

# EMC Performance Optimization for VMware Enabled by EMC PowerPath/VE

Applied Technology

Abstract

This white paper is an overview of the tested features and performance enhancing technologies of EMC<sup>®</sup> PowerPath<sup>®</sup>/VE 5.4. The performance and reliability of EMC PowerPath/VE are compared to the performance of VMware Native Multipathing (NMP) technology including the MRU (most recently used), fixed, and round-robin methods.

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All performance data contained in this report was obtained in a rigorously controlled environment. Results obtained in other operating environments may vary significantly. EMC Corporation does not warrant or represent that a user can or will achieve similar performance expressed in transactions per minute.

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The performance characteristics detailed in this document are intended to give indicative performance information on a single building block. If deploying at larger scale, then further validation should be carried out to ensure that the proposed environment performs as expected.

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# Executive summary

| Business case    | Data center managers are looking to virtualization as a means to   |
|------------------|--|
|                  | <ul> <li>reduce costs,</li> <li>increase efficiency, and</li> <li>deliver the service levels they require.</li> </ul>  |
|                  | In a virtualized data center, physical server consolidation results in   |
|                  | <ul> <li>reclaiming valuable data center space,</li> <li>realizing higher use rates,</li> <li>increasing operational efficiencies, and</li> <li>improving availability of resources and applications.</li> </ul>   |
|                  | As virtualized data centers expand, the physical connections between the servers and SAN storage resources become more critical.   |
| Product solution | EMC <sup>®</sup> PowerPath <sup>®</sup> /VE can provide improved performance and reliability compared to VMware Native Multipathing (NMP). PowerPath/VE provides   |
|                  | <ul> <li>superior load balancing,</li> <li>fast path failover, and</li> <li>improved device prioritization technology.</li> </ul>  |
|                  | PowerPath/VE improves your virtualized data center by  |
|                  | <ul> <li>providing predictable performance over both FC and iSCSI,</li> <li>providing higher reliability than VMware NMP, and</li> <li>providing failover and failback capability.</li> </ul>  |
| Key results      | EMC PowerPath/VE testing showed the following results:   |
|                  | <ul> <li>PowerPath/VE provides superior load-balancing performance across multiple paths using FC or iSCSI.</li> <li>PowerPath/VE seamlessly integrates and takes control of all device I/O, path selection, and failover without the need for additional configuration.</li> <li>VMware NMP requires that certain configuration parameters be specified to achieve improved performance.</li> </ul> |

| Introduction |  |
|--------------|--|
| Purpose      | This Applied Technology white paper demonstrates the tested features and performance enhancing technologies of EMC PowerPath/VE 5.4.   |
|              | The performance and reliability of EMC PowerPath/VE are compared to the performance of VMware Native Multipathing (NMP) technology including   |
|              | <ul><li>MRU (most recently used)</li><li>Fixed</li></ul>   |
|              | Round Robin  |
| Audience     | This white paper is intended for EMC employees, partners, and customers including IT planners, virtualization architects and administrators, and any others involved in evaluating, acquiring, managing, operating, or designing an EMC private cloud environment. |

# Multipath performance analysis

| Introduction   | To ensure maximum resource availability a data center infrastructure must  |
|----------------|--|
|                | <ul> <li>Provide multiple physical data paths between the server and the storage resources</li> <li>Allow path rerouting around problems such as failed components</li> <li>Balance the traffic loads across multiple physical paths</li> </ul>                                    |
| Multipathing   | To maintain a constant connection between a virtualized server host and its storage, a technique called <i>multipathing</i> is used.   |
|                | Multipathing maintains more than one physical path for data between the host and the storage device. If any element in the SAN fails such as an adapter, switch, or cable, the virtualized server host can switch to another physical path that does not use the failed component. |
|                | The process of path switching to avoid failed components is known as path failover.  |
| Load balancing | In addition to path failover, multipathing provides <i>load balancing</i> . Load balancing is the process of distributing loads across multiple physical paths to reduce or remove potential traffic bottlenecks.  |

# Key components

| Introduction             | For this performance analysis test PowerPath/VE was deployed on a virtualized data center that included  |
|--------------------------|--|
|                          | <ul> <li>2 ESX servers</li> <li>CLARiiON<sup>®</sup> CX4-480</li> <li>vSphere 4</li> <li>Load simulation software</li> </ul>   |
| PowerPath/VE             | PowerPath/VE works with VMware ESX as a Multipath Plugin (MPP) that provides path management to ESX hosts. It is installed as a kernel module on the vSphere host. It will plug in to the vSphere I/O stack framework to bring the advanced multipathing capabilities of PowerPath/VE including dynamic load balancing and automatic failover to the vSphere hosts.  |
|                          | The EMC CLARiiON CX4-480   |
| FLARE <sup>®</sup> 28.10 | <ul> <li>delivers best-in-class performance for midrange networked storage that scales seamlessly up to 471 TB of capacity</li> <li>supports up to 256 highly available, dual-connected hosts</li> <li>scales from 5 to 240 disks, and</li> <li>comes pre-configured with Fibre Channel (FC) and iSCSI connectivity, allowing customers to choose the best connectivity for their specific applications.</li> </ul>  |
| vSphere 4                | VMware vSphere 4 is the next logical step in IT computing, allowing customers to bring the power of cloud computing to their IT infrastructures. Building on the power of VMware Infrastructure, VMware vSphere 4 increases control over IT environments by supporting any OS, application, or hardware product.   |
|                          | VMware vSphere 4 is built on a proven virtualization platform to provide the foundation for internal and external clouds, using federation and standards to bridge cloud infrastructures—creating a secure, private cloud. Organizations of all sizes can achieve the full benefits of cloud computing, delivering the highest levels of application service agreements with the lowest total cost per application workload.   |
|                          | This EMC virtual infrastructure for Microsoft applications-data center solution delivers flexible, automatic I/O load balancing, powerful processing power, and simplified network switch management with these features introduced in VMware vSphere 4:   |
|                          | <ul> <li>EMC PowerPath/VE path failover integration (via VMware vStorage API for Multipathing)—As demonstrated in this solution, constantly adjusts I/O path usage and responds to changes in I/O loads from VMs.</li> <li>8 vCPU support—Increases the maximum number of virtual CPUs that can be assigned to a guest VM from four to eight.</li> <li>VMware vNetwork Distributed Switch—Takes the vSwitch capability one step further by extending the connections across the entire cluster.</li> </ul> |

| Simulation software | The following load simulation software was used:  |
|---------------------|---|
|                     | <ul> <li>Microsoft Exchange 2007 Jetstress — Jetstress simulates Exchange disk input/output (I/O) load. Specifically, Jetstress simulates the Exchange database and log file loads produced by a specific number of users.</li> <li>Oracle Workload ORION — ORION generates a synthetic I/O workload, using the same I/O software stack as Oracle, to simulate the Oracle database. ORION can generate a wide range of I/O workloads.</li> <li>Microsoft SQLIOSim — SQLIOSim simulates the I/O patterns of Microsoft SQL server 2005, SQL Server 2000, and SQL Server 7.0.</li> </ul> |

## **Physical architecture**

ArchitectureThe following illustration depicts the overall physical architecture of the performancediagramanalysis test environment.

Each host has the same storage adapter configuration as shown in the diagram to the left. The only difference is that Host A is utilizing VMware NMP and Host B is utilizing PowerPath VE.



## **Environment profile**

Hardware resources The hardware used in the performance analysis environment is listed below.

| Equipment                             | Quantity | Configuration  |
|---------------------------------------|----------|--|
| EMC CLARiiON CX4-480 FLARE<br>v.28.10 | 1        | 10 x 50 GB LUNs RAID 5 (4 paths per LUN)<br>1 x 1 TB LUN RAID 5 (4 paths per LUN) for VMDKs<br>2 x 4 Gb/s ports out per SP (2 FC, 2 iSCSI) |
| Dell 6850                             | 2        | Xeon Core 2<br>32 GB RAM<br>QLogic HBA, dual-port, 2 Gb/s  |
| Fibre Channel switch                  | 1        | Cisco MDS 9509 (4 Gb/s per port)<br>Cisco Catalyst 6513 (1Gbs IP)  |

The following figure shows the virtual machine organization and allocation.

Virtual allocation of hardware resources



#### Software resources

The software used in the performance analysis environment is listed below.

| Software                          | Version                |
|-----------------------------------|------------------------|
| vSphere Enterprise Plus           | 4.0 (build 164009)     |
| vCenter                           | 4.0 GA (build B162856) |
| PowerPath/VE                      | 5.4 (build 257)        |
| Microsoft Exchange 2007 JetStress | 08.02.0060             |
| Oracle Workload ORION             | 10.2.0.10              |
| Microsoft SQLIOSim                | 1.00.069               |

# Test design and validation

| Introduction       | This section outlines the test plan and implementation for the multipath performance<br>analysis using PowerPath/VE.<br>Performance tests will show that EMC PowerPath/VE provides superior load-<br>balancing, path failover, and device prioritization technology for vSphere servers.   |
|--------------------|--|
| Test plan          | <ul> <li>Create and deploy 10 virtual machines running Windows 2008 <ul> <li>During PowerPath/VE operations, the 10 VMs are on Server A</li> <li>During NMP operations, the 10 VMs are on Server B</li> </ul> </li> <li>Allocate the VMs as follows: <ul> <li>4 x Windows 2000 SQL servers</li> <li>3 x Exchange 2007 servers</li> <li>3 x Oracle ORION servers</li> </ul> </li> </ul>   |
|                    | <ul> <li>Implement a storage connection using Fibre Channel</li> <li>Install Exchange, SQL, and Oracle simulation software</li> <li>Test system performance using default VMware Native Multipathing (NMP)</li> <li>Test system performance using PowerPath/VE</li> <li>Change connectivity from Fibre Channel to iSCSI</li> <li>Test system performance using default VMware Native Multipathing (NMP)</li> <li>Test system performance using PowerPath/VE</li> </ul> |
| Test<br>parameters | The PowerPath/VE performance analysis test will examine the system response to<br>the following operations:<br>• Load balancing<br>- Single path<br>- Multipath<br>• Failover and failback<br>- Front-end failover<br>- Back-end failover<br>• VMotion changeover<br>- Change host<br>- Change datastore<br>- Change host and datastore  |

## Performance analysis tests

Single-path load-balance test The following table outlines the steps to perform a single-path load-balancing test to compare VMware NMP to PowerPath/VE performance.

| Step | Action   |
|------|--|
| 1    | Begin I/O simulation on a VM.  |
| 2    | <ul> <li>Record performance data of the ESX server (single path) using NMP</li> <li>a. Run ESXTOP</li> <li>b. Type "d" and then "P" to type the HBA name to view paths through the HBA.</li> <li>Note: All the I/O rates shown in ESXTOP indicate active I/O count, not</li> </ul> |
|      | the queued I/O count.  |
| 3    | Record performance data of the ESX server (single path) Utilizing<br>PowerPath/VE<br>a. Run ESXTOP<br>b. Type "d" and then "P" to type the HBA name to view paths<br>through the HBA.  |
|      | <b>Note:</b> All the I/O rates shown in ESXTOP indicate active I/O count, not the queued I/O count.  |

Multipath load-<br/>balance testThe following table outlines the steps to perform a multipath load-balancing test to<br/>compare VMware NMP to PowerPath/VE performance.

| Step | Action   |
|------|--|
| 1    | Begin I/O simulation on a VM.  |
| 2    | <ul> <li>Record performance data of the ESX server (multipath) using NMP</li> <li>a. Run ESXTOP</li> <li>b. Type "d" and then "P" to type the HBA name to view paths through the HBA.</li> </ul> |
|      | the queued I/O count.  |
| 3    | Install PowerPath/VE and register the PowerPath/VE license on each vSphere server.   |
| 4    | Record performance data of the ESX server (multipath) using<br>PowerPath/VE<br>a. Run ESXTOP   |
|      | b. Type "d" and then "P" to type the HBA name to view paths through the HBA.   |
|      | <b>Note:</b> All the I/O rates shown in ESXTOP indicate active I/O count, not the queued I/O count.  |

# Front-end<br/>failover testThe following table outlines the steps to perform a front-end failover test to compare<br/>VMware NMP to PowerPath/VE performance.

| Step | Action   |
|------|--|
| 1    | Begin I/O simulation on a VM.  |
| 2    | Fibre Channel:   |
|      | Disable any of the HBA ports through the switch fabric   |
|      | <ul> <li>Wait for the path failure on the disabled HBA (check the<br/>system log for the path failure message)</li> </ul>  |
|      | b. I/Os should still flow through the other HBA's active paths   |
|      | iSCSI:   |
|      | Disable any of the NIC ports through the Ethernet switch   |
|      | <ul> <li>Wait for the path failure on the disabled NIC (check the system<br/>log for the path failure message)</li> </ul>  |
|      | b. I/Os should still flow through the other NIC active paths   |
| 3    | Install PowerPath/VE and register the PowerPath/VE license on each vSphere server.   |
| 4    | Enable the port through the switch   |
|      | a. Wait for the paths to be restored   |
|      | <b>Note:</b> Automatic restoration of the paths can take up to 5 minutes. Within this time frame the paths should come back and I/O should start in those restored paths (check the system log). |
|      | <ul> <li>Alternatively, (when supported) the "powermt restore"<br/>command can be used to manually invoke the restore action.</li> </ul>   |
|      | <b>Note:</b> On CLARiiON systems there should not be any unnecessary trespass to the volume if the current LUN owner is alive and connected.   |

Back-endThe following table outlines the steps to perform a back-end failover test to comparefailover testVMware NMP to PowerPath/VE performance.

| Step | Action  |
|------|---|
| 1    | Begin I/O simulation on a VM.   |
| 2    | Disable any of the array ports through the fabric switch (Fibre Channel) or Ethernet switch (iSCSI)   |
|      | <ul> <li>a. Wait for the path failure on the disabled target (check the system log for the path failure message)</li> <li>b. I/Os should still flow through the other active paths</li> </ul> |
|      | <b>Note:</b> On CLARiiON systems you may see trespass when the current LUN owner is disabled, and I/O will flow on the trespassed paths.  |
| 3    | Install PowerPath/VE and register the PowerPath/VE license on each vSphere server.  |
| 4    | Enable the array port through the switch  |
|      | a. Wait for the paths to restored   |
|      | <b>Note:</b> Automatic restoration of the paths can take up to 5 minutes. Within this time frame the paths should be come back and I/O should start in those restored paths.                  |
|      | <ul> <li>Alternatively, (when supported) the "powermt restore"<br/>command can be used to manually invoke the restore action.</li> </ul>  |
|      | <b>Note:</b> On CLARiiON systems you should see failback of the LUN when a Current LUN owner connection is restored (check the system log).   |

VMotion change host test The following table outlines the steps to perform a VMotion change host test to compare VMware NMP to PowerPath/VE performance.

| Step | Action   |
|------|--|
| 1    | Power ON the VMs and migrate using the "Change Host" option.   |
| 2    | Begin I/O simulation on a VM, without enabling PowerPath/VE (this test case can be performed with or without I/O from the VM). |
| 3    | Select the destination ESX.  |
| 4    | Select the resource pool.  |
| 5    | Select the priority.   |
| 6    | Finish the migration.  |

**Result:** The VM should be migrated successfully (with or without I/O). If I/O was present, the I/O should not fail.

## VMware Native Multipathing performance results

Introduction This section describes the performance results of the test conditions when executed using the VMware VMkernel multipathing plug-in and the default VMware Native Multipathing (NMP).

The NMP is an extensible module that manages subplug-ins. There are two types of NMP subplug-ins:

- Storage Array Type Plug-ins (SATPs), and
- Path Selection Plug-ins (PSPs).

SATPs and PSPs can be built in and provided by VMware, or can be provided by a third party.

**Device configuration** The device configuration is shown in the following figure. Note that by default, VMware NMP will be the owner of all devices if there are no third-party Multipath Plug-ins (MPPs) such as EMC PowerPath/VE installed.

| tting Started 🔨 Summary 🥄 Virtual Mac                     |   |   |                           |  |                      |                              |  |  |                          |          |
|---|---|---|---------------------------|--|----------------------|------------------------------|--|--|--------------------------|----------|
|   | hines Perforn                             | nance Configuration Ta  | asks & E                  | vents Alarms F   | ermission            | s Maps St                    | orage Views  |  |                          |          |
| ardware   | Storage A                                 | dapters   |                           |  |                      |                              |  | Refre  | sh R                     | lescan.  |
| Processors  | Device                                    |   | Туре                      | WWN  |                      |                              |  |  |                          |          |
| Memory  | 82801EB/                                  | 'ER (ICH5/ICH5R) IDE Co   | ontrolle                  | er   |                      |                              |  |  |                          |          |
| Storage   | 🛛 🥥 vmh/                                  | pa5   | Block S                   | 5CSI   |                      |                              |  |  |                          |          |
| Networking  | 🥝 vmhl                                    | pa32  | Block S                   | 5CSI   |                      |                              |  |  |                          |          |
| Storage Adapters  | LP10000                                   | 2Gb Fibre Channel Host (  | Adapte                    | 2r   |                      |                              |  |  |                          |          |
| Network Adapters  |   | pal .   | Fibre                     | Channel 20:00  | 00:00:c9:            | :55:2a:F0 10:00              | :00:00:c9:55:2a:f0   |  |                          |          |
| Advanced Settings   | 52c1020                                   | Jan<br>DCT V Eusian MDT Dual I  | Hibre (                   |  | 00:00:09:            | :55:2a;e3 10:00              | ):00:00:09:55:2a:e3  |  |                          |          |
| Advanced Settings   |   | PCI-X FUSION-MPT Dual C   | лсгаза                    | 0 5051   |                      |                              |  |  |                          |          |
| tware   | Details                                   |   |                           |  |                      |                              |  |  |                          |          |
| Time Configuration<br>DNS and Routing<br>Power Management | Model:<br>WWN:<br>Targets                 | LP10000 2Gb Fibre Char<br>20:00:00:00:c9:55:2a:ei<br>: 4 Devices:   | nnel Hos<br>3 10:00<br>11 | st Adapter<br>:00:00:c9:55:2a:e3<br>Paths: 44  |                      |                              |  |  |                          |          |
| Virtual Machine Startup/Shutdown                          | view:                                     |   |                           | Dunking Name   | 11161                | Time                         | T  | Caracity                                     | <u></u>                  | <u> </u> |
| Security Drofile  | 1   | Identifier  | 1                         | Runtime Name   | LUN                  | Type                         | Iransport  | Capacity                                     | Owner                    |          |
| Sustem Descurse Allocation                                | c(naa                                     | naa.600601605710220050  | ua v                      | vmnbal:CU:TU:LU  | 4                    | disk                         | Fibre Channel  | 1.05 IB                                      | NMP                      |          |
| Advessed Cattings   | (Indd                                     | Dee 600601605710220046  | 84 V<br>Fac v             | vmhba1:C0:T0:L0  | 7                    | dick                         | Fibre Channel  | 50.00 GB                                     | NMP                      |          |
| Advanced Sectings   | (paa                                      | naa.600601605710220050  | n4 v                      | vmhba1:C0:T0:L8  | 8                    | disk                         | Fibre Channel  | 50.00 GB                                     | NMP                      |          |
|   | s (naa                                    | naa.60060160571022005;  | 14 1                      | vmhba1:C0:T0:L9  | 9                    | disk                         | Fibre Channel  | 50.00 GB                                     | NMP                      |          |
|   |   | (00(01(057100005)   | 24                        | vmbba1:C0:T0:L10   | 10                   | disk                         | Fibre Channel  | 50.00 GB                                     | NMP                      |          |
|   | <(naa                                     | naa.600601605/1022005/  |                           | VIIIIDG1.C0.10.C10   |                      |                              |  |  |                          |          |
|   | د(naa<br>د(naa                            | naa.60060160571022005   | 34 י                      | vmhba1:C0:T0:L11   | 11                   | disk                         | Fibre Channel  | 50.00 GB                                     | NMP                      |          |
|   | <(naa<br><(naa<br><(naa                   | naa.60060160571022005<br>naa.60060160571022005<br>naa.60060160571022005   | 34 v<br>44 v              | vmhba1:C0:T0:L11<br>vmhba1:C0:T0:L12   | 11<br>12             | disk<br>disk                 | Fibre Channel<br>Fibre Channel                                   | 50.00 GB<br>50.00 GB                         | NMP<br>NMP               |          |
|   | <(naa<br><(naa<br><(naa<br><(naa          | naa.60060160571022005<br>naa.60060160571022005<br>naa.60060160571022005   | 34 •<br>44 •              | vmhba1:C0:T0:L11<br>vmhba1:C0:T0:L12<br>vmhba1:C0:T0:L12   | 11<br>12<br>13       | disk<br>disk<br>disk         | Fibre Channel<br>Fibre Channel<br>Fibre Channel                  | 50.00 GB<br>50.00 GB<br>50.00 GB             | NMP<br>NMP<br>NMP        |          |
|   | <(naa<br><(naa<br><(naa<br><(naa<br><(naa | naa.60060160571022005<br>naa.60060160571022005<br>naa.60060160571022005<br>naa.60060160571022005<br>naa.60060160571022005 | 34 •<br>44 •<br>54 •      | vmhba1:C0:T0:L11<br>vmhba1:C0:T0:L12<br>vmhba1:C0:T0:L12<br>vmhba1:C0:T0:L13<br>vmhba1:C0:T0:L14 | 11<br>12<br>13<br>14 | disk<br>disk<br>disk<br>disk | Fibre Channel<br>Fibre Channel<br>Fibre Channel<br>Fibre Channel | 50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB | NMP<br>NMP<br>NMP<br>NMP |          |

The following figure showed that each LUN has four paths. There are two active and two standby paths. However, because VMware NMP is the owner of all devices, only one active path is used for I/O.

