Cisco and Hitachi Adaptive Solutions with FC-NVMe

Lab Validation Report

MK-SL-245-00
August 2022

Feedback

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Revision history

Changes	Date
Initial release	August 1, 2022

Lab Validation Report

This report documents the lab validation results achieved during Hitachi Virtual Storage Platform 5000 series (VSP 5000 series) Fibre Channel (FC) - SCSI vs FC — Non-Volatile Memory Express (NVMe) protocol performance on Cisco Unified Computing System supporting a virtualized VMware 7.0U2 environment. This document also describes how to enable NVMe on the VSP storage system specific to Cisco and Hitachi Adaptive Solution deployments.

This report is written for the following professional services staff:

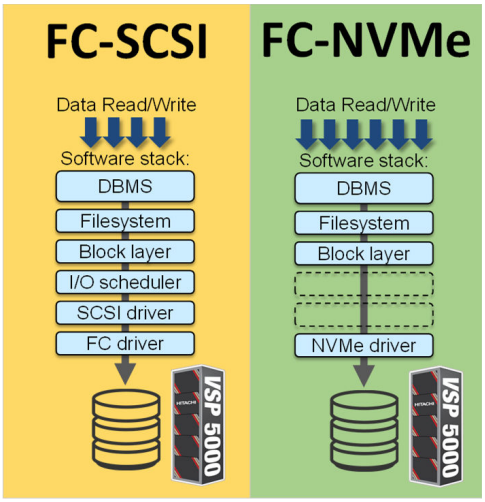
- Storage administrators
- VMware administrators
- Sales engineers
- Field consultants
- Validated Hitachi and Cisco resale partners

Readers of this document should understand RAID systems and their functions, VMware ESXi and vCenter environments, and converged infrastructure.

Note: Testing of these procedures was in a lab environment. Many factors impact production environments beyond prediction or duplication in a lab environment. Follow the recommended practice of conducting proof-of-concept testing for acceptable results in a non-production, isolated test environment that otherwise matches your production environment before your production implementation of this solution.

Introduction

The NVMe connection protocol was specifically written to replace the SCSI storage protocol to take advantage of SSD speed, parallelism, and lower latency. The command set is leaner, and it supports a nearly unlimited queue depth that takes advantage of the parallel nature of flash drives, which provide a maximum queue depth of 64K for up to 64K separate queues. The following figure shows the overhead of traditional FC-SCSI vs FC-NVMe.



The FC-NVMe communication protocol can be used over an FC-Storage Area Network (SAN) in which existing Fibre Channel network devices are used. This is where the Cisco and Hitachi Adaptive Solution give clients the flexibility to choose what best fits their datacenter needs. Hitachi Vantara has released the VSP 5000 series which now supports FC-NVMe, and the existing Cisco SAN infrastructure does not require a refresh to support FC-NVMe capability. To learn more about the VSP 5000 series click here.

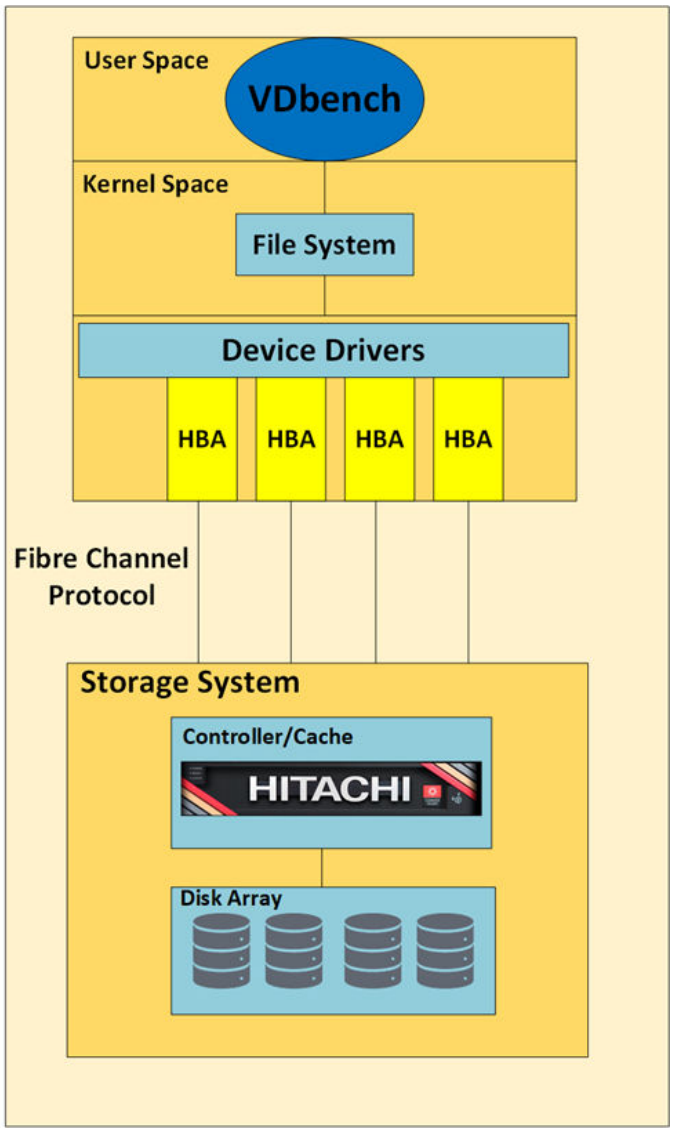
Product features

This section describes the products used in validation testing of VSP 5000 series SCSI vs NVMe protocol performance benchmark testing.

VDbench benchmark

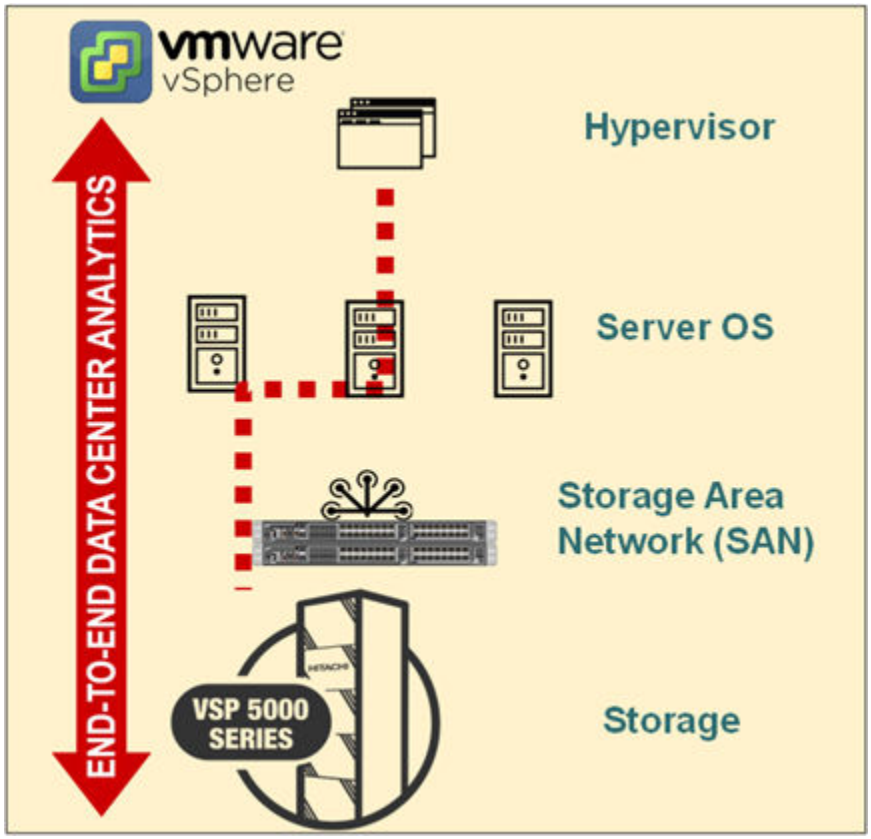
VDbench is a disk I/O workload generation tool used for testing and benchmarking block storage products to understand performance characteristics. With VDbench, various I/O workloads are produced that allows users to control workload parameters such as I/O rate, block size, thread count, read and write ratios, as well as read and write cache hit percentages coupled with random or sequential workloads. Once the test runs are completed, the run reports are produced in HTML format.

The following figure shows the VDbench architecture:



Hitachi Ops Center Analyzer detail view

Hitachi Ops Center Analyzer detail view server was used to collect host and storage performance data during VDbench load testing. Analyzer detail view server allows end-to-end metric collection from compute hosts, Fibre Channel switches, and backend storage systems. See Related documents (on page 15) for more information about Hitachi Ops Center. The following figure shows Ops Center Analyzer capabilities.


vmware
vSphere
Hypervisor
END-TO-END DATA CENTER ANALYTICS
Server OS
Storage Area
Network (SAN)
VSP 5000
SERIES
Storage

Tested solution components

The following tables list the tested solution components.

Table 1 Hardware components

Component	Version
Hitachi Virtual Storage Platform VSP 5600H	90-07-01-00/00
Cisco MDS 9132T Fibre Channel switch	8.4(2b)
Cisco Nexus 9332-FX2 switch	NXOS 7.0(3)I7(9)
Cisco Fabric Interconnect 6454	4.2(1f)
Cisco Unified Computing System 5108 Chassis with B200 M6 Blade Servers	4.2(1f)
Cisco Unified Computing System 2208XP IOM	4.2(1f)

Table 2 Software components

Component	Version
VMware vCenter Standalone (VCSA) 7.0 U3	7.0.3 19234570
VMware ESXi 7.0 U3 Cisco Custom Image	VMware ESXi, 7.0.3, 19193900
VMware ESXi 7.0U3 nenic	1.0.42.0
VMware ESXi 7.0U3 nfnic	5.0.0.34
VDbench	3.6.2

Test environment configuration

The following section covers the SAN and storage configuration used during testing.

