



Using Emulex Host Bus Adapters and Universal Converged Network Adapters with Windows Server 2008 and 2008 R2

At a Glance

Windows Server 2008 and 2008 R2 include many new features that are enhanced with networked storage. These include server virtualization and high-availability failover clustering, which rely on high-performance storage that is reliable, scalable and accessible from multiple servers.

Emulex has Host Bus Adapters (HBAs) and Universal Converged Network Adapters (UCNAs) with updated drivers and management support that are targeted at the Windows environment. This paper provides an overview of key features and benefits that should be considered when implementing a Fibre Channel-based Storage Area Network (SAN) with Windows Server 2008 and 2008 R2.

Products

- Emulex LightPulse® Fibre Channel HBAs
- Emulex OneConnect™ UCNAs (Fibre Channel over Ethernet, iSCSI)
- Emulex Virtual Port (vPort) technology
- Emulex PRO Pack for Virtual Machine Manager 2008
- Emulex OneCommand™ Manager application
- Emulex AutoPilot Installer®

Audience

- First-time users of networked storage with Windows
- Users planning to do server virtualization with Microsoft Hyper-V
- Networked storage users that are upgrading to Windows Server 2008 and 2008 R2 from earlier versions of Windows
- Current Emulex users who want to take advantage of new Emulex hardware and software products

Introduction

With an ever-increasing requirement to use and save data, networked storage has become a necessity for most mid-size and larger companies and organizations. Networked storage delivers all of the key “ilities” for today’s businesses—scalability, flexibility and reliability.

Studies have shown that Fibre Channel is the leading platform for SANs with Windows. More than 50% of the data connected to Windows servers worldwide is connected via networked storage using Fibre Channel. Additionally, Fibre Channel over Ethernet (FCoE) is promising to be the next big technology for SAN connectivity. Emulex OneConnect UCNAs support full offload of FCoE, iSCSI, and TCP/IP. If you want to learn more about using Emulex adapters with Windows Server 2008 and 2008 R2, you are in step with server and storage administrators at almost all of the Fortune 100 companies.

This paper provides an overview of key issues to be considered when deploying Emulex adapters. The following topics are discussed:

- **Hardware and software components**
Overview of what is included with Emulex HBA and UCNA products
- **Emulex software for Windows**
More details on drivers and management software
- **Boot from SAN**
Support for servers that boot-from-SAN-attached storage
- **High availability**
Key technologies for mission-critical applications
- **Hyper-V server virtualization**
Consolidating workloads from under-utilized servers
- **Performance and scalability**
Achieve maximum throughput with minimum CPU usage



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Hardware and Software Components

Emulex is into its eighth generation of Fibre Channel HBAs, which can transfer data at speeds up to 8Gb/s. Emulex is also into its second generation of CNAs that communicate over an Ethernet network using the Fibre Channel protocol.

Emulex HBA and UCNA products are a combination of the following hardware and software components for Windows:

- **Adapter**—This is the physical device that is installed in a server. In most cases, two or more adapters are installed in each server to provide increased bandwidth and redundancy. All Emulex 8Gb/s HBAs and UCNAs connect to the server using the PCI Express (PCIe) bus.
- **Firmware**—Firmware is software that is loaded in flash memory on the adapter. It's the part that communicates between the device driver that is installed on the operating system and the physical adapter. Emulex's exclusive Service Level Interface (SLI) design allows a single version of the device driver to be used for all Emulex adapters. However, each adapter requires a version of the firmware that is specific to its model, which is installed as part of the manufacturing process. Because of the time interval between manufacturing and installation, there may be newer versions of the firmware available for the adapter. Administrators should check with their supplier or the Emulex Web site for the most current version of the firmware. The firmware can be updated before installation using one of the Emulex offline utilities or after installation using the Emulex OneCommand™ Manager management application.
- **Boot code**—Boot code is another type of software that is loaded in flash memory on the adapter. It works with the BIOS software on the CPU and allows the operating system to boot from a disk on the SAN (boot-from-SAN) rather than from a local disk. There are two types of boot code for Windows - x86 BootBIOS for 32-bit systems and UEFIBoot for 64-bit systems. Currently x64 systems also use x86 BootBIOS, but that is likely to change as system manufacturers begin to support UEFIBoot for x64 systems. As with firmware, your supplier may be supporting a newer version of the boot code than what is loaded on the adapter at shipment. The boot code can be updated before installation using one of the Emulex offline utilities or after installation using the Emulex OneCommand Manager management application. There is more information later in this document on setting up boot-from-SAN.
- **Storport Miniport driver**—The Storport Miniport device driver is installed in the Windows Server 2008 and 2008 R2 operating systems to enable communication with the adapter. The Emulex driver distribution package also includes the ElxPlus driver that works with the Storport Miniport driver to support the OneCommand Manager application, persistent binding, and Logical Unit Number (LUN) mapping and masking. The Storport Miniport drivers for HBAs and UCNAs have identical code. However, they have different names due to Microsoft's

