THE TOLLY GROUP

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Hewlett-Packard Co.

StorageWorks 8Gb Simple SAN Connection Kit

Comparison of Performance and Ease of SAN Deployment using HP Simple SAN Connection Manager (SSCM) Solution

TOLLY Up to Spec CERTIFIED Test Summary

Premise: *Storage Area Networks (SANs) provide servers and applications with transparent access to distributed storage resources. While it is vital to ensure high performance of a SAN, it is also important for the Fibre Channel (FC) SAN vendors to reduce the complexity of deployment, in light of the increasing popularity of less costly SAN transport technologies like iSCSI.*

Hewlett-Packard Co. commissioned The Tolly Group to evaluate the performance of its Fibre Channel-based StorageWorks 8Gb Simple SAN Connection Kit compared to a traditional 4Gb Fibre Channel (FC) solution.

The Tolly Group certified HP's 8Gb Fibre Channel SAN solution featuring the StorageWorks 8Gb Simple SAN Connection Kit to be the "First 8Gb Fibre Channel SAN Solution" tested.

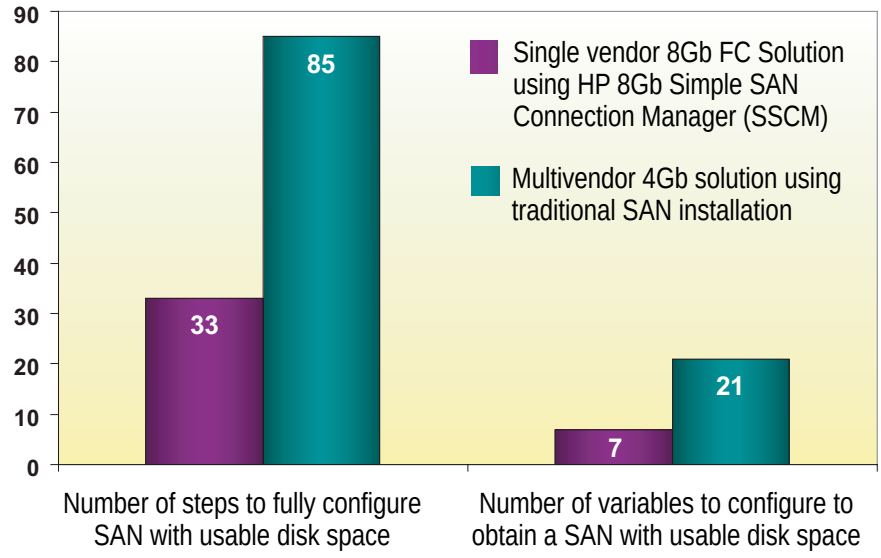
Tolly Group engineers also compared the ease of deployment of a single-vendor end-to-end FC SAN, using HP's Simple SAN Connection Manager, to that of a traditional multivendor FC SAN that required individual components like the HBA, switch and storage subsystem to be configured individually. Tests focused on the number of configuration steps and variables that needed to be configured to finish the deployment of the SAN.

Tests were conducted in February 2008.

Test Highlights

- HP Simple SAN Connection Manager requires 2/3rd fewer steps and 2/3rd fewer variables to configure a Fibre Channel SAN from a single interface, compared to installing a FC SAN solution by separately configuring multiple components
- HP 8Gb Simple SAN Connection Solution delivers an average of 1.8X more I/O operations per second and 1.8X more throughput with various request data sizes with 70% read and 30% random write requests compared to a 4Gb FC SAN solution

Ease of Deployment —HP 8Gb Fibre Channel End-to-End SAN Solution with Simple SAN Connection Kit versus a Traditional Multivendor FC SAN Solution
(Lower bars are better)



Source: The Tolly Group, February 2008

Figure 1

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Executive Summary

HP's 8Gb FC solution delivered 1.5X to 2X the IOPS and throughput as a 4Gb FC solution, while the Simple SAN Connection Manager (the management component of the StorageWorks Simple SAN Connection Kit) took half the time to configure and 2/3rd fewer configuration steps to deploy a FC SAN compared with configuring each component separately.

