Cisco MDS 9000 Family Highlights: Server Virtualization Series

Highlighted Feature: N-Port ID Virtualization

Purpose

The Cisco® MDS 9000 Family Highlights series provides both business and technical value propositions for the various Cisco MDS 9000 family features to address the business and technical challenges of the IT customer. This document begins by stating the relevant business and technical challenges that the Cisco MDS 9000 N-Port ID Virtualization (NPIV) feature addresses and then describes the solution benefits that help meet these challenges. To show how the Cisco MDS 9000 NPIV feature can be used, a sample NPIV configuration is provided.

Audience

Readers of the Cisco MDS 9000 Family Highlights series should have some familiarity with the existing business and technical challenges in IT departments and perhaps some high-level understanding of storage and SAN technologies and of VMware ESX Server. For the business solution reader, the main challenges and solutions sections provide concise explanations of the problems faced by IT departments and how they might be solved with the Cisco MDS 9000 family products. For the more technical reader, sample configurations provide insight into the solution configuration.

Background

As the modern data center evolves to become more scalable and flexible in delivering application services to end users, more organizations are deploying server virtualization and, in particular, VMware ESX Server, to virtually host their operating system and corporate applications. One factor behind this movement is the desire to increase the use of the multiprocessor, multicore CPUs found in modern PC servers. Since most applications are still developed as single-threaded applications, they in practice use only one core on one CPU at a time. Thus, allowing a hypervisor such as VMware ESX to host many sessions on virtual machines can more effectively utilize all the CPU power on a single PC server. Likewise, physical memory on the PC server can be tuned, shared, and dedicated in different amounts and be fully utilized among the virtual machine sessions. However, the one resource in the PC server platform that cannot be quantitatively allocated is the I/O coming into and out of the Fibre Channel Host base adaptors. Since all the virtual machine sessions make common use of the storage I/O, the aggregate I/O activity is greatly increased. However, the individual virtual machine session's I/O use is not separated out, making it very difficult to isolate and reengineer storage I/O traffic. For this reason, the Cisco MDS 9000 NPIV feature is introduced in combination with the VMware- and NPIV-enabled Fibre Channel host bus adaptors (HBAs) to allow a more granular view into each individual virtual machine session's I/O use. This capability gives the VMware and storage administrator a view into the storage I/O use for each virtual machine session and enables intelligent load-balancing changes to be made as necessary.

Executive Summary

The Cisco MDS 9000 NPIV feature in combination with the Cisco Fabric Manager and Fabric Manager Server (FMS) allows VMware and storage administrators to view and manage more effectively the allocation of storage I/O resources in a VMware ESX environment. With the capability to see the actual storage I/O use for each virtual machine session, the VMware and storage administrator no longer needs to guess or use trial and error to perform resource load balancing for virtual machine sessions.

Challenges

Business Challenges

- Data center owners with tight IT budgets need to reduce capital expenditures (CapEx) and operating expenses (OpEx) for server rack space, cooling, and power by using fewer physical PC servers while maintaining and increasing the number of supported corporate applications.
- To increase server and storage utilization, virtualization needs to be integrated at various points of the server and storage infrastructure. However, the increased complexity in the virtualized environment requires even more effort from already overextended IT department resources.

Technical Challenges

- With the use of a virtual machine session environment, administrators can dynamically allocate predefined amounts of CPU core and memory to each virtual machine hosting the corporate application, but cannot quantitatively manage the storage I/O of the individual VMware sessions.
- VMware and systems administrators need to track detailed Fibre Channel use for each VMware session to fine-tune the operating environment.

Solution

From a business perspective, the ultimate goal of server virtualization deployment is to reduce operating costs and increase utilization of the PC servers along with their respective storage resources. Using the VMware suite of server virtualization tools, an administrator can take a set of PC servers and provision multiple virtual machines with unique OSs and applications on each physical server. With the Cisco MDS 9000 NPIV feature, the administrator can achieve a finer granularity on the individual virtual machines and load balance resources and reengineer the storage I/O traffic as needed.