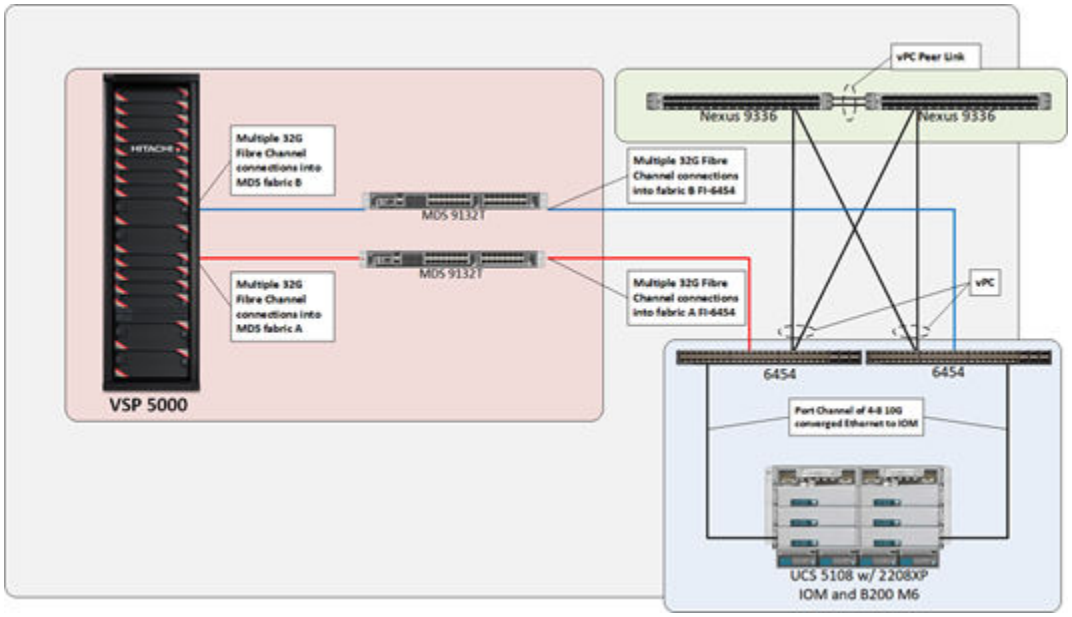
SAN configuration

Cisco and Hitachi Adaptive Solutions for Converged Infrastructure as a virtual server infrastructure is a best-practice datacenter architecture built in collaboration between Hitachi Vantara and Cisco Systems to meet your enterprise needs using virtual server workloads.

This architecture uses a Hitachi VSP connected to Cisco MDS multilayer switches that link to the Cisco UCS Fabric Interconnects and Cisco UCS chassis. Northbound networking is enabled through the Cisco Nexus 9000 family of switches.

For the FC-SCSI testing, all 4 ports connected to the fabric were in SCSI mode. During FC-NVMe testing all 4 ports connected into the fabric were in NVMe mode. See the Cisco and Hitachi Adaptive Solutions for Converged Infrastructure Deployment Guide for information on SAN connectivity.

The following figure shows the validated architecture for Cisco and Hitachi Adaptive Solutions for Converged Infrastructure. The red lines represent Fabric A connections, the blue lines represent Fabric B connections, and the rest are port channel connections.



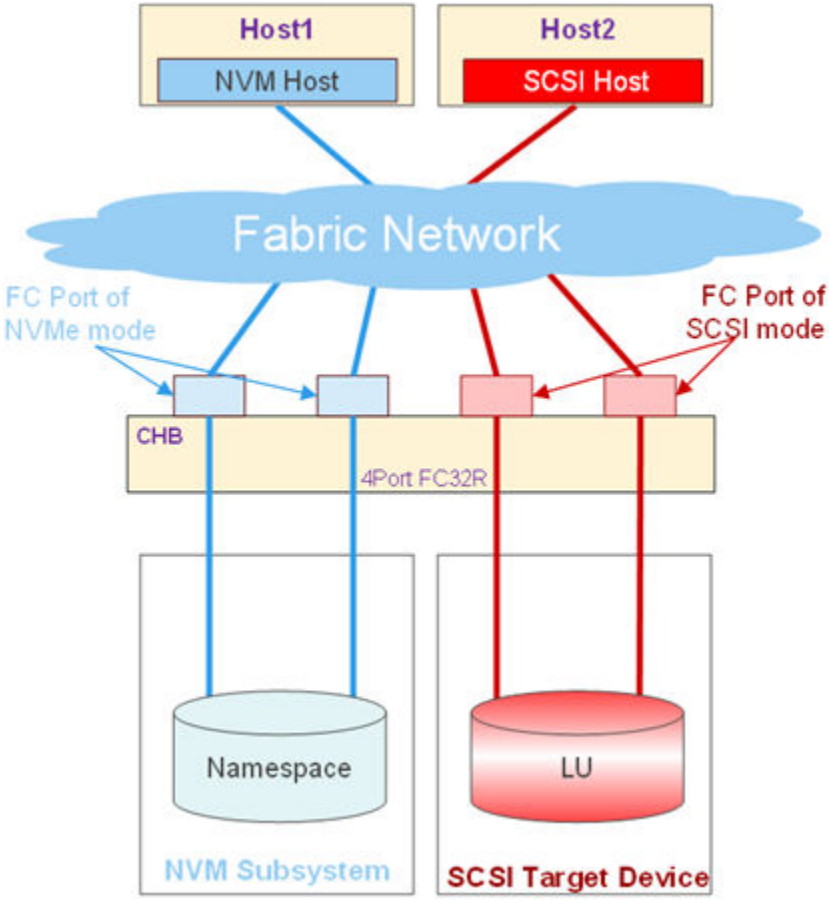
Cisco UCS Server vHBA preparation

With Cisco UCS servers, dedicated vHBAs must be created to manage FC-NVMe protocol traffic. The adapter policy FC-NVMe Initiator must be applied to the server from its server profile which in turn produces new WWPNs that must be zoned and then added to the Hitachi VSP NVMe host group and subsystem. For directions on how to create FC-NVMe Initiator vHBAs, refer to Cisco Storage-Related Policies. See Appendix A (on page 17) for information about configuring FC-NVMe on Hitachi VSP for Cisco and Hitachi Adaptive Solutions.

Storage configuration

Hitachi Virtual Storage Platform 5600H configuration
▪ 2 TB cache ▪ 64 × 3.8 TB NVMe drives ▪ 4 × 32 Gbps Fibre Channel ports used (4Port FC32R)

During testing, the four port FC32R channel board (CHB) was used for the SCSI and NVMe protocols. With this CHB, both 16G SFP and 32G SFP are supported with FC-NVMe. During testing, a full 32 GB data path was used with two ports connected to fabric A from VSP controller 1, and two ports connected to fabric B from VSP controller 2. In this configuration, NVMe mode and SCSI mode can coexist within the same CHB. However during testing all the four ports were in SCSI mode, and then in NVMe mode for benchmark runs. The following figure shows the four port FC32R CHB simultaneously providing both NVMe and SCSI transport modes.



Application configuration

The VDbench application uses a concept known as a configuration file to customize workload parameters to run against block storage systems. This section describes the three basic definitions required in a configuration file.

Storage definition

Storage definition specifies the storage that must be used for the testing. Before running the configuration LUNs must be defined and the mount locations must be specified.

```
sd=sd1,lun=/dev/sdb0
sd=sd2,lun=/dev/sdb1
sd=sd3,lun=/dev/sdb2
```

Workload definition

Workload definition specifies the workload used by the script for testing. Each workload definition name must be unique. Workload definition parameters include:

- `sd` – Test device
- `skeepct` – Percentage time to move location
- `rdpct` – Read percentage
- `xfersize` – Transfer size
- `skew` – Percentage of skew the workload receives from the total I/O rate
- `wd` – Default setup for the workload
- `threads` – The number of concurrent operations for the workload
- `hotband` – Runs a hotband workload against a range of storage

Run definition

Run definition specifies the storage and workload that will be run together and the duration of the run. Each run definition name must be unique.

- wd – Workload load definition
- iorate – IOPS
- warmup – Warm-up time that will be excluded from the elapsed time (10s/2m/1h)
- elapsed – How long to run
- interval – Stats collection interval
- threads – Number of threads
- forrdpct – Range of percentage read to run

Validation configuration file

The following configuration file was used during lab validation:

```
compratio=2
dedupratio=2
dedupunit=8k
dedupsets=5%

*SD:    Storage Definition
*WD:    Workload Definition
*RD:    Run Definition
debug=86
data_errors=10000
sd=sd1,lun=/dev/sda,openflags=o_direct
sd=sd2,lun=/dev/sdb,openflags=o_direct
sd=sd3,lun=/dev/sdc,openflags=o_direct
sd=sd4,lun=/dev/sdd,openflags=o_direct
sd=sd5,lun=/dev/sde,openflags=o_direct
```