Installing a Fibre Channel (FC) SAN solution involves complexity and requires time and experience. Often, SAN users need to invest a good deal of time getting trained on FC technology, and familiarizing themselves with configuring multiple FC infrastructure components and storage subsystems.

This process becomes doubly complicated when the SAN solution is made up of components from multiple vendors, since there often is very little data on how to connect them into an end-to-end solution. Often, each component must be configured using its own management interface.

Decreased complexity of installation procedure, and the convenience of using a complete end-to-end solution from a single vendor can yield benefits for users.

Tolly Group engineers tested the ease of deployment of HP's end-to-end FC SAN solution using HP StorageWorks 8Gb Simple SAN Connection Kit, against that of a traditional multivendor FC SAN solution comprised of popular SAN components using 4 Gb FC technology.

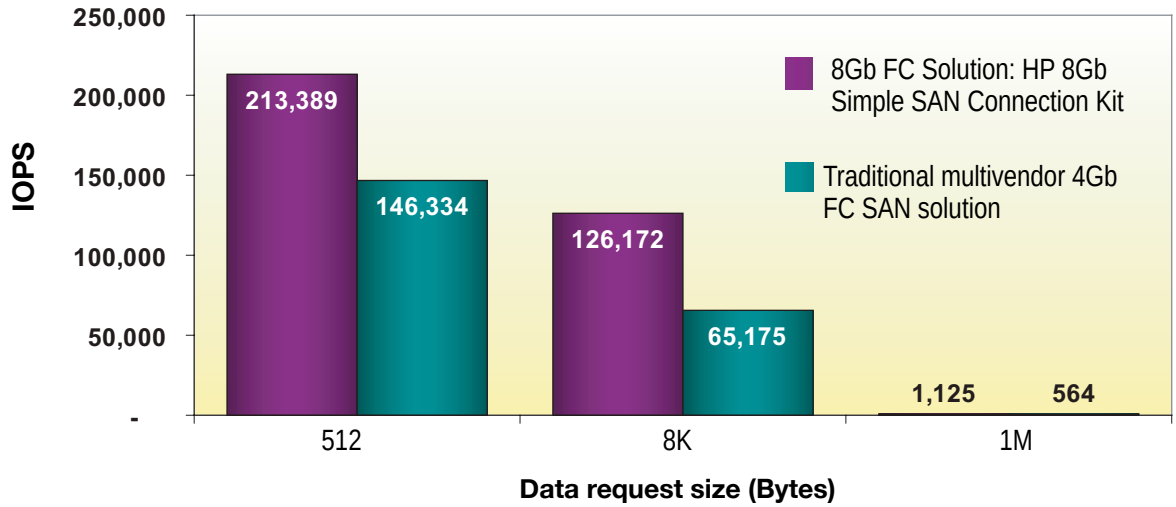
HP StorageWorks 8Gb Simple SAN Connection Kit

First 8Gb Fibre Channel SAN Solution Tested

(Note: the multivendor FC SAN solution will hereafter be referred to as a "traditional SAN" for simplicity.)

Engineers noted that using the Simple SAN Connection Manager software of the Simple SAN Connection Kit took less than half the time to configure and nearly 2/3rd fewer steps and variables to be

Comparison of Input/Output Operations per Second (IOPS) with 32 I/O Processes per Disk Space
as Reported by Iometer version 2006.07.27



Note: 8K bytes = 8,192 bytes and 1M bytes = 1,048,576 bytes

Source: The Tolly Group, February 2008

Figure 2

configured to deploy, compared to that of the traditional SAN that required configuring individual components of the SAN solution like the FC HBA, FC switch and the storage subsystem separately.

The HP StorageWorks 8Gb Simple SAN Connection Kit used 81Q PCI-E FC HBAs, 8/20q Fibre Channel Switch based on QLogic 8Gb Fibre Channel technology.

This translates into increased ease of deployment and less potential for human error when deploying the SAN solution using HP's kit.

This also helps in maintenance efficiency by having to use just a single efficient software management interface, — the Simple SAN Connection Manager — to configure and manage all SAN components rather than disparate tools from multiple vendors to configure each component independently.

