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About This Guide

The purpose of the *VMware vSphere 5.0 Evaluation Guide, Volume Three – Advanced Networking Features*, is to support a self-guided, hands-on evaluation of VMware vSphere® 5.0 ("vSphere") advanced networking features, such as NetFlow, port mirroring, and user-defined resource pools.

This guide covers evaluation cases that are suitable for IT professionals who have an existing VMware virtualization environment and who want to evaluate features in vSphere that enable greater consolidation while maintaining service levels.

System Requirements

To ensure the best experience when using this guide, the user will need to configure hardware and software as detailed in the Hardware Requirements section.

Hardware Requirements

This guide makes the following assumptions about users’ existing physical infrastructure:

**Servers**

Users must have at least three dedicated servers capable of running VMware ESXi™ 5.0 to provide resources for this evaluation.1

**Storage**

Users must have shared storage with enough space available to allow for three 100GB dedicated datastores. Shared storage can be SAN or network-attached storage (NAS). This document assumes users have SAN-based storage.

**Networking**

Users must also have at least three virtual networks configured to separate virtual machine, VMware vSphere® vMotion® (vMotion), and vSphere management networks. These networks can be set up on a single virtual switch with multiple port groups, or across multiple virtual switches. For the purpose of this evaluation guide, the configuration starts with a single vSphere standard switch and migrates port groups to a VMware vSphere Distributed Switch (VDS) to support evaluation of advanced networking features.

For more detailed requirements, see the following table.

---

1. These servers must be on the VMware vSphere 5.0 Hardware Compatibility List.


### Software and Licensing Requirements

This guide makes the following assumptions about users’ existing software infrastructure:

**vSphere**

This volume of the *VMware vSphere 5.0 Evaluation Guide* requires vSphere 5.0 and licensing for Enterprise Plus. The vSphere 5.0 evaluation license available from the VMware evaluation portal provides Enterprise Plus functionality for 60 days and is the best choice for performing the vSphere 5.0 evaluations.

**Guest Operating Systems**

This volume of the *VMware vSphere 5.0 Evaluation Guide* will require five or six virtual machines running Windows 2003 or Windows 2008.

### Evaluation Guide Environment Setup

The VMware technical marketing lab was built using a combination of Cisco UCS server hardware and EMC Clariion CX4 Fibre Channel (FC) storage. The environment consisted of eight identical four-node pods with most pods configured as a three-node ESXi cluster and a fourth node for management. In many cases, additional resources have been configured in the technical marketing test-bed configuration to support other evaluation projects and are present in the diagrams. The user can configure only what is called for in Figure 1 and can safely ignore additional resources in screen shots and topology diagrams. The following picture shows the technical marketing test rack.

<table>
<thead>
<tr>
<th>HARDWARE</th>
<th>MINIMUM</th>
<th>WHAT’S USED IN THIS GUIDE</th>
</tr>
</thead>
</table>
| ESXi       | 3 ESXi/ESX servers
            | CPU – 2 processors of 2GHz
            | Memory – 6GB
            | Network – 2 x 1GB network adaptor                                      | 3 ESXi servers (Cisco UCS 1.3.1)
            | CPU – 2 quad-core Intel eon Nehalem processors at 2.6GHz
            | Memory – 48GB
            | Network – 4 x 10GB network adaptor                                     |
| Storage    | 1 datastore (100GB)                                                     | 3 datastores (Fibre Channel—100GB each)                                                   |
| Network    | 1 VLAN for carrying virtual machine traffic
            | 1 VLAN for carrying management traffic                                      | Separate VLANs for ESXi management, vMotion, and virtual machine traffic
EMC CLARiiON CX$-120
Flare version 4.30.000.5.509
15x 600GB 15K SCSI
5x 200GB SSD
10x open slots

Cisco UCS 1.1.1(p)
32x dual quad-core Intel Xeon Nehalem Processors
48GB Memory
Dual-port Palo cards
1x 146GB local HDD
Configure with:
4x 10GB network adapters
2x 4/8GB HBAs
Slot 1 of each chassis reserved for core management
Server Configuration

The VMware vSphere 5.0 Evaluation Guide expects three modern server-class systems with adequate processors and memory to host 6–8 minimally configured virtual machines used for testing. The servers used for this evaluation do not need to be overly powerful, just reliable, and they must be on the VMware vSphere 5.0 Hardware Compatibility List (HCL).

Each server must have at least 2 x 1GB or 2 x 10GB network adaptors and a proper connection to shared storage. The following diagram summarizes the Evaluation Guide test-bed configuration.