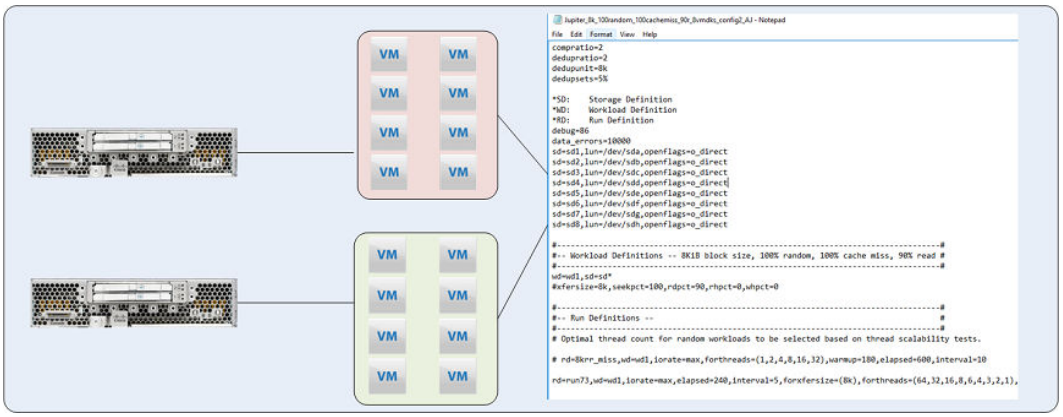
```
sd=sd6,lun=/dev/sdf,openflags=o_direct
sd=sd7,lun=/dev/sdg,openflags=o_direct
sd=sd8,lun=/dev/sdh,openflags=o_direct

#-------------------------------------------------------------------------------------#
#-- Workload Definitions -- 8KiB block size, 100% random, 100% cache miss, 90% read #
#-------------------------------------------------------------------------------------#
wd=wd1,sd=sd*
#-------------------------------------------------------------------------------------#
#-- Run Definitions --                                                               #
#-------------------------------------------------------------------------------------#
# Optimal thread count for random workloads to be selected based on thread
scalability tests.

rd=run73,wd=wd1,iorate=max,elapsed=240,interval=5,forxfersize=(8k),forthreads=(64,32,
16,8,6,4,3,2,1),rdpct=90,seekpct=100,forrhpct=0,forwhpct=0
```

Test methodology

A total of 16 VMs were used, each having 8 virtual disks evenly distributed on 2 Cisco B200 M6 blades being backed by 4 VMFS datastores. During testing VM loads were scaled from 1 to 64 threads with the intention of exploiting a queue depth of 512 (64 threads × 8 disks per VM). During testing, parameters of 8K block size complimented with 100% random workload, 100% cache miss, and 90% reads were used.



Test results and analysis

This section covers the test results from VDbench runs comparing FC-SCSI vs FC-NVMe on the VSP 5000.

VDbench results

The following tables list the raw performance results scores for FC-SCSI and FC-NVMe.

Table 3 FC-SCSI Performance Results

Threads/ Queue Depth	IOPS (IO/S)	Throughput (MB/s)	Latency (ms)	Read Latency (ms)	Write Latency (ms)
64 / 512	189698.6	1482.03	46.0649	46.0788	45.9395
32 / 256	190704.52	1489.87	22.9682	22.9774	22.8852
16 / 128	193166.01	1509.11	11.3892	11.3968	11.3206
8 / 64	192731.14	1505.71	5.7039	5.714	5.6134
6 / 48	192655.93	1505.12	4.2777	4.2906	4.1608
4 / 32	193690.69	1513.19	2.8434	2.8572	2.7198
3 / 24	193632.8	1512.76	2.1321	2.1464	2.0022
2 / 16	198452.85	1550.42	1.4094	1.4238	1.2793
1 / 8	202974.76	1585.75	0.6894	0.6993	0.6018

Table 4 FC-NVMe Performance Results

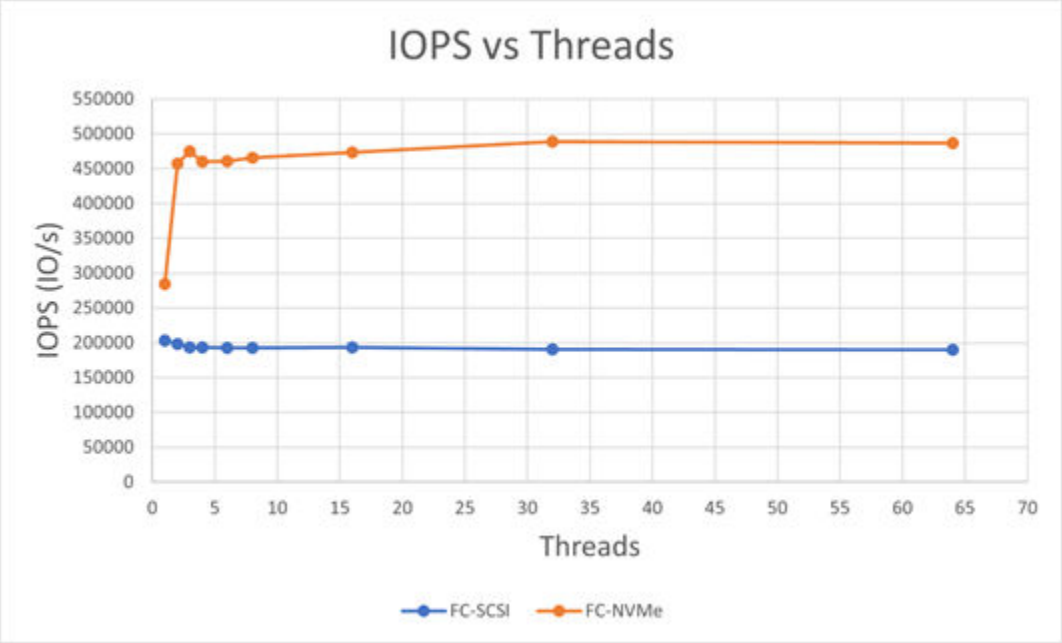
Threads/ Queue Depth	IOPS (IO/s)	Throughput (MB/s)	Latency (ms)	Read Latency (ms)	Write Latency (ms)
64 / 512	486706.19	3802.41	16.7999	16.8066	16.7386
32 / 256	489114.29	3821.2	8.3628	8.3694	8.3031
16 / 128	473745.91	3701.15	4.3141	4.3246	4.2196
8 / 64	465675.26	3638.09	2.1921	2.2053	2.0738
6 / 48	460835.37	3600.28	1.6602	1.6744	1.5323
4 / 32	460033.59	3594.03	1.1091	1.1247	0.9695
3 / 24	474781.34	3709.23	0.8064	0.8187	0.6942
2 / 16	457058.37	3570.75	0.558	0.5699	0.4495
1 / 8	284153.01	2219.94	0.4482	0.4576	0.3648

Analysis

This section covers the analysis of results among the VDbench runs comparing FC-SCSI to FC-NVMe performance.

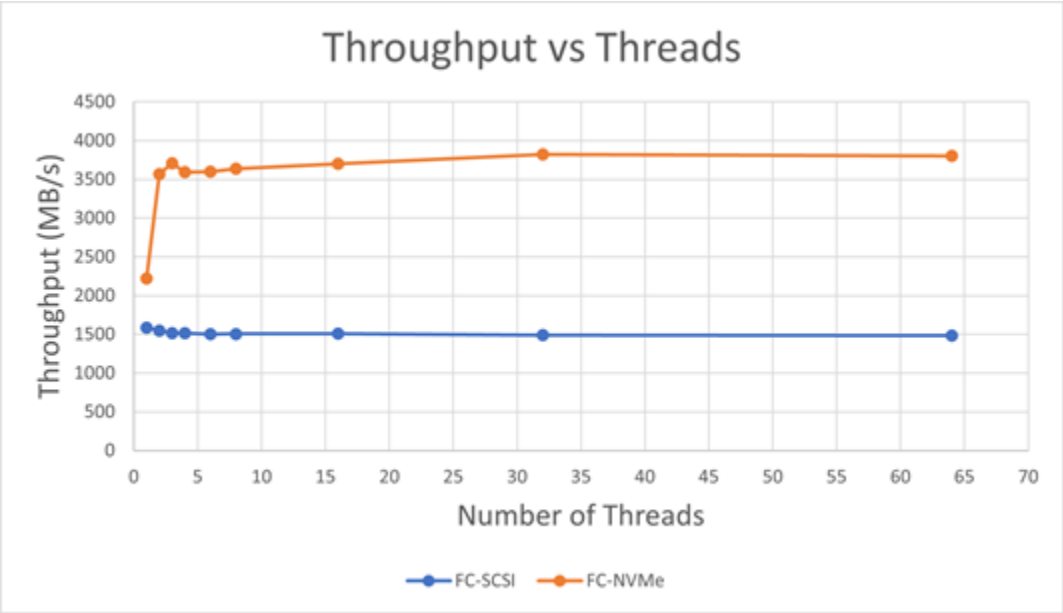
IOPS

Comparing results between FC-SCSI and FC-NVMe runs, FC-NVMe provides higher performance for IOPS in terms of input output operations per second. FC-NVMe produced a higher transaction load because of its leaner command set in conjunction with NVMe drives under the same conditions as FC-SCSI because threads are scaled from 1 to 64. Viewing the following data charts, FC-NVMe provides not only higher IOPS but also a positive linear performance trend as queue depth is pushed to 512. A 2.6 × performance gain was achieved when comparing FC-SCSI with FC-NVMe when the number of threads was pushed to 64 under the same conditions with the only change being the storage protocol.