Results

Ease of deployment test

Engineers observed that from the moment the SAN components were powered up, the end-to-end FC SAN solution using HP's Simple SAN Connection Kit took half the time to install compared to the traditional multivendor SAN solution.

Using the HP kit and its associated Simple SAN Connection Manager (SSCM) software, engineers needed to perform just 33 steps and set only seven variables to complete the installation of the FC SAN solution.

In contrast, with the installation of the traditional, multivendor FC SAN solution, engineers needed to perform 85 steps (2.6X more) and set 21 variables (3X more) using multiple software management utilities.

HP StorageWorks 8Gb Simple SAN Connection Kit

Performance and Ease of Deployment Comparison

IO Performance Test

Engineers used Iometer test tool to compare the performance of the 8Gb FC solution against the 4Gb FC solution. Test results showed that for a random read-write test using 32 I/O processes with 70% read and 30% write modes, the 8Gb FC solution achieved 1.5X to 2X more IOPS and throughput compared to the 4Gb FC

Product Specifications

Vendor-supplied information not necessarily verified by The Tolly Group

HP StorageWorks 8Gb Simple SAN Connection Kit

HP StorageWorks 8Gb Simple SAN Connection Kit includes:

- 8/20q Fibre Channel Switch with 8 Gbps FC ports (backward compatible with installed 2 Gbps and 4 Gbps FC connections on HP's storage systems) as well as support for advanced capabilities including NPIV (with targeted availability in 3Q08) and overlapping protection domains (OPD) for enabling flexible data protection processes.
- 81Q PCI-E FC HBA with advanced "virtualization ready" features for enhanced security, quality of service, and dynamic provisioning during live application migrations, as well as advanced power management functions (dynamic power throttling) to reduce the impact of HBAs on overall server power consumption.

Business Value

- HP simplifies enterprise-class SANs for SMB customers by combining state-of-the-art 8Gb Fibre Channel performance from the server to storage device with end-to-end SAN management software. The user's future is protected with an infrastructure capable of supporting emerging technologies at today's 4Gb prices.

Product Features and Benefits:

- High performance at affordable pricing
- Enterprise-class functionality
- Integrated end-to-end management
- Ease of deployment
- Aggressively priced bundle
- Scalability
- Investment protection

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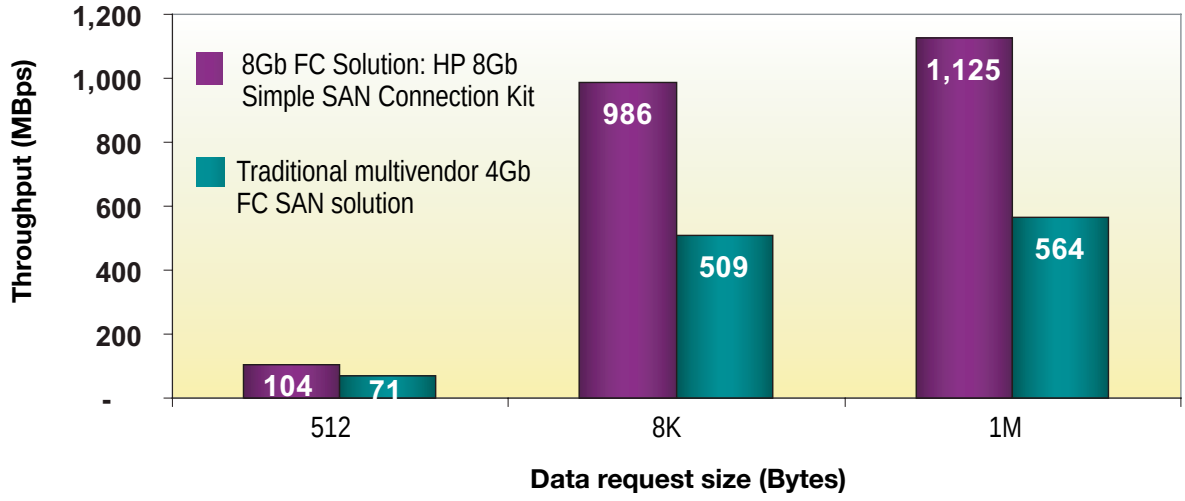
Comparison of Throughput for 8Gb and 4Gb Fibre Channel Solutions using 32 I/O Processes per Disk Space
as Reported by Iometer version 2006.07.27



Note: 8K bytes = 8,192 bytes and 1M bytes = 1,048,576 bytes

Source: The Tolly Group, February 2008 *Figure 3*

solution. (See Figures 2 and 3.)

