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SMB 3 Functional Validation for Hitachi NAS Platform 4000 Series

TECHNICAL PAPER

Tech Note

By Richard Andersen

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Hitachi Data Systems

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SMB 3 Functional Validation for Hitachi NAS Platform 4000 Series

Tech Note

This paper documents the results of functional validation testing performed in Hitachi Data System's Solution Engineering labs to verify whether or not Microsoft® Hyper-V® could use file shares hosted by Hitachi NAS Platform (HNAS) 4000 series with SMB 3 support enabled. The testing used two server blades on Hitachi Compute Blade 500 to host the Hyper-V environment. These server blades were configured as a failover cluster. Two Hitachi NAS Platform 4080 systems were configured as a cluster and managed by an SMU 400. The Hitachi NAS Platform cluster was connected to Hitachi Virtual Storage Platform G600 (VSP G600). Testing was performed to verify that a file share hosted by the Hitachi NAS Platform cluster could be used to host the configuration store and virtual hard drive (VHD) files for virtual machines created on the Hyper-V hosts.

Solution Components

These are the hardware and software components used to validate the test environment.

Hardware Components

Table 1 lists the information about the hardware components used in the test environment.

Table 1. Hardware Components

Hardware	Description	Version	Quantity
Hitachi NAS Platform 4080	Network attached storage (NAS) platform ■ 4 × 10 GbE Ethernet ports ■ 4 × 8 Gb/sec Fibre Channel ports ■ 2 × 10 GbE cluster interconnect ports	12.4.3924.02	2
Hitachi NAS Platform system management unit software 400	■ 2 × 10/100/1000 Mb/sec Ethernet ports	12.4.3924.02	1
Hitachi Virtual Storage Platform G600	■ Dual controllers ■ 16 × 8 Gb/sec Fibre Channel ports ■ 256 GB cache memory ■ 128 × 1.2 TB, 10K RPM, SAS disks	83-01-01-40	1
Hitachi Compute Blade 500 (CB 500) chassis	■ Up to 8 server blades ■ 2 management modules ■ 6 cooling fan modules ■ 4 power supply modules ■ 2 Brocade 5460 Fibre Channel switch modules ■ 2 Brocade VDX 6746 DCB 10 GbE switch modules	A0160-E-8004	1

Table 1. Hardware Components (Continued)

Hardware	Description	Version	Quantity
Hitachi Compute Blade 520H B2 server blade	■ Half-size blade ■ 2 × 12-core Intel Xeon E5-2697 v2 processors at 2.70 GHz ■ 256 GB RAM ■ 16 × 16 DIMMs ■ 2 hot-swappable 2.5 inch SAS drives ■ 1 Emulex 10 GbE onboard CNA ■ 1 Hitachi 16 Gb/sec Fibre Channel mezzanine card	04-05/10-10	2
Brocade 6720	24-port 10 GbE switch	2.0.1b	2
Brocade 6510	48-port 8-16 Gb/sec Fibre Channel switch	7.0.1.a	2

Software Components

Table 2 lists the software used in the test environment.

Table 2. Software Components

Software	Version
Hitachi Dynamic Provisioning	VSP G600 microcode dependent
Hitachi Storage Navigator	VSP G600 microcode dependent
Microsoft Windows Server®	2012 R2 Datacenter
Microsoft Windows Server	2012 R2 Standard
Microsoft System Center	2012 R2
Microsoft System Center Virtual Machine Manager	2012 R2
Microsoft SQL Server®	2012

Note the following:

- Hitachi Dynamic Provisioning was used on Hitachi Virtual Storage Platform G600.
- Microsoft Windows Server 2012 R2 Datacenter was installed on the Hyper-V hosts.
- Microsoft Windows Server 2012 R2 Standard was installed on all virtual machines.
- Microsoft System Center 2012 R2 was installed in the test environment but not used for the initial validation testing.
- Microsoft SQL Server 2012 was installed in the environment to host the required System Center databases.