Logical Network Setup

The VMware vSphere 5.0 Evaluation Guide, Volume Two, uses a simple network configuration consisting of three logical networks. The first is for vSphere management traffic, including vSphere High Availability (HA). The second is for vMotion and the third is for virtual machine traffic. Each logical network is configured as a port group on a standard switch, with a corresponding VLAN configured to provide physical isolation of the network traffic.
On the vSphere side, the network configuration looks like that in the following diagram.
Storage Setup

The VMware vSphere 5.0 Evaluation Guide, Volume Two, uses a storage configuration consisting of three 100GB FC LUNs presented to each host, allowing the creation of three datastores.

Virtual Machine Setup

The VMware vSphere 5.0 Evaluation Guide, Volume Two, uses a total of seven virtual machines for testing. This volume will require Windows 2003 or Windows 2008 guest operating systems. It is up to the user to configure virtual machines that can be brought up to a running state for testing. The following diagram shows VM_01 through VM_06 configured in the technical marketing test lab.
VMware vSphere 5.0 Evaluation Guide, Volume Three, Worksheet

Use the following worksheet to organize your evaluation process.

### HARDWARE CHECKLIST

<table>
<thead>
<tr>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>All hardware has been validated against the VMware vSphere 5.0 Hardware Compatibility List (HCL)</td>
</tr>
<tr>
<td>Each server has 2 x 1GB or 2 x 10GB network adaptors connected to a common switch (they will be configured as a network adaptor team)</td>
</tr>
<tr>
<td>Each server has the required HBA/network adaptor to access shared storage</td>
</tr>
</tbody>
</table>

### SOFTWARE CHECKLIST

<table>
<thead>
<tr>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware ESXi™ installation media available</td>
</tr>
<tr>
<td>VMware vCenter Server Appliance downloaded</td>
</tr>
<tr>
<td>VMware vSphere Client installed</td>
</tr>
<tr>
<td>ESXi host 1 name</td>
</tr>
<tr>
<td>ESXi host 2 name</td>
</tr>
<tr>
<td>ESXi host 3 name</td>
</tr>
<tr>
<td>Subnet, netmask, and default gateway for management network</td>
</tr>
<tr>
<td>Subnet, netmask, and default gateway for virtual machine network</td>
</tr>
<tr>
<td>Subnet, netmask, and default gateway for vMotion network</td>
</tr>
</tbody>
</table>

### STORAGE CHECKLIST

<table>
<thead>
<tr>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>All servers can see at least three common 100GB LUNs (or NFS exports)</td>
</tr>
<tr>
<td>Datastore 1 name</td>
</tr>
<tr>
<td>Datastore 2 name</td>
</tr>
<tr>
<td>Datastore 3 name</td>
</tr>
</tbody>
</table>
vSphere Advanced Network Features

With the release of vSphere 5.0, VMware brings a number of powerful new features and enhancements to the networking capabilities of the vSphere platform. There are two broad categories of enhancements:

- **Enhanced network I/O control**: vSphere 5.0 builds on network I/O control (NIOC) to allow user-defined network resource pools, enabling multitenancy deployment, and to bridge virtual and physical infrastructure quality of service with per-resource pool 802.1 tagging.

- **VDS improvements**: vSphere 5.0 provides improved visibility into virtual machine traffic through NetFlow and enhances monitoring and troubleshooting capabilities through the Switch Port Analyzer (SPAN) and LLDP.

In this Evaluation Guide volume, you will learn how to configure and test the following new networking features that are available on the VDS:

- NetFlow
- Port mirroring
- NIOC – user-defined resource pools

First, you will configure the VDS and then enable and test each of the new features one at a time.

**vSphere Distributed Switch Configuration**

**Overview**

The VDS simplifies virtual machine networking by enabling you to set up virtual machine networking for your entire datacenter from a centralized interface. A single VDS spans many VMware ESX®/ESXi hosts and aggregates networking to a centralized datacenter level.

**Configuring the VDS**

In this exercise, you will configure a VDS that spans across three hosts and provides a single network management interface to configure network parameters. The VDS configuration can be accomplished in either of two ways:

1. Using only the VDS user interface
2. Using a combination of the VDS and host profiles

This use case describes the configuration through the user interface. For more details on host profile–based migration, refer to *VMware vSphere Distributed Switch: Migration and Configuration*, available on vmware.com.

**Evaluation Environment for the VDS Configuration**

The evaluation environment consists of the following components, as shown in Figure 1:

1. A single vSphere datacenter (Datacenter)
2. Three ESXi 5.0 servers (tm-pod03-esx01.tmsb.local, tm-pod03-esx02.tmsb.local, tm-pod03-esx03.tmsb.local) in a cluster (Cluster)
3. A virtual network environment supporting the following different traffic types:
   a. Production02 (virtual machine traffic)
   b. vMotion traffic
   c. Management network traffic
   d. User-defined tenant traffic
4. Six virtual machines with a single vNIC attachment to the VDS
5. A vSphere Management Assistant, providing remote console access
Creating a VDS
The VDS is created at the datacenter level in the vSphere environment. As shown in Figure 2 under the Networking view, in the Datacenter level, you can click Create VDS button to configure a new VDS.
After the VDS has been created, the Networking panel will show a dvSwitch (the default name), and an uplink group for the uplinks (in this example, it is named dvSwitch-DVUplinks-26).