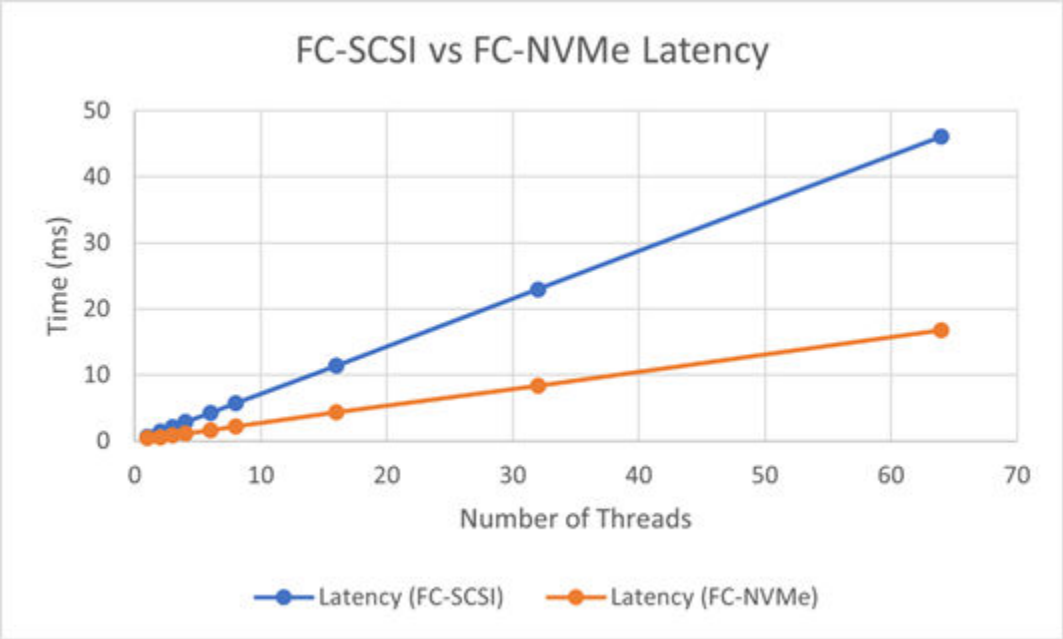
Throughput

Throughput results also showed improvement with FC-NVMe compared to FC-SCSI. This can be directly correlated to the increase in IOPS that is mentioned in the earlier section. When comparing the throughput results for 64 threads, which translates into a 512 queue depth, FC-NVMe showed a 2.6 × performance gain compared to FC-SCSI.



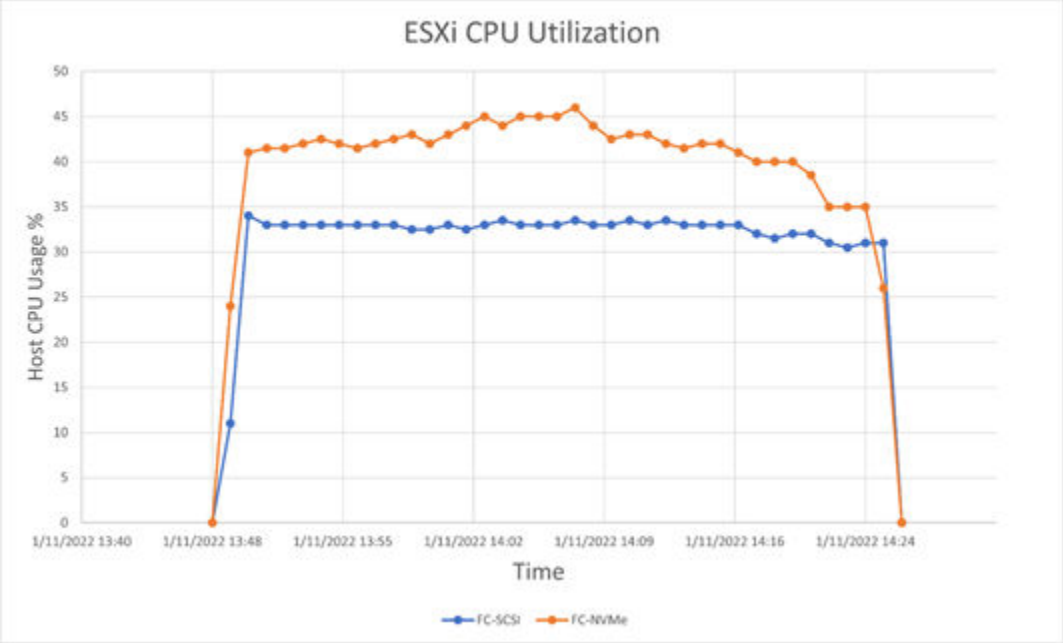
Latency

Latency reflects the average latency between read and write; it improved with FC-NVMe vs FC-SCSI under the same conditions. Performance gains were realized across the scaling of threads among the benchmark runs. At peak queue depth, a total latency improvement of 2.7 × was obtained.



CPU

ESXi host CPUs were also monitored. During FC-NVMe testing, there was a 21.5% increase in the CPU utilization compared to FC-SCSI as indicated in the following figure. During the same test cycles, FC-NVMe produced an increase in IOPS compared to FC-SCSI, and the IOPS percentage increase with FC-NVMe was 56.86% compared to FC-SCSI. Calculating the difference between FC-NVMe and FC-SCSI IOPS generated and CPU percentage utilized, FC-NVMe provides a gain of 58.1% in performance. Customers can expect to use CPU cycles much more efficiently with the FC-NVMe protocol compared to traditional FC-SCSI with NVMe drive sets.



Conclusion

With Hitachi Vantara's latest enterprise VSP 5000 system, users can expect better operational efficiencies within a virtualized environment when using the FC-NVMe protocol in conjunction with NVMe drive sets compared to the traditional FC-SCSI protocol. These efficiencies will be realized when leveraging the infinite queue depth capabilities of FC-NVMe and associated drive sets. Throughout all benchmark runs FC-NVMe provided better performance in terms of IOPS, throughput, latency, and CPU usage compared to FC-SCSI. With VSP microcode enhancements, FC-SCSI provides near FC-NVMe performance for underlying applications in certain conditions, but FC-NVMe takes advantage of the reduced command overhead, parallelism, and larger queue depth to provide better storage latency and performance within a virtualized environment.

Related documents

- Cisco and Hitachi Adaptive Solutions for Converged Infrastructure Design Guide
- Cisco and Hitachi Adaptive Solutions for Converged Infrastructure Deployment Guide

- Virtual Storage Platform 5000
- Hitachi Ops Center

Solution references

See the following solution references for more information about products in this solution.

Network

- Cisco Nexus 9000 Series Switches Data Sheets
- Cisco MDS 9000 Series Multilayer Switches

Compute

- Cisco Unified Computing
- Cisco UCS 6400 Series Fabric Interconnects Data Sheet
- Cisco UCS 5100 Series Blade Server Chassis Data Sheet
- Cisco UCS VIC 1440 Adapter Data Sheet
- Cisco UCS Manager

Storage

- Hitachi Virtual Storage Platform 5000 Series

Virtualization Layer

- VMware vCenter Server
- VMware vSphere

Compatibility Matrixes

- Hitachi Interoperability Reports
- VMware Compatibility Guide
- Cisco UCS Hardware and Software Compatibility