| .15.110 ¥Mware ESX, 4.0.0, 164    | 009                  |                                     |                 |               |            |                           |         |        |
|-----------------------------------|----------------------|-------------------------------------|-----------------|---------------|------------|---------------------------|---------|--------|
| g Started 🔪 Summary 🔨 Virtual Mar | chines Performance C | onfiguration Tasks & Events Ala     | rms Permission: | s Maps        | Storaç     | je Views                  |         |        |
| ware                              | Storage Adapters     |                                     |                 |               |            |                           | Refresh | Rescan |
| ocessors                          | Device               | Туре                                | WWN             |               |            |                           |         |        |
| oory                              | 82801EB/ER (ICH5     | /ICH5R) IDE Controller              |                 |               |            |                           |         |        |
| 7                                 | 🛛 🎯 vmhba5           | Block SCSI                          |                 |               |            |                           |         |        |
| vin a                             | 🛛 🎯 vmhba32          | Block SCSI                          |                 |               |            |                           |         |        |
| n ig                              | LP10000 2Gb Fibre    | Channel Host Adapter                |                 |               |            |                           |         |        |
| ipters                            | 😋 vmhba1             | Fibre Channel                       | 20:00:00:00:c9: | :55:2a:f0 10: | 00:00:     | 00:c9:55:2a:f0            |         |        |
| s                                 | 🕝 vmhba4             | Fibre Channel                       | 20:00:00:00:c9: | :55:2a:e310:  | 00:00      | :00:c9:55:2a:e3           |         |        |
|                                   | 53c1030 PCI-X Fus    | ion-MPT Dual Ultra320 SCSI          |                 |               |            |                           |         |        |
|                                   | Details              |                                     |                 |               |            |                           |         |        |
|                                   | vmhba4               |                                     |                 |               |            |                           |         |        |
| ures                              | Model: LP1000        | 00 2Gb Fibre Channel Host Adapter   |                 |               |            |                           |         |        |
| uration                           | WWN: 20:00:0         | 00:00:c9:55:2a:e3 10:00:00:00:c9:55 | :2a:e3          |               |            |                           |         |        |
| uting                             | Targets: 4           | Devices: 11 Paths:                  | 44              |               |            |                           |         |        |
| agement                           | Nimm Daving F        |                                     |                 |               |            |                           |         |        |
| nine Startup/Shutdown             | VIEW: Devices        | Paths                               |                 |               |            |                           |         |        |
| ine Swapfile Location             | Runtime Name         | Target                              |                 | LUN 🗠         | Stat       | us                        |         |        |
| le                                | vmhba4:C0:T0:L0      | 50:06:01:60:bc:e0:15:35 50:06:01:   | :69:3c:e0:15:35 | 0             | •          | Active                    |         |        |
| e Allocation                      | vmhba4:C0:T1:L0      | 50:06:01:60:bc:e0:15:35 50:06:01:   | :68:3c:e0:15:35 | 0             | •          | Active (I/O)              |         |        |
| as                                | vmhba4:C0:T3:L0      | 50:06:01:60:bc:e0:15:35 50:06:01:   | :61:3c:e0:15:35 | 0             | $\diamond$ | Stand by                  |         |        |
|                                   | vmhba4:C0:T2:L0      | 50:06:01:60:bc:e0:15:35 50:06:01:   | :60:3c:e0:15:35 | 0             | $\diamond$ | Stand by                  |         |        |
|                                   | vmhba4:C0:T2:L6      | 50:06:01:60:bc:e0:15:35 50:06:01:   | :60:3c:e0:15:35 | 6             | •          | Active                    |         |        |
|                                   | vmhba4:C0:T3:L6      | 50:06:01:60:bc:e0:15:35 50:06:01:   | :61:3c:e0:15:35 | 6             | •          | Active (I/O)              |         |        |
|                                   | vmhba4:C0:T0:L6      | 50:06:01:60:bc:e0:15:35 50:06:01:   | :69:3c:e0:15:35 | 6             | $\diamond$ | Stand by                  |         |        |
|                                   | vmhba4:C0:T1:L6      | 50:06:01:60:bc:e0:15:35 50:06:01:   | :68:3c:e0:15:35 | 6             | $\diamond$ | Stand by                  |         |        |
|                                   | vmhba4:C0:T2:L7      | 50:06:01:60:bc:e0:15:35 50:06:01:   | :60:3c:e0:15:35 | 7             | •          | Active                    |         |        |
|                                   | vmhba4:C0:T3:L7      | 50:06:01:60:bc:e0:15:35 50:06:01:   | 61:3c:e0:15:35  | 7             | •          | Active (I/O)              |         |        |
|                                   | vmhba4:C0:T0:L7      | 50:06:01:60:bc:e0:15:35 50:06:01:   | 69:3c:e0:15:35  | _             |            | Stand by                  |         |        |
|                                   | vmhba4:C0:T1:L7      | 50:06:01:60:bc:e0:15:35 50:06:01:   | :68:3c:e0:15:35 | 2             | 2          | Stand by                  |         |        |
|                                   | vmhba4:C0:T2:L8      | 50:06:01:60:bc:e0:15:35 50:06:01:   | :60:3c:e0:15:35 | 8             |            | Active                    |         |        |
|                                   | Vmnba4:C0:T3:L8      | 50:06:01:60:bc:e0:15:35 50:06:01:   | 61:3c:e0:15:35  | 8             |            | Active (I/O)              |         |        |
|                                   | Vmnba4:C0:10:L8      | 50:06:01:60:0c:e0:15:35 50:06:01:   | :69:30:e0:15:35 | 0             | l X        | otand by                  |         |        |
|                                   | vmnba4;C0;11;L8      | 50:00:01:00:00:00:15:35 50:06:01:   | 00;30;80;15;35  | 0             | l 🎽        | Active                    |         |        |
|                                   | vmnba4;C0;12;L9      | 50:06:01:60:bc:e0:15:35 50:06:01:   | 00:30:00:15:35  | 9             |            | Active (1/O)              |         |        |
|                                   | viinba4:C0:13:L9     | 50:00:01:00:00:00:15:35 50:06:01:   | 01:30:00:15:35  | 9             |            | ALLIVE (1)(U)<br>Stand bu |         |        |
|                                   | viniba4:C0:T0:L9     | 50.06.01:60:bc;e0:15:35 50:06:01:   | 07.3C80:15:35   | ,             | I X        | Stand by                  |         |        |
|                                   | vmbba4;C0;T2;L10     | 50:06:01:60:bc:e0:15:35 50:06:01:   | -00.3C;80:15:35 | ,<br>10       | l 🎽        | Active                    |         |        |
|                                   | vmbba4;C0;T2;L10     | 50:06:01:60:bc:e0:15:35 50:06:01:   | 61:3c:e0:15:35  | 10            | 1.         | Active (1/O)              |         |        |
|                                   | vmbba4;C0;T0;L10     | 50:06:01:60:bc:e0:15:35 50:06:01:   | 69:3c:e0:15:35  | 10            | 1.         | Stand by                  |         |        |
|                                   | VIIII0047.C0.10(E10  | 30,00,01,00,00,00,10,00 30,00,01;   | .07.30.60.13.33 | 10            | $\sim$     | ocaria by                 |         |        |

VMware NMP policy does round-robin across multiple active paths based on usage. There is only one active I/O path at a given time and it sends down a certain number of I/Os before switching to another active path. The default path switching is based on "number of IOs" and the default value for that is 1,000. That value can be changed with the following command:

esxcli nmp device setpolicy --device <device UID> --psp VMW\_PSP\_RR esxcli nmp roundrobin setconfig --device <device UID> --iops 1 --type iops

| PORT-ID         | USED-SY                                 | TEAB-PNIC | DNAME  | FKTTX/#  | MoTX/# | PKTPX/#  | MD\$X/a | DEPTIC | DEFRI   |
|-----------------|---|-----------|--|--|--------|----------|---------|--------|---|
| 16777217        | Banagement                              | 10/ m     | vSwitch0   | 0,00   | 0.00   | 0.00     | 0.00    | 0.00   | 0.00  |
| 16777258        | visic8                                  |           | v5witch0   |  |        | 10.68    | 0.01    | 0.00   | 0.00  |
| 16777219        | 4095;vsv110                             | VEN1108   | vSwitch0   | 14.24  | 20.0   | 7.63     | 0.00    | 0,00   | 0.00  |
| 16777220 4248:  | VH151_CX_LUN13                          | vensch    | vSwitzb0   |  |        | 0.00     | 0.00    | 0.00   | 0.00  |
| 16777221 4257:  | VR152 CX LUNI4                          | VHB108    | viwitch0   | 0.00   | 0.00   | 0.00     | 0.00    | 0.00   | 0.00  |
| 16777222 4284:  | V#153 CX LUN16                          | venice.   | v3w1tch0   |  | 0.00   | 1.02     | 0.00    | 0.00   | 0.00  |
|                 | 43021V#171                              | VHB100    | vSwitch0   | 0,51   | 0.00   | 0.55     | 0.00    | 0.00   | 0.00  |
| 16777224:4314:9 | indows200882-7                          | vanics    | vffwitch0  | 0.00   | 0.00   | 0.00     | 0.00    | 0.00   | 0.00  |
| 16777225 433318 | 18/000000000000000000000000000000000000 | V96128    | v3vitch0   | 0,00   | 0.00   | 0.00     | 0.00    | 0.00   | 0,00  |
| 16777226 43511  | Vindows7FC7137                          | VMA125    | v3witch0   | 0.00   | 0.00   | 0.00     | 0.00    | 0.00   | 0.00  |
| 16777238 6656   | LV#145 CX LUNS                          | VHB108    | v2w1tch0   | 0.00   |        |          | 0.00    | 0.00   | 0,00  |
| 16777239 6673   | :VH146 CX LUN9                          | vanică    | vSwitch0   | 0.00   | 0.00   | 0.00     | 0.00    | 0.00   | 0.00  |
| 16777240 66861  | VH147 CX LONIO                          | VN6108    | vflwitch0  | 0.00   | 0.00   | 0.00     | 0.00    | 0.00   | 0.00  |
| 16777241 6702:  | VH149 CX LUNI2                          | V901108   | v3w1tch0   | 0.00   | 0.00   | 0.00     | 0.00    | 0.00   | 0.00  |
| 16777242 67171  | VH140 CX LUMIL                          | venic8    | VSwitch0   | 0.00   | 0.00   | 0,00     | 0.00    | 0.00   | 0.00  |
| 16777243        | 6741:V#140                              | ventce.   | vdvitch0   | 0.00   | 0.00   | 0.00     | 0.00    | 0.00   | 0.00  |
| 16777244        | 67651V#162                              | Vmm1c8    | vSwitch0   | 0,00   | 0,00   | 0.00     | 0.00    | 0.06   | 0,00  |
| 16777245        | 6700:VE164                              | venică    | v3witch0   | 0.00   | 0.00   | 0.00     | 0.00    | 0.00   | 0.00  |
| 33554433        | Ranagement.                             | 1./ B     | vSwitcht   | 0.00   | 0.00   | 0.00     | 0.00    | 0.00   | 0.00  |
| 23554424        | vmn1c10                                 |           | vSwitch1   | 0.00   | 0.00   | 0.00     | 0.00    | 0.00   | 0.00  |
| 33554435        | VeikO                                   | venic10   | vSwitcht   | 0.00   |        | 0.00     | 0.00    | 0.00   | 0.00  |
| \$0331652       | Management                              | 1./ A     | vSwitch2   | 0.00   | 0.00   |          | 0.00    | 0.00   | 0.00  |
|                 | Contraction of the                      |           | Conception of the local division of the loca | and the state of t |        |          |         | 1122   | ALC: NOT THE OWNER OF THE OWNER OWNER OF THE OWNER OWNE |
| 50331654        | Visita                                  | V961C4    | ARAITCHI   | 10732-36   | 200.09 | 16107.03 | 40.25   | 0.00   | 0.00  |
| 67109865        | management.                             | 1./ A     | ANALCCU3   | 0.00   | 0.00   | 0.00     | 0.00    | 0.00   | 0.00  |
| 67109846        | VINLLCD                                 |           | ABAITCR3   | 11057-54   | 191.76 | 21427-50 | 44.27   | 0.00   | 0,00  |
| 67100057        | VeRI                                    | Vaciac5   | Vow11ch3   | 11040.59   | 191.86 | 15294.08 | 41.42   | 0.00   | 0.00  |

The results after changing the IOPS value to 1 are shown in the following figure:

# I/O traffic performance

When there are four Windows 2008 VMs running SQLIOstress, three Windows 2008 VMs running JetStress 2007, and three Windows 2003 VMs running Oracle ORION, there are about 11,000 I/Os at one time. As illustrated from the ESXTOP utility, all these I/Os come through only one path, vmhba4, to access the CLARiiON LUNs.

| 🛃 root@ | 6850 | A:~   |       |        |         |       |            |          |           |           |          |          |        | × |
|---------|------|-------|-------|--------|---------|-------|------------|----------|-----------|-----------|----------|----------|--------|---|
| 1:09:3  | 6pm  | up 13 | 8 day | 78 2:3 | 21, 190 | world | is; CPU lo | ad avera | ge: 0.72, | 0.37, 0.3 | 34       |          |        | ^ |
| ADAPTR  | CID  | TID   | LID   | NCHNS  | NTGTS N | LUNS  | CMDS/s     | READS/s  | WRITES/s  | MBREAD/s  | MBWRTN/s | DAVG/cmd | KAVG/c |   |
| vmhba0  |      |       |       | 1      | 1       | 1     | 0.80       | 0.00     | 0.80      | 0.00      | 0.00     | 0.09     | ο.     |   |
| vmhba1  |      |       |       | 1      | 4       | 44    | 0.00       | 0.00     | 0.00      | 0.00      | 0.00     | 0.00     | Ο.     |   |
| vmhba2  |      |       |       | 1      | 0       | 0     | 0.00       | 0.00     | 0.00      | 0.00      | 0.00     | 0.00     | ο.     |   |
| vmhba3  |      |       |       | 1      | 0       | 0     | 0.00       | 0.00     | 0.00      | 0.00      | 0.00     | 0.00     | ο.     |   |
| vmhba32 |      |       |       | 2      | 0       | -0    | 0.00       | 0.00     | 0.00      | 0.00      | 0.00     | 0.00     | ο.     |   |
| vmhba4  |      |       |       | 1      | 4       | 44    | 11114.02   | 4460.18  | 6652.23   | 26.36     | 39.86    | 1.65     | ο.     |   |
| vmhba5  |      |       |       | 2      | 1       | 1     | 0.00       | 0.00     | 0.00      | 0.00      | 0.00     | 0.00     | Ο.     |   |
|         |      |       |       |        |         |       |            |          |           |           |          |          |        |   |
|         |      |       |       |        |         |       |            |          |           |           |          |          |        |   |
|         |      |       |       |        |         |       |            |          |           |           |          |          |        |   |
|         |      |       |       |        |         |       |            |          |           |           |          |          |        |   |
|         |      |       |       |        |         |       |            |          |           |           |          |          |        |   |
|         |      |       |       |        |         |       |            |          |           |           |          |          |        |   |
|         |      |       |       |        |         |       |            |          |           |           |          |          |        |   |

# Path selection<br/>profilesVMware NMP supports three PSPs by default. The following three figures show the<br/>Path Selection as Most Recently Used (MRU), Round Robin (RR), and Fixed.

#### Most Recently Used



#### **Round Robin**

| 🖗 DGC Fibre Cha                               | nnel Disk (naa. 600601605710220050dd54f1   | c60dde11) Ma   | anage Paths                      |                  |
|---|--|----------------|----------------------------------|------------------|
| Policy<br>Path Selection:<br>Storage Array Ty | Round Robin (VMware)<br>be: VMW_SATP_CX  |                |                                  | T                |
| Paths   |  |                |                                  |                  |
| Runtime Name                                  | Target   | LUN            | Status 🗠                         | Preferred 🔨      |
| vmhba4:C0:T1:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:68:3c:e0:15:35  | 0              | <ul> <li>Active (I/O)</li> </ul> |                  |
| vmhba1:C0:T1:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:68:3c:e0:15:35  | 0              | <ul> <li>Active (I/O)</li> </ul> |                  |
| vmhba4:C0:T0:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:69:3c:e0:15:35  | 0              | <ul> <li>Active (I/O)</li> </ul> |                  |
| vmhba1:C0:T0:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:69:3c:e0:15:35  | 0              | <ul> <li>Active (I/O)</li> </ul> |                  |
| vmhba4:C0:T3:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:61:3c:e0:15:35  | 0              | Stand by                         |                  |
| vmhba1:C0:T3:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:61:3c:e0:15:35  | 0              | <ul> <li>Stand by</li> </ul>     |                  |
| vmhba4:C0:T2:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:60:3c:e0:15:35  | 0              | <ul> <li>Stand by</li> </ul>     | ~                |
| Name:<br>Runtime Name:                        | fc.20000000c9552ae3:10000000c9552ae3-fc.50060160b<br>vmhba4:C0:T3:L0                               | ce01535:500601 | 613ce01535-naa.60060             | Refresh          |
| Fibre Channel<br>Adapter:<br>Target:          | 20:00:00:00:c9:55:2a:e3 10:00:00:00:c9:55:2a:e3<br>50:06:01:60:bc:e0:15:35 50:06:01:61:3c:e0:15:35 |                |                                  |                  |
|   |  |                |                                  | ose <u>H</u> elp |

#### Fixed

| DGC Fibre Cha                                 | nnel Disk (naa. 600601605710220050dd54f1c6   | iOdde11) Ma  | anage Paths                  |           |
|---|--|--------------|------------------------------|-----------|
| Policy<br>Path Selection:<br>Storage Array Ty | Fixed (VMware)<br>pe: VMW_SATP_CX  |              |                              | T         |
| Paths   |  |              | $\frown$                     |           |
| Runtime Name                                  | Target   | LUN          | Status 🛆 Pre                 | eferred 🔼 |
| vmhba1:C0:T3:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:61:3c:e0:15:35  | 0            | Active                       |           |
| vmhba4:C0:T2:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:60:3c:e0:15:35  | 0            | 🔶 Active                     |           |
| vmhba1:C0:T2:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:60:3c:e0:15:35  | 0            | 🔶 Active                     |           |
| vmhba4:C0:T3:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:61:3c:e0:15:35  | 0            | 🔶 Active (I/O)               |           |
| vmhba4:C0:T1:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:68:3c:e0:15:35  | 0            | Stand by                     |           |
| vmhba1:C0:T1:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:68:3c:e0:15:35  | 0            | <ul> <li>Stand by</li> </ul> |           |
| vmhba4:C0:T0:L0                               | 50:06:01:60:bc:e0:15:35 50:06:01:69:3c:e0:15:35  | 0            | <ul> <li>Stand by</li> </ul> | ~         |
| Name:<br>Runtime Name:                        | fc.20000000c9552ae3:10000000c9552ae3-fc.50060160bce<br>vmhba4:C0:T1:L0                             | 01535:500601 | 683ce01535-naa.60060160      | Refresh   |
| Fibre Channel<br>Adapter:<br>Target:          | 20:00:00:00:c9:55:2a:e3 10:00:00:00:c9:55:2a:e3<br>50:06:01:60:bc:e0:15:35 50:06:01:68:3c:e0:15:35 |              |                              |           |
|   |  |              | Close                        | Help      |

I/O results for path selection profiles The following three figures show the  $\ensuremath{\text{I/O}}$  performance in the three different Path Selections.

#### Most Recently Used

| 🖉 root@f | 6850/ | A:~   |       |         |         |        |           |           |            |           |          |          |          |          |          |   |
|----------|-------|-------|-------|---------|---------|--------|-----------|-----------|------------|-----------|----------|----------|----------|----------|----------|---|
| 10:59:01 | 1am າ | up 14 | ł day | 75 10 n | nin, 18 | 3 worl | ds; CPU l | oad avera | age: 0.42, | , 0.45, 0 | .25      |          |          |          |          | ^ |
| ADAPTR   | CID   | TID   | LID   | NCHNS   | NTGTS   | NLUNS  | CMDS/s    | READS/s   | WRITES/s   | MBREAD/s  | MBWRTN/s | DAVG/cmd | KAVG/cmd | GAVG/cmd | QAVG/cmd |   |
| vmhba0   | -     | -     | -     | 1       | 1       | 1      | 1.41      | 0.00      | 1.41       | 0.00      | 0.01     | 0.09     | 0.01     | 0.10     | 0.00     |   |
| vmhba1   |       |       |       |         |         | 44     | 1612.01   | 1605.99   | 6.02       | 2.87      | 0.03     | 0.11     | 0.01     | 0.12     | 0.00     |   |
| vmhba2   |       |       |       |         |         |        | 0.00      | 0.00      | 0.00       | 0.00      | 0.00     | 0.00     | 0.00     | 0.00     | 0.00     |   |
| vmhba3   |       |       |       |         |         |        | 0.00      | 0.00      | 0.00       | 0.00      | 0.00     | 0.00     | 0.00     | 0.00     | 0.00     |   |
| vmhba32  |       |       |       |         |         |        | 0.00      | 0.00      | 0.00       | 0.00      | 0.00     | 0.00     | 0.00     | 0.00     | 0.00     |   |
| vmhba4   |       |       |       |         |         | 44     | 8228.10   | 5859.58   | 2368.53    | 18.92     | 9.82     | 0.27     | 0.00     | 0.27     | 0.00     |   |
| vmhba5   |       |       |       |         |         |        | 0.00      | 0.00      | 0.00       | 0.00      | 0.00     | 0.00     | 0.00     | 0.00     | 0.00     |   |
|          |       |       |       |         |         |        |           |           |            |           |          |          |          |          |          |   |
|          |       |       |       |         |         |        |           |           |            |           |          |          |          |          |          |   |
|          |       |       |       |         |         |        |           |           |            |           |          |          |          |          |          |   |
|          |       |       |       |         |         |        |           |           |            |           |          |          |          |          |          |   |
|          |       |       |       |         |         |        |           |           |            |           |          |          |          |          |          |   |
|          |       |       |       |         |         |        |           |           |            |           |          |          |          |          |          |   |
|          |       |       |       |         |         |        |           |           |            |           |          |          |          |          |          |   |
|          |       |       |       |         |         |        |           |           |            |           |          |          |          |          |          |   |

#### **Round Robin**

| 🛃 root@f | 6850/ | \:~   |     |          |      |       |             |           |           |           |          |          |          |          |          |   |
|----------|-------|-------|-----|----------|------|-------|-------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---|
| 1:53:05  | 5pm ι | ap 13 | day | rs 3:05, | 190  | world | ls; CPU lo: | ad averaç | ge: 0.62, | 0.53, 0.0 | 51       |          |          |          |          | 1 |
| ADAPTR   | CID   | TID   | LID | NCHNS NI | IGTS | NLUNS | CMDS/s      | READS/s   | WRITES/s  | MBREAD/s  | MBWRTN/s | DAVG/cmd | KAVG/cmd | GAVG/cmd | QAVG/cmd |   |
| vmhba0   | -     | -     | -   | 1        | 1    | 1     | 16.24       | 0.00      | 16.04     | 0.00      | 0.94     | 0.17     | 0.01     | 0.17     | 0.00     |   |
| vmhba1   |       |       |     |          |      | 44    | 2091.43     | 813.80    | 1259.63   | 5.31      | 8.16     | 0.52     | 0.01     | 0.53     | 0.00     |   |
| vmhba2   |       |       |     |          |      | 0     | 0.00        | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     | 0.00     | 0.00     | 0.00     |   |
| vmhba3   |       |       |     |          |      | 0     | 0.00        | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     | 0.00     | 0.00     | 0.00     |   |
| vmhba32  |       |       |     |          |      | 0     | 0.00        | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     | 0.00     | 0.00     | 0.00     |   |
| vmhba4   |       |       |     |          |      | 44    | 7321.28     | 5991.23   | 1310.89   | 19.85     | 11.21    | 1.56     | 0.01     | 1.57     | 0.00     |   |
| vmhba5   |       |       |     |          |      | 1     | 0.20        | 0.00      | 0.00      | 0.00      | 0.00     | 3.24     | 0.01     | 3.25     | 0.00     |   |
|          |       |       |     |          |      |       |             |           |           |           |          |          |          |          |          |   |
|          |       |       |     |          |      |       |             |           |           |           |          |          |          |          |          |   |
|          |       |       |     |          |      |       |             |           |           |           |          |          |          |          |          |   |
|          |       |       |     |          |      |       |             |           |           |           |          |          |          |          |          |   |
|          |       |       |     |          |      |       |             |           |           |           |          |          |          |          |          |   |
|          |       |       |     |          |      |       |             |           |           |           |          |          |          |          |          |   |
|          |       |       |     |          |      |       |             |           |           |           |          |          |          |          |          |   |
|          |       |       |     |          |      |       |             |           |           |           |          |          |          |          |          |   |
|          |       |       |     |          |      |       |             |           |           |           |          |          |          |          |          |   |

#### Fixed

| P roote | a6850. | A:~  |       |           |       |       |           |           |           |           |          |          |          |          |          |  |
|---------|--------|------|-------|-----------|-------|-------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|--|
| 10:55:  | 09am - | up 1 | 4 day | 7s 7 min, | , 183 | world | s; CPU lo | ad averaç | ∫e: 0.44, | 0.24, 0.3 | .7       |          |          |          |          |  |
| ADAPT   | R CID  | TID  | LID   | NCHNS NT  | IGTS  | NLUNS | CMDS/s    | READS/s   | WRITES/s  | MBREAD/s  | MBWRTN/s | DAVG/cmd | KAVG/cmd | GAVG/cmd | QAVG/cmd |  |
| vmhba   | 0 –    |      |       | 1         | 1     | 1     | 1.61      | 0.00      | 1.61      | 0.00      | 0.01     | 0.10     | 0.01     | 0.11     | 0.00     |  |
| vmhba   |        |      |       |           |       | 44    | 2862.43   | 1492.95   | 1369.48   | 8.39      | 5.68     | 0.41     | 0.00     | 0.41     | 0.00     |  |
| vmhba   | 2 –    |      |       |           |       |       | 0.00      | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     | 0.00     | 0.00     | 0.00     |  |
| vmhba   |        |      |       |           |       |       | 0.00      | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     | 0.00     | 0.00     | 0.00     |  |
| vmhba3: | 2 –    |      |       |           |       |       | 0.00      | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     | 0.00     | 0.00     | 0.00     |  |
| vmhba   | 4 –    |      |       |           |       | 44    | 5522.48   | 4301.57   | 1220.90   | 14.15     | 5.05     | 0.28     | 0.00     | 0.28     | 0.00     |  |
| vmhba   | 5 –    |      |       |           |       |       | 0.00      | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     | 0.00     | 0.00     | 0.00     |  |
|         |        |      |       |           |       |       |           |           |           |           |          |          |          |          |          |  |
|         |        |      |       |           |       |       |           |           |           |           |          |          |          |          |          |  |
|         |        |      |       |           |       |       |           |           |           |           |          |          |          |          |          |  |
|         |        |      |       |           |       |       |           |           |           |           |          |          |          |          |          |  |
|         |        |      |       |           |       |       |           |           |           |           |          |          |          |          |          |  |
|         |        |      |       |           |       |       |           |           |           |           |          |          |          |          |          |  |
|         |        |      |       |           |       |       |           |           |           |           |          |          |          |          |          |  |
|         |        |      |       |           |       |       |           |           |           |           |          |          |          |          |          |  |
|         |        |      |       |           |       |       |           |           |           |           |          |          |          |          |          |  |

## Fibre Channel performance results

Introduction This section describes the performance test results when multipathing is handled by PowerPath/VE and connectivity is established using Fibre Channel.