An uplink group provides a policy template for the uplinks on that VDS. Security policies, VLAN trunk ranges, traffic shaping, and teaming/failover settings can be set at the uplink group level for the entire VDS. In this example, the environment shown in Figure 3, the uplink group consists of four uplinks (dvUplink1 to dvUplink4) and the first two uplinks are connected to vmnic0 and vmnic1 on the host. Depending on the number of vmnics available on a host, you can decide the number of dvUplink ports.
Configuring Distributed Virtual Port Groups

In this step, you will create distributed virtual port groups (DV port groups) on the VDS according to the evaluation environment requirements. The evaluation environment needs support for different types of system and user network traffic types. These traffic types are isolated from each other using different VLANs. Table 1 shows the different traffic types and corresponding port group, VLAN, and IP subnet information. Check the VLAN policies with your network administrators when configuring different port groups.

<table>
<thead>
<tr>
<th>TRAFFIC TYPE</th>
<th>PORT GROUP NAME</th>
<th>VLAN</th>
<th>IP NETWORK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Machine Traffic</td>
<td>Prod02</td>
<td>3001</td>
<td>10.91.35.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(DHCP allocation)</td>
</tr>
<tr>
<td>ESXi Host Management Traffic</td>
<td>Mgmt01</td>
<td>2912</td>
<td>10.91.33.0</td>
</tr>
<tr>
<td>vMotion Traffic</td>
<td>vMotion01</td>
<td>3002</td>
<td>10.91.36.9</td>
</tr>
<tr>
<td>Tenant1 Traffic</td>
<td>Tenant1</td>
<td>3001</td>
<td>10.91.35.0</td>
</tr>
<tr>
<td>Tenant2 Traffic</td>
<td>Tenant2</td>
<td>3001</td>
<td>10.91.35.0</td>
</tr>
</tbody>
</table>

Table 1. Traffic Types and VLAN Assignments in the Example Environment
Once you have the table of port groups and associated VLAN and IP mapping, you can start creating the individual DV port groups.

1. From the Home > Inventory > Networking view, select the VDS. In this example environment, the VDS is labeled dvSwitch.

2. Click New Port Group. Figure 4 shows the first panel in creating the dvpg-Mgmt01 DV port group. Note the number of ports. This defaults to 128 and is the number of ports that this DV port group will allow once created. This also means that up to 128 virtual machines can use this DV port group. You can modify this to a higher number based on the number of virtual machines you want to support within a single DV port group.

3. Continue creating the DV port groups according to the table and enter the VLAN and IP information during the configuration. The Tenant1 and Tenant2 port groups are used during the testing of the enhanced Network I/O Control (NIOC) feature. After creating the DV port groups, the VDS panel should look like it does in Figure 5.
Adding a Host to a VDS

After creating a VDS, you can migrate hosts and physical adapters to this VDS. In this step, you will migrate the standard switch environment of the host to the VDS and DV port groups created in steps 1 and 2.

Figure 6 shows the standard switch configuration of a host that is going to be migrated to the VDS. The switch configuration shows the current port groups and physical adapters. Migration of these port groups and physical adapters is carried out through the following steps:
1. Switch to the **Home > Inventory > Networking** view.
2. Right-click the dvSwitch and select **Add Host**. See Figure 7.

![Image of networking configuration](image)

**Figure 6.** Standard Switch Configuration of a Host to Be Migrated to the VDS

**Figure 7.** Preparing to Add a Host
3. Select the hosts to migrate to the VDS as shown in Figure 8. In your environment, if you have three hosts in a cluster you will see those hosts along with their physical adapter listed as shown in the following panel. In this example, choose to migrate vmnic0 and vmnic1 from the standard switch, vSwitch0, to the uplink port group of the VDS dvSwitch-DVUplinks-26. Click Next.

4. Match up the port groups on the standard switch with the DV port groups of the VDS. In Figure 9, the Management Network port group on the standard switch is matched with the dvpg-Mgmt01 DV port group on the VDS.
5. Repeat the matching process of port groups from the standard switch to DV port groups of the VDS. Double-check the matchups before starting the migration action by clicking Next in the panel shown in Figure 10.
Figure 10. Association of Standard Switch Port Groups to VDS DV Port Groups

This step does not provide the option of transferring the port groups for the virtual machines (Prod02).