From a technical perspective, NPIV enables the creation of virtual port world-wide names (vpWWNs), to be associated to each virtual machine session. Even as VMware VMotion migrates the virtual machine session to another physical PC server, the I/O traffic for the virtual machine session’s vpWWN continues to be tracked. Thus, the administrator can constantly monitor the storage I/O utilization of each individual virtual machine session’s vpWWN in the Cisco Fabric Manager tool. To track the historical I/O utilization trend of these vpWWN, the Cisco FMS can track the flow of storage I/O between the vpWWN of the virtual machine session and the Fibre Channel target it is using. In this manner, each virtual machine session’s I/O utilization becomes completely visible, allowing the administrator to manually load balance the VMware environment as needed.

Sample Configuration

Configuring Two VMware ESX Servers, Each Running a Virtual Machine Session

Figure 1 shows two VMware ESX servers equipped with Fibre Channel HBAs that are NPIV enabled. There are two virtual machine sessions: one on each ESX Server. The virtual machines are each configured and zoned with an individual disk array logical unit number (LUN). As the Cisco Fabric Manager in Figure 2 shows, the virtual machine session VM-HDS1 is running on ESX Server pe2950-2, and virtual machine session VM-HDS2 is running on ESX Server pe2950-1. Each virtual machine session has a unique vpWWN, 28:23:00:0c:29:00:00:07 for VM-HDS1 and 28:23:00:0c:29:00:00:0c for VM-HDS2, but the two are physically connected to the Fibre Channel ports of the physical servers on which they are running (port fc6/4 for pe2950-1 and port fc6/3 for pe2950-2).

Figure 1. Two VMware ESX Hosts, Each Running a Unique Virtual Machine Session

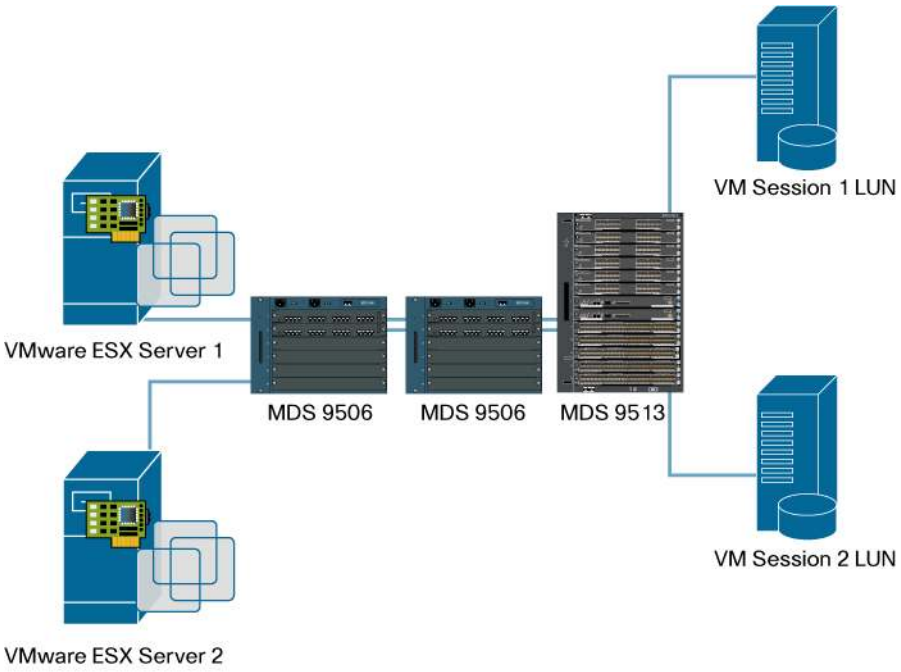
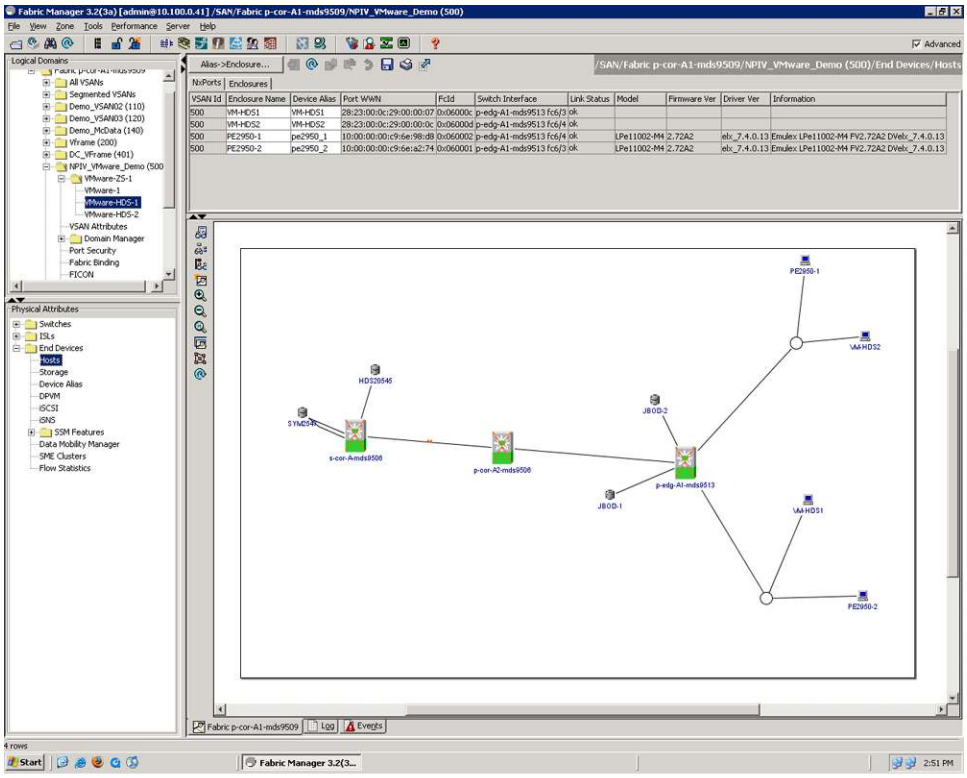