WHQL/support policy. The FCoE and Fibre Channel drivers for Windows are code-identical but have different names to comply with Microsoft logo requirements. Emulex UCNAs are also NOT supported with Windows Plug and Play (not included in the list of known devices). Users will get a unknown device error and need to install the UCNA version of the Storport Miniport driver.

- **OneCommand**—The Emulex OneCommand Manager management application (previously called HBAnyware®) provides comprehensive management of Emulex adapters on both local and remote servers.
- **AutoPilot Installer**—The Emulex AutoPilot utility is used to install the Storport Miniport and ElxPlus drivers and the OneCommand Manager management application.

References:

www.emulex.com/artifacts/e92cf990-03c8-460c-a94b-f4a056ac083d/SLI-architecture.pdf

www.emulex.com/downloads/emulex/cnas-and-hbas/drivers/windows/storport-miniport-driver-core-kit.html

Emulex Software for Windows

Storport Miniport driver

Storport Miniport is the third-generation device driver for Emulex adapters. It is the only Emulex device driver that is supported by Windows Server 2008 and 2008 R2.

Both Windows Server 2008 and 2008 R2 ship with the Storport Miniport driver included on the distribution media. A driver that is included with the distribution is typically called the "inbox" driver and is automatically copied onto the server as part of the Windows Server 2008 and 2008 R2 installations.

When an adapter is added to a system running Windows, the Windows Plug and Play software will attempt to identify the new device. If the adapter is identified, the inbox Storport Miniport driver will be installed automatically. The best procedure is to begin by using the inbox driver. The inbox driver is a reliable baseline driver that can be used with no additional actions required. However, newer adapters may not be supported by the inbox driver. If that occurs, install a newer version of the driver that supports the adapter.

New features have been added with subsequent updates to the Storport Miniport driver that are available on Emulex and OEM Web sites. Installing a driver update will also add the OneCommand Manager management application, which is not included on the Windows Server 2008 or 2008 R2 media. A one-step installation procedure will update the inbox Storport Miniport driver and also install the ElxPlus driver and OneCommand Manager management application to enable full management of the adapter.

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AutoPilot Installer

The Emulex Web site provides updates to the Storport Miniport driver that are packaged in a distribution kit that includes AutoPilot Installer and all of the components needed to run OneCommand Manager. There are two types of kits:

- **Full kits**—All of the drivers and components needed for local and remote management with both the Graphical User Interface (GUI) and Command Line Interface (CLI) versions of OneCommand Manager. Full kits will not install on a Windows Server 2008 or 2008 R2 Core installation.
- **Core kits**—All of the drivers, but only the OneCommand Manager components needed for local CLI management and remote GUI management. Core kits can be installed on any Windows Server 2008 or 2008 R2 installation, including a Core installation.

The Windows Server 2008 and 2008 R2 Core installation is a minimal set of operating system components and management applications. Core installations support local CLI management and remote GUI management, which is a perfect fit with the Storport Miniport core kit. AutoPilot Installer automatically detects when a Storport Miniport core kit is being installed on a Windows Server 2008 or 2008 R2 Core installation and switches to a text-mode process that can be run from a command prompt or a command procedure.

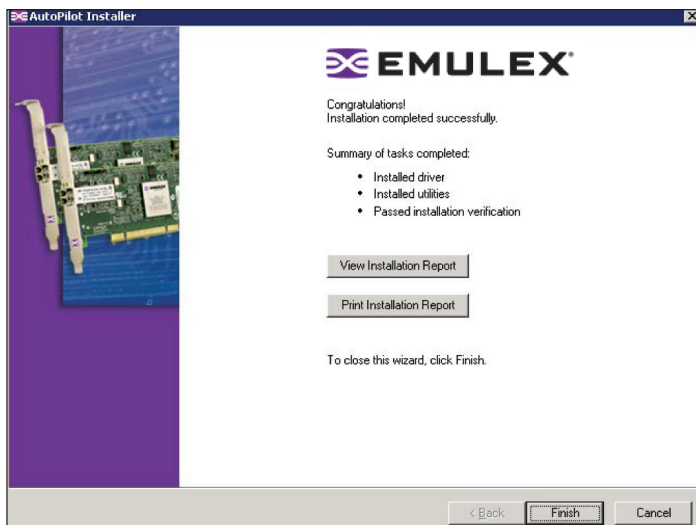


Figure 1 Emulex AutoPilot Installer automatically installs or updates drivers and OneCommand Manager components.

