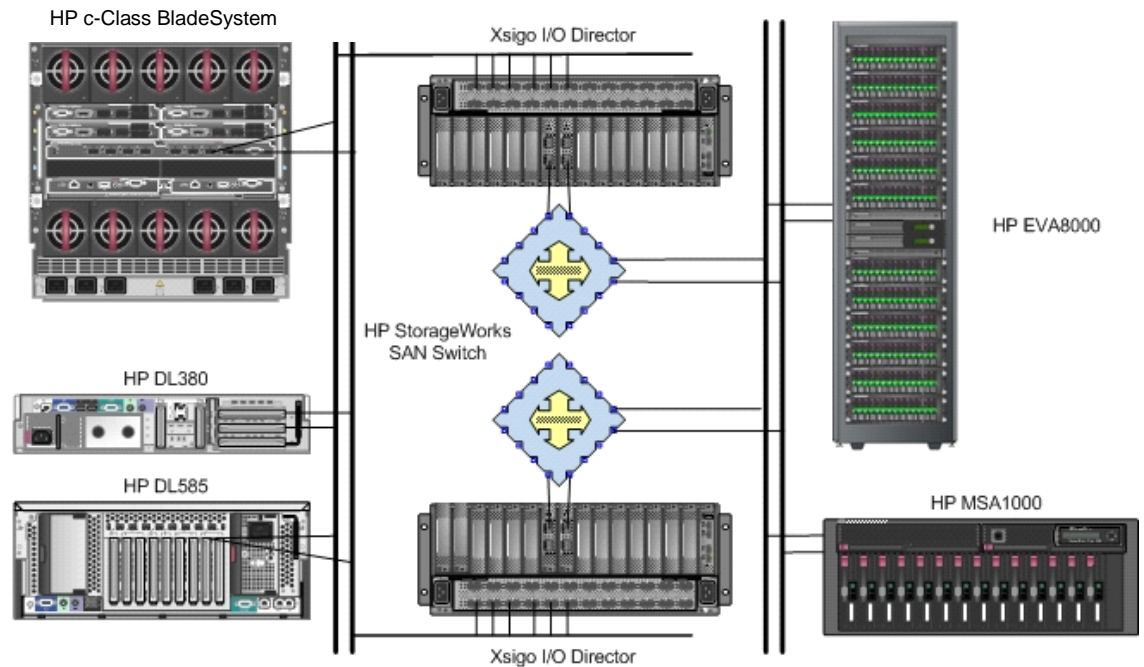
**Note**

N\_Port ID Virtualization (NPIV) enables multiple fibre channel initiators to login and occupy a single physical port. The SAN switch device must be running a version of switch OS that supports NPIV, and the feature must be enabled.

## Phase two: Multi-path storage I/O

Multi-path I/O solutions such as HP Secure Path and Linux Device Mapper are often employed with dual SAN fabrics to improve resilience and protect against single point of failure in the storage network. The Xsigo I/O Director supports high availability in the fibre channel environment by creating two vHBAs and then running multi-pathing software on the host. The purpose of phase two testing was to validate the Xsigo I/O Director's response in a multi-path failover scenario.

**Figure 2.** Multi-Path Storage I/O Topology



Each server was connected to two Xsigo chassis via dual-port InfiniBand Host Channel Adapters. Traffic was communicated through separate SAN fabrics, ultimately terminating at a single HP storage system. HP Secure Path and Linux Device Mapper managed the LUN path information across the multi-switch fabric. Path failures were initiated at the server Host Channel Adapter, Xsigo I/O Director and storage controller. Traffic was monitored to ensure rapid failover to the redundant data path.

## Phase three: Scalability

The purpose of phase three testing was to test the overall scalability of a single 4-Gigabit port within the Xsigo Fibre Channel I/O Module. Two test beds were created using a ProLiant DL585 running Red Hat Enterprise Linux 4.0 and Windows Server 2003 x64 Edition. The DL585 was configured with two redundant InfiniBand networks each running a total of 256 IOMeter streams across 16 vHBAs. Each vHBA was provisioned with 16 LUNs located on an HP StorageWorks EVA8000.