Appendix A

```
C:\HORCM\etc>raidcom modify port -port CL1-B -port_mode nvme -request_id auto
REQID : 134

C:\HORCM\etc>raidcom modify port -port CL2-B -port_mode nvme -request_id auto
REQID : 135

C:\HORCM\etc>raidcom modify port -port CL3-B -port_mode nvme -request_id auto
REQID : 136

C:\HORCM\etc>raidcom modify port -port CL4-B -port_mode nvme -request_id auto
REQID : 137

C:\HORCM\etc>raidcom get port -key detail
PORT   TYPE  ATTR   SPD  LPID  FAB  CONN  SSW   SL   Serial#  WWN
PHY_PORT PORT_MODE
CL1-A  FIBRE TAR    AUT    EF  Y    PtoP  Y      0    540016  50060e80089c5000
-        SCSI
CL1-B  FIBRE TAR    AUT    D9  Y    PtoP  N      0    540016  50060e80089c5001
-        NVME
CL1-C  FIBRE TAR    AUT    E1  Y    PtoP  Y      0    540016  50060e80089c5002
-        SCSI
CL1-D  FIBRE TAR    AUT    D3  Y    PtoP  Y      0    540016  50060e80089c5003
-        SCSI
CL1-E  FIBRE TAR    AUT    B2  Y    PtoP  N      0    540016  50060e80089c5004
-        SCSI
CL1-F  FIBRE TAR    AUT    A7  Y    PtoP  N      0    540016  50060e80089c5005
-        SCSI
CL1-G  FIBRE TAR    AUT    AC  Y    PtoP  N      0    540016  50060e80089c5006
-        SCSI
CL1-H  FIBRE TAR    AUT    9F  Y    PtoP  N      0    540016  50060e80089c5007
-        SCSI
CL2-A  FIBRE TAR    AUT    CD  Y    PtoP  Y      0    540016  50060e80089c5010
-        SCSI
CL2-B  FIBRE TAR    AUT    C3  Y    PtoP  N      0    540016  50060e80089c5011
-        NVME
CL2-C  FIBRE TAR    AUT    C9  Y    PtoP  Y      0    540016  50060e80089c5012
-        SCSI
CL2-D  FIBRE TAR    AUT    B6  Y    PtoP  Y      0    540016  50060e80089c5013
-        SCSI
CL2-E  FIBRE TAR    AUT    98  Y    PtoP  N      0    540016  50060e80089c5014
-        SCSI
CL2-F  FIBRE TAR    AUT    80  Y    PtoP  N      0    540016  50060e80089c5015
-        SCSI
CL2-G  FIBRE TAR    AUT    88  Y    PtoP  N      0    540016  50060e80089c5016
-        SCSI
CL2-H  FIBRE TAR    AUT    76  Y    PtoP  N      0    540016  50060e80089c5017
-        SCSI
```

```
CL3-A  FIBRE TAR    AUT    E8  Y    PtoP  Y      0    540016  50060e80089c5020
-        SCSI
CL3-B  FIBRE TAR    AUT    D6  Y    PtoP  N      0    540016  50060e80089c5021
-        NVME
CL3-C  FIBRE TAR    AUT    E0  Y    PtoP  Y      0    540016  50060e80089c5022
-        SCSI
CL3-D  FIBRE TAR    AUT    D2  Y    PtoP  Y      0    540016  50060e80089c5023
-        SCSI
CL3-E  FIBRE TAR    AUT    B1  Y    PtoP  N      0    540016  50060e80089c5024
-        SCSI
CL3-F  FIBRE TAR    AUT    A6  Y    PtoP  N      0    540016  50060e80089c5025
-        SCSI
CL3-G  FIBRE TAR    AUT    AB  Y    PtoP  N      0    540016  50060e80089c5026
-        SCSI
CL3-H  FIBRE TAR    AUT    9E  Y    PtoP  N      0    540016  50060e80089c5027
-        SCSI
CL4-A  FIBRE TAR    AUT    CC  Y    PtoP  Y      0    540016  50060e80089c5030
-        SCSI
CL4-B  FIBRE TAR    AUT    BC  Y    PtoP  N      0    540016  50060e80089c5031
-        NVME
CL4-C  FIBRE TAR    AUT    C7  Y    PtoP  Y      0    540016  50060e80089c5032
-        SCSI
CL4-D  FIBRE TAR    AUT    B5  Y    PtoP  Y      0    540016  50060e80089c5033
-        SCSI
CL4-E  FIBRE TAR    AUT    97  Y    PtoP  N      0    540016  50060e80089c5034
-        SCSI
CL4-F  FIBRE TAR    AUT    7C  Y    PtoP  N      0    540016  50060e80089c5035
-        SCSI
CL4-G  FIBRE TAR    AUT    84  Y    PtoP  N      0    540016  50060e80089c5036
-        SCSI
CL4-H  FIBRE TAR    AUT    75  Y    PtoP  N      0    540016  50060e80089c5037
-        SCSI
CL5-A  FIBRE TAR    AUT    E4  Y    PtoP  Y      0    540016  50060e80089c5040
-        SCSI
CL5-B  FIBRE TAR    AUT    D5  Y    PtoP  N      0    540016  50060e80089c5041
-        SCSI
CL5-C  FIBRE TAR    AUT    DC  Y    PtoP  N      0    540016  50060e80089c5042
-        SCSI
CL5-D  FIBRE TAR    AUT    D1  Y    PtoP  N      0    540016  50060e80089c5043
-        SCSI
CL5-E  FIBRE TAR    AUT    AE  Y    PtoP  N      0    540016  50060e80089c5044
-        SCSI
CL5-F  FIBRE TAR    AUT    A5  Y    PtoP  N      0    540016  50060e80089c5045
-        SCSI
CL5-G  FIBRE TAR    AUT    AA  Y    PtoP  N      0    540016  50060e80089c5046
-        SCSI
CL5-H  FIBRE TAR    AUT    9D  Y    PtoP  N      0    540016  50060e80089c5047
-        SCSI
CL6-A  FIBRE TAR    AUT    CB  Y    PtoP  N      0    540016  50060e80089c5050
-        SCSI
CL6-B  FIBRE TAR    AUT    BA  Y    PtoP  N      0    540016  50060e80089c5051
```

```
-        SCSI
CL6-C  FIBRE TAR    AUT    C6  Y    PtoP  N      0    540016  50060e80089c5052
-        SCSI
CL6-D  FIBRE TAR    AUT    B4  Y    PtoP  N      0    540016  50060e80089c5053
-        SCSI
CL6-E  FIBRE TAR    AUT    90  Y    PtoP  N      0    540016  50060e80089c5054
-        SCSI
CL6-F  FIBRE TAR    AUT    7A  Y    PtoP  N      0    540016  50060e80089c5055
-        SCSI
CL6-G  FIBRE TAR    AUT    82  Y    PtoP  N      0    540016  50060e80089c5056
-        SCSI
CL6-H  FIBRE TAR    AUT    74  Y    PtoP  N      0    540016  50060e80089c5057
-        SCSI
CL7-A  FIBRE TAR    AUT    E2  Y    PtoP  N      0    540016  50060e80089c5060
-        SCSI
CL7-B  FIBRE TAR    AUT    D4  Y    PtoP  N      0    540016  50060e80089c5061
-        SCSI
CL7-C  FIBRE TAR    AUT    DA  Y    PtoP  N      0    540016  50060e80089c5062
-        SCSI
CL7-D  FIBRE TAR    AUT    CE  Y    PtoP  N      0    540016  50060e80089c5063
-        SCSI
CL7-E  FIBRE TAR    AUT    AD  Y    PtoP  N      0    540016  50060e80089c5064
-        SCSI
CL7-F  FIBRE TAR    AUT    A3  Y    PtoP  N      0    540016  50060e80089c5065
-        SCSI
CL7-G  FIBRE TAR    AUT    A9  Y    PtoP  N      0    540016  50060e80089c5066
-        SCSI
CL7-H  FIBRE TAR    AUT    9B  Y    PtoP  N      0    540016  50060e80089c5067
-        SCSI
CL8-A  FIBRE TAR    AUT    CA  Y    PtoP  N      0    540016  50060e80089c5070
-        SCSI
CL8-B  FIBRE TAR    AUT    B9  Y    PtoP  N      0    540016  50060e80089c5071
-        SCSI
CL8-C  FIBRE TAR    AUT    C5  Y    PtoP  N      0    540016  50060e80089c5072
-        SCSI
CL8-D  FIBRE TAR    AUT    B3  Y    PtoP  N      0    540016  50060e80089c5073
-        SCSI
CL8-E  FIBRE TAR    AUT    8F  Y    PtoP  N      0    540016  50060e80089c5074
-        SCSI
CL8-F  FIBRE TAR    AUT    79  Y    PtoP  N      0    540016  50060e80089c5075
-        SCSI
CL8-G  FIBRE TAR    AUT    81  Y    PtoP  N      0    540016  50060e80089c5076
-        SCSI
CL8-H  FIBRE TAR    AUT    73  Y    PtoP  N      0    540016  50060e80089c5077
-        SCSI

C:\HORCM\etc>raidcom modify port -port CL1-B -security_switch y

C:\HORCM\etc>raidcom modify port -port CL2-B -security_switch y

C:\HORCM\etc>raidcom modify port -port CL3-B -security_switch y
```

```
C:\HORCM\etc>raidcom modify port -port CL4-B -security_switch y

C:\HORCM\etc>raidcom get port -key detail
PORT   TYPE  ATTR   SPD  LPID  FAB  CONN  SSW   SL   Serial#  WWN
PHY_PORT PORT_MODE
CL1-A  FIBRE TAR    AUT    EF  Y    PtoP  Y      0    540016  50060e80089c5000
-        SCSI
CL1-B  FIBRE TAR    AUT    D9  Y    PtoP  Y      0    540016  50060e80089c5001
-        NVME
CL1-C  FIBRE TAR    AUT    E1  Y    PtoP  Y      0    540016  50060e80089c5002
-        SCSI
CL1-D  FIBRE TAR    AUT    D3  Y    PtoP  Y      0    540016  50060e80089c5003
-        SCSI
CL1-E  FIBRE TAR    AUT    B2  Y    PtoP  N      0    540016  50060e80089c5004
-        SCSI
CL1-F  FIBRE TAR    AUT    A7  Y    PtoP  N      0    540016  50060e80089c5005
-        SCSI
CL1-G  FIBRE TAR    AUT    AC  Y    PtoP  N      0    540016  50060e80089c5006
-        SCSI
CL1-H  FIBRE TAR    AUT    9F  Y    PtoP  N      0    540016  50060e80089c5007
-        SCSI
CL2-A  FIBRE TAR    AUT    CD  Y    PtoP  Y      0    540016  50060e80089c5010
-        SCSI
CL2-B  FIBRE TAR    AUT    C3  Y    PtoP  Y      0    540016  50060e80089c5011
-        NVME
CL2-C  FIBRE TAR    AUT    C9  Y    PtoP  Y      0    540016  50060e80089c5012
-        SCSI
CL2-D  FIBRE TAR    AUT    B6  Y    PtoP  Y      0    540016  50060e80089c5013
-        SCSI
CL2-E  FIBRE TAR    AUT    98  Y    PtoP  N      0    540016  50060e80089c5014
-        SCSI
CL2-F  FIBRE TAR    AUT    80  Y    PtoP  N      0    540016  50060e80089c5015
-        SCSI
CL2-G  FIBRE TAR    AUT    88  Y    PtoP  N      0    540016  50060e80089c5016
-        SCSI
CL2-H  FIBRE TAR    AUT    76  Y    PtoP  N      0    540016  50060e80089c5017
-        SCSI
CL3-A  FIBRE TAR    AUT    E8  Y    PtoP  Y      0    540016  50060e80089c5020
-        SCSI
CL3-B  FIBRE TAR    AUT    D6  Y    PtoP  Y      0    540016  50060e80089c5021