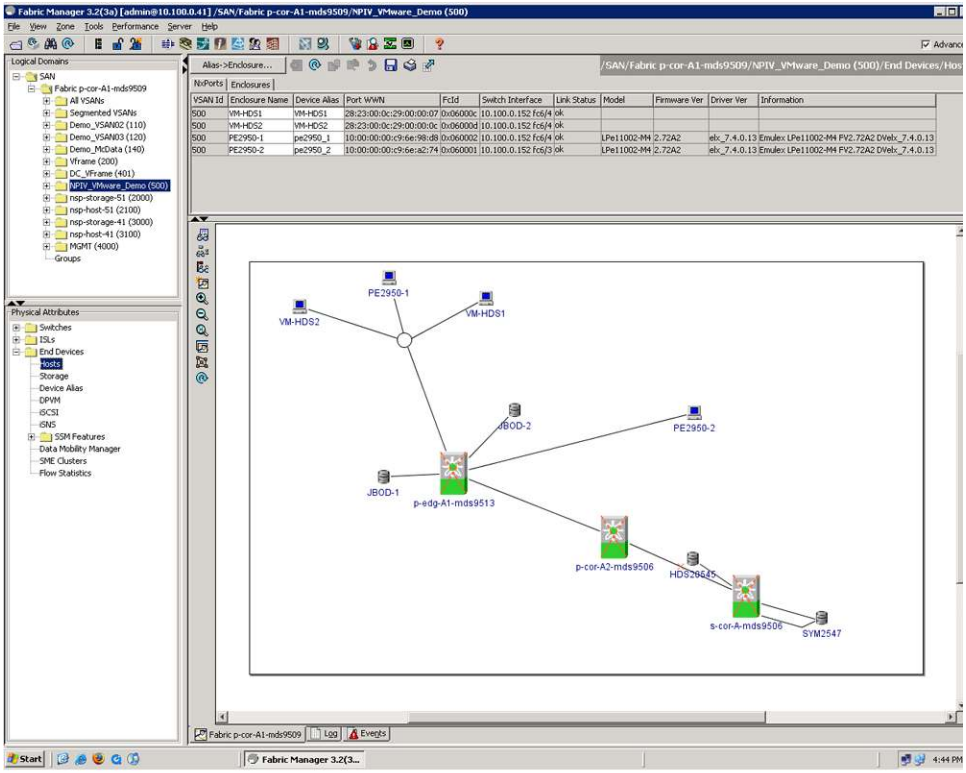
Figure 2. Cisco Fabric Manager with Two VMware ESX Hosts, Each Running a Unique Virtual Machine Session



Configuring One VMware ESX Server Running Two Virtual Machine Sessions

In contrast to the scenario shown in Figure 2, after a VMware VMotion migration, there are two virtual machine sessions, both running on ESX Server pe2950-1. As the Cisco Fabric Manager in Figure 3 shows, virtual machine sessions VM-HDS1 and VM-HDS2 are both running on ESX Server pe2950-1. Each virtual machine session has a unique vpWWN, 28:23:00:0c:29:00:00:07 for VM-HDS1 and 28:23:00:0c:29:00:00:0c for VM-HDS2, and in this case both are physically connected to the Fibre Channel ports of the physical servers on which they are running: port fc6/4 for pe2950-1.