PowerPath/VE works with VMware ESX as a Multipath Plug-in (MPP) that provides path management to ESX hosts. It is installed as a kernel module on the vSphere host. It will plug in to the vSphere I/O stack framework to bring the advanced multipathing capabilities of PowerPath/VE, including dynamic load balancing and automatic failover, to the vSphere hosts.

Device configuration

After PowerPath/VE is installed on a vSphere host, it claims all storage devices on which it is supported. The figure below shows that PowerPath/VE is the owner of devices on a CLARiiON CX4-480.

| Storage A | dapters  |   |   |  |  | Refre  | sh Resca   |
|-----------|--|---|---|--|--|--|--|
| Device    | T  | ype WW  | N   |  |  |  |  |
| 82801EB/  | ER (ICH5/ICH5R) IDE Cont   | roller  |   |  |  |  |  |
| 🕓 🚱 vmhb  | a5 Bl  | lock SCSI   |   |  |  |  |  |
| 🛛 🧿 vmhb  | a32 Bl   | lock SCSI   |   |  |  |  |  |
| LP10000 2 | 2Gb Fibre Channel Host Ad  | apter   |   |  |  |  |  |
| 🛛 🥝 vmhb  | oa1 Fi   | ibre Channel 20:0   | 0:00:00:c9  | :55:2d:0c 10:0   | 0:00:00:c9:55:2d:0c  |  |  |
| 🌀 vmhb    | oa4 Fi   | ibre Channel 20:0   | 0:00:00:c9  | ):55:2a:a5 10:0  | 0:00:00:c9:55:2a:a5  |  |  |
| 53c1030 F | PCI-X Fusion-MPT Dual Ulti   | ra320 SCSI  |   |  |  |  |  |
| Details   |  |   |   |  |  |  |  |
| vmhba4    |  |   |   |  |  |  |  |
| Model:    | LP10000 2Gb Fibre Channe   | el Host Adapter   |   |  |  |  |  |
| WWN:      | 20:00:00:00:c9:55:2a:a5 1  | 0:00:00:00:c9:55:2a:a                                       | 5   |  |  |  |  |
| Targets:  | : 4 Devices: 16  | Paths: 64   | 4   |  |  |  |  |
| Vioun     | Jourison Daths   |   |   |  |  |  |  |
| VICW: D   | Paulis Paulis  |   |   |  |  |  |  |
|           | Identifier   | Runtime Name  | LUN   | Туре   | Transport  | Capacity   | Owner  |
| < (naa    | naa.60060160571022004e4.   | vmhba1:C0:T0:L0   | 0   | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| < (naa    | naa.60060160571022004f4c   | vmhba1:C0:T0:L1   | 1   | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| <(naa     | naa.6006016057102200504.   | vmhba1:C0:T0:L2   | 2   | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| - (naa    | naa.600601605710220054d.   | vmhba1:C0:T0:L3   | 3   | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| <(naa     | naa.600601605710220055d.   | vmhba1:C0:T0:L4   | 4   | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| <(naa     | naa.600601605710220056d.   | vmhba1:C0:T0:L5   | 5   | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| <(naa     | naa.600601605710220057d.   | vmhba1:C0:T0:L6   | 6   | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| < (naa    | naa.6006016057102200514.   | vmhba1:C0:T0:L7   | 7   | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| < (naa    | naa.6006016057102200524.   | vmhba1:C0:T0:L8   | 8   | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| <(naa     | naa.6006016057102200534.   | vmhba1:C0:T0:L9   | 9   | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| د(naa     | naa.600601605710220058d.   | vmhba1:C0:T0:L10  | 10  | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| د(naa     | naa.6006016057102200544.   | vmhba1:C0:T0:L11  | 11  | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| د(naa     | naa.6006016057102200554.   | vmhba1:C0:T0:L12  | 12  | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| <(naa     | naa.6006016057102200564.   | vmhba1:C0:T0:L13  | 13  | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| <(naa     | naa.60060160571022001c5.   | vmhba1:C0:T0:L15  | 15  | disk   | Fibre Channel  | 50.00 GB   | PowerPath  |
| / (naa    | ppp 600601605710220050d  | vmbba1·C0·T0·L20  | 20  | disk   | Eibre Channel  | 1.05 TB  | PowerPath  |
|           | Device<br>82801EB/<br>@ vmhb<br>Device<br>82801EB/<br>@ vmhb<br>Carrier<br>Sactor<br>Details<br>View: [<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constant<br>Constan | Device         T           82801EB/ER (ICH5/ICH5R) IDE Cont | Device         Type         WW           82801EB/ER (ICH5/ICH5R) IDE Controller | Device         Type         WWN           B2801EB/ER (ICH5/ICH5R) IDE Controller         Block SCS1           Image: State of the state o | Device         Type         WWN           B2801EB/ER (ICH5/ICH5R) IDE Controller <ul></ul> | Device         Type         WWN           B2801EB/ER (ICH5/ICH5R) IDE Controller | Device         Type         WWN           B2801EB/ER (ICH5/ICH5R) IDE Controller |

# PowerPath/VEPowerPath/VE is designed to use all paths at all times. PowerPath/VE distributes I/Odynamic loadrequests to logical devices across all available paths, rather than requiring a singlebalancingpath to bear the entire I/O requests.

The figure below shows ESXTOP output. I/O requests on both vmhba1 and vmhba4 are well balanced.

| 🖉 root@6 | 850E | łt≁   |     |        |         |         |            |           |           |           |      |
|----------|------|-------|-----|--------|---------|---------|------------|-----------|-----------|-----------|------|
| 3:51:36  | pm u | ւp 32 | day | ys 1:0 | D5, 2O2 | 2 world | ls; CPU lo | ad averaç | ge: 0.46, | 0.54, 0.5 | 50 🗹 |
| ADAPTR ( | CID  | TID   | LID | NCHINS | NTGTS   | NLUNS   | CMDS/s     | READS/s   | WRITES/s  | MBREAD/s  | MBWR |
| vmhba0   |      |       |     | 1      | 1       | 1       | 0.38       | 0.00      | 0.38      | 0.00      |      |
| vmhba1   |      |       |     | 1      | 4       | 44      | 5496.03    | 1783.37   | 3712.65   | 13.98     | 1    |
| vmhba2   |      |       |     | 1      | 0       | 0       | 0.00       | 0.00      | 0.00      | 0.00      |      |
| vmhba3   |      |       |     | 1      | 0       | 0       | 0.00       | 0.00      | 0.00      | 0.00      |      |
| vmhba32  |      |       |     | 2      | 0       | 0       | 0.00       | 0.00      | 0.00      | 0.00      |      |
| vmhba4   |      |       |     | 1      | 4       | 44      | 5419.16    | 1793.67   | 3625.49   | 14.02     | 1    |
| vmhba5   |      |       |     | 2      | 1       | 1       | 0.00       | 0.00      | 0.00      | 0.00      |      |
|          |      |       |     |        |         |         |            |           |           |           |      |
|          |      |       |     |        |         |         |            |           |           |           |      |

PowerPath/VE also provides a command line tool for path management. The figure below shows each device has two optimal paths to handle I/O requests. As noticed earlier, it also showed the I/O requests are balanced between two paths.

| 🖨 root@6850B;~                                      |                    |                   |                    |                        |                           |            | × |
|---|--------------------|-------------------|--------------------|------------------------|---------------------------|------------|---|
| Host Bus Adapters<br>### HW Path                    | I<br>Summary       | /O Paths<br>Total | ======<br><br>Dead | ========<br><br>TO/Sec | =======<br>Stats<br>0-10s | <br>Frrors | ~ |
|   | =========          | ========          | ======             | ========               | Q=108<br>======           | ======     |   |
| 1 vmhba4<br>2 vmhba1                                | optimal<br>optimal | 44<br>44          | 0<br>0             | 3741<br>3771           | 4<br>3                    | 0<br>0     |   |
| CLARiiON logical device count=11                    |                    |                   | ======             |                        |                           |            |   |
| Host Bus Adapters<br>### HW Path                    | I<br>Summary       | /O Paths<br>Total | Dead               | <br>IO/Sec             | Stats<br>Q-IOs            | Errors     |   |
| 1 vmhba4<br>2 vmhba1                                | optimal<br>optimal | 44<br>44<br>44    | <br>0<br>0         | 2585<br>2632           | 1<br>2                    | 0<br>0     |   |
| CLARiiON logical device count=11                    |                    |                   |                    |                        |                           |            |   |
| Host Bus Adapters                                   | I                  | /O Paths          |                    |                        | Stats                     |            |   |
| ### HW Path<br>==================================== | Summary<br>======= | Total             | Dead               | IO/Sec<br>=======      | Q-IOs<br>======           | Errors     |   |
| 1 vmhba4<br>2 vmhba1                                | optimal<br>optimal | 44<br>44          | 0<br>0             | 3755<br>3753           | 5<br>5                    | 0<br>0     | Ę |
|   |                    |                   |                    |                        |                           |            | ~ |

The following two figures show the path status and LUN status.

#### Path Status

| re                    | Storage Adapters  |                                   |                  |              |          |                | Refresh | Rescan. |
|-----------------------|-------------------|-----------------------------------|------------------|--------------|----------|----------------|---------|---------|
| accord                | Device            | Туре                              | WWN              |              |          |                |         |         |
| 070                   | 82801EB/ER (ICH5  | /ICH5R) IDE Controller            |                  |              |          |                |         |         |
| ory                   | 🔄 vmhba5          | Block SCSI                        |                  |              |          |                |         |         |
| aye                   | 🕒 🚱 vmhba32       | Block SCSI                        |                  |              |          |                |         |         |
| orking                | LP10000 2Gb Fibre | Channel Host Adapter              |                  |              |          |                |         |         |
| Adapters              | 🕝 vmhba1          | Fibre Channel                     | 20:00:00:00:c9   | :55:2d:0c 10 | :00:00:0 | 00:c9:55:2d:0c |         |         |
| lapters               | 🕝 vmhba4          | Fibre Channel                     | 20:00:00:00:c9   | :55:2a:a5 10 | :00:00:0 | 00:c9:55:2a:a5 |         |         |
| tings                 | 53c1030 PCI-X Fus | ion-MPT Dual Ultra320 SCSI        |                  |              |          |                |         |         |
|                       | Details           |                                   |                  |              |          |                |         |         |
|                       | vmhba1            |                                   |                  |              |          |                |         |         |
| eatures               | Model: LP1000     | 0 2Gb Fibre Channel Host Adapter  |                  |              |          |                |         |         |
| guration              | WWN: 20:00:0      | 0:00:c9:55:2d:0c 10:00:00:00:c9:5 | 5:2d:0c          |              |          |                |         |         |
| outing                | Targets: 4        | Devices: 11 Paths:                | 44               |              |          |                |         |         |
| ement                 | Uinum Daviana II  |                                   |                  |              |          |                |         |         |
| ine Startup/Shutdown  | VIEW: Devices     | aths                              |                  |              |          |                |         |         |
| ine Swapfile Location | Runtime Name      | Target                            |                  | LUN 🗠        | Statu    | s              |         |         |
|                       | vmhba1:C0:T0:L1   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:61:3c:e0:15:35 | 1            | •        | Active         |         |         |
| ce Allocation         | vmhba1:C0:T3:L2   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:68:3c:e0:15:35 | 2            | •        | Active         |         |         |
| ;                     | vmhba1:C0:T2:L2   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:60:3c:e0:15:35 | 2            | •        | Active         |         |         |
|                       | vmhba1:C0:T1:L2   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:69:3c:e0:15:35 | 2            | •        | Active         |         |         |
|                       | vmhba1:C0:T0:L2   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:61:3c:e0:15:35 | 2            | •        | Active         |         |         |
|                       | vmhba1:C0:T3:L7   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:68:3c:e0:15:35 | 7            | •        | Active         |         |         |
|                       | vmhba1:C0:T2:L7   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:60:3c:e0:15:35 | 7            |          | Active         |         |         |
|                       | vmhba1:C0:T1:L7   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:69:3c:e0:15:35 | 7            |          | Active         |         |         |
|                       | Vmhba1:CU:TU:L7   | 50:06:01:60:00:15:35 50:06:0      | 1:61:30:e0:15:35 | <i>'</i>     |          | Active         |         |         |
|                       | Vmnba1:C0:13:L8   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:68:30:e0:15:35 | 8            |          | Active         |         |         |
|                       | vmhba1;C0;T2;L8   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:00:30:00:15:35 | 0            |          | Active         |         |         |
|                       | vmbba1:C0:T0:L8   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:61:3c:e0:15:35 | 8            |          | Active         |         |         |
|                       | vmbba1:C0:T3:L9   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:68:3c:e0:15:35 | 9            |          | Active         |         |         |
|                       | vmbha1:C0:T2:L9   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:60:3c:e0:15:35 | 9            |          | Active         |         |         |
|                       | vmhba1:C0:T1:L9   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:69:3c:e0:15:35 | 9            |          | Active         |         |         |
|                       | vmhba1:C0:T0:L9   | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:61:3c:e0:15:35 | 9            | •        | Active         |         |         |
|                       | vmhba1:C0:T2:L11  | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:60:3c:e0:15:35 | 11           | •        | Active         |         |         |
|                       | vmhba1:C0:T3:L11  | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:68:3c:e0:15:35 | 11           | •        | Active         |         |         |
|                       | vmhba1:C0:T0:L11  | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:61:3c:e0:15:35 | 11           |          | Active         |         |         |
|                       | vmhba1:C0:T1:L11  | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:69:3c:e0:15:35 | 11           |          | Active         |         |         |
|                       | vmhba1:C0:T2:L12  | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:60:3c:e0:15:35 | 12           | •        | Active         |         |         |
|                       | vmbha1:C0:T3:L12  | 50:06:01:60:bc:e0:15:35 50:06:0   | 1:68:3c:e0:15:35 | 12           | •        | Active         |         |         |

#### LUN Status

| 🗿 DGC Fibre Cha                      | nnel Disk (naa. 60060160571022004e4c1b383  | i5cde11) M   | anage Paths                   |                    |
|--------------------------------------|--|--------------|-------------------------------|--------------------|
| Policy                               |  |              |                               |                    |
| Path Selection:                      |  |              |                               | ~                  |
| Storage Array Tvi                    | De:  |              |                               |                    |
|                                      |  |              |                               |                    |
| Paths                                |  |              |                               |                    |
| Runtime Name                         | Target   | LUN          | Status                        | <u>^</u>           |
| vmhba4:C0:T1:L0                      | 50:06:01:60:bc:e0:15:35 50:06:01:61:3c:e0:15:35  | 0            | Active                        |                    |
| vmhba4:C0:T2:L0                      | 50:06:01:60:bc:e0:15:35 50:06:01:68:3c:e0:15:35  | 0            | <ul> <li>Active</li> </ul>    |                    |
| vmhba4:C0:T3:L0                      | 50:06:01:60:bc:e0:15:35 50:06:01:60:3c:e0:15:35  | 0            | le Active                     |                    |
| vmhba4:C0:T0:L0                      | 50:06:01:60:bc:e0:15:35 50:06:01:69:3c:e0:15:35  | 0            | 🔶 Active                      |                    |
| vmhba1:C0:T0:L0                      | 50:06:01:60:bc:e0:15:35 50:06:01:61:3c:e0:15:35  | 0            | 🔶 Active                      |                    |
| vmhba1:C0:T1:L0                      | 50:06:01:60:bc:e0:15:35 50:06:01:69:3c:e0:15:35  | 0            | 🔶 Active                      |                    |
| vmhba1:C0:T2:L0                      | 50:06:01:60:bc:e0:15:35 50:06:01:60:3c:e0:15:35  | 0            | 🔶 Active                      | ✓                  |
| Name:<br>Runtime Name:               | fc.20000000c9552aa5:10000000c9552aa5-fc.50060160bce<br>vmhba4:C0:T1:L0                             | 01535:500601 | 613ce01535-naa.60060160571022 | Refresh            |
| Fibre Channel<br>Adapter:<br>Target: | 20:00:00:00:c9:55:2a:a5 10:00:00:00:c9:55:2a:a5<br>50:06:01:60:bc:e0:15:35 50:06:01:61:3c:e0:15:35 |              |                               |                    |
|                                      |  |              |                               | Close <u>H</u> elp |

# Front-endIn this test, we simulate the path failure on the front end by disabling the HBA port on<br/>a Fibre Channel switch.

In the following figure, ESXTOP shows that only one path handles I/O requests.

| 🛃 root@( | 6850E | 8:~   |       |        |         |         |            |           |           |           |          | 2        |    |
|----------|-------|-------|-------|--------|---------|---------|------------|-----------|-----------|-----------|----------|----------|----|
| 1:01:1:  | ו 1pm | up 32 | 2 day | ys 22: | 15, 202 | 2 world | s; CPU lo: | ad averaç | ge: O.66, | 0.61, 0.2 | 29       |          | ^  |
| ADAPTR   | CID   | TID   | LID   | NCHNS  | NTGTS   | NLUNS   | CMDS/s     | READS/s   | WRITES/s  | MBREAD/s  | MBWRTN/s | DAVG/cmd | KA |
| vmhba0   |       |       |       | 1      | 1       | 1       | 20.68      | 0.00      | 20.68     | 0.00      | 2.91     | 0.35     |    |
| vmhba1   |       |       |       | 1      | 4       | 44      | 0.00       | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     |    |
| vmhba2   |       |       |       | 1      | 0       | 0       | 0.00       | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     |    |
| vmhba3   |       |       |       | 1      | 0       | 0       | 0.00       | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     |    |
| vmhba32  |       |       |       | 2      | 0       | 0       | 0.00       | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     |    |
| vmhba4   |       |       |       | 1      | 4       | 44      | 3224.82    | 3208.36   | 16.46     | 12.04     | 0.05     | 0.25     |    |
| vmhba5   |       |       |       | 2      | 1       | 1       | 0.00       | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     |    |

In the following figure, the powermt utility shows only one path is optimal and the other path is failed.