After you click Next in the step 5, you will be presented with the panel shown in Figure 11. In this panel, you have an option to migrate your virtual machines from the standard switch port groups to VDS DV port groups. In this example environment, there are six virtual machines that are running on three hosts. In your environment, if you have virtual machines running on the hosts, you can use this screen to migrate those virtual machines to the appropriate VDS DV port groups. Select Migrate virtual machine networking as in Figure 11.
You will be prompted with the following screen, shown in Figure 12, with all the available virtual machines listed, along with the option to migrate them to a destination port group.
7. Using the drop-down menu, select the DV port group to which you want the virtual machine connected. In this example environment, all the virtual machines are migrated to the **dvpg-Prod02** port group, as shown in Figure 13 and Figure 14.
Figure 13. Choosing a Destination DV Port Group for Each Virtual Machine
8. Click **Next** and **Finish**, and wait for the operation to complete. Track the status in the Recent Tasks panel at the bottom of the vSphere Client panel. The VDS should now appear as shown in Figure 15.
Figure 15. VDS After Migration Is Complete

Some evaluators might not have the same port group configurations on the standard switch as shown in this example environment. However, the migration steps remain the same as in this example.

Deleting a Standard Switch from a Host
Deleting the standard switch from the host is not mandatory, but preferred as a way of cleaning up after the migration to the VDS.

To delete the standard switch, follow these steps:

1. Go to the **Home > Inventory > Hosts and Clusters** view and select the **Configuration** tab, and then select **Networking** from the Hardware box.
2. Select **Remove** from the panel above the vSwitch0 graphic.
NetFlow

Overview
NetFlow is a networking protocol that collects IP traffic information as records and sends them to a collector such as CA NetQoS for traffic flow analysis. VDS now supports NetFlow version 5 and helps in monitoring virtual infrastructure traffic.

In this exercise, you will configure the NetFlow session that sends the flow information to the collector. To demonstrate how different flows in a virtual infrastructure are collected and sent to the collector, evaluators are expected to create traffic among different virtual machines using traffic generators.

Evaluation Environment for NetFlow
The evaluation environment consists of the following components as shown in Figure 16 and Figure 17:

1. Three virtual machines running Windows OS on Host1
2. Three virtual machines running Windows OS on Host2
3. Each virtual machine has following software tool installed:
   a. JPerf tool (You can download this tool at http://sourceforge.net/projects/iperf/files/)
4. On one of the virtual machines (VM_02) on Host2 ManageEngine NetFlow Analyzer is installed as a collector tool.
Configuring NetFlow

The NetFlow session can be configured at the VDS level. You should collect the following information regarding the collector before the configuration process starts:

1. The collector’s IP address: In this evaluation the virtual machine VM_02 has the collector tool installed, and its IP address is 10.91.35.72.
2. NetFlow’s Listener Port: As shown in Figure 18, the listener port number is 9996.
Once you have the required information about the collector, you can now create a NetFlow session on the VDS. Start the NetFlow configuration process by editing the VDS settings and selecting the NetFlow tab. Enter the following parameters, as shown in Figure 19, to set up the session.

1. The Collector Settings of IP address and Port is configured according to the information collected about the collector tool installed on VM_02.
2. The other NetFlow parameters remain default parameters, but you can modify them. To change the amount of information that is collected, you can change the sampling rate. For example, a sampling rate of 2 indicates that the VDS will collect data from every other packet. You can also modify the Idle flow export timeout values.
3. The VDS IP address configuration is useful when you want to see all flow information in the collector tool as part of one VDS IP address and not as a separate host management network IP address. In this example, because the VDS IP address is not entered, the collector tool will provide flow details under each host’s management network IP address.
Figure 19. NetFlow Configuration

Generating Traffic

After the NetFlow session configuration, you can test the way in which the VDS collects and sends flow data to the collector by generating some traffic using a standard traffic generator. Also, to demonstrate how the new monitoring capability provides the visibility into the virtual machine to virtual machine traffic, you can create traffic flows between two virtual machines on Host1.

The following are the different flows that are created using the JPerf tool:

1. The VM_01 to VM_03 TCP session running on Host1
2. The VM_05 on Host1 to VM_02 on Host2 TCP session

More details on how to configure the JPerf tool is provided below.

JPerf is a tool that helps in measuring network bandwidth. The tool requires a client- and server-side setup. Figure 20 shows the server side configuration running on VM_01. The server listens on port 5001 for any traffic from the client. Under Choose iPerf Mode, when you select “Server,” the tool automatically fills the iperf command field with appropriate command.
Figure 20. The JPerf Server Settings

Figure 21 shows the client-side configuration running on VM_03. The JPerf client running on VM_03 should send traffic to server IP address 10.91.35.73 on port 5001. To configure the client side, under **Choose iPerf Mode**, select “Client” and enter the Server address and Port fields. To control the amount of traffic that the client will send, you can configure the **Application layer options**.

Figure 21. The JPerf Client Settings
You can generate additional traffic flows between other virtual machines by launching the client and server side of the JPerf tool.