-        NVME
CL3-C  FIBRE TAR    AUT    E0  Y    PtoP  Y      0    540016  50060e80089c5022
-        SCSI
CL3-D  FIBRE TAR    AUT    D2  Y    PtoP  Y      0    540016  50060e80089c5023
-        SCSI
CL3-E  FIBRE TAR    AUT    B1  Y    PtoP  N      0    540016  50060e80089c5024
-        SCSI
CL3-F  FIBRE TAR    AUT    A6  Y    PtoP  N      0    540016  50060e80089c5025
-        SCSI
CL3-G  FIBRE TAR    AUT    AB  Y    PtoP  N      0    540016  50060e80089c5026
```

```
-        SCSI
CL3-H  FIBRE TAR    AUT    9E  Y    PtoP  N      0    540016  50060e80089c5027
-        SCSI
CL4-A  FIBRE TAR    AUT    CC  Y    PtoP  Y      0    540016  50060e80089c5030
-        SCSI
CL4-B  FIBRE TAR    AUT    BC  Y    PtoP  Y      0    540016  50060e80089c5031
-        NVME
CL4-C  FIBRE TAR    AUT    C7  Y    PtoP  Y      0    540016  50060e80089c5032
-        SCSI
CL4-D  FIBRE TAR    AUT    B5  Y    PtoP  Y      0    540016  50060e80089c5033
-        SCSI
CL4-E  FIBRE TAR    AUT    97  Y    PtoP  N      0    540016  50060e80089c5034
-        SCSI
CL4-F  FIBRE TAR    AUT    7C  Y    PtoP  N      0    540016  50060e80089c5035
-        SCSI
CL4-G  FIBRE TAR    AUT    84  Y    PtoP  N      0    540016  50060e80089c5036
-        SCSI
CL4-H  FIBRE TAR    AUT    75  Y    PtoP  N      0    540016  50060e80089c5037
-        SCSI
CL5-A  FIBRE TAR    AUT    E4  Y    PtoP  Y      0    540016  50060e80089c5040
-        SCSI
CL5-B  FIBRE TAR    AUT    D5  Y    PtoP  N      0    540016  50060e80089c5041
-        SCSI
CL5-C  FIBRE TAR    AUT    DC  Y    PtoP  N      0    540016  50060e80089c5042
-        SCSI
CL5-D  FIBRE TAR    AUT    D1  Y    PtoP  N      0    540016  50060e80089c5043
-        SCSI
CL5-E  FIBRE TAR    AUT    AE  Y    PtoP  N      0    540016  50060e80089c5044
-        SCSI
CL5-F  FIBRE TAR    AUT    A5  Y    PtoP  N      0    540016  50060e80089c5045
-        SCSI
CL5-G  FIBRE TAR    AUT    AA  Y    PtoP  N      0    540016  50060e80089c5046
-        SCSI
CL5-H  FIBRE TAR    AUT    9D  Y    PtoP  N      0    540016  50060e80089c5047
-        SCSI
CL6-A  FIBRE TAR    AUT    CB  Y    PtoP  N      0    540016  50060e80089c5050
-        SCSI
CL6-B  FIBRE TAR    AUT    BA  Y    PtoP  N      0    540016  50060e80089c5051
-        SCSI
CL6-C  FIBRE TAR    AUT    C6  Y    PtoP  N      0    540016  50060e80089c5052
-        SCSI
CL6-D  FIBRE TAR    AUT    B4  Y    PtoP  N      0    540016  50060e80089c5053
-        SCSI
CL6-E  FIBRE TAR    AUT    90  Y    PtoP  N      0    540016  50060e80089c5054
-        SCSI
CL6-F  FIBRE TAR    AUT    7A  Y    PtoP  N      0    540016  50060e80089c5055
-        SCSI
CL6-G  FIBRE TAR    AUT    82  Y    PtoP  N      0    540016  50060e80089c5056
-        SCSI
CL6-H  FIBRE TAR    AUT    74  Y    PtoP  N      0    540016  50060e80089c5057
-        SCSI
```

```
CL7-A  FIBRE TAR    AUT    E2  Y    PtoP  N      0    540016  50060e80089c5060
-        SCSI
CL7-B  FIBRE TAR    AUT    D4  Y    PtoP  N      0    540016  50060e80089c5061
-        SCSI
CL7-C  FIBRE TAR    AUT    DA  Y    PtoP  N      0    540016  50060e80089c5062
-        SCSI
CL7-D  FIBRE TAR    AUT    CE  Y    PtoP  N      0    540016  50060e80089c5063
-        SCSI
CL7-E  FIBRE TAR    AUT    AD  Y    PtoP  N      0    540016  50060e80089c5064
-        SCSI
CL7-F  FIBRE TAR    AUT    A3  Y    PtoP  N      0    540016  50060e80089c5065
-        SCSI
CL7-G  FIBRE TAR    AUT    A9  Y    PtoP  N      0    540016  50060e80089c5066
-        SCSI
CL7-H  FIBRE TAR    AUT    9B  Y    PtoP  N      0    540016  50060e80089c5067
-        SCSI
CL8-A  FIBRE TAR    AUT    CA  Y    PtoP  N      0    540016  50060e80089c5070
-        SCSI
CL8-B  FIBRE TAR    AUT    B9  Y    PtoP  N      0    540016  50060e80089c5071
-        SCSI
CL8-C  FIBRE TAR    AUT    C5  Y    PtoP  N      0    540016  50060e80089c5072
-        SCSI
CL8-D  FIBRE TAR    AUT    B3  Y    PtoP  N      0    540016  50060e80089c5073
-        SCSI
CL8-E  FIBRE TAR    AUT    8F  Y    PtoP  N      0    540016  50060e80089c5074
-        SCSI
CL8-F  FIBRE TAR    AUT    79  Y    PtoP  N      0    540016  50060e80089c5075
-        SCSI
CL8-G  FIBRE TAR    AUT    81  Y    PtoP  N      0    540016  50060e80089c5076
-        SCSI
CL8-H  FIBRE TAR    AUT    73  Y    PtoP  N      0    540016  50060e80089c5077
-        SCSI

C:\HORCM\etc>raidcom add host_grp -port CL1-B-1 -host_grp_name VSI_5600-0_Fab_A

C:\HORCM\etc>raidcom add host_grp -port CL2-B-1 -host_grp_name VSI_5600-0_Fab_A

C:\HORCM\etc>raidcom add host_grp -port CL3-B-1 -host_grp_name VSI_5600-0_Fab_B

C:\HORCM\etc>raidcom add host_grp -port CL4-B-1 -host_grp_name VSI_5600-0_Fab_B

C:\HORCM\etc>raidcom add host_grp -port CL1-B-2 -host_grp_name VSI_5600-1_Fab_A

C:\HORCM\etc>raidcom add host_grp -port CL2-B-2 -host_grp_name VSI_5600-1_Fab_A

C:\HORCM\etc>raidcom add host_grp -port CL3-B-2 -host_grp_name VSI_5600-1_Fab_B

C:\HORCM\etc>raidcom add host_grp -port CL4-B-2 -host_grp_name VSI_5600-1_Fab_B

C:\HORCM\etc>raidcom add host_grp -port CL1-B-3 -host_grp_name VSI_5600-2_Fab_A
```

```
C:\HORCM\etc>raidcom add host_grp -port CL2-B-3 -host_grp_name VSI_5600-2_Fab_A

C:\HORCM\etc>raidcom add host_grp -port CL3-B-3 -host_grp_name VSI_5600-2_Fab_B

C:\HORCM\etc>raidcom add host_grp -port CL4-B-3 -host_grp_name VSI_5600-2_Fab_B

C:\HORCM\etc>raidcom add host_grp -port CL1-B-4 -host_grp_name VSI_5600-3_Fab_A

C:\HORCM\etc>raidcom add host_grp -port CL2-B-4 -host_grp_name VSI_5600-3_Fab_A

C:\HORCM\etc>raidcom add host_grp -port CL3-B-4 -host_grp_name VSI_5600-3_Fab_B

C:\HORCM\etc>raidcom add host_grp -port CL4-B-4 -host_grp_name VSI_5600-3_Fab_B

C:\HORCM\etc>raidcom get host_grp -port CL1-B
PORT   GID  GROUP_NAME                       Serial# HMD          HMO_BITs
CL1-B    0  1B-G00                            540016 LINUX/IRIX
CL1-B    1  VSI_5600-0_Fab_A                  540016 LINUX/IRIX
CL1-B    2  VSI_5600-1_Fab_A                  540016 LINUX/IRIX
CL1-B    3  VSI_5600-2_Fab_A                  540016 LINUX/IRIX
CL1-B    4  VSI_5600-3_Fab_A                  540016 LINUX/IRIX

C:\HORCM\etc>raidcom get host_grp -port CL2-B
PORT   GID  GROUP_NAME                       Serial# HMD          HMO_BITs
CL2-B    0  2B-G00                            540016 LINUX/IRIX
CL2-B    1  VSI_5600-0_Fab_A                  540016 LINUX/IRIX
CL2-B    2  VSI_5600-1_Fab_A                  540016 LINUX/IRIX
CL2-B    3  VSI_5600-2_Fab_A                  540016 LINUX/IRIX
CL2-B    4  VSI_5600-3_Fab_A                  540016 LINUX/IRIX

C:\HORCM\etc>raidcom get host_grp -port CL3-B
PORT   GID  GROUP_NAME                       Serial# HMD          HMO_BITs
CL3-B    0  3B-G00                            540016 LINUX/IRIX
CL3-B    1  VSI_5600-0_Fab_B                  540016 LINUX/IRIX
CL3-B    2  VSI_5600-1_Fab_B                  540016 LINUX/IRIX
CL3-B    3  VSI_5600-2_Fab_B                  540016 LINUX/IRIX
CL3-B    4  VSI_5600-3_Fab_B                  540016 LINUX/IRIX

C:\HORCM\etc>raidcom get host_grp -port CL4-B
PORT   GID  GROUP_NAME                       Serial# HMD          HMO_BITs
CL4-B    0  4B-G00                            540016 LINUX/IRIX
CL4-B    1  VSI_5600-0_Fab_B                  540016 LINUX/IRIX
CL4-B    2  VSI_5600-1_Fab_B                  540016 LINUX/IRIX
CL4-B    3  VSI_5600-2_Fab_B                  540016 LINUX/IRIX
CL4-B    4  VSI_5600-3_Fab_B                  540016 LINUX/IRIX

C:\HORCM\etc>raidcom add hba_wwn -port CL1-B-1 -hba_wwn 20000025,B5850A0B

C:\HORCM\etc>raidcom add hba_wwn -port CL2-B-1 -hba_wwn 20000025,B5850A0B

C:\HORCM\etc>raidcom add hba_wwn -port CL3-B-1 -hba_wwn 20000025,B5850B0B
```

```
C:\HORCM\etc>raidcom add hba_wwn -port CL4-B-1 -hba_wwn 20000025,B5850B0B

C:\HORCM\etc>raidcom add hba_wwn -port CL1-B-2 -hba_wwn 20000025,B5850A0A

C:\HORCM\etc>raidcom add hba_wwn -port CL2-B-2 -hba_wwn 20000025,B5850A0A

C:\HORCM\etc>raidcom add hba_wwn -port CL3-B-2 -hba_wwn 20000025,B5850B0A

C:\HORCM\etc>raidcom add hba_wwn -port CL4-B-2 -hba_wwn 20000025,B5850B0A

C:\HORCM\etc>raidcom add hba_wwn -port CL1-B-3 -hba_wwn 20000025,B5850A09

C:\HORCM\etc>raidcom add hba_wwn -port CL2-B-3 -hba_wwn 20000025,B5850A09

C:\HORCM\etc>raidcom add hba_wwn -port CL3-B-3 -hba_wwn 20000025,B5850B09

C:\HORCM\etc>raidcom add hba_wwn -port CL4-B-3 -hba_wwn 20000025,B5850B09

C:\HORCM\etc>raidcom add hba_wwn -port CL1-B-4 -hba_wwn 20000025,B5850A08

C:\HORCM\etc>raidcom add hba_wwn -port CL2-B-4 -hba_wwn 20000025,B5850A08

C:\HORCM\etc>raidcom add hba_wwn -port CL3-B-4 -hba_wwn 20000025,B5850B08