| 🖻 root@6850B;~   |                                 |                              |                   |                      |                |             | × |
|--|---------------------------------|------------------------------|-------------------|----------------------|----------------|-------------|---|
| Host Bus Adapters<br>### HW Path                                       | ========<br>I/<br>Summary       | eeeeeeee<br>O Paths<br>Total | <br>Dead          | <br>IO/Sec           | Stats<br>Q-IOs | Errors      | ~ |
| 1 vmhba4<br>2 vmhba1   | eeeeeeeeee<br>optimal<br>failed | =======<br>44<br>44          | ======<br>0<br>44 | =======<br>1668<br>0 | <br>8<br>0     | <br>0<br>44 |   |
| CLARiiON logical device count=11<br>================================== |                                 |                              |                   |                      |                |             |   |
| Host Bus Adapters<br>### HW Path<br>                                   | I/<br>Summary                   | O Paths<br>Total             | Dead              | <br>I0/Sec           | Stats<br>Q-IOs | Errors      |   |
| 1 vmhba4<br>2 vmhba1   | optimal<br>failed               | 44<br>44<br>44               | <br>0<br>44       | 3264<br>0            | 22<br>0        | <br>0<br>44 |   |
| CLARiiON logical device count=11                                       |                                 |                              |                   |                      |                |             |   |
| Host Bus Adapters<br>### HW Path                                       | I/<br>Summary                   | O Paths<br>Total             | Dead              | <br>IO/Sec           | Stats<br>Q-IOs | Errors      |   |
| 1 vmhba4<br>2 vmhba1   | optimal<br>failed               | =======<br>44<br>44          | ======<br>0<br>44 | 1151<br>0            | <br>7<br>0     | <br>0<br>44 | E |
|  |                                 |                              |                   |                      |                |             | ~ |

| dware                        | Storage Adapters | •                                 |                    |              |                      |                  | Refresh |
|------------------------------|------------------|-----------------------------------|--------------------|--------------|----------------------|------------------|---------|
| oressors                     | Device           | Туре                              | WWN                |              |                      |                  |         |
| lemenu                       | 82801EB/ER (ICH  | 5/ICH5R) IDE Controller           |                    |              |                      |                  |         |
| herrory                      | 🌍 vmhba5         | Block SCSI                        |                    |              |                      |                  |         |
|                              | 🌀 vmhba32        | Block SCSI                        |                    |              |                      |                  |         |
| etworking                    | LP10000 2Gb Fibr | e Channel Host Adapter            |                    |              |                      |                  | _       |
| rage Adapters                | 🕝 vmhba1         | Fibre Channel                     | 20:00:00:00:c9     | :55:2d:0c 10 | ):00:00              | ):00:c9:55:2d:0c |         |
| vork Adapters                | 🕝 vmhba4         | Fibre Channel                     | 20:00:00:00:c9     | :55:2a:a5 10 | :00:00               | ):00:c9:55:2a:a5 |         |
| nced Settings                | 53c1030 PCI-X Fu | ision-MPT Dual Ultra320 SCSI      |                    |              |                      |                  |         |
|                              | Details          |                                   |                    |              |                      |                  |         |
|                              | vmhba1           |                                   |                    |              |                      |                  |         |
| insed reatures               | Model: LP100     | 000 2Gb Fibre Channel Host Adapte | r                  |              |                      |                  |         |
| ne Configuration             | WWN: 20:00       | :00:00:c9:55:2d:0c 10:00:00:00:c9 | 9:55:2d:0c         |              |                      |                  |         |
| 5 and Routing                | Targets: 4       | Devices: 11 Pat                   | ns: 44             |              |                      |                  |         |
| er Management                | Day .            | D-th-                             |                    |              |                      |                  |         |
| ial Machine Startup/Shutdown | View: Devices    | Paths                             |                    |              |                      |                  |         |
| al Machine Swapfile Location | Runtime Name     | Target                            |                    | LUN 🗠        | Stat                 | tus              |         |
| rity Profile                 | vmhba1:C0:T3:L0  | 50:06:01:60:bc:e0:15:35 50:06     | :01:68:3c:e0:15:35 | 0            | - 🔶                  | Active           |         |
| em Resource Allocation       | vmhba1:C0:T2:L0  |                                   |                    | 0            | 0                    | Dead             |         |
| oced Settings                | vmhba1:C0:T1:L0  | 50:06:01:60:bc:e0:15:35 50:06     | :01:69:3c:e0:15:35 | 0            | •                    | Active           |         |
|                              | vmhba1:C0:T0:L0  |                                   |                    | 0            | •                    | Dead             |         |
|                              | vmhba1:C0:T3:L1  | 50:06:01:60:bc:e0:15:35 50:06     | :01:68:3c:e0:15:35 | 1            | •                    | Active           |         |
|                              | vmhba1:C0:T2:L1  |                                   |                    | 1            | <ul> <li></li> </ul> | Dead             |         |
|                              | vmhba1:C0:T1:L1  | 50:06:01:60:bc:e0:15:35 50:06     | :01:69:3c:e0:15:35 | 1            | •                    | Active           |         |
|                              | vmhba1:C0:T0:L1  |                                   |                    | 1            | <ul> <li></li> </ul> | Dead             |         |
|                              | vmhba1:C0:T3:L2  | 50:06:01:60:bc:e0:15:35 50:06     | :01:68:3c:e0:15:35 | 2            | •                    | Active           |         |
|                              | vmhba1:C0:T2:L2  |                                   |                    | 2            | 0                    | Dead             |         |
|                              | vmhba1:C0:T1:L2  | 50:06:01:60:bc:e0:15:35 50:06     | :01:69:3c:e0:15:35 | 2            | •                    | Active           |         |
|                              | vmhba1:C0:T0:L2  |                                   |                    | 2            | $\diamond$           | Dead             |         |
|                              | vmhba1:C0:T3:L7  | 50:06:01:60:bc:e0:15:35 50:06     | :01:68:3c:e0:15:35 | 7            | •                    | Active           |         |
|                              | vmhba1:C0:T2:L7  |                                   |                    | 7            | 0                    | Dead             |         |
|                              | vmhba1:C0:T1:L7  | 50:06:01:60:bc:e0:15:35 50:06     | :01:69:3c:e0:15:35 | 7            | •                    | Active           |         |
|                              | vmhba1:C0:T0:L7  |                                   |                    | 7            | 0                    | Dead             |         |
|                              | vmhba1:C0:T3:L8  | 50:06:01:60:bc:e0:15:35 50:06     | :01:68:3c:e0:15:35 | 8            | •                    | Active           |         |
|                              | vmhba1:C0:T2:L8  |                                   |                    | 8            | $\diamond$           | Dead             |         |
|                              | vmhba1:C0:T1:L8  | 50:06:01:60:bc:e0:15:35 50:06     | :01:69:3c:e0:15:35 | 8            | •                    | Active           |         |
|                              | vmhba1:C0:T0:L8  |                                   |                    | 8            | 0                    | Dead             |         |
|                              | vmhba1:C0:T3:L9  | 50:06:01:60:bc:e0:15:35 50:06     | :01:68:3c:e0:15:35 | 9            | •                    | Active           |         |
|                              | vmhba1:C0:T2:L9  |                                   |                    | 9            |                      | Dead             |         |

In the following figure, vCenter also shows one path is dead.

After enabling the port on the Fibre Channel switch, the failed path will be automatically restored on a path test or bus rescan within a maximum 360 seconds. Issuing a manual "powermt restore" will restore the failed path immediately.

# Back-end failover results

We simulate the back-end failure by disabling CLARiiON SP ports on the Fibre Channel switch. When one port on each SP is disabled, both paths went into degraded mode, as shown in the following figure.

| 🖉 root@6850B:~                                      |                      |                             |                    |              |                          |                |   |
|---|----------------------|-----------------------------|--------------------|--------------|--------------------------|----------------|---|
| Host Bus Adapters<br>### HW Path                    | I/0<br>Summarv       | =======<br>) Paths<br>Total | ======<br><br>Dead | <br>IO/Sec   | ======<br>Stats<br>0-10s | Errors         | ^ |
| 1 vmhba4  | degraded             | 44                          | 22                 | 3480         | 3                        | 22             |   |
| 2 vmhbal<br>CLARiiON logical device count=11        | degraded             | 44                          | 22                 | 3609         | 4                        | 22             |   |
| Host Bus Adapters                                   | I/:                  | =======<br>)                | ======<br>         |              | Stats                    |                |   |
| ### HW Path<br>==================================== | Summary              | Total                       | Dead<br>======     | IO/Sec       | Q-IOs                    | Errors         |   |
| 1 vmhba4<br>2 vmhba1                                | degraded<br>degraded | 44<br>44                    | 22<br>22           | 3473<br>3346 | 5<br>5                   | 22<br>22       |   |
| CLARiiON logical device count=11                    |                      |                             | :                  |              |                          |                |   |
| Host Bus Adapters<br>### HW Path                    | I/0<br>Summary       | ) Paths<br>Total            | Dead               | IO/Sec       | Stats<br>Q-IOs           | <br>Errors     |   |
|   | degraded<br>degraded | =======<br>44<br>44         | 22<br>22<br>22     | 2640<br>2751 | <br>5<br>6               | 22<br>22<br>22 |   |
|   |                      |                             |                    |              |                          |                | * |

#### The following figure shows that only one SP port has active I/O requests.

| 🛃 root@f | 6850E | 3t~   |     |                  |         |          |           |           |           |           |          | 2        |    |
|----------|-------|-------|-----|------------------|---------|----------|-----------|-----------|-----------|-----------|----------|----------|----|
| 1:09:03  | ipm u | ıp 32 | day | 78 22 <b>:</b> 2 | 23, 203 | 3 world: | s; CPU lo | ad averaç | ge: 0.81, | 0.55, 0.5 | 55       |          | ~  |
| ADAPTR   | CID   | TID   | LID | NCHNS            | NTGTS   | NLUNS    | CMDS/s    | READS/s   | WRITES/s  | MBREAD/s  | MBWRTN/s | DAVG/cmd | KA |
| vmhba0   |       |       |     | 1                | 1       | 1        | 0.76      | 0.00      | 0.76      | 0.00      | 0.01     | 0.11     |    |
| vmhba1   |       |       |     | 1                | 4       | 44       | 2872.28   | 2395.06   | 474.93    | 11.23     | 8.13     | 1.46     |    |
| vmhba2   |       |       |     | 1                | 0       | 0        | 0.00      | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     |    |
| vmhba3   |       |       |     | 1                | 0       | 0        | 0.00      | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     |    |
| vmhba32  |       |       |     | 2                | 0       | 0        | 0.00      | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     |    |
| vmhba4   |       |       |     | 1                | 4       | 44       | 2857.59   | 2350.43   | 504.88    | 11.05     | 7.04     | 1.45     |    |
| vmhba5   |       |       |     | 2                | 1       | 1        | 0.00      | 0.00      | 0.00      | 0.00      | 0.00     | 0.00     |    |
|          |       |       |     |                  |         |          |           |           |           |           |          |          | -  |
|          |       |       |     |                  |         |          |           |           |           |           |          |          |    |
|          |       |       |     |                  |         |          |           |           |           |           |          |          |    |

| 🛃 root@6850B:~                    |           |           |        |          |       |         | ×      |
|-----------------------------------|-----------|-----------|--------|----------|-------|---------|--------|
|                                   |           |           | ====== |          |       |         | ~      |
| Host Bus Adapters                 | I         | /O Paths  |        |          | Stats |         |        |
| ### HW Path                       | Summary   | Total     | Dead   | IO/Sec   | 0-I0s | Errors  |        |
|                                   | ========= | ========= |        | ======== |       |         |        |
| 1 ymbha4                          | ontimal   | 44        | Ω      | 2964     | 8     | Ω       |        |
| 2 sombhai                         | optimal   | лл<br>44  | 0<br>0 | 3115     | 6     | 0<br>0  |        |
| 2 Vilibar                         | opcimai   |           | U      | 5115     | U     | 0       |        |
| CLADICAN Levinel device reported1 |           |           |        |          |       |         |        |
| CLARITON TOGICAL device count=11  |           |           |        |          |       |         |        |
|                                   |           |           |        |          |       |         |        |
| Host Bus Adapters                 | I         | /O Paths  |        |          | Stats |         |        |
| ### HW Path                       | Summary   | Total     | Dead   | IO/Sec   | Q-IOs | Errors  |        |
|                                   |           |           |        |          |       |         |        |
| 1 vmhba4                          | optimal   | 44        | 0      | 3469     | 4     | 0       |        |
| 2 vmhbal                          | optimal   | 44        | 0      | 3479     | 4     | 0       |        |
|                                   |           |           |        |          |       |         |        |
| CLARiiON logical device count=11  |           |           |        |          |       |         |        |
| -                                 |           |           |        |          |       |         |        |
| Host Bus Adapters                 | I         | /O Paths  |        |          | Stats |         |        |
| ### HW Path                       | Summary   | Total     | Dead   | TO/Sec   | 0-103 | Errors  |        |
| no i don                          |           | ========= | ====== | ======== | ·     | ======= |        |
| 1 mulled                          | ontimol   |           |        | 2055     | ~ ~   |         |        |
|                                   | optimal   | 44        | 0      | 2900     |       | 0       | 170    |
| 2 Vmnbal                          | optimal   | 44        | U      | 2796     | 2     | U       | 厚      |
|                                   |           |           |        |          |       |         |        |
|                                   |           |           |        |          |       |         | $\sim$ |

After the SP ports were enabled again, both paths are back to the optimal mode as shown in the following two figures.

| 🖉 root@f | 6850E | 8:~   |       |                  |         |         |            |           |           |           |          |         |     |
|----------|-------|-------|-------|------------------|---------|---------|------------|-----------|-----------|-----------|----------|---------|-----|
| 1:11:30  | )pm ເ | ıp 32 | 2 day | 78 22 <b>:</b> 2 | 25, 202 | 2 world | s; CPU loa | ad averaç | ge: 0.75, | 0.74, 0.6 | 53       |         | ^   |
| NUNDER   | CID   | TID   | LTD   | NCHMS            | MTGTS   | MUUNS   | CMDS/s     | READS/S   | NRITES/s  | MBRF0D/s  | MBNRTN/s | DWG/cmd | KD  |
| vmhba0   |       | -     | -     | 1                | 1       | 1       | 1.61       | 0.00      | 1.61      | 0.00      | 0.02     | 0.10    | nn. |
| vmhba1   |       |       |       | 1                | 4       | 44      | 4817.36    | 1838.88   | 2978.48   | 8.57      | 16.25    | 1.46    |     |
| vmhba2   |       |       |       | 1                | 0       | 0       | 0.00       | 0.00      | 0.00      | 0.00      | 0.00     | 0.00    |     |
| vmhba3   |       |       |       | 1                | 0       | 0       | 0.00       | 0.00      | 0.00      | 0.00      | 0.00     | 0.00    |     |
| vmhba32  |       |       |       | 2                | 0       | 0       | 0.00       | 0.00      | 0.00      | 0.00      | 0.00     | 0.00    |     |
| vmhba4   |       |       |       | 1                | 4       | 44      | 4704.53    | 1873.62   | 2830.91   | 8.78      | 14.88    | 1.48    |     |
| vmhba5   |       |       |       | 2                | 1       | 1       | 0.00       | 0.00      | 0.00      | 0.00      | 0.00     | 0.00    |     |
|          |       |       |       |                  |         |         |            |           |           |           |          |         | 100 |
|          |       |       |       |                  |         |         |            |           |           |           |          |         |     |
|          |       |       |       |                  |         |         |            |           |           |           |          |         |     |

#### **iSCSI** performance results

Introduction This section describes the performance test results when multipathing is handled by PowerPath/VE and connectivity is established using iSCSI.

PowerPath/VE works with VMware ESX as a Multipath Plug-in (MPP) that provides path management to ESX hosts. It is installed as a kernel module on the vSphere host. It will plug in to the vSphere I/O stack framework to bring the advanced multipathing capabilities of PowerPath/VE, including dynamic load balancing and automatic failover, to the vSphere hosts.

Environment<br/>configurationPerformance tests conducted for iSCSI included 10 virtual machines. They are as<br/>follows

- 3 Oracle Simulators (using ORION software)
- 4 SQL Simulators (using SQL lostress)
- 3 Exchange Simulators (using Jetstress)

The following illustration shows the test environment configuration.



Single-pathThe following figure shows a screenshot of the PowerPath/VE host with only oneload-balancingpath.results

| 24am up 7 days 21:09, 211 worlds; CFU load average: 0.23, 0.15, 0.14           T-ID         USED-BY         TEAM-PNIC DNAME         PKTTX/s         MDTX/s         PXTRX/s         MDRX/s         ADRPIX         SDRPX           7217         Management         h/a v\$witch0         0.00         0.00         0.00         0.00         0.00         0.00         0.00           7218         vmnic8         - v\$witch0         148.30         0.81         111.58         0.06         0.00         0.00           7220         4096.vswif0         vmnic8 v\$witch0         148.30         0.81         9.54         0.00         0.00         0.00           7235         6253:VM164         vmnic8 v\$witch0         0.00         0.00         1.91         0.00         0.00         0.00           7236         6317:VM145         CX_LUN12         vmnic8 v\$witch0         0.00         0.00         1.91         0.00         0.00         0.00           7240         6347:VM146         CX_LUN1         vmnic8 v\$witch0         0.00         0.00         1.91         0.00         0.00         0.00           7240         637:VM146         CX_LUN1         vmnic8 v\$witch0         0.00         0.00         1.91         0.00         0.00 <th>root@6850</th> <th>)B:~</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>S</th>  | root@6850 | )B:~                 |             |              |             |        |          |        |                   | S      |
|---|-----------|----------------------|-------------|--------------|-------------|--------|----------|--------|-------------------|--------|
| TI-ID         USED-BY         TEAM-PNIC DNAME         PKTTX/s         MbTX/s         PKTRX/s         NDRX/s         \$DRPTX         \$DRPTX         \$DRPTX           7217         Management         n/a         vSwitch0         0.00 </th <th>:40:24am</th> <th>up 7 days 21:09, 211</th> <th>worlds; CPU</th> <th>load average</th> <th>0.23, 0.15,</th> <th>0.14</th> <th></th> <th></th> <th></th> <th></th> | :40:24am  | up 7 days 21:09, 211 | worlds; CPU | load average | 0.23, 0.15, | 0.14   |          |        |                   |        |
| 77217       Management       n/a vSwitch0       0.00  | PORT-ID   | USED-BY              | TEAM-PNIC   | DNAME        | PKTTX/s     | MbTX/s | PKTRX/s  | MbRX/s | <pre>%DRPTX</pre> | *DRPRX |
| 7718       Vmnic8       - vSwitch0       148.30       0.81       111.58       0.06       0.00       0.00         7219       vmk0       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7220       4096:vswif0       vmnic8       vSwitch0       148.30       0.81       9.54       0.00       0.00       0.00         7237       6351:VM164       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7237       6317:VM145       LUNN       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7238       6317:VM145       CX LUNN       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7240       6347:VM146       CX LUNN       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7244       6478:VM147_CX LUNN       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7244       6478:VM147_CX LUNN       vmnic8       vSwitch1       0.00   | 6777217   | Management           | n/a         | vSwitch0     | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| T219       vnk0       vnnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7220       4096;vswif0       vnnic8       vSwitch0       148.30       0.81       9.54       0.00   | 6777218   | vmnic8               |             | vSwitch0     | 148.30      | 0.81   | 111.58   | 0.06   | 0.00              | 0.00   |
| 7220       4096:vswif0       vmnic8       vSwitch0       148.30       0.81       9.54       0.00       0.00       0.00         7235       6259:VM164       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7236       637:VM145_CX_LUN8       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7237       6310:VM149_CX_LUN12       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7238       6310:VM149_CX_LUN11       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7240       6347:VM148_CX_LUN1       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7242       6400:VM147_CX_LUN10       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7243       6450:VM101_CX_LUN7       vmnic8       vSwitch1       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00   | 6777219   | vmk0                 | vmnic8      | vSwitch0     | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 7735       6259:VM164       Vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7726       6271:VM160       Vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         77287       6317:VM145_CX_LUN8       Vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7728       6317:VM146_CX_LUN1       Vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         77240       6347:VM146_CX_LUN1       Vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         77241       6393:VM146_CX_LUN6       Vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         77243       6450:VM10_CX_LUN6       Vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         77243       6450:VM10_CX_LUN6       Vmnic8       vSwitch1       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00   | 6777220   | 4096:vswif0          | vmnic8      | vSwitch0     | 148.30      | 0.81   | 9.54     | 0.00   | 0.00              | 0.00   |
| 7736       6271:VM160       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7237       6317:VM145_CX_LUN2       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7238       6310:VM149_CX_LUN12       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7239       6347:VM148_CX_LUN11       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7241       6393:VM146_CX_LUNN       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7244       6450:VM101_CX_LUNN       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7244       6786:VM103_CX_LUNN       vmnic8       vSwitch1       0.00 <td>6777235</td> <td>6259:VM164</td> <td>vmnic8</td> <td>vSwitch0</td> <td>0.00</td> <td>0.00</td> <td>1.91</td> <td>0.00</td> <td>0.00</td> <td>0.00</td>   | 6777235   | 6259:VM164           | vmnic8      | vSwitch0     | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 7237       6317:VM145_CX_LUN8       vmnic8 vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7238       6351:VM146_CX_LUN12       vmnic8 vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7239       6351:VM146_CX_LUN1       vmnic8 vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7240       6437:VM146_CX_LUN1       vmnic8 vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7241       6439:VM146_CX_LUN1       vmnic8 vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7244       6786:VM103_CX_LUN8       vmnic8 vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7244       6786:VM103_CX_LUN7       vmnic8 vSwitch1       0.00<   | 6777236   | 6271:VM160           | vmnic8      | vSwitch0     | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 77238       6310:VM149_CX_LUN12       vmmic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7239       6351:VM146_CX_LUN11       vmmic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7240       6347:VM146_CX_LUN11       vmmic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7241       6393:VM146_CX_LUN10       vmmic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7243       6450:VM101_CX_LUN6       vmmic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7244       6786:VM103_CX_LUN7       vmmic8       vSwitch0       0.00  | 5777237   | 6317:VM145 CX LUN8   | vmnic8      | vSwitch0     | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 7239       6351:VM162       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7240       6331:VM148       CX       LUN11       vmmic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7241       6331:VM146       CX       LUN1       vmmic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7242       6450:VM101       CX       LUN7       vmnic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7244       6786:VM103       CX       LUN7       vmnic8       vSwitch1       0.00 </td <td>6777238</td> <td>6310:VM149 CX LUN12</td> <td>vmnic8</td> <td>vSwitch0</td> <td>0.00</td> <td>0.00</td> <td>1.91</td> <td>0.00</td> <td>0.00</td> <td>0.00</td>  | 6777238   | 6310:VM149 CX LUN12  | vmnic8      | vSwitch0     | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 7240       6347:VM148_CX_LUN11       vmnic8 vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7241       6393:VM146_CX_LUN9       vmnic8 vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7242       6400:VM147_CX_LUN10       vmnic8 vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7243       6550:VM105_CX_LUN7       vmnic8 vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7243       6560:VM103_CX_LUN7       vmnic8 vSwitch1       0.00   | 6777239   | 6351:VM162           | vmnic8      | vSwitch0     | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$  | 6777240   | 6347:VM148 CX LUN11  | vmnic8      | vSwitch0     | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 77242       6400:VM147_CX_LUN10       vmmic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         7243       6450:VM103_CX_LUN7       vmmic8       vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         4433       Management       n/a       vSwitch1       0.00 </td <td>6777241</td> <td>6393:VM146 CX LUN9</td> <td>vmnic8</td> <td>vSwitch0</td> <td>0.00</td> <td>0.00</td> <td>1.91</td> <td>0.00</td> <td>0.00</td> <td>0.00</td>   | 6777241   | 6393:VM146 CX LUN9   | vmnic8      | vSwitch0     | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$  | 6777242   | 6400:VM147 CX LUN10  | vmnic8      | vSwitch0     | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 77244       6786:VM103_CX_LUN7       vmmic8 vSwitch0       0.00       0.00       1.91       0.00       0.00       0.00         74433       Management       n/a vSwitch1       0.00  | 6777243   | 6450:VM101 CX LUN6   | vmnic8      | vSwitch0     | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 44433       Management       n/a vSwitch1       0.00  | 6777244   | 6786:VM103 CX LUN7   | vmnic8      | vSwitch0     | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 4434       vmnic10       - vSwitch1       0.00 </td <td>3554433</td> <td>Management</td> <td>n/a</td> <td>vSwitch1</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td>  | 3554433   | Management           | n/a         | vSwitch1     | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 4435       vmk1       vmnic10       vSwitch1       0.00 <td>3554434</td> <td>vmnic10</td> <td></td> <td>vSwitch1</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td>   | 3554434   | vmnic10              |             | vSwitch1     | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| Management         n/a vSwitch2         0.00 <td>3554435</td> <td>vmk1</td> <td>vmnic10</td> <td>vSwitch1</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td>                           | 3554435   | vmk1                 | vmnic10     | vSwitch1     | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 11653       vmk3       fallback vSwitch2       0.95       0.00       0   | 0331649   | Management           | n/a         | vSwitch2     | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 1655         vmnic4         - vSwitch2         0.95         0.00   | 0331653   | vmk3                 | fallback    | vSwitch2     | 0.95        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| Management         -         DvsPortset-0         0.00  | 0331655   | vmnic4               |             | vSwitch2     | 0.95        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 120         DwsPortset-0         0.00  | 7108865   | Management           |             | DvsPortset-0 | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 8867       121       - DvsPortset-0       0.00 </td <td>7108866</td> <td>120</td> <td></td> <td>DvsPortset-0</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td>  | 7108866   | 120                  |             | DvsPortset-0 | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 122         -         DvsPortset-0         0.00   | 7108867   | 121                  |             | DvsPortset-0 | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 123         - DwsPortset-0         0.00  | 7108868   | 122                  |             | DvsPortset-0 | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 124         - DwsPortset-0         0.00  | 7108869   | 123                  |             | DvsPortset-0 | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 125       - DvsPortset-0       0.00 </td <td>7108870</td> <td>124</td> <td></td> <td>DvsPortset-0</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td>  | 7108870   | 124                  |             | DvsPortset-0 | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 126         DvsPortset-0         0.00  | 7108871   | 125                  |             | DvsPortset-0 | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 6687         Management         n/a vSwitch3         0.00 <td>7108872</td> <td>126</td> <td></td> <td>DvsPortset-0</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td>                               | 7108872   | 126                  |             | DvsPortset-0 | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 16089         vmk2         vmnic5         vSwitch3         10100.84         596.90         31846.52         67.28         0.00         0.00           16090         vmnic5         -         vSwitch3         10100.36         596.81         40291.79         71.50         0.00         0.00  | 3886087   | Management           | n/a         | vSwitch3     | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 10100.36 596.81 40291.79 71.50 0.00 0.00  | 3886089   | vmk2                 | vmnic5      | vSwitch3     | 10100.84    | 596.90 | 31846.52 | 67.28  | 0.00              | 0.00   |
|   | 3886090   | vmnic5               |             | vSwitch3     | 10100.36    | 596.81 | 40291.79 | 71.50  | 0.00              | 0.00   |
|   |           |                      |             |              |             |        |          |        |                   |        |
|   |           |                      |             |              |             |        |          |        |                   |        |