Figure 3. Cisco Fabric Manager with One VMware ESX Host Running Two Unique Virtual Machine Sessions



Monitoring Individual Virtual Machine Sessions in Cisco FMS

For deeper level of traffic analysis, a traffic flow has been defined in the Cisco FMS for the virtual machine session VM-HDS1 and the historical data server (HDS) target CL1H. Figure 4 shows the average utilization for this specific flow, and Figure 5 shows a historical trend graph of this flow over the past week.

Figure 4. Cisco FMS Showing Flows Between Virtual Machine Session VM-HDS1 and HDS Target CL2H

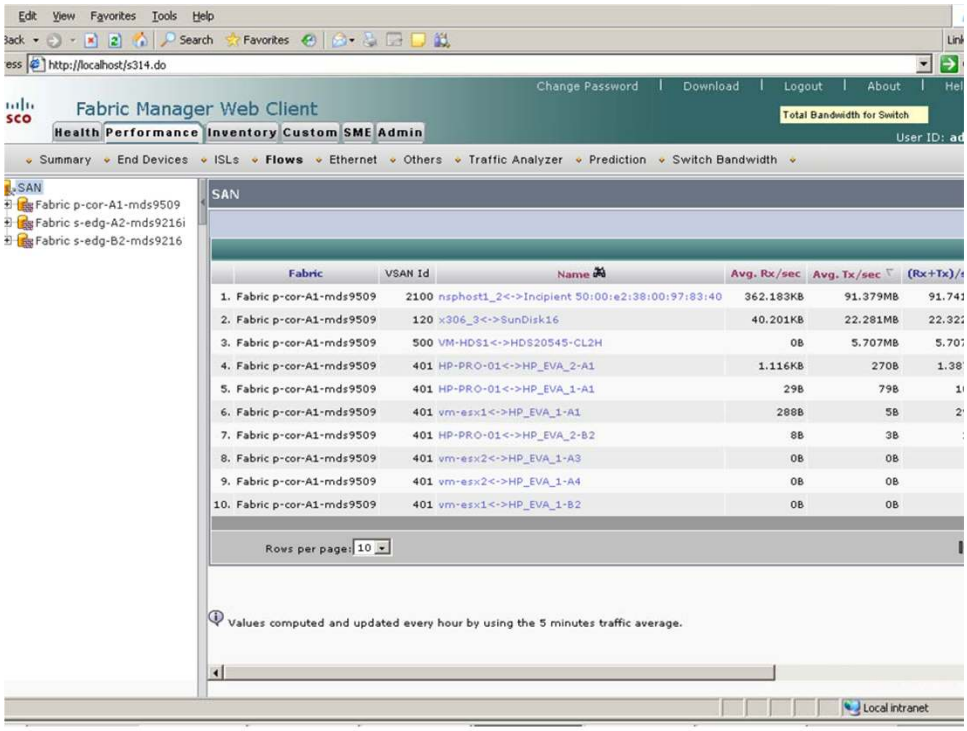
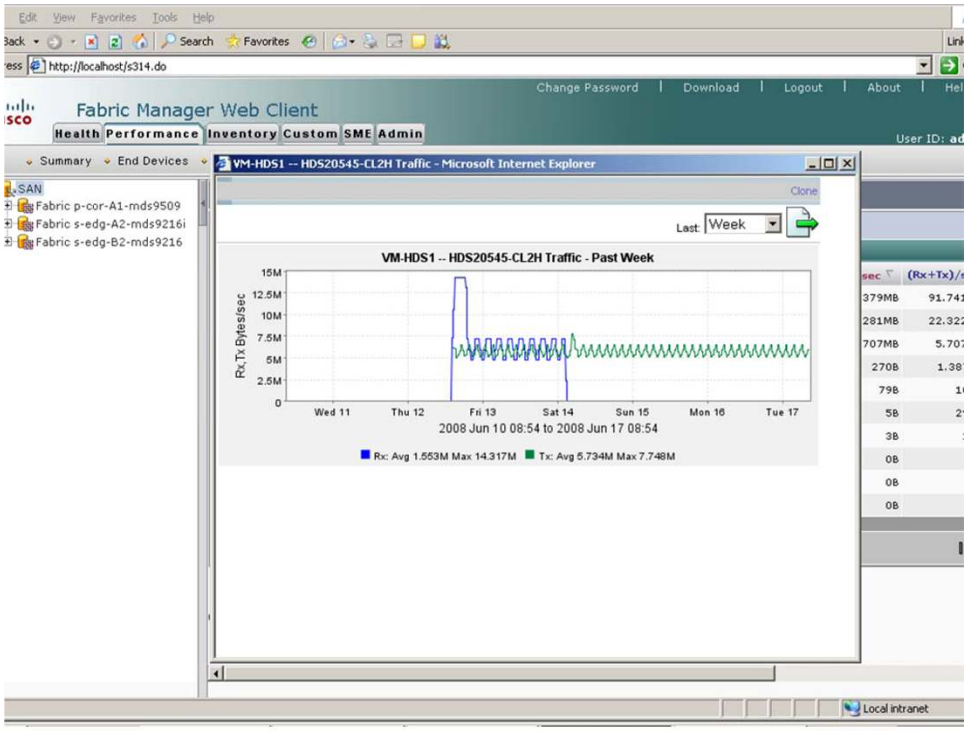