**Checking Collector Results**

After the traffic generation, you can check the collector tool interface for the flow data that was processed and sent by the VDS. In this example environment, two TCP sessions are created. One TCP session runs between two virtual machines on the same host and other between two virtual machines on different hosts. A TCP session consists of two flows. Traffic flowing from the client to the server is one flow and traffic flowing from the server to the client is another flow.

VDS captures the flows that are flowing through the virtual switch on a host, and then sends the flow data over a UDP session to the collector. Along with the flow data, the VDS sends the VDS IP address configured in the NetFlow Session. If the VDS IP address is not configured, as is the case in this example environment, the VDS sends the Host Management IP address along with flow data to identify the flows monitored on a particular host. The following are the Management IP addresses used for the two hosts in this environment:

1. Host1 – tm-pod03-esx01.tmsb.local: 10.91.33.9
2. Host2 – tm-pod03-esx02.tmsb.local: 10.91.33.10

Figure 22 shows the collector screen shot that provides the information on the data collected. The highlighted (red rectangle) application is NetFlow and shows the Source IP address as the Management IP addresses of the two hosts.

![Figure 22. Collector Screen Shot](image-url)
The collector tool also provides historical data as shown in the screen shot in Figure 23. It provides Top Application traffic pie chart information as well as statistics on the Top Devices sending traffic. You can find many more stats and reports in this Collector tool that will help you measure the performance of the application traffic as well as detect any security breaches.

![Figure 23. Collector Screen Shot](image)

**Port Mirroring**

**Overview**

Port mirroring is the capability on a network switch to send a copy of network packets seen on a switch port to a network monitoring device connected to another switch port. Port mirroring is also referred to as SPAN on Cisco switches. In vSphere 5.0, a distributed switch provides a port mirroring capability similar to that available on a physical network switch.

In this exercise, you will configure the port mirroring session such that it will provide complete visibility into the traffic flowing to and from a virtual machine. To demonstrate how network administrators can troubleshoot the virtual infrastructure traffic, evaluators are encouraged to create different internal traffic patterns and to use different destinations (virtual machine or uplink) to send mirror traffic. In this example environment, the virtual machine is configured as the mirror destination. On this destination the virtual machine Wireshark tool is installed to capture and analyze the mirror traffic.

**Evaluation Environment for a Port Mirroring Session**

The evaluation environment of Port Mirroring is similar to the one used during the evaluation of NetFlow feature. Figure 16 and Figure 17 show the different components in this environment:

1. Three virtual machines running Windows OS on Host1
2. Three virtual machines running Windows OS on Host2
3. Each virtual machine with the following software tool installed:
   a. JPerf tool
4. On one of the virtual machines on Host1, Wireshark is installed. Wireshark is a network protocol analyzer tool that will allow you to monitor the mirror traffic.

**Configuring a Port Mirroring Session**

A port mirroring session can be configured at the VDS level and needs the following parameters to perform the setup:

1. **Source to be monitored:** virtual machine dvPort number
2. **Which traffic:** ingress only, egress only, or both ingress and egress
3. **Destination where the packet will be mirrored to:** virtual machine, vmkNIC, or uplink dvPort number

Once you decide which virtual machine traffic you want to monitor, you can get the corresponding dvPort number using the following steps:

1. Switch to the **Home > Inventory > Networking** view.
2. Select dvSwitch and choose the **Ports** tab on the right panel. Scroll down to see the virtual machines and the associated port ID. Figure 24 shows virtual machines and port ID mapping.

In the example environment, the ingress traffic of virtual machine VM_01 is monitored and virtual machine VM_05 is the destination port to which packets will be mirrored. Both these virtual machines are on Host1.

The terms **ingress traffic** and **egress traffic** are with respect to the VDS. So when you want to monitor the traffic that is going out of the virtual machine towards the VDS, it is called ingress traffic. The traffic seeks ingress to the VDS and hence the source is called ingress. If you want to monitor traffic that is received by a virtual machine, then configure the port mirroring session with the source as egress.

![Figure 24. Port ID and Virtual Machine Mapping](image-url)
3. Once you have identified the port IDs, it is time to configure the port mirroring session by selecting dvSwitch in Networking view. Right-click on dvSwitch and select Edit Settings.

4. Select the Port Mirroring tab and click Add as shown in Figure 25.

![Figure 25. Adding a Port Mirroring Session]
5. Choose a name for the session and click **Next**.

![Port Mirroring Session Configuration (Continued)](image)
6. Because you are monitoring ingress traffic on VM_01, select Ingress from the Traffic direction drop-down menu.