Multipath loadbalancing results

| lardware   | Storage Adapters   |  |  |  |  |   |   | Refresh | Rescan.   |
|--|--|--|--|--|--|---|---|---------|-----------|
| Processors   | Device   | Type W   | WN   |  |  | 2   |   |         |           |
| Processors   | 53c1030 PCI-X Fusion-MPT Dual U  | tra320 SCSI  |  |  |  |   |   |         |           |
| Memory   | 🕝 vmhba8   | SCSI   |  |  |  |   |   |         |           |
| Storage  | G vmhba9   | SCSI   |  |  |  |   |   |         |           |
| Networking   | iSCSI Software Adapter   |  |  |  |  |   |   |         |           |
| <ul> <li>Storage Adapters</li> </ul>   | 🔘 vmhba33  | iSCSI iq   | n.1998-01.   | com.vmware:6   | 850a-6a30e0c3:   |   |   |         |           |
| Network Adapters   | 82801EB/ER (ICH5/ICH5R) IDE Cor  | troller  |  |  |  |   |   |         |           |
| Advanced Settings  | 🕝 vmhba5   | Block SCSI   |  |  |  |   |   |         |           |
| oftware  | Details  |  |  |  |  |   |   |         |           |
| 1.0.000  | vmhba33  |  |  |  |  |   |   |         | Propertie |
| Licensed Features  | Model: iSCSI Software  | Adapter  |  |  |  |   |   |         |           |
| Time Configuration   | iSCSI Name: ign 1998-01 cr   | m. vmware:6850a-6a3  | 06043  |  |  |   |   |         |           |
|  | incontrainer ignitione enter   | 5m, 4mm/arc. 0050a-0ac   | 00000  |  |  |   |   |         |           |
| DNS and Routing  | ISCSI Alias:   | 5m. 4mmai 6.00000-000  | 00000  |  |  |   |   |         |           |
| DNS and Routing<br>Power Management  | iSCSI Alias:<br>Connected Targets: 4 De  | evices: 11   | aths:  | 44   |  |   |   |         |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown  | iSCSI Alias:<br>Connected Targets: 4 De  | evices: 11   | Paths:   | 44   |  |   |   |         |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown<br>Virtual Machine Swapfile Location   | ISCSI Alias:<br>Connected Targets: 4 De<br>View: Devices Paths   | evices: 11 I   | Paths:   | 44   |  |   |   |         |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile   | ISCST Name   | evices: 11 I   | Paths:   | 44<br>Type   | Transport  | Capacity  | Owner   |         |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation                       | Science Andrew Connected Targets: 4 De     View: Devices Paths     Name     DGC Fibre Channel Disk (nas.6006)  | avices: 11 I   | Paths:   | 44<br>Type<br>disk   | Transport<br>ISCSI   | Capacity<br>50.00 GB  | Owner<br>NMP  | 1       |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settinas  | View: Devices Paths           DGC Fibre Channel Disk (naa.6006   | avices: 11  Runtime Name vmhba33:C0:T2:L vmhba33:C0:T2:L   | 2aths:   | 44<br>Type<br>disk<br>disk   | Transport<br>ISCSI<br>ISCSI  | Capacity<br>50.00 GB<br>50.00 GB  | Owner<br>NMP<br>NMP   | 1       |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Swapfile Location<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings | View: Devices Paths           DGC Fibre Channel Disk (naa.6006           DGC Fibre Channel Disk (naa.6006           DGC Fibre Channel Disk (naa.6006   | vices: 11  Runtime Name vmhba33:C0:T2:L vmhba33:C0:T2:L  | LUN<br>10<br>11<br>12  | 44<br>Type<br>disk<br>disk<br>disk<br>disk   | Transport<br>ISCSI<br>ISCSI<br>ISCSI   | Capacity<br>50.00 GB<br>50.00 GB<br>50.00 GB  | Owner<br>NMP<br>NMP<br>NMP  | 1       |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Startur/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings  | ISCST Allas:<br>Connected Targets: 4 De<br>View: Devices Paths<br>Name<br>DGC Fibre Channel Disk (nas.6006<br>DGC Fibre Channel Disk (nas.6006<br>DGC Fibre Channel Disk (nas.6006<br>DGC Fibre Channel Disk (nas.6006   | Runtime Name           vrices:         11           Runtime Name           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L,           vmhba33:C0:T2:L,   | LUN<br>10<br>11<br>12<br>13  | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>ISCSI<br>ISCSI<br>ISCSI<br>ISCSI  | Capacity<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB  | Owner<br>NMP<br>NMP<br>NMP<br>NMP   | ]       |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Skartur/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings  | View: Devices Paths     View: Devices Paths     Name     DGC Fibre Channel Disk (nas.6006     DGC Fibre Channel Disk (nas.6006)   | Runtime Name           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L.,   | LUN<br>10<br>11<br>12<br>13<br>14  | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>ISCSI<br>ISCSI<br>ISCSI<br>ISCSI<br>ISCSI   | Capacity<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB  | Owner<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP                                    | ]       |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Skartup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings  | View: Devices Paths View: Devices Paths DGC Fibre Channel Disk (naa.6006  | Runtime Name           vices:         11           Runtime Name           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L.,  | LUN<br>10<br>11<br>12<br>13<br>14<br>16  | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>15CS1<br>15CS1<br>15CS1<br>15CS1<br>15CS1<br>15CS1<br>15CS1   | Capacity<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB  | Owner<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP                             | 1       |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Swapfile Location<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings | SCST Allas: Connected Targets: 4 De     View: Devices Paths     Name     DGC Fibre Channel Disk (nas.6006     DGC Fibre Channel Disk (nas.6006)     DGC Fib    | Runtime Name           writes:         11           Runtime Name           vmhba33:C0:T2:L.,           vmhba33:C0:T2:L,           vmhba33:C0:T2:L,           vmhba33:C0:T2:L,           vmhba33:C0:T2:L,           vmhba33:C0:T2:L,           vmhba33:C0:T2:L,           vmhba33:C0:T2:L,  | 2aths:<br>10<br>11<br>12<br>13<br>14<br>16<br>0  | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>19051<br>19051<br>19051<br>19051<br>19051<br>19051<br>19051   | Capacity<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB  | Owner<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP                      | ]       |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Skertur/Shutdown<br>Virtual Machine Swepfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings  | View: Devices Paths     View: Devices Paths     View: Devices Paths     View: Devices Paths     DGC Fibre Channel Disk (nas.6006     DGC Fibre Channel Disk (nas.6006)       | Runtime Name           vmhba33:C0:T2:L.,   | LUN<br>11<br>12<br>14<br>14<br>16<br>0<br>6  | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1  | Capacity<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>1.05 TB<br>50.00 GB   | Owner<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP                      | ]       |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Skartup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings  | View: Devices Paths     View: Devices Paths     Disc Fibre Channel Disk (naa.6006     Disc Fibre Channel Disk (naa.6006)     | Runtime Name<br>which as a state of the state  | LUN<br>11<br>12<br>13<br>14<br>16<br>0<br>6<br>7   | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51  | Capacity<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>1.05 TB<br>50.00 GB<br>50.00 GB<br>50.00 GB                         | Owner<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP               | 1       |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings                                      | SCST Alias: Connected Targets: 4 De     View: Devices Paths     Name     DGC Fibre Channel Dick (naa.6006     DGC Fibre Channel Dick (naa.6006)     DGC Fibre Channel Cha    | Runtime Loodo da.<br>Runtime Name<br>winba33:C0:124<br>winba33:C0:124<br>winba33:C0:124<br>winba33:C0:124<br>winba33:C0:124<br>winba33:C0:124<br>winba33:C0:124<br>winba33:C0:124  | Deaths:  | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51  | Capacity<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB            | Owner<br>MMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP        |         |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings                                      | View: Devices Paths     DGC Fibre Channel Disk (nas.6006     DGC Fibre Channel Disk (nas.6006)     DGC Fi | Runtime Ecologia de-<br>evices: 11 / /<br>///////////////////////////////  | LUN           10           11           12           13           14           6           7           8           9 | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1  | Capachy<br>50.00 GB<br>50.00 GB | Owner<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP |         |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Swapfile Location<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings | SCST Alias: connected Targets: 4     Ore Connected Targets: 4     View: Devices: Paths     Name     DGC Fibre Channel Disk (nas.6006     DGC Fibre Channel Disk (nas.6006)   | evices: 11 III<br>Runtime Name<br>winba33:00:12:L.<br>winba33:00:12:L.<br>winba33:00:12:L.<br>winba33:00:12:L.<br>winba33:00:12:L.<br>winba33:00:12:L.<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9<br>winba33:00:12:L9 | 2aths:<br>LUN<br>10<br>11<br>12<br>13<br>14<br>16<br>0<br>6<br>7<br>8<br>9   | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk | Transport<br>6C51<br>6C51<br>6C51<br>6C51<br>6C51<br>6C51<br>6C51<br>6C51<br>6C51<br>6C51  | Capacity<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB                        | Owner<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP |         |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings                                      | SCST Allas:     Connected Targets: 4     Dec Transe Disk (naa.6006     DGC Fibre Channel Disk (naa.6006)     DGC Fibre Channel Disk (naa.6006)   | Runtime Loodo de-<br>vices: 11 minute Loodo de-<br>vmhba33:C0:T2:L.,<br>vmhba33:C0:T2:L,<br>vmhba33:C0:T2:L,<br>vmhba33:C0:T2:L0<br>vmhba33:C0:T2:L0<br>vmhba33:C0:T2:L1<br>vmhba33:C0:T2:L9   | LUN<br>- 10<br>- 11<br>- 12<br>- 13<br>- 14<br>- 16<br>- 0<br>- 6<br>- 7<br>- 8<br>- 9                               | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1 | Capachy<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>1.05 TB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB                          | Owner<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP |         |           |
| DNS and Routing<br>Power Management<br>Virtual Machine Skartup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings  | View: Devices Paths     DGC Fibre Channel Disk (nas.6006     DGC Fibre Channel Disk (nas.6006)  | Runtime Loodo de-<br>vices: 11 / /<br>///////////////////////////////  | LUN<br>24ths:<br>10<br>11<br>12<br>13<br>14<br>16<br>0<br>6<br>7<br>8<br>9   | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1<br>ISCS1   | Capachy<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB                         | Owner<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP<br>NMP | ]       |           |

|   | - 1 220 - 0.12 - 1 <sup>2 - 1</sup>  | 20 - CO  | is friebs (storage news f  |  |               |  | 20 7 54 12 |            |
|---|--|--|--|--|---------------|--|------------|------------|
| Hardware  | Storage Adapters   |  |  |  |               |  | Refresh    | Rescan     |
| Processors  | Device   | Туре   | WWN  |  |               |  |            |            |
| Memory  | 🔘 vmhba10  | Fibre Channel  | 20:00:00:00:c9:55:2a:e310:0  | 0:00:00:00:0   | :9:55:2a:     | :e3  |            |            |
| Storage   | 53c1030 PCI-X Fusion-M   | PT Dual Ultra320 SCSI  |  |  |               |  |            |            |
| Networking  | ymhba8   | SCSI   |  |  |               |  |            |            |
| Storage Adapters  | 😋 vmhba9   | SCSI   |  |  |               |  |            |            |
| Storage Adapters  | iSCSI Software Adapter   |  |  |  |               |  |            |            |
| Network Adapters  | Vmhba33  | ISCSI  | iqn.1998-01.com.vmware:685   | 0a-6a30e   | 0c3:          |  |            |            |
| Advanced Settings   | 82801EB/ER (ICH5/ICH5  | R) IDE Lontroller  |  |  |               |  |            |            |
| oftware   | Details  |  |  |  |               |  |            |            |
|   | vmhba33  |  |  |  |               |  |            | Properties |
| Licensed Features   | Model: iSC   | ISI Software Adapter   |  |  |               |  |            |            |
| Time Configuration  | iSCSI Name: igr  | 1998-01.com.vmware:6850  | a-6a30e0c3   |  |               |  |            |            |
| DNS and Routing   | iSCSI Alias:   |  |  |  |               |  |            |            |
| Power Management  | Connected Targets: 4   | Devices: 11  | Paths: 44  |  |               |  |            |            |
| Virtual Machine Startup/Shutdown                                    | View Devices Paths   |  |  |  |               |  |            |            |
| Virtual Machine Swapfile Location                                   | Tiem boricos rous  |  |  |  |               |  |            | (          |
|   | of an end of the state of the s |  |  |  | - Contraction | 20   |            |            |
| Security Profile  | Runtime Name   | Target   |  | LUN  | Statu         | IS /   |            | -          |
| Security Profile<br>System Resource Allocation                      | Runtime Name<br>vmhba33:C1:T1:L7   | Target<br>iqn.1992-04.com.emo  | ::cx.apm00083100302.a4:192   | LUN<br>7   | Statu         | Active   |            | 1          |
| Security Profile<br>System Resource Allocation<br>Advanced Settings | Runtime Name<br>vmhba33:C1:T1:L7<br>vmhba33:C1:T1:L8   | Target<br>iqn.1992-04.com.emo<br>iqn.1992-04.com.emo   | ::cx.apm00083100302.a4:192<br>:cx.apm00083100302.a4:192  | LUN<br>7<br>8  | Stati         | Active<br>Active   |            |            |
| Security Profile<br>System Resource Allocation<br>Advanced Settings | Runtime Name<br>vmhba33:C1:T1:L7<br>vmhba33:C1:T1:L8<br>vmhba33:C1:T1:L9   | Target<br>iqn.1992-04.com.emo<br>iqn.1992-04.com.emo<br>iqn.1992-04.com.emo  | ::cx.apm00083100302.a4:192<br>:cx.apm00083100302.a4:192<br>:cx.apm00083100302.a4:192   | LUN<br>7<br>8<br>9   | Statu         | Active<br>Active<br>Active   |            |            |
| Security Profile<br>System Resource Allocation<br>Advanced Settings | Runtime Name<br>vmhba33:C1:T1:L7<br>vmhba33:C1:T1:L8<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T0:L0<br>vmhba33:C1:T0:L0   | Target<br>iqn.1992-04.com.emo<br>iqn.1992-04.com.emo<br>iqn.1992-04.com.emo<br>iqn.1992-04.com.emo<br>iqn.1992-04.com.emo  | ::cx.apm00083100302.a4:192<br>:cx.apm00083100302.a4:192<br>:cx.apm00083100302.a4:192<br>:cx.apm00083100302.b4:192  | LUN<br>7<br>8<br>9<br>0  | Stati         | IS Active   |            |            |
| Security Profile<br>System Resource Allocation<br>Advanced Settings | Runtime Name<br>vmhba33:C1:T1:L7<br>vmhba33:C1:T1:L8<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T0:L0<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L10   | Target<br>iqn.1992-04.com.emo<br>iqn.1992-04.com.emo<br>iqn.1992-04.com.emo<br>iqn.1992-04.com.emo<br>iqn.1992-04.com.emo<br>iqn.1992-04.com.emo   | ::cx.apm00083100302.a4:192<br>:cx.apm00083100302.a4:192<br>:cx.apm00083100302.a4:192<br>:cx.apm00083100302.b4:192<br>:cx.apm00083100302.a4:192   | LUN<br>7<br>8<br>9<br>0<br>10  | Statu         | IS Active<br>Active<br>Active<br>Active<br>Active  |            |            |
| Security Profile<br>System Resource Allocation<br>Advanced Settings | Runtime Name<br>vmhba33:C1:T1:L7<br>vmhba33:C1:T1:L8<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L0<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L11  | Target<br>iqn.1992-04.com.emc<br>iqn.1992-04.com.emc<br>iqn.1992-04.com.emc<br>iqn.1992-04.com.emc<br>iqn.1992-04.com.emc<br>iqn.1992-04.com.emc<br>ign.1992-04.com.emc  | ::cx.apm00083100302.a4:192<br>::cx.apm00083100302.a4:192<br>::cx.apm00083100302.a4:192<br>::cx.apm00083100302.b4:192<br>::cx.apm00083100302.a4:192<br>::cx.apm00083100302.a4:192   | LUN<br>7<br>8<br>9<br>0<br>10<br>11<br>11  | Stati         | IS Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active  |            |            |
| Security Profile<br>System Resource Allocation<br>Advanced Settings | Runtime Name<br>vmhba33:C1:T1:L7<br>vmhba33:C1:T1:L8<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L11<br>vmhba33:C1:T1:L12<br>vmhba33:C1:T1:L12   | Target<br>iqn. 1992-04.com.emc<br>iqn. 1992-04.com.emc<br>iqn. 1992-04.com.emc<br>iqn. 1992-04.com.emc<br>iqn. 1992-04.com.emc<br>iqn. 1992-04.com.emc<br>iqn. 1992-04.com.emc<br>iqn. 1992-04.com.emc   | ::cx.apm00083100302,a4:192,<br>::cx.apm00083100302,a4:192,<br>::cx.apm00083100302,a4:192,<br>::cx.apm00083100302,a4:192,<br>::cx.apm00083100302,a4:192,<br>::cx.apm00083100302,a4:192,<br>::cx.apm00083100302,a4:192,  | LUN<br>7<br>8<br>9<br>0<br>10<br>11<br>12<br>12                                      | Stati         | IS Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active  |            |            |
| Security Profile<br>System Resource Allocation<br>Advanced Settings | Runtime Name<br>vmhba33:C1:T1:L7<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L0<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L11<br>vmhba33:C1:T1:L12<br>vmhba33:C1:T1:L12   | Target<br>ign. 1992-04.com.emc<br>ign. 1992-04.com.emc<br>ign. 1992-04.com.emc<br>ign. 1992-04.com.emc<br>ign. 1992-04.com.emc<br>ign. 1992-04.com.emc<br>ign. 1992-04.com.emc<br>ign. 1992-04.com.emc<br>ign. 1992-04.com.emc   | tcx: apm00083100302.a4:192<br>tcx: apm00083100302.a4:192<br>tcx: apm00083100302.a4:192<br>tcx: apm00083100302.a4:192<br>tcx: apm00083100302.a4:192<br>tcx: apm00083100302.a4:192<br>tcx: apm00083100302.a4:192<br>tcx: apm00083100302.a4:192   | LUN<br>7<br>8<br>9<br>0<br>10<br>11<br>12<br>13<br>14                                | Stati         | IS Active   |            |            |
| Security Profile<br>System Resource Allocation<br>Advanced Settings | Runtime Name<br>vmhba33:C1:T1:L7<br>vmhba33:C1:T1:L8<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L11<br>vmhba33:C1:T1:L12<br>vmhba33:C1:T1:L12<br>vmhba33:C1:T1:L12  | Target<br>iqn. 1992-04.com.emc<br>iqn. 1992-04.com.emc   | ICX apm00083100302.44:192.,<br>ICX apm0008310302.44:192.,<br>ICX apm0008310302.44:192.,<br>ICX apm00083100302.44:192.,<br>ICX apm0008310302.44:192.,<br>ICX apm0008310302.44:192.,<br>ICX apm0008310302.44:192.,<br>ICX apm0008310302.44:192.,<br>ICX apm0008310302.44:192.,<br>ICX apm0008310302.44:192.,<br>ICX apm008310302.44:192.,<br>ICX apm008310302.,<br>ICX apm00830.,<br>ICX apm0083100302.,<br>ICX apm0083100 | LUN<br>7<br>8<br>9<br>0<br>10<br>11<br>12<br>13<br>14<br>16                          | Statu         | Active Octave Active Ac   |            |            |
| Security Profile<br>System Resource Allocation<br>Advanced Settings | Runtime Name<br>vmhba33:C1:T1:L7<br>vmhba33:C1:T1:L8<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L11<br>vmhba33:C1:T1:L12<br>vmhba33:C1:T1:L13<br>vmhba33:C1:T1:L14<br>vmhba33:C1:T1:L16  | Target<br>ign. 1992-04.com.emc<br>ign. 1992-04.com.emc   | ICX. apm00083100302, a4:192,<br>ICX. apm00083100302, b5:192,<br>ICX. apm00083100322, b5:192,<br>ICX. apm0083100322, b5:192,<br>ICX. apm008310032, b5:192,<br>ICX. apm008310032, b5:192,<br>ICX. apm008310032, b5:192,<br>ICX. apm008310032, b5:192,<br>ICX. apm008310032,<br>ICX. apm008310032,<br>ICX. apm008310032,<br>ICX. apm008310032,<br>ICX. apm008310032,<br>ICX. apm008310032,<br>ICX. apm0083100032,<br>ICX.   | LUN<br>7<br>8<br>9<br>0<br>10<br>11<br>12<br>13<br>14<br>16<br>0                     | Statu         | Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active   |            |            |
| Security Profile<br>System Resource Allocation<br>Advanced Settings | Runtime Name<br>vmhba33:C1:T1:L7<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L0<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L12<br>vmhba33:C1:T1:L12<br>vmhba33:C1:T1:L14<br>vmhba33:C1:T1:L16<br>vmhba33:C0:T2:L6   | Target<br>iqn. 1992-04.com.emc<br>iqn. 1992-04.c | ICX. apm00083100302.44192<br>ICX. apm00083100302.45192<br>ICX. apm00083100302.45192<br>ICX. apm00083100302.45192<br>ICX. apm00083100302.45192   | LUN<br>7<br>8<br>9<br>0<br>10<br>11<br>12<br>13<br>14<br>16<br>0<br>6                | Statu         | IS Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active    |            |            |
| Security Profile<br>System Resource Allocation<br>Advanced Settings | Runtime Name<br>vmhba33:C1:T1:L7<br>vmhba33:C1:T1:L8<br>vmhba33:C1:T1:L8<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L11<br>vmhba33:C1:T1:L12<br>vmhba33:C1:T1:L12<br>vmhba33:C1:T1:L16<br>vmhba33:C1:T1:L16<br>vmhba33:C1:T2:L6<br>vmhba33:C0:T2:L6   | Target<br>iqn. 1992-04.com.emc<br>iqn. 1992-04.com.emc   | ICX apm00083100302.44:192.,<br>ICX apm00083100302.44:192.,<br>ICX apm00083100302.44:192.,<br>ICX apm00083100302.44:192.,<br>ICX apm00083100302.44:192.,<br>ICX apm00083100302.44:192.,<br>ICX apm00083100302.44:192.,<br>ICX apm00083100302.44:192.,<br>ICX apm00083100302.45:192.,<br>ICX apm0008310032.45:192.,<br>ICX apm0008310082.45:192.,<br>ICX apm0008310082.45:192.,<br>ICX apm0008310082.45:192.,<br>ICX apm008310.45:10082.45:10082.,<br>ICX apm008310.45:10082.,<br>ICX apm008310.45:10082.,<br>ICX apm008310.45:10082.,<br>ICX apm0083         | LUN<br>7<br>8<br>9<br>0<br>10<br>11<br>12<br>13<br>14<br>16<br>0<br>6<br>7           | Statu         | Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Ac |            |            |
| Security Profile<br>System Resource Allocation<br>Advanced Settings | Runtime Name<br>vmhba33:C1:T1:L7<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L11<br>vmhba33:C1:T1:L13<br>vmhba33:C1:T1:L14<br>vmhba33:C1:T1:L14<br>vmhba33:C0:T2:L6<br>vmhba33:C0:T2:L7<br>vmhba33:C0:T2:L7   | Target<br>ign. 1992-04.com.emc<br>ign. 1992-04.c | ICX. apm00083100302, a4:192,<br>ICX. apm00083100302, a5:192,<br>ICX. apm0083100302, a5:192,<br>ICX. apm0083100302, ab:192,<br>ICX. apm0083100   | LUN<br>7<br>8<br>9<br>0<br>10<br>11<br>12<br>13<br>14<br>16<br>0<br>6<br>7<br>8      | Statu         | Active (I/O) Active (I/O) Active (I/O) Active (I/O)  |            |            |
| Security Profile<br>System Resource Allocation<br>Advanced Settings | Runtime Name<br>vmhba33:C1:T1:L7<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L9<br>vmhba33:C1:T1:L0<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L10<br>vmhba33:C1:T1:L12<br>vmhba33:C1:T1:L12<br>vmhba33:C1:T1:L14<br>vmhba33:C1:T1:L16<br>vmhba33:C0:T2:L6<br>vmhba33:C0:T2:L6<br>vmhba33:C0:T2:L9   | Target<br>iqn. 1992-04.com.emc<br>iqn. 1992-04.com.emc   | ICX. apm00083100302, a4:192,<br>ICX. apm00083100302, a5:192,<br>ICX. apm00083103022, a5:192,<br>ICX. apm0008310322, a5:192,<br>ICX. apm0008310322, a5:192,<br>ICX. apm0008310322, a5:192,<br>ICX. apm000831032, a5:192,<br>ICX. apm000831032, a5:192,<br>ICX. apm000831032, a5:192,<br>ICX. apm00082, a5:192,<br>ICX. apm000831032, a5:192,<br>ICX. apm000831032, a5:192,<br>ICX. apm000831032, a5:192,<br>ICX. apm00831032, ab;102,<br>ICX. apm008310,<br>ICX. apm008310,<br>ICX. apm008310,<br>ICX. apm008310,<br>ICX. ap   | LUN<br>7<br>8<br>9<br>0<br>10<br>11<br>12<br>13<br>14<br>16<br>0<br>6<br>7<br>8<br>9 | Statu         | Active (I/O) Active (I/O) Active (I/O) Active (I/O) Active (I/O)  |            |            |