Test Setup & Methodology

Tolly Group engineers tested HP's end-to-end 8Gb FC SAN solution with the 8Gb Simple SAN Connection Kit, against a traditional multi-vendor 4Gb Fibre Channel (FC) solution.

The 8Gb FC SAN solution consisted of HP StorageWorks 81Q PCI-E FC HBA (single 8Gb FC port with firmware ver. 4.02 and driver ver. 9.1.6.15), HP StorageWorks 8/20q FC switch (software ver. 6.9.0.8.0), and a HP StorageWorks EVA 4100 Storage Array with two HSV200 controllers and eight 146GB 10K hard disk drives.

The traditional multi-vendor 4Gb FC solution consisted of an HP Array Configuration Utility (ACU) (ver. 7.31.1.0), QLogic SANblade QLE2460 PCI-E FC HBA (one 4Gb port with firmware ver. 4.02 and driver ver. 9.1.7.15), QLogic SANsurfer FC HBA Manager (ver. 5.0.1 Build 21), QLogic Fabric OS (ver. 3.2.0), a leading FC switch with its management software application, and HP StorageWorks Modular Smart Array (MSA) 1000 storage array with one controller and three 72.8GB 10K hard disk drives.

Engineers tested the simplicity of configuring two different (8Gb and 4Gb) FC SAN solutions onto two identical HP ProLiant DL360 G5 E5335 servers, respectively (with Quad-Core 2 GHz Intel Xeon Processor, 2 GB RAM and Microsoft Windows Server 2003 R2 (See Figure 5.).

With all the devices ready (cables plugged in and powered up) for SAN installation, engineers started with the 8Gb solution installation using HP Simple SAN Connection Manager (SSCM) software, and then installed the 4Gb installation using HP ACU, QLogic SANsurfer and the FC switch management application.

After configuring the SAN installations of both solutions, engineers verified the available usable disk space.

During this process, engineers recorded the time expended on deployment, counted the number of configuration steps and identified the number of variables that needed to be configured.

All software for the 4Gb solution was preloaded onto the hard drive, simplifying the install process.

In the performance test, engineers used Texas Memory Systems RamSan-325 Storage system (four 4Gb FC ports) for testing both the 8Gb and 4Gb FC solutions under test. Engineers cre-

ated four 8GB disk spaces, so that each FC port was associated with one disk space. (See Figure 4.)

Then engineers used Iometer (ver. 2006.07.27) with 32 I/O processes per disk space and tested with 512, 8K, 1M-byte (8K bytes = 8,192 bytes and 1M bytes = 1,048,576 bytes) request data with 70 % read and 30% write requests in a random distribution. Engineers recorded the Input/Output operations per second (IOPS) and throughput in MBps for both solutions. Tests were run three times and average results were reported.