The following roles and features were installed on both of the server blades:

- Hyper-V role
- Multipath I/O feature
- Failover Clustering feature

Test Environment Configuration

The test environment consisted of the following:

- Two server blades configured as a failover cluster with the Hyper-V role enabled.
- Hitachi Virtual Storage Platform G600 with one Hitachi Dynamic Provisioning pool configured to hold configuration stores and VHD files for the infrastructure virtual machines (VMs) and Web Server virtual machines.
- Two Hitachi NAS Platform 4080 systems configured as a cluster managed with an SMU 400.
- Hitachi Virtual Storage Platform G600 with one Hitachi Dynamic Provision pool, eight RAID-6 (6D+2P) raid groups, and 16 LUNs presented to the Hitachi NAS Platform cluster. This was for functionality and performance testing.
- Each of the sixteen LUNs from the G600 storage array was configured as a 1.04 TB system drive on Hitachi NAS Platform. One storage pool was created, consisting of sixteen system drives. A 20 TB file system was configured as a storage pool. The file system was assigned to an EVS configured on the Hitachi NAS Platform 4080 cluster. A CIFS server was configured and a CIF share was created for the file system.
- A second Hitachi Dynamic Provisioning pool was created on the Hitachi Virtual Storage Platform G600, eight RAID-6 (6D+2P) raid groups, and one 64 TB Lun, presented to test a large VHDX LUN.

Figure 1 shows the high level architecture of the test environment. Note that infrastructure Fibre Channel switches and Ethernet switches are not shown. All Fibre Channel connections were made through a pair of Brocade 6510 switches.