The following figure is an ESXTOP screen showing the performance data for NMP (notice no load balancing).

| ys 31 min, 257<br>USED-BY | wonlda. CD                           |  |   |  |  |  |  |  |   |
|---------------------------|--------------------------------------|--|---|--|--|--|--|--|---|
| USED-BY                   | WOFILDS; CP                          | U load av  | erage: 0.14, 0.14,  | 0.14   |  |  |  |  |   |
| USED-BY                   |                                      |  |   |  |  |  |  |  |   |
| COLD DI                   | TEAM-PNIC                            | DNAME  | PKITX/s   | MbTX/s   | PKTRX/s  | MbRX/s   | *DRPTX   | *DRPRX   |   |
| Management                | n/a                                  | vSwitch0   | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |   |
| vmnic8                    |                                      | vSwitch0   | 45.18   | 0.25   | 28.35  | 0.01   | 0.00   | 0.00   |   |
| 4096:vsw110               | vmnic8                               | vSwitch0   | 44.21   | 0.25   | 11.53  | 0.01   | 0.00   | 0.00   |   |
| M151_CX_LUN13             | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| M152_CX_LUN14             | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| M153_CX_LUN16             | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| 4302:VM171                | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| ndows2008R2-7             | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| ndows2008-VM1             | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| indows7RC7137             | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |   |
| VM101_CX_LUN6             | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| VM103_CX_LUN7             | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| VM145_CX_LUN8             | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| M148_CX_LUN11             | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| 4768:VM162                | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| M149_CX_LUN12             | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| 4806:VM164                | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| M147_CX_LUN10             | vmnic8                               | vSwitch0   | 0.00  | 0.00   | 1.44   | 0.00   | 0.00   | 0.00   |   |
| 4854:VM160                | vmnic8                               | vSwitch0   | 0.48  | 0.00   | 0.96   | 0.00   | 0.00   | 0.00   |   |
| VM146_CX_LUN9             | vmnic8                               | vSwitch0   | 0.48  | 0.00   | 0.96   | 0.00   | 0.00   | 0.00   |   |
| Management                | n/a                                  | vSwitch1   | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |   |
| vmnic10                   |                                      | vSwitch1   | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |   |
| vmk0                      | vmnic10                              | vSwitch1   | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |   |
| Management                | n/a                                  | vSwitch2   | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |   |
| vmnic4                    |                                      | vSwitch2   | 0.00  | 0.00   | 0.48   | 0.00   | 0.00   | 0.00   |   |
| vmk2                      | vmnic4                               | vSwitch2   | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |   |
| Management                | n/a ·                                | vSwitch3   | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |   |
|                           |                                      | vSwitch3   | 3651.06   | 762.15   | 38914.96   | 27.43  | 0.00   | 0.00   |   |
| vmnic5                    | vmnic5                               | vSwitch3   | 3651.06   | 762.15   | 36471.15   | 26.20  | 0.00   | 0.00   |   |
| vn<br>Manage              | nic4<br>vmk2<br>ment<br>nic5<br>vmk1 | nic4<br>vmk2 vmnic4<br>ment n/a<br>nic5<br>vmk1 vmnic5 | nic4 - vSwitch2<br>vmk2 vmnic4 vSwitch2<br>ment n/a vSwitch3<br>nic5 - vSwitch3<br>vmk1 vmnic5 vSwitch3 | nic4 - vSwitch2 0.00<br>vmk2 vmnic4 vSwitch2 0.00<br>ment n/a vSwitch3 0.00<br>nic5 - vSwitch3 3651.06<br>vmk1 vmnic5 vSwitch3 3651.06 | unic4         - vSwitch2         0.00         0.00           vmk1         vmmic5         vSwitch3         0.00         0.00           ment         n/a vSwitch3         0.00         0.00         0.00           mint5         - vSwitch3         3651.06         762.15           vmk1         vmnic5         vSwitch3         3651.06         762.15 | nic4         - vSwitch2         0.00         0.00         0.48           vmk1         vmanic4         vSwitch2         0.00         0.00         0.00           ment         n/a         vSwitch3         0.00         0.00         0.00         0.00           mis5         - vSwitch3         3651.06         762.15         38914.96         36471.15 | unic4         - vSwitch2         0.00         0.00         0.48         0.00           vmk1         vmmic5         vSwitch2         0.00         0.00         0.00         0.00           ment         n/a vSwitch3         0.00         0.00         0.00         0.00         0.00           min55         - vSwitch3         3651.06         762.15         38914.96         27.43           vmk1         vmnic5         vSwitch3         3651.06         762.15         36471.15         26.20 | nic4         - vSwitch2         0.00         0.00         0.48         0.00         0.00           vmk1         vmmic4         vSwitch3         0.00 | nic4         - vSwitch2         0.00         0.00         0.48         0.00         0.00         0.00           vmk1         vmknic5         vSwitch3         0.00 |

| lardware   | Storage Adapters  |   |  |  |   |   |   | Refresh | Rescan  |
|--|---|---|--|--|---|---|---|---------|---------|
| Processors   | Device  | Туре  | WWN  |  | 1   |   |   |         |         |
| Memory   | O vmhba10   | Fibre Channel   | 20:00:00:00  | 1:c9:55:2a:a5 10   | 0:00:00:00:c9:55:2a:a5  |   |   |         |         |
| Changes  | 53c1030 PCI-X Fusion-MPT Dual U   | ltra320 SCSI  |  |  |   |   |   |         |         |
| Storage  | 🕥 vmhba8  | SCSI  |  |  |   |   |   |         |         |
| Networking   | 🕥 vmhba9  | SCSI  |  |  |   |   |   |         |         |
| Storage Adapters   | iSCSI Software Adapter  |   |  |  |   |   |   |         |         |
| Network Adapters   | 🕥 vmhba33   | iSCSI   | qn.1998-01   | .com.vmware:6  | 850B-75881c69:  |   |   |         |         |
| Advanced Settings  | 82801EB/ER (ICH5/ICH5R) IDE Co  | ntroller  |  |  | 2   |   |   |         |         |
| oftware  | Details   |   |  |  |   |   |   |         |         |
| National States  | vmhba33   |   |  |  |   |   |   |         | Propert |
| Licensed reatures  | Madel, Jacob Jacob Jacob  | a Adambau   |  |  |   |   |   |         |         |
| Contract Contraction of the Contract of the Co | Model: IDCDI Softwar  | e Adapter   |  |  |   |   |   |         |         |
| Time Configuration   | iSCSI Name: iqn.1998-01.0   | e Adapter<br>:om.vmware:6850B-75  | 881c69   |  |   |   |   |         |         |
| Time Configuration<br>DNS and Routing  | iSCSI Name: iqn.1998-01.0<br>iSCSI Alias:   | e Adapter<br>:om.vmware:6850B-75  | 881c69   |  |   |   |   |         |         |
| Time Configuration<br>DNS and Routing<br>Power Management  | iSCSI Name: iqn.1998-01.0<br>iSCSI Alias:<br>Connected Targets: 4 D   | e Adapter<br>:om.vmware:6850B-75<br>vevices: 11   | 881c69<br>Paths:   | 44   |   |   |   |         |         |
| Time Configuration<br>DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown  | iSCSI Name: ign.1998-01.c<br>iSCSI Allas:<br>Connected Targets: 4 E   | e Adapter<br>com.vmware:6850B-75<br>revices: 11   | 881c69<br>Paths:   | 44   |   |   |   |         |         |
| Time Configuration<br>DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown<br>Virtual Machine Swapfile Location   | iSCSI Name: ign. 1998-01.0<br>iSCSI Alias:<br>Connected Targets: 4 Devices Paths  | e Moapter<br>:om.vmware:6850B-75<br>revices: 11   | 881c69<br>Paths:   | 44   |   |   |   |         |         |
| Time Configuration<br>DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile   | indee: ibC3130ttvar<br>iSCSI Alias:<br>Connected Targets: 4 D<br>View: Devices Paths<br>Name  | e Adapter<br>:om.vmware:6850B-75<br>revices: 11<br>Runtime Name   | 881c69<br>Paths:   | 44<br>Type   | Transport   | Capacity  | Owner   | 1       |         |
| Time Configuration<br>DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation   | Indee: IDCL3 Jottvar<br>ISCSI Allas:<br>Connected Targets: 4 D<br>View: Devices Paths<br>Name<br>DGC Fibre Channel Disk (naa.6006   | e Adapter<br>iom.vmware:6850B-75<br>evices: 11<br>Runtime Name<br>vmhba33:C0:T3:L   | 881c69<br>Paths:<br>LUN  | 44<br>Type<br>disk   | Transport<br>ISCSI  | Capacity<br>50.00 GB  | Owner<br>PowerPath  |         |         |
| Time Configuration<br>DNS and Routing<br>Power Management<br>Virtual Machine Startur/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Sethions  | Indee: IDCL3 Jottware<br>IGCSI Allae: Ign.1998-01.c<br>Connected Targets: 4 D<br>View: Devices Paths<br>Name<br>DGC Fibre Channel Disk (naa.6006<br>DGC Fibre Channel Disk (naa.6006  | e Adapter<br>com.vmware:6850B-73<br>evices: 11<br>Runtime Name<br>vmhba33:C0:T3:L<br>vmhba33:C0:T3:L  | 881c69<br>Paths:<br>LUN<br>11<br>20  | 44<br>Type<br>disk<br>disk   | Transport<br>ISCSI<br>ISCSI   | Capacity<br>50.00 GB<br>1.05 TB   | Owner<br>PowerPath<br>PowerPath   |         |         |
| Time Configuration<br>DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings  | Indee: DCL3 Jottvar<br>ISCSI Allas:<br>Connected Targets: 4 D<br>View: Devices Paths<br>DGC Fibre Channel Disk (naa.6006<br>DGC Fibre Channel Disk (naa.6006<br>DGC Fibre Channel Disk (naa.6006  | e Wagteer<br>iom.vmware:68508-73<br>revices: 11<br>Runtime Name<br>vmhba33:C0:T3:L<br>vmhba33:C0:T3:L   | 881c69<br>Paths:<br>LUN<br>11<br>20<br>12  | 44<br>Type<br>disk<br>disk<br>disk   | Transport<br>ISCSI<br>ISCSI<br>ISCSI  | Capacity<br>50.00 GB<br>1.05 TB<br>50.00 GB   | Owner<br>PowerPath<br>PowerPath<br>PowerPath  |         |         |
| Time Configuration<br>DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings  | Indee: DCL3 Jottvarf     ISC3 Jottvarf     ISC3 Allas:     Connected Targets: 4      Uiew: Devices Paths     Name     DGC Fibre Channel Disk (naa.6006     DGC Fibre Channel Disk (naa.6006)   | e Magteer<br>com. vmware:68508-73<br>evices: 11<br>Runtime Name<br>vmhba33:C0:T3:L<br>vmhba33:C0:T3:L<br>vmhba33:C0:T3:L  | 881c69<br>Paths:<br>   | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>6551<br>6551<br>6551<br>6551   | Capacity<br>50.00 GB<br>1.05 TB<br>50.00 GB<br>50.00 GB   | Owner<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath   |         |         |
| Time Configuration<br>DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shukdown<br>Virtual Machine Startup/Shukdown<br>Virtual Machine Swapfie Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings   | Indee: DC_3 Jottvar     ISC3 Jottvar     ISC3 Allas:     Connected Targets: 4      Connected Targets: 4      DC     View: Devices Paths     Name     DCC Fibre Channel Disk (naa. 6006     DGC Fibre Channel Disk (naa. 6006)  | e Wagteer<br>iomvmware:68508-73<br>evices: 11<br>Runtime Name<br>vmhba33:C0:T3:L<br>vmhba33:C0:T3:L<br>vmhba33:C0:T3:L<br>vmhba33:C0:T3:L   | 881c69<br>Paths:<br>   | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>ISCSI<br>ISCSI<br>ISCSI<br>ISCSI<br>ISCSI  | Capacity<br>50.00 GB<br>1.05 TB<br>50.00 GB<br>50.00 GB<br>50.00 GB   | Owner<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath   | 1       |         |
| Time Configuration<br>DNS and Routing<br>Power Management<br>Virtual Machine Skartup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings  | Indee: DCL3 Jottvar     ISC3 Jottvar     ISC3 Allas:     Connected Targets: 4      E     View: Devices Paths     DGC Fibre Channel Disk (naa.6006     DGC Fibre Channel Disk (naa.6006)     DGC Fibr  | e Magteer<br>isom, vmware:68508-73<br>vevices: 11<br>Runtime Name<br>vmhba33:C0:T3:L<br>vmhba33:C0:T3:L<br>vmhba33:C0:T3:L<br>vmhba33:C0:T3:L<br>vmhba33:C0:T3:L  | 881c69<br>Paths:<br>LUN<br>11<br>20<br>12<br>13<br>15<br>0 0                         | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51<br>15C51  | Capacity<br>50.00 GB<br>1.05 TB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB   | Owner<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath  | 1       |         |
| Time Configuration<br>DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings  | Indee: DCL3 Jottwarf     ISC3 Jottwarf     ISC3 Jalas:     Connected Targets: 4      Uiew: Devices Paths     Name     DGC Fibre Channel Disk (naa.6006     DGC Fibre Channel Disk (naa.6006)     DGC   | e wapter<br>oom. vmware:68508-79<br>evices: 11<br>Runtime Name<br>vmhba33:C0:13:L<br>vmhba33:C0:13:L<br>vmhba33:C0:13:L<br>vmhba33:C0:13:L<br>vmhba33:C0:13:L<br>vmhba33:C0:13:L  | 881c69<br>Paths:<br>LUN<br>11<br>20<br>12<br>13<br>15<br>0<br>1                      | 44<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>6C51<br>6C51<br>6C51<br>6C51<br>6C51<br>6C51<br>6C51   | Capacity<br>50.00 GB<br>1.05 TB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB                                     | Owner<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath                           | 1       |         |
| Time Configuration<br>DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings  | Indee: DSC3.30(Waf     SC3) Name: DSC3.30(Waf     SC3) Alas:     Connected Targets: 4 D     View: Devices Paths     DGC Fibre Channel Disk (naa.6006     DGC Fibre Channel Disk (naa.6006)     DGC  | e Adapter<br>evices: 11<br>Runhime Name<br>vmhba33:Co:13:1.<br>vmhba33:Co:13:1.<br>vmhba33:Co:13:1.<br>vmhba33:Co:13:1.<br>vmhba33:Co:13:1.<br>vmhba33:Co:13:1.<br>vmhba33:Co:13:1.<br>vmhba33:Co:13:1.   | B881c69<br>Paths:<br>LUN<br>11<br>20<br>12<br>13<br>15<br>0<br>0<br>1<br>1<br>2<br>2 | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport<br>(SCS1<br>(SCS1<br>(SCS1<br>(SCS1<br>(SCS1<br>(SCS1<br>(SCS1<br>(SCS1)<br>(SCS1<br>(SCS1)<br>(SCS1<br>(SCS1)<br>(SCS1<br>(SCS1)<br>(SCS1<br>(SCS1)<br>(SCS1<br>(SCS1)<br>(SCS1<br>(SCS1)<br>(SCS1<br>(SCS1)<br>(SCS1<br>(SCS1)<br>(SCS1<br>(SCS1)<br>(SCS1<br>(SCS1)<br>(SCS1)<br>(SCS1<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS1)<br>(SCS | Capacity<br>50.00 GB<br>1.05 TB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB                         | Owner<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath              | 1       |         |
| Time Configuration<br>DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shutdown<br>Virtual Machine Swapfile Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings  | Indee: DSC3.30tWar     SC31 Allas:     Connected Targets: 4     Co | e Adapter<br>omvmware:66508-73<br>evices: 11<br>Runtime Name<br>vmhba33:00:131.<br>vmhba33:00:131.<br>vmhba33:00:131.<br>vmhba33:00:131.<br>vmhba33:00:131.<br>vmhba33:00:131.<br>vmhba33:00:131.<br>vmhba33:00:131.  | 881c69<br>Paths:<br>11<br>12<br>13<br>15<br>0 0<br>1 1<br>2 2<br>7 7                 | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk   | Transport         ISCS1           ISCS1         ISCS1           ISCS1         ISCS1           ISCS1         ISCS1           ISCS1         ISCS1           ISCS1         ISCS1           ISCS1         ISCS1   | Capacity<br>50.00 GB<br>1.05 TB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB             | Owner<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath              | 1       |         |
| Time Configuration<br>DNS and Routing<br>Power Management<br>Virtual Machine Startup/Shukdown<br>Virtual Machine Startup/Shukdown<br>Virtual Machine Swapfiel Location<br>Security Profile<br>System Resource Allocation<br>Advanced Settings  | Initial Social Software           ISCSI Name:           ISCSI Allas:           Connected Targets:           Connected Targets:           IName           DGC Fibre Channel Disk (naa. 6006<br>DGC Fibre Channel Disk (naa. 6006)           DGC Fibre Channel Disk (naa. 6006)  | e Adapter<br>om, vinware: 68508-73<br>evices: 11<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbba33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb30:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnbb33:00:131,<br>wnb53:00 | 881c69<br>Paths:<br>11<br>12<br>13<br>15<br>0 0<br>1 1<br>2 2<br>7 7<br>8 8          | 44<br>Type<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk<br>disk | Transport<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1<br>5CS1   | Capacity<br>50.00 GB<br>1.05 TB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB<br>50.00 GB | Owner<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath<br>PowerPath | 1       |         |

The following two figures show PowerPath/VE ownership and path status.