C:\HORCM\etc>raidcom add hba_wwn -port CL4-B-4 -hba_wwn 20000025,B5850B08

C:\HORCM\etc>raidcom get hba_wwn -port CL1-B-1
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL1-B    1 VSI_5600-0_Fab_A  20000025b5850a0b   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL1-B-2
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL1-B    2 VSI_5600-1_Fab_A  20000025b5850a0a   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL1-B-3
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL1-B    3 VSI_5600-2_Fab_A  20000025b5850a09   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL1-B-4
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL1-B    4 VSI_5600-3_Fab_A  20000025b5850a08   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL2-B-1
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL2-B    1 VSI_5600-0_Fab_A  20000025b5850a0b   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL2-B-2
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL2-B    2 VSI_5600-1_Fab_A  20000025b5850a0a   540016 -
```

```
C:\HORCM\etc>raidcom get hba_wwn -port CL2-B-3
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL2-B    3 VSI_5600-2_Fab_A  20000025b5850a09   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL2-B-4
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL2-B    4 VSI_5600-3_Fab_A  20000025b5850a08   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL3-B-1
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL3-B    1 VSI_5600-0_Fab_B  20000025b5850b0b   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL3-B-2
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL3-B    2 VSI_5600-1_Fab_B  20000025b5850b0a   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL3-B-3
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL3-B    3 VSI_5600-2_Fab_B  20000025b5850b09   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL3-B-4
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL3-B    4 VSI_5600-3_Fab_B  20000025b5850b08   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL4-B-1
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL4-B    1 VSI_5600-0_Fab_B  20000025b5850b0b   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL4-B-2
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL4-B    2 VSI_5600-1_Fab_B  20000025b5850b0a   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL4-B-3
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL4-B    3 VSI_5600-2_Fab_B  20000025b5850b09   540016 -

C:\HORCM\etc>raidcom get hba_wwn -port CL4-B-4
PORT   GID GROUP_NAME                   HWWN  Serial# NICK_NAME
CL4-B    4 VSI_5600-3_Fab_B  20000025b5850b08   540016 -

C:\HORCM\etc>raidcom modify host_grp -port CL1-B-0 -host_mode LINUX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL2-B-0 -host_mode LINUX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL3-B-0 -host_mode LINUX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL4-B-0 -host_mode LINUX -
set_host_mode_opt 13
```

```
C:\HORCM\etc>raidcom get host_grp -port CL1-B-1
PORT   GID  GROUP_NAME                       Serial# HMD          HMO_BITs
CL1-B    0  1B-G00                           540016 LINUX/IRIX   13
CL1-B    1  VSI_5600-0_Fab_A                 540016 LINUX/IRIX
CL1-B    2  VSI_5600-1_Fab_A                 540016 LINUX/IRIX
CL1-B    3  VSI_5600-2_Fab_A                 540016 LINUX/IRIX
CL1-B    4  VSI_5600-3_Fab_A                 540016 LINUX/IRIX

C:\HORCM\etc>raidcom get host_grp -port CL2-B-1
PORT   GID  GROUP_NAME                       Serial# HMD          HMO_BITs
CL2-B    0  1B-G00                           540016 LINUX/IRIX   13
CL2-B    1  VSI_5600-0_Fab_A                 540016 LINUX/IRIX
CL2-B    2  VSI_5600-1_Fab_A                 540016 LINUX/IRIX
CL2-B    3  VSI_5600-2_Fab_A                 540016 LINUX/IRIX
CL2-B    4  VSI_5600-3_Fab_A                 540016 LINUX/IRIX

C:\HORCM\etc>raidcom get host_grp -port CL3-B-1
PORT   GID  GROUP_NAME                       Serial# HMD          HMO_BITs
CL3-B    0  1B-G00                           540016 LINUX/IRIX   13
CL3-B    1  VSI_5600-0_Fab_B                 540016 LINUX/IRIX
CL3-B    2  VSI_5600-1_Fab_B                 540016 LINUX/IRIX
CL3-B    3  VSI_5600-2_Fab_B                 540016 LINUX/IRIX
CL3-B    4  VSI_5600-3_Fab_B                 540016 LINUX/IRIX

C:\HORCM\etc>raidcom get host_grp -port CL4-B-1
PORT   GID  GROUP_NAME                       Serial# HMD          HMO_BITs
CL4-B    0  1B-G00                           540016 LINUX/IRIX   13
CL4-B    1  VSI_5600-0_Fab_B                 540016 LINUX/IRIX
CL4-B    2  VSI_5600-1_Fab_B                 540016 LINUX/IRIX
CL4-B    3  VSI_5600-2_Fab_B                 540016 LINUX/IRIX
CL4-B    4  VSI_5600-3_Fab_B                 540016 LINUX/IRIX

C:\HORCM\etc>raidcom modify host_grp -port CL1-B-1 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL1-B-2 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL1-B-3 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL1-B-4 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL2-B-1 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL2-B-2 -host_mode VMWARE_EX -
set_host_mode_opt 13
```

```
C:\HORCM\etc>raidcom modify host_grp -port CL2-B-3 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL2-B-4 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL3-B-1 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL3-B-2 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL3-B-3 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL3-B-4 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL4-B-1 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL4-B-2 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL4-B-3 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom modify host_grp -port CL4-B-4 -host_mode VMWARE_EX -
set_host_mode_opt 13

C:\HORCM\etc>raidcom get host_grp -port CL1-B-1
PORT   GID  GROUP_NAME                       Serial# HMD          HMO_BITs
CL1-B    0  1B-G00                           540016 LINUX/IRIX   13
CL1-B    1  VSI_5600-0_Fab_A                 540016 VMWARE_EX    13
CL1-B    2  VSI_5600-1_Fab_A                 540016 VMWARE_EX    13
CL1-B    3  VSI_5600-2_Fab_A                 540016 VMWARE_EX    13
CL1-B    4  VSI_5600-3_Fab_A                 540016 VMWARE_EX    13

C:\HORCM\etc>raidcom get host_grp -port CL2-B-1
PORT   GID  GROUP_NAME                       Serial# HMD          HMO_BITs
CL2-B    0  2B-G00                           540016 LINUX/IRIX   13
CL2-B    1  VSI_5600-0_Fab_A                 540016 VMWARE_EX    13
CL2-B    2  VSI_5600-1_Fab_A                 540016 VMWARE_EX    13
CL2-B    3  VSI_5600-2_Fab_A                 540016 VMWARE_EX    13
CL2-B    4  VSI_5600-3_Fab_A                 540016 VMWARE_EX    13

C:\HORCM\etc>raidcom get host_grp -port CL3-B-1
PORT   GID  GROUP_NAME                       Serial# HMD          HMO_BITs
CL3-B    0  3B-G00                           540016 LINUX/IRIX   13
CL3-B    1  VSI_5600-0_Fab_B                 540016 VMWARE_EX    13
CL3-B    2  VSI_5600-1_Fab_B                 540016 VMWARE_EX    13
```

```
CL3-B    3  VSI_5600-2_Fab_B                 540016 VMWARE_EX    13
CL3-B    4  VSI_5600-3_Fab_B                 540016 VMWARE_EX    13

C:\HORCM\etc>raidcom get host_grp -port CL4-B-1
PORT   GID  GROUP_NAME                       Serial# HMD          HMO_BITs
CL4-B    0  4B-G00                           540016 LINUX/IRIX   13
CL4-B    1  VSI_5600-0_Fab_B                 540016 VMWARE_EX    13
CL4-B    2  VSI_5600-1_Fab_B                 540016 VMWARE_EX    13
CL4-B    3  VSI_5600-2_Fab_B                 540016 VMWARE_EX    13
CL4-B    4  VSI_5600-3_Fab_B                 540016 VMWARE_EX    13

C:\HORCM\etc>raidcom add nvm_subsystem -nvm_subsystem_id 2 -nvm_subsystem_name
UCS_nvm_subsystem -host_mode VMWARE_EX -request_id auto
REQID : 138

C:\HORCM\etc>raidcom get nvm_subsystem -nvm_subsystem_id 2
NVMSS_ID  RGID  NVMSS_NAME                  SECURITY T10PI    HMD         HMO_BITs
       2     0  UCS_nvm_subsystem           ENABLE   DISABLE  VMWARE_EX   -

C:\HORCM\etc>raidcom get nvm_subsystem -nvm_subsystem_id 2 -key opt
NVMSS_ID  NVMSS_NAME                  NVMSS_NQN
       2  UCS_nvm_subsystem           nqn.1994-04.jp.co.hitachi:nvme:storage-
subsystem-sn.5-40016-nvmssid.00002

C:\HORCM\etc>raidcom add nvm_subsystem_port -nvm_subsystem_id 2 -port CL1-B -
request_id auto
REQID : 139

C:\HORCM\etc>raidcom add nvm_subsystem_port -nvm_subsystem_id 2 -port CL2-B -
request_id auto
REQID : 13a