7. Specify the source by providing the port ID of VM_01 in the Port IDs field and then move it to the right field, under Port. Figure 29 shows the screen shot after the source port is entered. Click Next.
Figure 28. Port Mirroring Session Configuration (Continued)

Figure 29. Port Mirroring Session Configuration (Continued)
8. Specify destination by selecting either Port or Uplink from the Destination type drop-down menu. In this example, you are sending the mirror traffic to virtual machine VM_05, which is running on the same Host1 where virtual machine VM_01 is running. Select Port from the drop-down menu. You also have an option to mirror the traffic to an uplink port by selecting Uplink under Destination type.

Figure 30. Port Mirroring Session Configuration (Continued)
9. Enter the port ID number of VM_05 in the Port IDs field and move it to the right under the Port field. Figure 32 shows the screen shot after the VM_05 port is selected as the destination.

Figure 31. Port Mirroring Session Configuration (Continued)

Figure 32. Port Mirroring Session Configuration (Continued)
10. This completes the creation of the port mirroring session. As shown in Figure 33, the status of the session is Disabled.

![Figure 33: Port Mirroring Session Configuration Is Complete](image)

11. To enable the port mirroring session, click **Edit**, as shown in Figure 33. This will pop up the panel shown in Figure 34. Select **Enabled** as the status.
Generating Traffic
After the port mirroring session configuration, you can test the way in which the VDS mirrors the packets to the destination port by generating some traffic using a standard traffic generator. Also, to demonstrate how the port mirroring capability provides visibility to all packets that a virtual machine sends or receives, you can create traffic between two virtual machines as in the following example:

1. VM_01 (10.91.35.60) to VM_03 (10.91.35.73) TCP session running on Host1

You can configure the JPerf server on VM_03 and the JPerf client on VM_01. For more details on how to configure the JPerf client and server, you can refer to the steps described in the NetFlow evaluation section, along with Figure 20 and Figure 21.

Checking Mirrored Traffic Using Wireshark
To check the mirrored traffic on the destination VM_05, you must install the Wireshark tool. This tool helps in analyzing network traffic. You can download this tool from www.wireshark.org. After installing the Wireshark tool, you can configure it to monitor the TCP traffic that you have mirrored from VM_01.

1. Click How to Capture to configure the filter for TCP traffic.
2. After Wireshark’s Capture Options panel pops up, you can click the **Capture Filter** tab to choose the traffic that you want to monitor.
3. Figure 37 shows the Capture Filter panel with different protocol options. You can select the **TCP only** option because the packets that will be mirrored from VM_01 will be TCP packets.

![Wireshark Filter Configuration](image)

*Figure 37. Wireshark Filter Configuration*
4. Click **Start** to start the capture process.

![Wireshark Capture Options](image)

**Figure 38. Start Capture**

1. The screen shot in Figure 39 provides the packets captured by the Wireshark tool. These are the packets that are sent out by the virtual machine VM_01 as part of the TCP session. VDS then mirror these packets to the virtual machine VM_05. TCP session traffic consists of packets that flow to and from the two end points. In this example, VM_01 (10.91.35.60) and VM_03 (10.91.35.73) are the two end points of the TCP session. As you can see from the screen shot, the Wireshark Analyzer captures only traffic going out of VM_01. This is because the port mirroring session was configured to mirror **only ingress traffic** to the destination.

You can also define port mirroring sessions to mirror either both traffic or egress only traffic to the destination. Check the mirrored traffic on the destination using the Wireshark tool.
Network I/O Control (NIOC) is the advanced feature of the VDS that provides traffic management capability. Network traffic management provides the required control and guarantee for different traffic types in the consolidated I/O environment. In the vSphere 5.0 platform, NIOC supports traffic management capabilities for the system, the virtual machine, and user-defined traffic types.

**NIOC Rationale**
Applications have different CPU, memory, and network I/O resource requirements. Business-critical applications have high resource requirements and higher Service Level Agreements (SLAs) as compared to noncritical applications. In the virtual infrastructure, where business-critical applications run along with noncritical applications, it becomes critical that resources are allocated according to the individual workload requirements.

The vSphere virtual platform provides you the capability to manage CPU, memory, and network resources. Network resources are managed through the NIOC feature on the VDS. When NIOC is enabled, the VDS traffic is divided into the following predefined network resource pools: VMware Fault Tolerance (FT) traffic, iSCSI traffic, vMotion traffic, management traffic, NFS traffic, and virtual machine traffic. The vSphere 5.0 release enhances the NIOC by enabling you to create user-defined network resource pools for any traffic type.