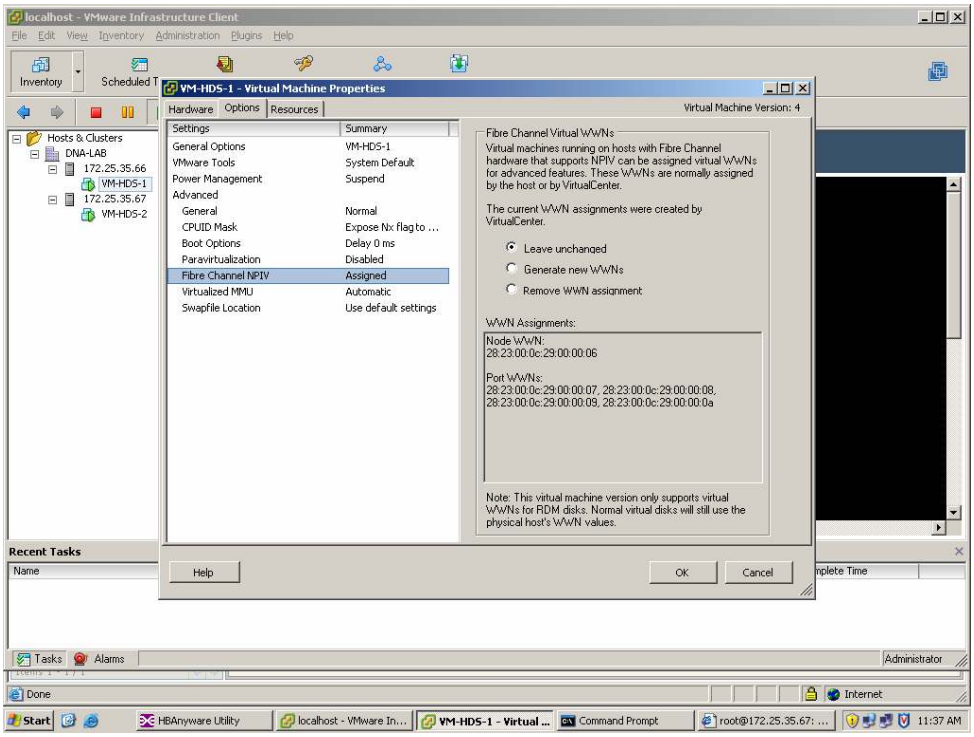
Figure 5. Cisco FMS Showing Historical Graphs Between Virtual Machine Session VM-HDS1 and HDS Target CL2H



Properties Individual Virtual Machine Sessions in Virtual Infrastructure 3

In Figure 6, the properties of the Virtual Machine Session VM-HDS1 is shown. Notice the virtual Node PWWN and Port PWWNs that are associated with the VM-HDS1.

Figure 6. From VMware Infrastructure, properties of the Virtual Machine Session VM-HDS1



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