Two Xsigo I/O Director features were observed during scalability testing. First, during initial set up all 16 vHBA resources were provisioned without requiring a single reboot of the server. Second, Xsigo was also able to shape the fibre channel traffic by adjusting the I/O capacity of each vHBA without stopping the data stream.

## Summary

Xsigo and HP test plans incorporated a wide range of deployment scenarios utilizing various combinations of HP StorageWorks arrays, ProLiant servers and operating system environments. Each combination underwent thorough testing including 72 hours of continuous I/O stress testing, performance and scalability testing. Xsigo successfully completed the testing required to qualify the VP780 I/O Director against HP systems and storage.

## Appendix A: Equipment details

<b>Xsigo Systems</b>	
Xsigo VP780 I/O Director	XgOS v1.0.1
Xsigo host software	Windows Server 2003 with SP2 Windows Server 2003 x64 Edition with SP2 Red Hat Enterprise Linux 4 U4 (x86/x86_64) Red Hat Enterprise Linux 5 (x86/x86_64)
Xsigo 2 x 4Gb Fibre Channel I/O Module	X11F42FQZ-1
Xsigo Dual-Port Host Channel Adapter (PCI-Express)	MHEA28-XTC
<b>HP StorageWorks Systems</b>	
HP MSA1000	Controller Firmware: v7.00 Active/Active Firmware; v5.20 Active/Passive Firmware
HP EVA8000	Controller Firmware: XCS v6.100
<b>Multi-Path Software</b>	
HP Secure Path	Version 4.0c with SP 2-9 for Windows
Linux Device Mapper	RHEL 4 U4 (1.02.07-4.0.RHEL4.rpm) RHEL 5 (1.02.13-1.el5.rpm)
<b>HP ProLiant Host Servers</b>	
HP DL380 G4	DL380 G4 with 2 x Dual-Core Intel® Xeon® processors 2.80GHz/800MHz FSB-2x2MB L2 cache, 4GB Memory, 2x36GB 15K SCSI Drives
HP DL585 G2	DL585 G2 with 4 x Dual-Core AMD Opteron™ 8220 2.8GHz processors, 1MB Cache, 32GB Memory, 4 x 72GB 10K SAS Drives
HP -BL460c server blade with HP BladeSystem c7000 Enclosure	BL460c with 2 x Dual-Core Intel Xeon processors 3.0 GHz /1333MHz 4MB L2 cache, 8 GB Memory, 2x146 GB SAS HDD drives. Onboard Administrator (OA) firmware v.2.02a which requires HP Integrated Lights-Out 2 (iLO 2) v.1.35 or higher. (OA Firmware must be at least v.1.2 to support internal HP 4X DDR IB switch.)
<b>HP StorageWorks SAN Switch Fabric</b>	
HP StorageWorks 4/16 SAN Switch	5.2.1b Firmware
HP StorageWorks 4/32 SAN Switch	5.2.1b Firmware
<b>Test Applications</b>	
IOMeter	Application is used for SCSI block level traffic generation
Data Test (DT)	Application is used to perform I/O testing

## Appendix B: Summary of tests conducted

Description	Result
Install Xsigo drivers on RHEL Linux. Confirm vHBA is functional	PASSED
Install Xsigo drivers on Window Server 2003 (32/64bit). Confirm vHBA is functional	PASSED
Configured multiple vHBAs connected to multiple FC ports	PASSED
Move vHBA to another server	PASSED
Reboot server with vHBAs configured	PASSED
Reboot Xsigo system with vHBA configured	PASSED
Disconnect and reconnect server extender cable	PASSED
Confirm Worldwide Node Name (WWNN) on vHBAs	PASSED
Confirm Worldwide Port Name (WWPN) on vHBAs	PASSED