**Evaluation Overview**
In this example environment, first you will see the impact on the network I/O when only the virtual machine network resource pool is used and shared among different workloads. After that demonstration, you will configure user-defined network resource pools for individual workloads and see how it improves the network I/O performance.
Evaluation Environment for NIOC
The evaluation environment is same as that used during the NetFlow and port mirroring evaluation. It consists of the following components as shown in Figure 1:

1. Three virtual machines running Windows OS on Host1
2. Three virtual machines running Windows OS on Host2
3. Each virtual machine has the following software tool installed:
   a. JPerf tool
4. vSphere Management Assistant to provide remote command access

Challenges When Using the Virtual Machine Traffic Type for Multiple Workloads
In this example environment, you will use a predefined virtual machine traffic resource pool to allocate shares and limits to the virtual machine traffic from different workloads. In this approach all virtual machines (workloads) share the network resources allocated to the virtual machine traffic type. To begin, you have to configure the NIOC with the virtual machine traffic’s shares and limits parameters.

First, enable the NIOC and configure the Virtual Machine Traffic type:
1. Enable the NIOC by selecting the Properties under the Resource Allocation tab. Figure 41 shows the panel where you should check the box.

![Figure 40. How to Enable NIOC](image)
2. Change the parameters of the virtual machine traffic type by clicking **Edit Settings** as shown in Figure 42.

3. You can limit the virtual machine traffic type by entering the bandwidth number in the host limit field. In this example, the virtual machine traffic is limited to 20Mbps. In this example environment, there are three VMs on Host 1 (VM_01, VM_02, VM_03) that will share this 20Mbps of network I/O capacity.
In the normal operation it is not recommended to limit the traffic. However, in this example, to minimize the amount of traffic you have to generate, the limit configuration is used.

After completing the NIOC configuration, you can generate traffic to simulate two workload scenarios. In the example environment, the traffic is generated using the JPerf tool between virtual machines running on different hosts as follows:

1. VM_01 on Host1 to VM_02 on Host2 TCP session
2. VM_03 on Host1 to VM_04 on Host2 TCP session

You can configure the JPerf server on VM_02 and VM_04 and the JPerf client on VM_01 and VM_03. For more details on how to configure the JPerf client and server, you can refer to steps described in the NetFlow evaluation section along with Figure 20 and Figure 21.

Once the setup of the two TCP sessions between the virtual machines is complete, you can monitor the performance of these flows from the JPerf client view. Figure 44 and Figure 45 shows the JPerf client screens of VM_03 and VM_01, respectively.

When 20Mbps of bandwidth is shared between two workloads, you can see how the bandwidth is unevenly distributed between the two TCP sessions. In this situation, if VM_03 utilizes more bandwidth, VM_01 suffers and vice versa. This ultimately impacts the performance of both TCP sessions. Consider this deployment with an important application workload that shares traffic with other workloads that are bursty in nature. Application traffic will suffer and consequently users will see the performance degradation in terms of response time and availability.
Figure 44. Client1-Side Bandwidth

Figure 45. Client2-Side Bandwidth
This network I/O issue is addressed through the new user-defined resource pools feature in the vSphere 5.0 platform. The following section will demonstrate the advantage of this new capability.

**Configuring User-Defined Resource Pools**

In this step, you will make use of the user-defined resource pools and allocate those resource pools to different workloads. This approach of allocating resources to individual workloads eliminates the problems faced by the use of the virtual machine traffic type for different workloads.

To define user-defined resource pools, follow these steps:

1. Switch to the **Home > Inventory > Networking** view.
2. Select the dvSwitch and choose the **Resource Allocation** tab on the right panel.
3. Click **New Network Resource Pool**.

![Image of user-defined resource pool configuration](image)

4. In the panel shown in Figure 47, provide a name for the new network resource pool. In this example, this resource pool will be associated with the VM_01 workload. The host limit is set to 10Mbps. The option of QoS priority tag helps in tagging the packets with the 802.1p tag. You can use this option so that the network infrastructure treats the packets according to the priority and thus provides End-to-End QoS. In this example, the packets are not tagged.
5. Repeat Step 4 and define another resource pool for the VM_02 workload with the same shares and limits parameters.
6. Figure 49 shows the screen shot of the Resource Allocation tab view after custom resources are created.

Figure 49. Network I/O Resource Allocation View

**Associating New Resource Pools with Tenant Port Groups**

After creating the custom resource pools, you have to associate them with DV port groups. Once the resource pool is associated with a DV port group, the virtual machine connected to the DV port group gets the allocated network I/O resources.

In this example environment, you have two new resource pools, Tenant1 and Tenant2. Also, you have already defined two port groups named dvpg-Tenant1 and dvpg-Tenant2. Follow the steps to associate the Tenant1 resource pool with the dvpg-Tenant1 port group and the Tenant2 resource pool with the dvpg-Tenant2 port group.

1. Under the **Home > Inventory > Networking** view, select dvpg-Tenant1.
2. Right-click dvpg-Tenant1 and select **Edit Settings**.
3. Select **Resource Allocation** in the left panel and in the Policies pane on the right, click the **Network Resource Pool** pull-down menu. You will see the two new resource pools that were created in earlier steps.
4. Choose the **Tenant1** resource pool and click **OK**.