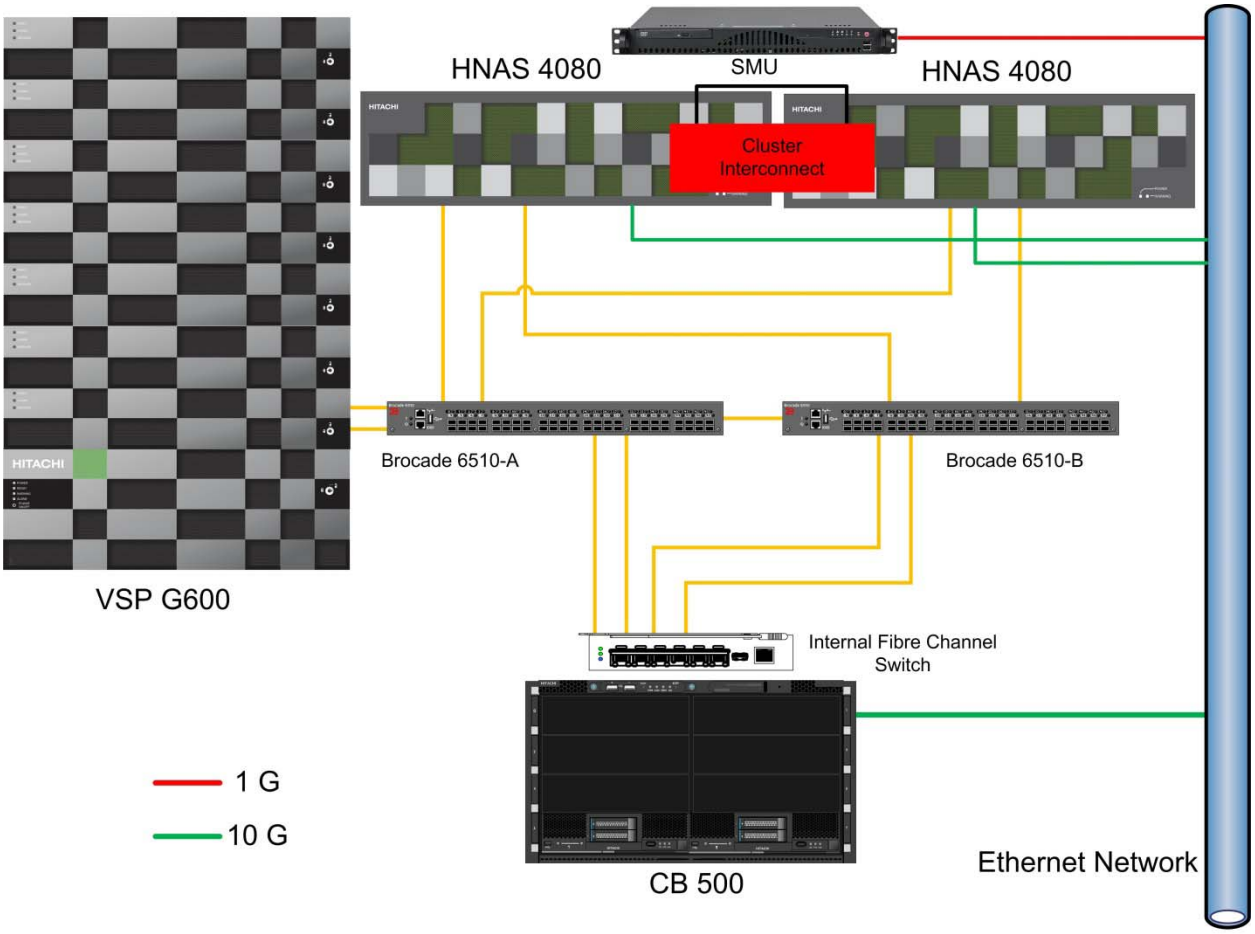

Figure 1

Storage Configuration

One storage system was used for the test environment:

- Hitachi Virtual Storage Platform G600 – Attached to Hitachi Compute Blade 500 and used to host VHDX files and configuration files for infrastructure virtual machines and Web Server virtual machines.

Hitachi Virtual Storage Platform G600 Configuration

Two Hitachi Dynamic Provisioning (HDP) pools were configured on the Virtual Storage Platform G600 The configuration details for the pool are listed in Table 3.

Table 3. Virtual Storage Platform G600 HDP Pool Configuration

HDP Pool	HDP RAID Configuration	Number of Drives	Drive Capacity	Pool Capacity	Use
HNAS-FS-1	RAID-6 (6D+2P)	64	1.2 TB SAS 10K RPM	23.99 TB	Large VHDX testing
HYPER-V-1	RAID-6 (6D+2P)	64	1.2 TB SAS 10K RPM	23.99 TB	Functionality Performance Testing

Three LDEVs were allocated from the dynamic provisioning pools and mapped to storage ports as shown in Table 4.

Table 4. Virtual Storage Platform G600 LDEV Configuration

HDP Pool	LDEV	LUN	Size (GB)	Use	Storage Port
HYPER-V-1	00:00:82	0	1	Quorum	5A,6A
	00:00:83	1	500	Cluster Shared Volume	5A,6A

The LUNs were presented to two Hitachi Compute Blade 500 server blades that were configured in a failover cluster and used for the following:

- LUN 0 - Configured as the quorum disk for the failover cluster
- LUN 1 - Configured as a cluster shared volume and used for the configuration store and VHDs for the environment infrastructure virtual machines

Hitachi Virtual Storage Platform G600 HNAS Configuration

Storage allocated to the Hitachi NAS Platform 4080 cluster consisted of eight RAID groups. Each RAID group consisted of four 1.2 TB SAS 10K RPM drives configured as RAID-6 (6D+2P). One LDEV was created in each RAID group. Each LDEV was presented to the Hitachi NAS Platform 4080 cluster as a LUN and each LUN was configured as a system drive. One storage pool was created on the Hitachi NAS Platform 4080 cluster consisting of sixteen system drives. Table 5 shows the configuration.

Table 5. Hitachi Virtual Storage Platform 600 HNAS Configuration

LDEV	LUN	Storage Ports	HNAS Storage Pool
00:00:6A	0	5A,6A	HNAS-FS-1
00:00:6B	1	5A,6A	HNAS-FS-1
00:00:6C	2	5A,6A	HNAS-FS-1
00:00:6D	2	5A,6A	HNAS-FS-1
00:00:6E	4	5A,6A	HNAS-FS-1
00:00:6F	5	5A,6A	HNAS-FS-1
00:00:70	6	5A,6A	HNAS-FS-1

Table 5. Hitachi Virtual Storage Platform 600 HNAS Configuration (Continued)

LDEV	LUN	Storage Ports	HNAS Storage Pool
00:00:71	7	5A,6A	HNAS-FS-1
00:00:72	8	5A,6A	HNAS-FS-1
00:00:73	9	5A,6A	HNAS-FS-1
00:00:74	10	5A,6A	HNAS-FS-1
00:00:75	11	5A,6A	HNAS-FS-1
00:00:74	12	5A,6A	HNAS-FS-1
00:00:73	13	5A,6A	HNAS-FS-1
00:00:74	14	5A,6A	HNAS-FS-1
00:00:75	15	5A,6A	HNAS-FS-1