HP takes the complexity out of SANs

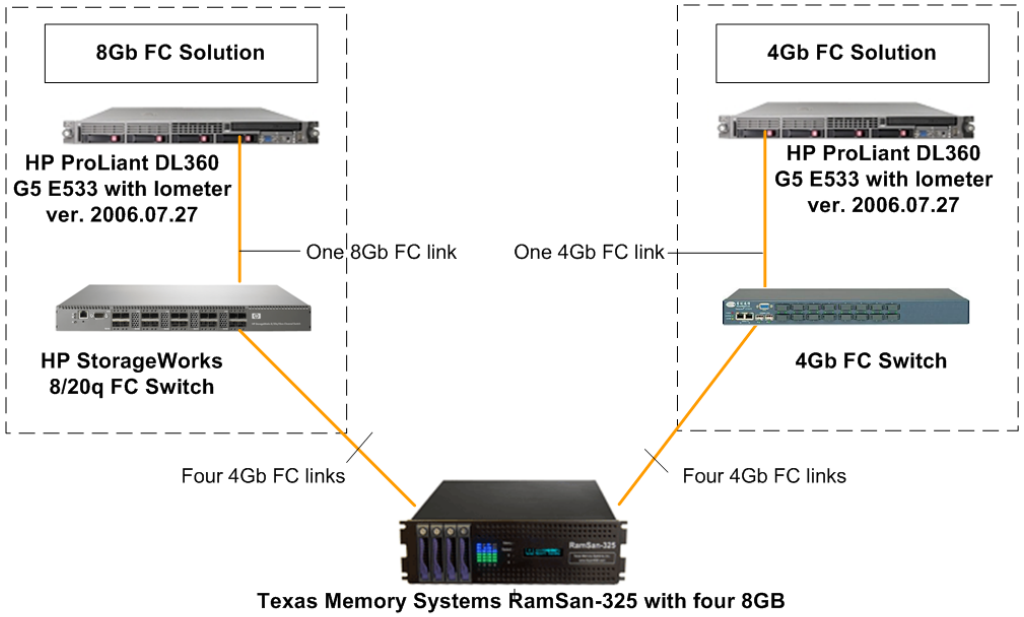
The HP StorageWorks 8Gb Simple SAN Connection portfolio seeks to simplify installation of a SAN by automating every aspect of setup and configuration. An entire SAN may now be deployed in minutes – including switch, host bus adapter (HBA) and storage provisioning.

SAN novices and seasoned experts will appreciate the simplicity and power of the included Simple SAN Connection Manager software. It works seamlessly with both HP StorageWorks Enterprise Virtual Arrays (EVA) and HP StorageWorks Modular Storage Array (MSA) storage systems, HP 81Q PCI-E FC HBAs and the 8/20q Fibre Channel Switch to handle common cross-platform management and maintenance tasks quickly while masking underlying complexity.

The fully-integrated dashboard, wizards and automated features give users a competitive advantage by allowing IT professionals to accomplish more in less time.

Source: Hewlett-Packard Co., February 2008

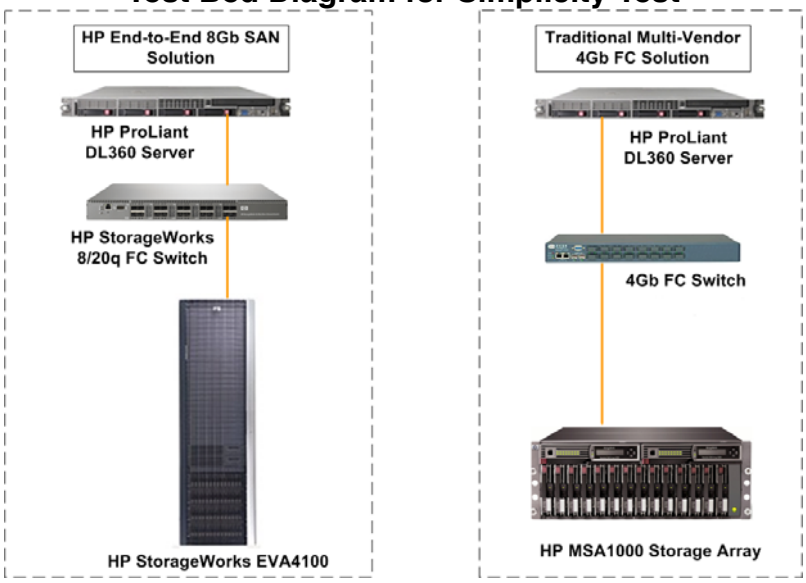
Test Bed Diagram for Performance Test



Source: The Tolly Group, February 2008

Figure 4

Test Bed Diagram for Simplicity Test



Source: The Tolly Group, February 2008

Figure 5

The Tolly Group is a leading global provider of third-party validation services for vendors of IT products, components and services.

The company is based in Boca Raton, FL and can be reached by phone at (561) 391-5610, or via the Internet at:
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Test Tool Summary

Vendor	Product	Web URL:
Public Domain	Iometer Ver. 2006.07.27	http://www.iometer.org

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