![Figure 52. Association in Progress](image)

5. Repeat steps 2 to 4 to associate the dvpg-Tenant2 port group with the Tenant2 resource pool.

![Figure 53. Association Complete](image)
Moving Virtual Machines to the Tenant Port Groups

In this step, you will move virtual machines VM_01 and VM_03 running on Host 1 from the dvpg-Prod02 port group to new tenant port groups. When you move VM_01 to the dvpg-Tenant1 port group, you allocate VM_01 with network I/O resources defined by the Tenant1 resource pool. Similarly, moving VM_03 to the dvpg-Tenant2 port group allocates network I/O resources defined by the Tenant2 resource pool.

Follow these steps to perform the virtual machine transition to new port groups.

1. Switch to the Home > Inventory > Hosts and Clusters view.
2. Select VM_01 and click Edit Settings.

3. Choose Network adapter 1, and from the Network label drop-down menu, select dvpg-Tenant1.
Figure 55. Changing it to dvpg-Tenant1

Figure 56. Migration Complete
4. Figure 57 shows the screen shot after VM_01 is moved to the dvpg-Tenant1 port group.

![VM_01 on dvpg-Tenant1 Port Group](image1)

Figure 57. VM_01 on dvpg-Tenant1 Port Group

5. Repeat steps 2 to 4 to move VM_03 to the dvpg-Tenant2 port group.

![Migrating VM_03](image2)

Figure 58. Migrating VM_03
Testing the I/O Performance of the Virtual Machines

After completing the virtual machines’ transition to tenant port groups, you can generate traffic to simulate two workload scenarios. In the example environment, the traffic is generated using the JPerf tool between virtual machines running on different hosts as follows:

1. VM_01 on Host1 to VM_02 on Host2 TCP session
2. VM_03 on Host1 to VM_04 on Host2 TCP session

You can configure the JPerf server on VM_02, VM_04 and the JPerf client on VM_01 and VM_03. For more details on how to configure the JPerf client and server, you can refer to steps described in the NetFlow evaluation section along with Figure 17 and Figure 18.

Once the setup of the two TCP sessions between the virtual machines is complete, you can monitor the performance of these flows from the JPerf client view. Figure 60 and Figure 61 show the JPerf client screens of VM_01 and VM_03, respectively.

The bandwidth charts in both the figures indicate that the two TCP sessions get uniform network I/O resources. This is because you have isolated the two workloads by assigning them to their individual resource pool. There is no sharing of bandwidth as it happens with one virtual machine traffic type. This demonstrates the advantage of using custom resource pools.
Figure 60. JPerf Client Screen of VM_01

Figure 61. JPerf Client Screen of VM_03
You can also use vSphere Management Assistant to check the network I/O utilization. Run the resxtop command on Host1 to get the network utilization of the running virtual machines.

Run "resxtop –server=10.91.32.23 –vihost tm-pod03-esx01.tmsb.local" and then press n for network stats. Figure 62 shows the screen shot of the network utilization. You can see the bandwidth used by the VM_01 and VM_03 virtual machines.

![Figure 62. Screen Shot of the Network Utilization](image)

**Conclusion**

The VMware vSphere 5.0 platform provides the visibility in virtual machine traffic through the NetFlow and port mirroring features and enhances network I/O control through user-defined resource pools. These new networking features help network administrators when troubleshooting network issues, and they provide advanced traffic management capability. This evaluation guide covered the step-by-step configuration of these new features and also provided simple exercises on how to test these features. After going through these evaluation exercises in this guide, you should be able to see how these new features can benefit your virtual infrastructure and cloud deployments.
Help and Support During the Evaluation

This guide is intended to provide an overview of the steps required to ensure a successful evaluation of VMware vSphere. It is not meant to substitute for product documentation. Please refer to the online product documentation for vSphere for more detailed information (see below for links). You may also consult the online knowledge base if you have any additional questions. Should you require further assistance, please contact a VMware sales representative or channel partner.

VMware vSphere and vCenter Resources:

- Product documentation: http://www.vmware.com/support/pubs/
- Online support: http://www.vmware.com/support/
- Support offerings: http://www.vmware.com/support/services
- Education services: http://mylearn1.vmware.com/mgrreg/index.cfm
- Support knowledge base: http://kb.vmware.com
  (or type Get-VIToolkitCommunity within PowerCLI)
- PowerCLI blogs: http://blogs.vmware.com/vipowershell

VMware Contact Information

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Providing Feedback

We appreciate your feedback on the material included in this guide. In particular, we would be grateful for any guidance on the following topics:

- How useful was the information in this guide?
- What other specific topics would you like to see covered?
- Overall, how would you rate this guide?

Please send your feedback to the following address: tmdocfeedback@vmware.com, with “VMware vSphere 5.0 Evaluation Guide” in the subject line. Thank you for your help in making this guide a valuable resource.