Hitachi NAS Platform 4080 Configuration

The HNAS configuration is a cluster consisting of two HNAS 4080 server nodes managed by a HNAS SMU 400. The HNAS storage configuration is outlined below:

- Sixteen 1.4 TB System Drives - LUNs from the Hitachi Virtual Storage Platform G600 storage array.
- 22 TB Storage Pool consisting of sixteen 1.4TB System Drives.
- File System was created on the HNAS 4080 named "HV1" to contain the virtual machine VHDX and configuration files for testing.
- File System was formatted with a 4K block size for performance.

Note — Set the Superflush option to 3 × 128 KB for each System Drive to allow for better performance.

Server Configuration

Two Hitachi Compute Blade 500 server blades were used to host the test environment. The server blades had the Hyper-V role installed and were configured as a failover cluster. The server blades are listed in Table 6.

Table 6. Blade Server Configuration

Server	Server Name	Role	Operating System
520H B2	CB500-12-B2	Hyper-V host server	Windows Server 2012 R2 Datacenter
520H B3	CB500-12-B3	Hyper-V host server	Windows Server 2012 R2 Datacenter

The virtual machines required for the infrastructure are listed in Table 7.

Table 7. Virtual Machine Configuration

VM Name	Role	vCPU	Virtual Memory	Operating System
Hnas-cloud-DC1	Domain controller and DNS	1	4 GB	Windows Server 2012 R2 Standard
Hnas-cloud-DC2	Domain controller and DNS	1	4 GB	Windows Server 2012 R2 Standard

Table 7. Virtual Machine Configuration

VM Name	Role	vCPU	Virtual Memory	Operating System
SCCOM	System Center Configuration Manager	2	8 GB	Windows Server 2012 R2 Standard
SCVMM	System Center Virtual Machine Manager	2	8 GB	Windows Server 2012 R2 Standard
SC-SQL	SQL Server for System Center databases	4	16 GB	Windows Server 2012 R2 Standard

Each Active Directory® domain controller was installed as a virtual machines on one of the hosts.

- Hnas-cloud-DC1 was installed on CB500-12-B2
- Hnas-cloud-DC2 was installed on CB500-12-B3

The domain controllers were not configured to fail over in the event of a blade server failure.

The other infrastructure virtual machines were installed on a Hyper-V host and configured as roles in Failover Cluster Manager to enable failover in the event of a blade server failure.

SAN Configuration

Two sets of zones were required for this environment. One set of zones was for the connections between the Compute Blade 500 server blades and the VSP G600. The other set of zones were for the connections between the HNAS 4060 heads and the VSP G600 storage system. The zone configuration details are shown in Table 8.

Table 8. Fibre Channel Zone Configuration

Host	Host HBA or Port	Zone Name	Storage Ports
CB500-12-B2	HBA1_1	CB500_11_B6_HBA1_1_ASE42_26_3A	3A
	HBA1_2	CB500_11_B6_HBA1_2_ASE42_26_4A	4A
CB500-12-B3	HBA1_1	CB500_11_B7_HBA1_1_ASE42_26_5A	5A
	HBA1_2	CB500_11_B7_HBA1_2_ASE42_26_6A	6A
HNAS_522	1	HNAS_522_P1_ASE42_26_5A_6A	5A,6A
	2	HNAS_522_P2_ASE42_26_5A_6A	5A,6A
HNAS_523	1	HNAS_0523_P1_ASE42_26_5A_6A	5A,6A
	2	HNAS_0523_P2_ASE42_26_5A_6A	5A,6A

Network Configuration

To keep network configuration simple and reduce the chance of network configuration issues, all traffic used the same network interfaces and VLAN. This was acceptable for the test environment because only validation testing was being performed. In a production environment or for performance testing multiple network interfaces and VLANs should be used to separate the traffic. In a production environment, the following types of traffic must be planned for:

- File share access - Traffic between the Hyper-V hosts and the file shares on Hitachi NAS Platform
- Cluster communications - Traffic between the nodes in the failover cluster
- Management - Traffic between the server or servers used to manage the environment and the devices being managed
- Client/Server communications - Traffic between the clients and the Hyper-V host servers

Test Methodology

Testing to validate Hitachi NAS Platform SMB 3 functionality in a Microsoft environment consisted of the following test cases:

1. Verify that the configuration store and the VHDX for a Hyper-V virtual machine can be stored on a file share hosted on Hitachi NAS Platform 4080. Verify that the Hyper-V virtual machine can execute a heavy Web Server workload.