| 5ummary 🔨 Virtual Machines 🔨 Perform | ance Configuration Tasks & Ev   | vents Alarms Permissions   | Maps Storage Vie <u>ws</u>   |  |                         |  |         |            |
|--------------------------------------|---|--|--|--|-------------------------|--|---------|------------|
| Hardware                             | Storage Adapters  |  |  |  |                         |  | Refresh | Rescan     |
| Droceccore                           | Device  | Туре   | WWN  |  |                         |  |         |            |
| Processors                           | 🕥 vmhba10   | Fibre Channel  | 20:00:00:00:c9:55:2a:a510:f  | 00:00:00:  | c9:55:2a                | :a5  |         |            |
| Memory                               | 53c1030 PCI-X Fusion-M  | IPT Dual Ultra320 SCSI   |  |  |                         |  |         |            |
| Storage                              | 🔘 vmhba8  | SCSI   |  |  |                         |  |         |            |
| Networking                           | 🕝 vmhba9  | SCSI   |  |  |                         |  |         |            |
| Storage Adapters                     | iSCSI Software Adapter  |  |  |  |                         |  |         |            |
| Network Adapters                     | 🕥 vmhba33   | iSCSI  | ign.1998-01.com.vmware:685   | OB-75881   | c69:                    |  |         |            |
| Advanced Settings                    | 82801EB/ER (ICH5/ICH5   | iR) IDE Controller   |  |  |                         | 20<br>20   |         |            |
| oftware                              | Details   |  |  |  |                         |  |         |            |
| Licenced Features                    | vmhba33   |  |  |  |                         |  |         | Properties |
| Time Coofficiention                  | Model: iSC  | CSI Software Adapter   |  |  |                         |  |         |            |
| DNC and Deutine                      | iSCSI Name: igr   | n.1998-01.com.vmware:6850B-  | 75881c69   |  |                         |  |         |            |
| DNS and Routing                      | iSCSI Alias:  | a 6 - 6  |  |  |                         |  |         |            |
| Power Management                     | Connected Targets: 4  | Devices: 11  | Paths: 44  |  |                         |  |         |            |
| Virtual Machine Startup/Shutdown     | View: Devices Paths   |  |  |  |                         |  |         |            |
| Virtual Machine Swapfile Location    | Durchime Mame   | Target   |  | TUN  | Chak                    |  |         |            |
| Security Profile                     | umbha22.C0.T2.L11   | ian 1002 04 com omeu   | w appr00002100202 kE 102   | 11   | Jucac                   | Achive   |         | -          |
| System Resource Allocation           | viiii 0855:C0:T5:E11  | ign 1992-04.com.emc.t  | x.apin00063100302.05:192   | 20   |                         | Active   |         |            |
| Advanced Settings                    | viiii (Ja33:C3:11:L20   | ign 1992-04.com emor   | x.apiil00063100302.04:192  | 20   | · · · ·                 | Active   |         |            |
|                                      |   | 11111 7 7/ TUT I UUL DUU   | 1 <b>2 1 1 1 1 1 1 1 1 1 1</b>   | 12   |                         | ð etime  |         |            |
|                                      | umbba33(C0)T3(L13   | ign 1992-04 com emory  | × apm00083100302 b5:192  | 12   |                         | Active   |         |            |
|                                      | vmhba33:C0:T3:L13   | ign.1992-04.com.emc;   | x.apm00083100302.b5:192  | 12<br>13<br>15   |                         | Active<br>Active   |         |            |
|                                      | vmhba33:C0:T3:L13<br>vmhba33:C0:T3:L15<br>vmbba33:C2:T2:L20   | ign.1992-04.com.emc;<br>ign.1992-04.com.emc;<br>ign.1992-04.com.emc;   | :x.apm00083100302.b5:192<br>:x.apm00083100302.b5:192<br>x.apm00083100302.a5:192  | 12<br>13<br>15<br>20   |                         | Active<br>Active<br>Active   |         |            |
|                                      | vmhba33:C0:T3:L13<br>vmhba33:C0:T3:L15<br>vmhba33:C2:T2:L20<br>vmbba33:C0:T3:L0   | ign.1992-04.com.emc:o<br>ign.1992-04.com.emc:o<br>ign.1992-04.com.emc:o<br>ign.1992-04.com.emc:o   | x.apm00083100302.b5:192<br>x.apm00083100302.b5:192<br>x.apm00083100302.a5:192<br>x.apm00083100302.a5:192   | 12<br>13<br>15<br>20   | *                       | Active<br>Active<br>Active<br>Active   |         |            |
|                                      | vmhba33:C0:T3:L13<br>vmhba33:C0:T3:L15<br>vmhba33:C2:T2:L20<br>vmhba33:C0:T3:L0<br>vmhba33:C0:T3:L1   | iqn.1992-04.com.emc:c<br>iqn.1992-04.com.emc:c<br>iqn.1992-04.com.emc:c<br>iqn.1992-04.com.emc:c<br>iqn.1992-04.com.emc:c  | x.apm00083100302.b5:192<br>x.apm00083100302.b5:192<br>x.apm00083100302.a5:192<br>x.apm00083100302.b5:192<br>y.apm00083100302.b5:192  | 12<br>13<br>15<br>20<br>0  | •••••                   | Active<br>Active<br>Active<br>Active<br>Active   |         | ş          |
|                                      | vmhba33:C0:T3:L13<br>vmhba33:C0:T3:L15<br>vmhba33:C2:T2:L20<br>vmhba33:C0:T3:L0<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L1   | ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:   | x: apm00083100302.b5:192<br>x: apm00083100302.b5:192<br>x: apm00083100302.b5:192<br>x: apm00083100302.b5:192<br>x: apm00083100302.b5:192   | 12<br>13<br>15<br>20<br>0<br>1<br>2                                    | •                       | Active<br>Active<br>Active<br>Active<br>Active<br>Active   |         | 2          |
|                                      | vmhba33:C0:T3:L13<br>vmhba33:C0:T3:L15<br>vmhba33:C2:T2:L20<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L2<br>vmhba33:C0:T3:L2   | ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:  | x.apm00083100302.b5:192<br>x.apm00083100302.b5:192<br>x.apm00083100302.a5:192<br>x.apm00083100302.b5:192<br>x.apm00083100302.b5:192<br>x.apm00083100302.b5:192   | 12<br>13<br>15<br>20<br>0<br>1<br>2<br>7                               |                         | Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active   |         | 2          |
|                                      | vmhba33:C0:T3:L13<br>vmhba33:C0:T3:L15<br>vmhba33:C2:T2:L20<br>vmhba33:C0:T3:L0<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L7<br>vmhba33:C0:T3:L8   | ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:<br>ign. 1992-04.com.emc:   | x.apm00083100302.b5:192<br>x.apm00083100302.b5:192<br>x.apm00083100302.b5:192<br>x.apm00083100302.b5:192<br>x.apm00083100302.b5:192<br>x.apm00083100302.b5:192<br>x.apm00083100302.b5:192  | 12<br>13<br>15<br>20<br>0<br>1<br>2<br>7<br>8                          | •••••                   | Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active   |         | ¢.         |
|                                      | vmhba33:C0:T3:L13<br>vmhba33:C0:T3:L15<br>vmhba33:C0:T3:L20<br>vmhba33:C0:T3:L0<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L2<br>vmhba33:C0:T3:L2<br>vmhba33:C0:T3:L8<br>vmhba33:C0:T3:L8   | ign. 1992-04. com. emot<br>ign. 1992-04. com. emot   | x: apm00083100302.b5:192<br>x: apm00083100302.b5:192<br>x: apm00083100302.b5:192<br>x: apm00083100302.b5:192<br>x: apm00083100302.b5:192<br>x: apm00083100302.b5:192<br>x: apm00083100302.b5:192<br>x: apm00083100302.b5:192   | 12<br>13<br>15<br>20<br>0<br>1<br>2<br>7<br>8<br>9                     | •••••                   | Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active   |         |            |
|                                      | vmhba33:C0:T3:L13<br>vmhba33:C0:T3:L15<br>vmhba33:C0:T3:L15<br>vmhba33:C0:T3:L0<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L7<br>vmhba33:C0:T3:L8<br>vmhba33:C0:T3:L8<br>vmhba33:C2:T2:L0   | ign. 1992-04. com. emot<br>ign. 1992-04. com. emot   | x. apm00083100302.b5:192<br>x. apm00083100302.b5:192<br>x. apm00083100302.b5:192<br>x. apm00083100302.b5:192<br>x. apm00083100302.b5:192<br>x. apm00083100302.b5:192<br>x. apm00083100302.b5:192<br>x. apm00083100302.b5:192<br>x. apm00083100302.b5:192   | 12<br>13<br>15<br>20<br>0<br>1<br>2<br>7<br>8<br>9<br>0                | • • • • • • • • • •     | Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active   |         |            |
|                                      | vmhba33:C0:T3:L13<br>vmhba33:C0:T3:L15<br>vmhba33:C0:T3:L15<br>vmhba33:C0:T3:L0<br>vmhba33:C0:T3:L0<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L9<br>vmhba33:C0:T3:L9<br>vmhba33:C2:T2:L1   | ign. 1992-04.com. emc:<br>ign. 1992-04.com. emc:   | x. apm00083100302.b5:192.,<br>x. apm00083100302.b5:192.,<br>x. apm0083100302.b5:192.,<br>x. apm00083100302.b5:192.,<br>x. apm0008310032.b5:192.,<br>x. apm00083100832.b5:192.,<br>x. apm0008310832.b5:192.,<br>x. apm0008310832.b5:192.,<br>x. apm0008310832.b5:192.,<br>x. apm0008310832.b5:192.,<br>x. apm008310832.b5:192.,<br>x. apm008310832.b5 | 12<br>13<br>15<br>20<br>0<br>1<br>2<br>7<br>8<br>9<br>0<br>1           | • • • • • • • • • •     | Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active   |         |            |
|                                      | vmhba33:C0:T3:L13<br>vmhba33:C0:T3:L15<br>vmhba33:C0:T3:L120<br>vmhba33:C0:T3:L20<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L2<br>vmhba33:C0:T3:L9<br>vmhba33:C0:T3:L9<br>vmhba33:C2:T2:L1<br>vmhba33:C2:T2:L1                   | ign. 1992-04. com. emc:<br>ign. 1992-04. com. em | xx apm00083100302.b5:192<br>xx apm00083100302.b5:192<br>xx apm008100302.b5:192<br>xx apm008100302.b5:192<br>xx apm008100302.b5:192<br>xx apm008100302.b5:192<br>xx apm008100302.b5:192<br>xx apm008100302.b5:192<br>xx apm008100302.b5:192<br>xx apm008100302.b5:192<br>xx apm0083100302.b5:192<br>xx apm008310032.b5:192<br>xx apm008310032<br>xx apm00831  | 12<br>13<br>15<br>20<br>0<br>1<br>2<br>7<br>8<br>9<br>0<br>1<br>2      | • • • • • • • • • • •   | Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active           |         |            |
|                                      | vmhba33:C0:T3:L13<br>vmhba33:C0:T3:L15<br>vmhba33:C0:T3:L15<br>vmhba33:C0:T3:L0<br>vmhba33:C0:T3:L0<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L1<br>vmhba33:C0:T3:L9<br>vmhba33:C0:T3:L9<br>vmhba33:C2:T2:L0<br>vmhba33:C2:T2:L1<br>vmhba33:C2:T2:L1 | ign. 1992-04. com. emot<br>ign. 1992-04. com. emot  | x. apm00083100302.b5:192<br>x. apm0008310032<br>x. apm0008310<br>x. apm0008310.   | 12<br>13<br>15<br>20<br>0<br>1<br>2<br>7<br>8<br>9<br>0<br>1<br>2<br>7 | • • • • • • • • • • • • | Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active<br>Active |         |            |

The following figure is an ESXTOP screen showing the I/O with PowerPath/VE enabled. Note that the load is evenly distributed across VMkernel NICs and physical NICs.

| Proot@6850B |                       |            |                      | -             | a se |           |         |        |        |   |
|-------------|-----------------------|------------|----------------------|---------------|--|-----------|---------|--------|--------|---|
| 1:42:32pm   | up 7 days 11 min, 211 | worlds; Cl | PU load average      | : 0.17, 0.14, | 0.15                                     |           |         |        |        | - |
| DODE TO     |                       | TRAN DUTO  | D113.1/2             |               | NO THE                                   | DITEDIT ( | M. DIL  | 100000 |        |   |
| PORI-ID     | USED-B1               | ILAM-PNIC  | DNAME                | PRIIX/S       | MDIX/S                                   | PRIRA/S   | MDRA/ S | *DRPIX | SDRPKA |   |
| 16777210    | Management            | n/a        | VSWILCHU             | 102.50        | 0.00                                     | 0.00      | 0.00    | 0.00   | 0.00   |   |
| 16777210    | Villies               | -          | VSWILCHO             | 102.52        | 0.49                                     | 01.04     | 0.04    | 0.00   | 0.00   |   |
| 16777220    | VII.K.0               | VIIIIICo   | VSWILCHO             | 102.00        | 0.00                                     | 0.48      | 0.00    | 0.00   | 0.00   |   |
| 16777220    | 4096:VSWII0           | VIIIIIE6   | VSWILCHO             | 103.00        | 0.49                                     | 0.11      | 0.00    | 0.00   | 0.00   |   |
| 16777222    | 4313.VH160            | VIIIIIE6   | VSWILCHO             | 0.00          | 0.00                                     | 0.48      | 0.00    | 0.00   | 0.00   |   |
| 16777222    | 4311: VM14/_CA_LONIO  | VIIIIIE6   | VSWILCHO             | 0.00          | 0.00                                     | 0.48      | 0.00    | 0.00   | 0.00   |   |
| 16777224    | 4373:VM105_CA_LON7    | VIIIIIE6   | VSWILCHO             | 0.00          | 0.00                                     | 0.48      | 0.00    | 0.00   | 0.00   |   |
| 16777227    | 43/9:VH146_CA_LON9    | VIIIIIE6   | VSWILCHO             | 0.00          | 0.00                                     | 0.48      | 0.00    | 0.00   | 0.00   |   |
| 16777220    | 4415:VM162            | VIIIIICO   | VSWILCHO             | 0.00          | 0.00                                     | 0.48      | 0.00    | 0.00   | 0.00   |   |
| 16777220    | 4303.001 A 0 0 10011  | VIIIIICO   | VSWILCHO             | 0.00          | 0.00                                     | 0.48      | 0.00    | 0.00   | 0.00   |   |
| 16777220    | 4393: VM148_CA_LUN11  | VIIIIICO   | VSWILCHO             | 0.00          | 0.00                                     | 0.48      | 0.00    | 0.00   | 0.00   |   |
| 16777231    | 4394: VHI49_CA_LONI2  | villi1C6   | vSwitch0             | 0.00          | 0.00                                     | 0.48      | 0.00    | 0.00   | 0.00   |   |
| 16777222    | 5585: VM145_CA_LUN6   | VIIIIICO   | VSWILCHO             | 0.00          | 0.00                                     | 0.48      | 0.00    | 0.00   | 0.00   |   |
| 20111232    | S634:VHIDI_CA_LONG    | viuiico    | vSwitch0             | 0.00          | 0.00                                     | 0.48      | 0.00    | 0.00   | 0.00   |   |
| 22554422    | Management            | II/ d      | vSwitchi<br>wSwitchi | 0.00          | 0.00                                     | 0.00      | 0.00    | 0.00   | 0.00   |   |
| 22554434    | Villicio              | -<br>      | vSwitchi<br>wSwitchi | 0.00          | 0.00                                     | 0.00      | 0.00    | 0.00   | 0.00   |   |
| 50001640    | Viiiki                | viuiicio   | vSwitchi<br>wSwitch2 | 0.00          | 0.00                                     | 0.00      | 0.00    | 0.00   | 0.00   |   |
| 50331649    | Management            | II/a       | vSwitch2             | 2477 10       | 201 21                                   | 10062 60  | 21 60   | 0.00   | 0.00   |   |
| 50331653    | VIIIKS                | VIUITCH    | vSwitch2             | 2477 57       | 201.21                                   | 25022.00  | 34.60   | 0.00   | 0.00   |   |
| 67100065    | Management            |            | DuraDortant 0        | 54//.5/       | 301.21                                   | 25055.00  | 0.00    | 0.00   | 0.00   |   |
| 67100065    | Management            |            | DvsFortset-0         | 0.00          | 0.00                                     | 0.00      | 0.00    | 0.00   | 0.00   |   |
| 67100060    | 120                   |            | DvsFortset-0         | 0.00          | 0.00                                     | 0.00      | 0.00    | 0.00   | 0.00   |   |
| 67108868    | 122                   |            | DwsPortset_0         | 0.00          | 0.00                                     | 0.00      | 0.00    | 0.00   | 0.00   |   |
| 67100060    | 122                   |            | DvsFortset-0         | 0.00          | 0.00                                     | 0.00      | 0.00    | 0.00   | 0.00   |   |
| 67100009    | 123                   |            | DvsFortset-0         | 0.00          | 0.00                                     | 0.00      | 0.00    | 0.00   | 0.00   |   |
| 67100070    | 125                   |            | DvsFortset-0         | 0.00          | 0.00                                     | 0.00      | 0.00    | 0.00   | 0.00   |   |
| 67100071    | 125                   |            | DvsFortset-0         | 0.00          | 0.00                                     | 0.00      | 0.00    | 0.00   | 0.00   |   |
| 07100072    | Managamant            |            | DVSFOILSEL-0         | 0.00          | 0.00                                     | 0.00      | 0.00    | 0.00   | 0.00   |   |
| 030060007   | management            | II/a       | vSwitch2             | 2016 12       | 202 20                                   | 10522.22  | 20.00   | 0.00   | 0.00   |   |
| 03000009    | VIII.K.2              | VIIIIIIGS  | VSWILCHS             | 2016.13       | 363.30                                   | 10000.20  | 20.27   | 0.00   | 0.00   |   |
| 03006090    | VIIIIICS              |            | VOWI CONS            | 3013.05       | 303.22                                   | 21036.34  | 30.93   | 0.00   | 0.00   |   |
|             |                       |            |                      |               |  |           |         |        |        |   |
|             |                       |            |                      |               |  |           |         |        |        |   |

# **Front-end** The following figure shows the I/O before the simulated front-end path failure. failover results

| root@6850E |                      |             |                 |             |        | <u> </u> | <u> </u> |        |        |
|------------|----------------------|-------------|-----------------|-------------|--------|----------|----------|--------|--------|
| 0:36:50am  | up 7 days 21:05, 212 | worlds; CPU | J load average: | 0.23, 0.15, | 0.14   |          |          |        |        |
| PORT-ID    | USED-BY              | TEAM-PNIC   | DNAME           | PKTTX/3     | MbTX/s | PKTRX/s  | MbRX/s   | *DRPTX | *DRPRX |
| 16777217   | Management           | n/a         | vSwitch0        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 16777218   | vmnic8               |             | vSwitch0        | 178.68      | 0.98   | 141.76   | 0.10     | 0.00   | 0.00   |
| 16777219   | vmk0                 | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 16777220   | 4096:vswif0          | vmnic8      | vSwitch0        | 177.69      | 0.98   | 18.70    | 0.03     | 0.00   | 0.00   |
| 16777235   | 6259:VM164           | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 16777236   | 6271:VM160           | vmnic8      | vSwitch0        | 0.49        | 0.00   | 0.49     | 0.00     | 0.00   | 0.00   |
| 16777237   | 6317:VM145 CX LUN8   | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 16777238   | 6310:VM149 CX LUN12  | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 16777239   | 6351:VM162           | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 16777240   | 6347:VM148 CX LUN11  | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 16777241   | 6393:VM146 CX LUN9   | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 16777242   | 6400:VM147 CX LUN10  | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 16777243   | 6450:VM101 CX LUN6   | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 16777244   | 6786:VM103 CX LUN7   | vmnic8      | vSwitch0        | 0.49        | 0.00   | 0.49     | 0.00     | 0.00   | 0.00   |
| 33554433   | Management           | n/a         | vSwitch1        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 33554434   | vmnic10              |             | vSwitch1        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 33554435   | vmk1                 | vmnic10     | vSwitch1        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 50331649   | Management           | n/a         | vSwitch2        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 50331653   | vmk3                 | vmnic4      | vSwitch2        | 2431.56     | 402.63 | 19411.15 | 38.78    | 0.00   | 0.00   |
| 0331655    | vmnic4               |             | vSwitch2        | 2431.56     | 402.40 | 24214.71 | 41.08    | 0.00   | 0.00   |
| 67108865   | Management           |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 67108866   | 120                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 67108867   | 121                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 67108868   | 122                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 67108869   | 123                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 67108870   | 124                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 67108871   | 125                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 57108872   | 126                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 33886087   | Management           | n/a         | vSwitch3        | 0.00        | 0.00   | 0.00     | 0.00     | 0.00   | 0.00   |
| 83886089   | vmk2                 | vmnic5      | vSwitch3        | 3264.40     | 352.35 | 17208.96 | 40.35    | 0.00   | 0.00   |
| 83886090   | vmnic5               |             | vSwitch3        | 3264.40     | 352.35 | 22132.14 | 42.72    | 0.00   | 0.00   |

| root@68508 | 3:~                  |             |                 |             |        |          |        |                   |        |
|------------|----------------------|-------------|-----------------|-------------|--------|----------|--------|-------------------|--------|
| L0:40:24am | up 7 days 21:09, 211 | worlds; CPU | J load average: | 0.23, 0.15, | 0.14   |          |        |                   |        |
|            |                      |             |                 |             |        |          |        |                   |        |
| PORT-ID    | USED-BY              | TEAM-PNIC   | DNAME           | PKTTX/s     | MbTX/s | PKTRX/s  | MbRX/s | <pre>%DRPTX</pre> | *DRPRX |
| 16777217   | Management           | n/a         | vSwitch0        | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 16777218   | vmnic8               |             | vSwitch0        | 148.30      | 0.81   | 111.58   | 0.06   | 0.00              | 0.00   |
| 16777219   | vmk0                 | vmnic8      | vSwitch0        | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 16777220   | 4096:vswif0          | vmnic8      | vSwitch0        | 148.30      | 0.81   | 9.54     | 0.00   | 0.00              | 0.00   |
| 16777235   | 6259:VM164           | vmnic8      | vSwitch0        | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 16777236   | 6271:VM160           | vmnic8      | vSwitch0        | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 16777237   | 6317:VM145_CX_LUN8   | vmnic8      | vSwitch0        | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 16777238   | 6310:VM149_CX_LUN12  | vmnic8      | vSwitch0        | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 16777239   | 6351:VM162           | vmnic8      | vSwitch0        | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 16777240   | 6347:VM148_CX_LUN11  | vmnic8      | vSwitch0        | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 16777241   | 6393:VM146_CX_LUN9   | vmnic8      | vSwitch0        | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 16777242   | 6400:VM147_CX_LUN10  | vmnic8      | vSwitch0        | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 16777243   | 6450:VM101_CX_LUN6   | vmnic8      | vSwitch0        | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 16777244   | 6786:VM103_CX_LUN7   | vmnic8      | vSwitch0        | 0.00        | 0.00   | 1.91     | 0.00   | 0.00              | 0.00   |
| 33554433   | Management           | n/a         | vSwitch1        | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 33554434   | vmnic10              |             | vSwitch1        | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 33554435   | vmk1                 | vmnic10     | vSwitch1        | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 50331649   | Management           | n/a         | vSwitch2        | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 50331653   | vmk3                 | fallback    | vSwitch2        | 0.95        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 50331655   | vmnic4               |             | vSwitch2        | 0.95        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 67108865   | Management           |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 67108866   | 120                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 67108867   | 121                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 67108868   | 122                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 67108869   | 123                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 67108870   | 124                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 67108871   | 125                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 67108872   | 126                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 83886087   | Management           | n/a         | vSwitch3        | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |
| 83886089   | vmk2                 | vmnic5      | vSwitch3        | 10100.84    | 596.90 | 31846.52 | 67.28  | 0.00              | 0.00   |
| 83886090   | vmnic5               |             | vSwitch3        | 10100.36    | 596.81 | 40291.79 | 71.50  | 0.00              | 0.00   |
|            |                      |             |                 |             |        |          |        |                   |        |

The following figure shows the I/O after the simulated front-end path failure. Data moved to a single VMkernel NIC within 5-10 seconds (2-second delay at least on ESXTOP, most likely instantly).