C:\HORCM\etc>raidcom add nvm_subsystem_port -nvm_subsystem_id 2 -port CL3-B -
request_id auto
REQID : 13b

C:\HORCM\etc>raidcom add nvm_subsystem_port -nvm_subsystem_id 2 -port CL4-B -
request_id auto
REQID : 13c

C:\HORCM\etc>raidcom get nvm_subsystem_port -nvm_subsystem_id 2
PORT   NVMSS_ID  NVMSS_NAME
CL1-B         2  UCS_nvm_subsystem
CL2-B         2  UCS_nvm_subsystem
CL3-B         2  UCS_nvm_subsystem
CL4-B         2  UCS_nvm_subsystem

C:\HORCM\etc>raidcom add host_nqn -nvm_subsystem_id 2 -host_nqn nqn.2014-
08.local.hvlab.vsi:nvme:esxi-0 -request_id auto
REQID : 13d
```

```
C:\HORCM\etc>raidcom add host_nqn -nvm_subsystem_id 2 -host_nqn nqn.2014-
08.local.hvlab.vsi:nvme:esxi-1 -request_id auto
REQID : 13e

C:\HORCM\etc>raidcom add host_nqn -nvm_subsystem_id 2 -host_nqn nqn.2014-
08.local.hvlab.vsi:nvme:esxi-2 -request_id auto
REQID : 13f

C:\HORCM\etc>raidcom add host_nqn -nvm_subsystem_id 2 -host_nqn nqn.2014-
08.local.hvlab.vsi:nvme:esxi-3 -request_id auto
REQID : 140

C:\HORCM\etc>raidcom get host_nqn -nvm_subsystem_id 2
NVMSS_ID  NVMSS_NAME                 HOST_NQN
       2  UCS_nvm_subsystem          nqn.2014-08.local.hvlab.vsi:nvme:esxi-2
       2  UCS_nvm_subsystem          nqn.2014-08.local.hvlab.vsi:nvme:esxi-3
       2  UCS_nvm_subsystem          nqn.2014-08.local.hvlab.vsi:nvme:esxi-0
       2  UCS_nvm_subsystem          nqn.2014-08.local.hvlab.vsi:nvme:esxi-1

C:\HORCM\etc>raidcom get ldev -ldev_id 14
Serial#  : 540016
LDEV : 14
SL : 0
CL : 0
VOL_TYPE : OPEN-V-CVS
VOL_Capacity(BLK) : 4294967296
NUM_PORT : 0
PORTs :
F_POOLID : NONE
VOL_ATTR : CVS : HDP
CMP : -
EXP_SPACE : -
B_POOLID : 0
LDEV_NAMING : VSI-VMFS_NVME-01
STS : NML
OPE_TYPE : NONE
OPE_RATE : 100
MP# : 3
SSID : 0004
Used_Block(BLK) : 0
FLA(MB) : Disable
RSV(MB) : 0
CSV_Status : DISABLED
CSV_PROGRESS(%) : -
CSV_Mode : DISABLED
CSV_PROCESS_MODE : -
DEDUPLICATION_DATA : DISABLED
ALUA : Disable
RSGID : 0
PWSV_S : -
CL_MIG : N
```

```
C:\HORCM\etc>raidcom get ldev -ldev_id 15
Serial#  : 540016
LDEV : 15
SL : 0
CL : 0
VOL_TYPE : OPEN-V-CVS
VOL_Capacity(BLK) : 4294967296
NUM_PORT : 0
PORTs :
F_POOLID : NONE
VOL_ATTR : CVS : HDP
CMP : -
EXP_SPACE : -
B_POOLID : 0
LDEV_NAMING : VSI-VMFS_NVME-02
STS : NML
OPE_TYPE : NONE
OPE_RATE : 100
MP# : 0
SSID : 0004
Used_Block(BLK) : 0
FLA(MB) : Disable
RSV(MB) : 0
CSV_Status : DISABLED
CSV_PROGRESS(%) : -
CSV_Mode : DISABLED
CSV_PROCESS_MODE : -
DEDUPLICATION_DATA : DISABLED
ALUA : Disable
RSGID : 0
PWSV_S : -
CL_MIG : N

C:\HORCM\etc>raidcom get ldev -ldev_id 16
Serial#  : 540016
LDEV : 16
SL : 0
CL : 0
VOL_TYPE : OPEN-V-CVS
VOL_Capacity(BLK) : 4294967296
NUM_PORT : 0
PORTs :
F_POOLID : NONE
VOL_ATTR : CVS : HDP
CMP : -
EXP_SPACE : -
B_POOLID : 0
LDEV_NAMING : VSI-VMFS_NVME-03
STS : NML
OPE_TYPE : NONE
```

```
OPE_RATE : 100
MP# : 1
SSID : 0004
Used_Block(BLK) : 0
FLA(MB) : Disable
RSV(MB) : 0
CSV_Status : DISABLED
CSV_PROGRESS(%) : -
CSV_Mode : DISABLED
CSV_PROCESS_MODE : -
DEDUPLICATION_DATA : DISABLED
ALUA : Disable
RSGID : 0
PWSV_S : -
CL_MIG : N

C:\HORCM\etc>raidcom get ldev -ldev_id 17
Serial#  : 540016
LDEV : 17
SL : 0
CL : 0
VOL_TYPE : OPEN-V-CVS
VOL_Capacity(BLK) : 4294967296
NUM_PORT : 0
PORTs :
F_POOLID : NONE
VOL_ATTR : CVS : HDP
CMP : -
EXP_SPACE : -
B_POOLID : 0
LDEV_NAMING : VSI-VMFS_NVME-04
STS : NML
OPE_TYPE : NONE
OPE_RATE : 100
MP# : 2
SSID : 0004
Used_Block(BLK) : 0
FLA(MB) : Disable
RSV(MB) : 0
CSV_Status : DISABLED
CSV_PROGRESS(%) : -
CSV_Mode : DISABLED
CSV_PROCESS_MODE : -
DEDUPLICATION_DATA : DISABLED
ALUA : Disable
RSGID : 0
PWSV_S : -
CL_MIG : N

C:\HORCM\etc>raidcom add namespace -nvm_subsystem_id 2 -ns_id auto -ldev_id 14 -
request_id auto
```

```
REQID : 141

C:\HORCM\etc>raidcom add namespace -nvm_subsystem_id 2 -ns_id auto -ldev_id 15 -
request_id auto
REQID : 142

C:\HORCM\etc>raidcom add namespace -nvm_subsystem_id 2 -ns_id auto -ldev_id 16 -
request_id auto
REQID : 143

C:\HORCM\etc>raidcom add namespace -nvm_subsystem_id 2 -ns_id auto -ldev_id 17 -
request_id auto
REQID : 144

C:\HORCM\etc>raidcom get namespace -nvm_subsystem_id 2
NVMSS_ID  NVMSS_NAME                  NSID  LDEVID  CAPACITY(BLK)
       2  UCS_nvm_subsystem             1      14     4294967296
       2  UCS_nvm_subsystem             2      15     4294967296
       2  UCS_nvm_subsystem             3      16     4294967296
       2  UCS_nvm_subsystem             4      17     4294967296

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 1 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-0 -request_id auto
REQID : 145

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 2 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-0 -request_id auto
REQID : 146

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 3 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-0 -request_id auto
REQID : 147

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 4 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-0 -request_id auto
REQID : 148

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 1 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-1 -request_id auto
REQID : 149

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 2 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-1 -request_id auto
REQID : 14a

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 3 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-1 -request_id auto
REQID : 14b

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 4 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-1 -request_id auto
```

```
REQID : 14c

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 1 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-2 -request_id auto
REQID : 14d

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 2 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-2 -request_id auto
REQID : 14e

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 3 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-2 -request_id auto
REQID : 14f

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 4 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-2 -request_id auto
REQID : 150

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 1 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-3 -request_id auto
REQID : 151

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 2 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-3 -request_id auto
REQID : 152

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 3 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-3 -request_id auto
REQID : 153

C:\HORCM\etc>raidcom add namespace_path -nvm_subsystem_id 2 -ns_id 4 -host_nqn
nqn.2014-08.local.hvlab.vsi:nvme:esxi-3 -request_id auto
REQID : 154

C:\HORCM\etc>raidcom get namespace_path -nvm_subsystem_id 2
NVMSS_ID  NVMSS_NAME                   NSID  LDEV#  HOST_NQN
       2  UCS_nvm_subsystem              1     14  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-2
       2  UCS_nvm_subsystem              2     15  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-2
       2  UCS_nvm_subsystem              3     16  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-2
       2  UCS_nvm_subsystem              4     17  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-2
       2  UCS_nvm_subsystem              1     14  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-3
       2  UCS_nvm_subsystem              2     15  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-3
       2  UCS_nvm_subsystem              3     16  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-3
       2  UCS_nvm_subsystem              4     17  nqn.2014-
```

```
08.local.hvlab.vsi:nvme:esxi-3
       2  UCS_nvm_subsystem               1     14  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-0
       2  UCS_nvm_subsystem               2     15  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-0
       2  UCS_nvm_subsystem               3     16  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-0
       2  UCS_nvm_subsystem               4     17  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-0
       2  UCS_nvm_subsystem               1     14  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-1
       2  UCS_nvm_subsystem               2     15  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-1
       2  UCS_nvm_subsystem               3     16  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-1
       2  UCS_nvm_subsystem               4     17  nqn.2014-
08.local.hvlab.vsi:nvme:esxi-1
```

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