2. Verify that the maximum VHDX of 64 TB is supported and the configuration store and VHDX for a Hyper-V virtual machine can be stored on a 64 TB file share hosted on Hitachi NAS Platform 4080.

3. Examine the performance characteristics of hosting virtual machines workloads on a Hitachi NAS Platform file share. Tests were executed to compare the performance of a Web Server workload running on Hitachi NAS Platform versus a similar workload on the VSP G600.

4. To perform testing for test case 1, an attempt was made to create a new virtual machine with the location of the configuration store and the VHDX set to \\HV1\HV1. A UNC path is required for using a remote share for storage of the virtual machine.

Results

With SMB 3 enabled on Hitachi NAS Platform, the results were:

- Put both configuration store and VHD on the CIFS share hosted by Hitachi NAS Platform
  - Using SMB 3 on HNAS - Success
- Put configuration file on a local drive and VHD on the CIFS share
  - Using SMB 3 on HNAS – Success
  - Put both configuration store and 64 TB VHDX on the CIFS share hosted by Hitachi NAS Platform. Also tested allocating a dynamic VHDX with a starting size of 138 GB on the CIFS share and growing to 64 TB.
  - Using SMB 3 on HNAS –Success

Performance

The goal of the performance testing was to measure the throughput and response times when executing a Web Server workload against the Hitachi NAS Platform 4080 cluster.

For this testing, standalone and multiple Web servers were deployed. The industry standard Iometer profile was used to generate Web server traffic. The I/O definition for this profile consists of random reads of various block sizes as shown in Table X. The Web server I/O profile was originally distributed by Intel, the author of Iometer, and used by Microsoft as a typical Web server profile.

Size	Percent of Size	Percent Reads	Percent Random	Delay	Burst	Align	Reply
512	22	100	100	0	1	0	0
1024	15	100	100	0	1	0	0
2048	8	100	100	0	1	0	0
4096	23	100	100	0	1	0	0
8192	15	100	100	0	1	0	0
16384	2	100	100	0	1	0	0
32768	6	100	100	0	1	0	0
65536	7	100	100	0	1	0	0
131072	1	100	100	0	1	0	0
524288	100	100	100	0	1	0	0

This configuration meets Microsoft's 20 millisecond I/O response time requirement to the disks that host the Web Server virtual machines. Each Web server VM is configured with four virtual CPUs and 1.5 GB of memory.

The table below shows the performance of a Web Server virtual machine running against Hitachi NAS Platform 4080 with a VHDX hosted on a file share, and a Web Server virtual machines running against Hitachi Virtual Storage Platform G600 with a VHDX hosted on a cluster shared volume.

Storage Platform	Virtual Machine	Web Server IOPS	Avg. Response Time (msec)
HNAS 4080	SMB3File1	22510	7.10
VSP G600	SMB3Blk1	26906	4.75

The table below shows performance of 2 virtual machines running a heavy Web Server workload in parallel against HNAS 4080 storage.

Virtual Machine	Web Server IOPS	Avg. Response Time (msec)
SMB3File1	9181	13.39
SMB3File2	9039	14.15

The table below shows performance of 2 virtual machines running a heavy Web Server workload in parallel against Hitachi Virtual Storage G600 storage.

Virtual Machine	Web Server IOPS	Avg. Response Time (msec)
SMB3Blk1	13740	18.62
SMB3Blk2	13643	18.76

Hitachi Data Systems

Corporate Headquarters
2845 Lafayette Street
Santa Clara, CA 96050-2639 USA
www.HDS.com community.HDS.com

Regional Contact Information
Americas: +1 408 970 1000 or info@hds.com
Europe, Middle East and Africa: +44 (0) 1753 618000 or info.emea@hds.com
Asia Pacific: +852 3189 7900 or hds.marketing.apac@hds.com

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