-

Back-end<br/>failover resultsThe following figure shows the PowerPath/VE host before any back-end ports were<br/>shut down to simulate a back-end failure.

| Proot@6850B |                      |             |                 |             |        |          |        |                   |        |  |
|-------------|----------------------|-------------|-----------------|-------------|--------|----------|--------|-------------------|--------|--|
| 11:57:06am  | up 7 days 22:26, 199 | worlds; CPU | J load average: | 0.23, 0.15, | 0.14   |          |        |                   |        |  |
| PORT-ID     | USED-BY              | TEAM-PNIC   | DNAME           | PKTTX/s     | MbTX/s | PKTRX/s  | MbRX/s | <pre>%DRPTX</pre> | &DRPRX |  |
| 16777217    | Management           | n/a         | vSwitch0        | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 16777218    | vmnic8               |             | vSwitch0        | 86.63       | 0.36   | 54.64    | 0.05   | 0.00              | 0.00   |  |
| 16777219    | vmk0                 | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.98     | 0.00   | 0.00              | 0.00   |  |
| 16777220    | 4096:vswif0          | vmnic8      | vSwitch0        | 86.63       | 0.36   | 20.67    | 0.03   | 0.00              | 0.00   |  |
| 16777235    | 6259:VM164           | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.98     | 0.00   | 0.00              | 0.00   |  |
| 16777237    | 6317:VM145_CX_LUN8   | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.98     | 0.00   | 0.00              | 0.00   |  |
| 16777238    | 6310:VM149_CX_LUN12  | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.98     | 0.00   | 0.00              | 0.00   |  |
| 16777239    | 6351:VM162           | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.98     | 0.00   | 0.00              | 0.00   |  |
| 16777240    | 6347:VM148 CX LUN11  | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.98     | 0.00   | 0.00              | 0.00   |  |
| 16777241    | 6393:VM146_CX_LUN9   | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.98     | 0.00   | 0.00              | 0.00   |  |
| 16777242    | 6400:VM147 CX LUN10  | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.98     | 0.00   | 0.00              | 0.00   |  |
| 16777245    | 6915:VM160           | vmnic8      | vSwitch0        | 0.00        | 0.00   | 0.98     | 0.00   | 0.00              | 0.00   |  |
| 33554433    | Management           | n/a         | vSwitch1        | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 33554434    | vmnic10              |             | vSwitch1        | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 33554435    | vmkl                 | vmnic10     | vSwitch1        | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 50331649    | Management           | n/a         | vSwitch2        | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 50331653    | vmk3                 | vmnic4      | vSwitch2        | 2464.54     | 324.07 | 15899.66 | 35.37  | 0.00              | 0.00   |  |
| 50331655    | vmnic4               |             | vSwitch2        | 2464.54     | 324.07 | 19956.53 | 37.33  | 0.00              | 0.00   |  |
| 67108865    | Management           |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 67108866    | 120                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 67108867    | 121                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 67108868    | 122                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 67108869    | 123                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 67108870    | 124                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 67108871    | 125                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 67108872    | 126                  |             | DvsPortset-0    | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 83886087    | Management           | n/a         | vSwitch3        | 0.00        | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 83886089    | vmk2                 | vmnic5      | vSwitch3        | 2191.85     | 300.61 | 14685.85 | 31.83  | 0.00              | 0.00   |  |
| 83886090    | vmnic5               |             | vSwitch3        | 2191.85     | 300.61 | 18549.77 | 33.69  | 0.00              | 0.00   |  |

The following figure shows that after failing one port on SPB (vLAN 318) the I/O is mostly load balanced, though not as ideal as with an even number of paths.

| Proot@6850B | -                    |             |                    |           |        |          |        |        |        |  |
|-------------|----------------------|-------------|--------------------|-----------|--------|----------|--------|--------|--------|--|
| 12:02:11pm  | up 7 days 22:31, 199 | worlds; CPU | J load average: 0. | 23, 0.15, | 0.14   |          |        |        |        |  |
| PORT-ID     | USED-BY              | TEAM-PNIC   | DNAME              | PKTTX/s   | MbTX/s | PKTRX/s  | MbRX/s | &DRPTX | *DRPRX |  |
| 16777217    | Management           | n/a         | vSwitch0           | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 16777218    | vmnic8               |             | vSwitch0           | 74.86     | 0.36   | 46.25    | 0.03   | 0.00   | 0.00   |  |
| 16777219    | vmk0                 | vmnic8      | vSwitch0           | 0.00      | 0.00   | 0.48     | 0.00   | 0.00   | 0.00   |  |
| 16777220    | 4096:vswif0          | vmnic8      | vSwitch0           | 74.86     | 0.36   | 7.15     | 0.00   | 0.00   | 0.00   |  |
| 16777235    | 6259:VM164           | vmnic8      | vSwitch0           | 0.00      | 0.00   | 0.48     | 0.00   | 0.00   | 0.00   |  |
| 16777237    | 6317:VM145_CX_LUN8   | vmnic8      | vSwitch0           | 0.00      | 0.00   | 0.48     | 0.00   | 0.00   | 0.00   |  |
| 16777238    | 6310:VM149_CX_LUN12  | vmnic8      | vSwitch0           | 0.00      | 0.00   | 0.48     | 0.00   | 0.00   | 0.00   |  |
| 16777239    | 6351:VM162           | vmnic8      | vSwitch0           | 0.00      | 0.00   | 0.48     | 0.00   | 0.00   | 0.00   |  |
| 16777240    | 6347:VM148 CX LUN11  | vmnic8      | vSwitch0           | 0.00      | 0.00   | 0.48     | 0.00   | 0.00   | 0.00   |  |
| 16777241    | 6393:VM146 CX LUN9   | vmnic8      | vSwitch0           | 0.00      | 0.00   | 0.48     | 0.00   | 0.00   | 0.00   |  |
| 16777242    | 6400:VM147 CX LUN10  | vmnic8      | vSwitch0           | 0.00      | 0.00   | 0.48     | 0.00   | 0.00   | 0.00   |  |
| 16777245    | 6915:VM160           | vmnic8      | vSwitch0           | 0.00      | 0.00   | 0.48     | 0.00   | 0.00   | 0.00   |  |
| 33554433    | Management           | n/a         | vSwitch1           | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 33554434    | vmnic10              |             | vSwitch1           | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 33554435    | vmk1                 | vmnic10     | vSwitch1           | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 50331649    | Management           | n/a         | vSwitch2           | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 50331653    | vmk3                 | vmnic4      | vSwitch2           | 5453.59   | 228.87 | 13467.79 | 22.48  | 0.00   | 0.00   |  |
| 50331655    | vmnic4               |             | vSwitch2           | 5454.54   | 228.90 | 17534.73 | 24.48  | 0.00   | 0.00   |  |
| 67108865    | Management           |             | DvsPortset-0       | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 67108866    | 120                  |             | DvsPortset-0       | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 67108867    | 121                  |             | DvsPortset-0       | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 67108868    | 122                  |             | DvsPortset-0       | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 67108869    | 123                  |             | DvsPortset-0       | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 67108870    | 124                  |             | DvsPortset-0       | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 67108871    | 125                  |             | DvsPortset-0       | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 67108872    | 126                  |             | DvsPortset-0       | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 83886087    | Management           | n/a         | vSwitch3           | 0.00      | 0.00   | 0.00     | 0.00   | 0.00   | 0.00   |  |
| 83886089    | vmk2                 | vmnic5      | vSwitch3           | 6611.82   | 238.31 | 15406.13 | 106.17 | 0.00   | 0.00   |  |
| 83886090    | vmnic5               |             | vSwitch3           | 6611.35   | 237.83 | 25450.23 | 111.21 | 0.00   | 0.00   |  |
|             |                      |             |                    |           |        |          |        |        |        |  |

| Proot@6850B | -                    |            |                 |             |        |         |        |                   |        |   |
|-------------|----------------------|------------|-----------------|-------------|--------|---------|--------|-------------------|--------|---|
| 12:05:27pm  | up 7 days 22:34, 199 | worlds; CP | J load average: | 0.23, 0.15, | 0.14   |         |        |                   |        | 4 |
| PORT-ID     | USED-BY              | TEAM-PNIC  | DNAME           | PKTTX/s     | MbTX/s | PKTRX/s | MbRX/s | <pre>%DRPTX</pre> | *DRPRX |   |
| 16777217    | Management           | n/a        | vSwitch0        | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 16777218    | vmnic8               |            | vSwitch0        | 61.51       | 0.35   | 41.01   | 0.04   | 0.00              | 0.00   |   |
| 16777219    | vmk0                 | vmnic8     | vSwitch0        | 0.00        | 0.00   | 0.95    | 0.00   | 0.00              | 0.00   |   |
| 16777220    | 4096:vswif0          | vmnic8     | vSwitch0        | 61.51       | 0.35   | 11.44   | 0.02   | 0.00              | 0.00   |   |
| 16777235    | 6259:VM164           | vmnic8     | vSwitch0        | 0.00        | 0.00   | 0.95    | 0.00   | 0.00              | 0.00   |   |
| 16777237    | 6317:VM145 CX LUN8   | vmnic8     | vSwitch0        | 0.00        | 0.00   | 0.95    | 0.00   | 0.00              | 0.00   |   |
| 16777238    | 6310:VM149 CX LUN12  | vmnic8     | vSwitch0        | 0.00        | 0.00   | 0.95    | 0.00   | 0.00              | 0.00   |   |
| 16777239    | 6351:VM162           | vmnic8     | vSwitch0        | 0.00        | 0.00   | 0.95    | 0.00   | 0.00              | 0.00   |   |
| 16777240    | 6347:VM148 CX LUN11  | vmnic8     | vSwitch0        | 0.00        | 0.00   | 0.95    | 0.00   | 0.00              | 0.00   |   |
| 16777241    | 6393:VM146 CX LUN9   | vmnic8     | vSwitch0        | 0.00        | 0.00   | 0.95    | 0.00   | 0.00              | 0.00   |   |
| 16777242    | 6400:VM147 CX LUN10  | vmnic8     | vSwitch0        | 0.00        | 0.00   | 0.95    | 0.00   | 0.00              | 0.00   |   |
| 16777245    | 6915:VM160           | vmnic8     | vSwitch0        | 0.00        | 0.00   | 0.95    | 0.00   | 0.00              | 0.00   |   |
| 33554433    | Management           | n/a        | vSwitch1        | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 33554434    | vmnic10              |            | vSwitch1        | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 33554435    | vmk1                 | vmnic10    | vSwitch1        | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 50331649    | Management           | n/a        | vSwitch2        | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 50331653    | vmk3                 | vmnic4     | vSwitch2        | 2160.55     | 82.21  | 5122.66 | 25.97  | 0.00              | 0.00   |   |
| 50331655    | vmnic4               |            | vSwitch2        | 2163.41     | 82.33  | 7122.04 | 26.96  | 0.00              | 0.00   |   |
| 67108865    | Management           |            | DvsPortset-0    | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 67108866    | 120                  |            | DvsPortset-0    | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 67108867    | 121                  |            | DvsPortset-0    | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 67108868    | 122                  |            | DvsPortset-0    | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 67108869    | 123                  |            | DvsPortset-0    | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 67108870    | 124                  |            | DvsPortset-0    | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 67108871    | 125                  |            | DvsPortset-0    | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 67108872    | 126                  |            | DvsPortset-0    | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 83886087    | Management           | n/a        | vSwitch3        | 0.00        | 0.00   | 0.00    | 0.00   | 0.00              | 0.00   |   |
| 83886089    | vmk2                 | vmnic5     | vSwitch3        | 2239.23     | 81.83  | 5157.95 | 25.95  | 0.00              | 0.00   |   |
| 83886090    | vmnic5               |            | vSwitch3        | 2239.70     | 81.83  | 7172.58 | 26.95  | 0.00              | 0.00   |   |
|             |                      |            |                 |             |        |         |        |                   |        |   |
|             |                      |            |                 |             |        |         |        |                   |        |   |
|             |                      |            |                 |             |        |         |        |                   |        |   |
|             |                      |            |                 |             |        |         |        |                   |        |   |
|             |                      |            |                 |             |        |         |        |                   |        |   |

The following figure shows the I/O after SPB vlan 318 port has been re-enabled (10-20 seconds). It load balanced perfectly.

#### VMotion change host results

The following figure shows Host 2 (NMP enabled) before the VMs migrated from the PowerPath/VE ESX host.

| DODE TO  |                      | TRANK DUTO | DUTINE   | Determine / | No mar / |         | NO DIL |        |        |
|----------|----------------------|------------|----------|-------------|----------|---------|--------|--------|--------|
| PORT-ID  | USED-BY              | ILAM-PNIC  | DNAME    | PKTTX/s     | MDIX/S   | PKIRX/S | MDRX/3 | *DRPTX | SDRPRX |
| 16777217 | Management           | n/a        | vSwitch0 | 0.00        | 0.00     | 0.00    | 0.00   | 0.00   | 0.00   |
| 16777218 | vmnic8               |            | vSwitch0 | 10.74       | 0.02     | 8.79    | 0.00   | 0.00   | 0.00   |
| 16777219 | 4096:vswif0          | vmnic8     | vSwitch0 | 10.74       | 0.02     | 8.30    | 0.00   | 0.00   | 0.00   |
| 16777220 | 4248:VM151_CX_LUN13  | vmnic8     | vSwitch0 | 0.00        | 0.00     | 1.46    | 0.00   | 0.00   | 0.00   |
| 16777221 | 4257:VM152_CX_LUN14  | vmnic8     | vSwitch0 | 0.00        | 0.00     | 1.46    | 0.00   | 0.00   | 0.00   |
| 16777222 | 4284:VM153_CX_LUN16  | vmnic8     | vSwitch0 | 0.00        | 0.00     | 1.46    | 0.00   | 0.00   | 0.00   |
| 16777223 | 4302:VM171           | vmnic8     | vSwitch0 | 0.00        | 0.00     | 1.46    | 0.00   | 0.00   | 0.00   |
| 16777224 | 4314:Windows2008R2-7 | vmnic8     | vSwitch0 | 0.00        | 0.00     | 1.46    | 0.00   | 0.00   | 0.00   |
| 16777225 | 4333:Windows2008-VM1 | vmnic8     | vSwitch0 | 0.00        | 0.00     | 1.46    | 0.00   | 0.00   | 0.00   |
| 16777226 | 4351:Windows7RC7137  | vmnic8     | vSwitch0 | 0.00        | 0.00     | 0.00    | 0.00   | 0.00   | 0.00   |
| 33554433 | Management           | n/a        | vSwitch1 | 0.00        | 0.00     | 0.00    | 0.00   | 0.00   | 0.00   |
| 33554434 | vmnic10              |            | vSwitch1 | 0.00        | 0.00     | 0.00    | 0.00   | 0.00   | 0.00   |
| 33554435 | vmk0                 | vmnic10    | vSwitch1 | 0.00        | 0.00     | 0.00    | 0.00   | 0.00   | 0.00   |
| 50331652 | Management           | n/a        | vSwitch2 | 0.00        | 0.00     | 0.00    | 0.00   | 0.00   | 0.00   |
| 50331653 | vmnic4               |            | vSwitch2 | 0.00        | 0.00     | 0.49    | 0.00   | 0.00   | 0.00   |
| 50331654 | vmk2                 | vmnic4     | vSwitch2 | 0.00        | 0.00     | 0.00    | 0.00   | 0.00   | 0.00   |
| 67108865 | Management           | n/a        | vSwitch3 | 0.00        | 0.00     | 0.00    | 0.00   | 0.00   | 0.00   |
| 67108866 | vmnic5               |            | vSwitch3 | 6.35        | 0.03     | 6.35    | 0.00   | 0.00   | 0.00   |
| 67108867 | vmk1                 | vmnic5     | vSwitch3 | 6.35        | 0.03     | 5.86    | 0.00   | 0.00   | 0.00   |

|           | 4:~ ) 🛶               |            | (Cap-1)  |                     |        |          | -      | 691               |        |  |
|-----------|-----------------------|------------|----------|---------------------|--------|----------|--------|-------------------|--------|--|
| 1:49:29pm | up 2 days 31 min, 257 | worlds; CP | V load a | verage: 0.14, 0.14, | 0.14   |          |        |                   |        |  |
| PORT-ID   | USED-BY               | TEAM-PNIC  | DNAME    | PKTTX/s             | MbTX/s | PKTRX/s  | MbRX/s | <pre>%DRPTX</pre> | *DRPRX |  |
| 16777217  | Management            | n/a        | vSwitch0 | 0.00                | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 16777218  | vmnic8                |            | vSwitch0 | 45.18               | 0.25   | 28.35    | 0.01   | 0.00              | 0.00   |  |
| 16777219  | 4096:vswif0           | vmnic8     | vSwitch0 | 44.21               | 0.25   | 11.53    | 0.01   | 0.00              | 0.00   |  |
| 16777220  | 4248:VM151_CX_LUN13   | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777221  | 4257:VM152_CX_LUN14   | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777222  | 4284:VM153_CX_LUN16   | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777223  | 4302:VM171            | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777224  | 4314:Windows2008R2-7  | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777225  | 4333:Windows2008-VM1  | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777226  | 4351:Windows7RC7137   | vmnic8     | vSwitch0 | 0.00                | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 16777228  | 4694:VM101_CX_LUN6    | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777229  | 4701:VM103_CX_LUN7    | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777230  | 4727:VM145_CX_LUN8    | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777231  | 4734:VM148_CX_LUN11   | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777232  | 4768:VM162            | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777233  | 4761:VM149_CX_LUN12   | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777234  | 4806:VM164            | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777235  | 4814:VM147_CX_LUN10   | vmnic8     | vSwitch0 | 0.00                | 0.00   | 1.44     | 0.00   | 0.00              | 0.00   |  |
| 16777236  | 4854:VM160            | vmnic8     | vSwitch0 | 0.48                | 0.00   | 0.96     | 0.00   | 0.00              | 0.00   |  |
| 16777237  | 4847:VM146_CX_LUN9    | vmnic8     | vSwitch0 | 0.48                | 0.00   | 0.96     | 0.00   | 0.00              | 0.00   |  |
| 33554433  | Management            | n/a        | vSwitch1 | . 0.00              | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 33554434  | vmnic10               |            | vSwitch1 | . 0.00              | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 33554435  | vmk0                  | vmnic10    | vSwitch1 | . 0.00              | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 50331652  | Management            | n/a        | vSwitch2 | 0.00                | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 50331653  | vmnic4                |            | vSwitch2 | 0.00                | 0.00   | 0.48     | 0.00   | 0.00              | 0.00   |  |
| 50331654  | vmk2                  | vmnic4     | vSwitch2 | 0.00                | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 67108865  | Management            | n/a        | vSwitch3 | 0.00                | 0.00   | 0.00     | 0.00   | 0.00              | 0.00   |  |
| 67108866  | vmnic5                |            | vSwitch3 | 3651.06             | 762.15 | 38914.96 | 27.43  | 0.00              | 0.00   |  |
|           | vmk1                  | vmnic5     | vSwitch3 | 3651.06             | 762.15 | 36471.15 | 26.20  | 0.00              | 0.00   |  |

The following figure shows Host 2 after the VMs are migrated.

The following figure shows Host 1 (PowerPath/VE enabled) after all the VMs have been migrated off.

| P root@6850B:~ |                    | -          | Internal Street, | 100         |        |         |        |        |        |  |
|----------------|--------------------|------------|------------------|-------------|--------|---------|--------|--------|--------|--|
| 1:50:19pm up 7 | 7 days 19 min, 139 | worlds; CI | PU load average: | 0.01, 0.36, | 0.47   |         |        |        |        |  |
| PORT-ID        | USED-BY            | TEAM-PNIC  | DNAME            | PKTTX/s     | MbTX/s | PKTRX/s | MbRX/s | &DRPTX | *DRPRX |  |
| 16777217       | Management         | n/a        | vSwitch0         | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 16777218       | vmnic8             |            | vSwitch0         | 13.29       | 0.02   | 11.81   | 0.01   | 0.00   | 0.00   |  |
| 16777219       | vmk0               | vmnic8     | vSwitch0         | 0.00        | 0.00   | 1.48    | 0.00   | 0.00   | 0.00   |  |
| 16777220       | 4096:vswif0        | vmnic8     | vSwitch0         | 13.29       | 0.02   | 7.88    | 0.00   | 0.00   | 0.00   |  |
| 33554433       | Management         | n/a        | vSwitch1         | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 33554434       | vmnic10            |            | vSwitch1         | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 33554435       | vmk1               | vmnic10    | vSwitch1         | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 50331649       | Management         | n/a        | vSwitch2         | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 50331653       | vmk3               | vmnic4     | vSwitch2         | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 50331655       | vmnic4             |            | vSwitch2         | 0.00        | 0.00   | 0.49    | 0.00   | 0.00   | 0.00   |  |
| 67108865       | Management         |            | DvsPortset-0     | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 67108866       | 120                |            | DvsPortset-0     | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 67108867       | 121                |            | DvsPortset-0     | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 67108868       | 122                |            | DvsPortset-0     | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 67108869       | 123                |            | DvsPortset-0     | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 67108870       | 124                |            | DvsPortset-0     | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 67108871       | 125                |            | DvsPortset-0     | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 67108872       | 126                |            | DvsPortset-0     | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 83886087       | Management         | n/a        | vSwitch3         | 0.00        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 83886089       | vmk2               | vmnic5     | vSwitch3         | 0.49        | 0.00   | 0.00    | 0.00   | 0.00   | 0.00   |  |
| 83886090       | vmnic5             |            | vSwitch3         | 0.49        | 0.00   | 0.49    | 0.00   | 0.00   | 0.00   |  |

## Conclusion

| Summary    | <ul> <li>Performance tests show that EMC PowerPath/VE provides improved performance and reliability over VMware Native Multipathing (NMP).</li> <li>For vSphere servers, using PowerPath/VE provides</li> <li>superior load balancing,</li> <li>fast path failover, and</li> <li>improved device prioritization technology.</li> </ul>  |
|------------|---|
| Findings   | <ul> <li>The following results were determined using the stated test plan and methodology:</li> <li>PowerPath/VE provides superior load-balancing performance across multiple paths using FC or iSCSI.</li> <li>PowerPath/VE seamlessly integrates and takes control of all device I/O, path selection, and failover without the need for additional configuration.</li> <li>VMware NMP requires that certain configuration parameters be specified to achieve improved performance.</li> </ul> |
| Benefits   | <ul> <li>PowerPath/VE improves your virtualized data center by</li> <li>Providing predictable performance over both FC and iSCSI</li> <li>Providing higher reliability than VMware NMP</li> <li>Providing failover and failback capability</li> </ul>   |
| Next steps | EMC can help accelerate assessment, design, implementation, and management while lowering the implementation risks and cost of creating a virtualized data center. To learn more about this and other solutions contact an EMC representative or visit www.emc.com.   |