### Fibre Channel I/O Module

Description	Result
Shutdown and start Xsigo Fibre Channel I/O module	PASSED
Confirm that the Xsigo Fibre Channel I/O Module can correctly negotiate point to point with a fabric switch	PASSED
Confirm that the Xsigo Fibre Channel I/O Module can correctly negotiate speed, and link at the expected speed when hard configured.	PASSED
Confirm that the Xsigo Fibre Channel I/O Module correctly reports online and offline status	PASSED
FLOGIN / PLOGIN of virtual WWNs to fabric switch port	PASSED

### Name Server

Description	Result
Verify basic local fabric device registration	PASSED
Verify device registration after fabric switch reboot	PASSED
Verify device registration after Xsigo system reboot	PASSED
Verify device registration when fabric switches are disabled and enabled	PASSED
Verify basic device registration when a fabric switch-connected Xsigo port is moved	PASSED
Verify basic device registration when a Xsigo-connected server is rebooted	PASSED
Verify registration of symbolic name data	PASSED

## Zone Server

Description	Result
Activate zoneset node WWN zoning in the fabric	PASSED
Activate zoneset then change zoneset in fabric	PASSED
Verify that vHBAs are fully functional in a fabric zone when targets and vHBA are moved	PASSED
Verify that a local device coming online sends the correct RSCNs when fabric zoning is enabled	PASSED
Verify that a local device going offline sends the correct RSCNs when fabric zoning is enabled	PASSED
Zone enforcement and overlapping	PASSED
Zone enforcement - two vHBAs on one server, same fabric, same targets	PASSED

## Storage Array Data Path

Description	Result
Verify that a vHBA can send I/O to array ports with no data corruption	PASSED
Verify that multiple vHBAs can send I/O to array ports with no data corruption	PASSED
Verify that the Xsigo System can transmit Medusa data patterns designed to stress Fibre Channel, PCI , and chipset without error using multiple I/O block sizes	PASSED

## Quality of Service

Description	Result
Verify that QOS can be applied to vHBAs	PASSED
Verify that with QOS set to a value below the server / vHBAs max throughput to a given target that no data corruption occurs	PASSED
Verify that with QOS set on two vHBAs one getting a high value and the other getting a low value that the low value vHBA does not get starved	PASSED

## Stress

Description	Result
Verify that the Xsigo system can transmit error free I/O for 12 hours of continuous operation	PASSED
Verify that the Xsigo system can transmit error free I/O for 24 hours of continuous operation	PASSED
Verify that the Xsigo system can transmit error free I/O for 72 hours of continuous operation	PASSED

## Scalability

Description	Result
Verify that the maximum number of vHBAs can be added to a server	PASSED
Verify that the maximum number of vHBAs can be configured on all available servers	PASSED
Verify that the Xsigo system can repeatedly configure and delete 128 vHBAs	PASSED
Verify that the Xsigo System can send I/O from servers while the max number of vHBAs are configured	PASSED

## Multi-Path Software

Description	Result
Verify correct functionality with two vHBAs configured on the same server and bound to different FC ports on the same Xsigo Fibre Channel I/O Module.	PASSED
Verify correct functionality with two vHBAs configured on the same server and bound to different FC ports on two Xsigo Fibre Channel I/O Modules.	PASSED
Verify correct functionality with two vHBAs configured on the same server and bound to different FC ports on two Xsigo Fibre Channel I/O modules, on two Xsigo chassis.	PASSED
Verify correct functionality of HP Secure Path and Linux Device Mapper with two vHBAs in a server.	PASSED

## Performance

Description	Result
Test Configuration: Block size=1MB Read/Write =50/50 Random/Sequential=100% Sequential Test Duration: 1 hour	PASSED
Test Configuration: Block size=4 MB Read/Write = 50/50 Random/Sequential =100% sequential Test Duration: 1 hour	PASSED

## For more information

For detailed information of Xsigo VP780 I/O Director, please visit <http://www.xsigo.com>

Xsigo Technical Support: <http://support.xsigo.com>

HP StorageWorks Storage Arrays: <http://www.hp.com/go/storage>

HP BladeSystem: <http://www.hp.com/go/blades>

HP ProLiant Servers: <http://www.hp.com/go/proliant>

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