AutoPilot Installer supports a wide variety of installation options from a basic installation on the local server to customizable, automated installations on both local and remote servers. The Storport Miniport User Manual provides details on all of the options.

All that is required for a basic installation on the local server is to download and run the distribution kit. The AutoPilot installation automatically installs or updates the driver for all of the adapters on the server and also installs all of the components needed for OneCommand Manager. There is minimal user input and a reboot of Windows is usually not required.

References:

www.emulex.com/artifacts/fd56b2c2-5443-4cbc-97c6-284ed4629ed2/scalability-hba-cna-install.pdf

OneCommand Manager

OneCommand Manager is a comprehensive management application with both a GUI and CLI that supports a wide variety of management scenarios for Emulex adapters. The OneCommand Manager User Manual provides full details on all of the OneCommand Manager views and commands.

Some of the key OneCommand Manager features include:

- Discovery of all SAN elements with a choice of GUI views based on the host, fabric and vPorts
- Management of local and remote servers using the Fibre Channel connection or the Local Area Network (LAN) connection
- Management modes to limit both local and remote management
- Batch download option to update firmware on multiple servers and adapters with a single command
- Management of vPorts that provide a unique SAN identity for virtual machines (VMs) created for Windows Server 2008 Hyper-V server virtualization technology
- Flexible reporting that provides customized views of the SAN
- Beaconing function so that an adapter can be quickly identified
- Advanced scripting capabilities so that time can be saved by administrators
- Assists transition of adapter WWN from one server to another ensuring maximum SAN availability
- OneCommand Manager streamlines administration by integrating the iSCSI configuration and management processes; in typical iSCSI deployments, IT administrators would have to use tools within the BIOS or the operating system (OS) platform to configure the iSCSI adapter, and then use a separate application for management
- Optional Internet access for management from a remote laptop, workstation or server using the OneCommand Manager WebLaunch feature.

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Remote management

The OneCommand Manager application enables remote management of all the Emulex adapters that are connected to the SAN. Management can be done using the Fibre Channel connection and/or the LAN Ethernet connection. Access to adapters on remote servers can be limited in several ways.



Figure 2 OneCommand Manager provides centralized management of Emulex HBAs and UCNAs.

Remote management over a SAN connection—Fibre Channel zoning can be used to control access to remote adapters. Zoning is typically configured with the fabric switch management software. When zoning is implemented, adapters can only discover adapters that are in the same zone. Thus, for remote management, the management server must have adapters that are in the same zone as the adapters on remote servers.

Remote management over a LAN connection—Access to remote servers and their adapters can be controlled using the network access management tools in Windows Server 2008 and 2008 R2. In addition, the OneCommand Manager application can restrict server discovery based on a list of specific IP address or a range of IP addresses. This can significantly reduce OneCommand Manager start time when a large number of systems on the LAN are not connected to the SAN.

OneCommand Manager includes additional features to control remote management of adapters that can be discovered with the Fibre Channel or LAN connection. OneCommand Manager supports setting one of three management modes for each server connected to the SAN:

- **Strictly local management**—Management of adapters on the local server. No management of adapters on remote servers. No management of local adapters from remote servers.

- **Local management plus**—Management of adapters on the local server. No management of adapters on remote servers. Management of local adapters from remote servers.
- **Full management**—Management of adapters on the local server and remote servers that allow it. Management of local adapters from remote servers.

The default setting is Local Management Plus.

In addition, OneCommand Manager supports setting a read-only mode that prevents access to OneCommand Manager commands that would affect adapter settings.

Using OneCommand Manager CLI with PowerShell

The OneCommand Manager CLI supports all of the basic commands that are available in the OneCommand Manager GUI. Because the CLI is truly a command-line interface requiring no user interaction, commands can be integrated into scripts to automate management functions.

With the introduction of PowerShell, the Microsoft Windows command-line shell and scripting language, scripting capabilities have taken a quantum leap forward with Windows Server 2008 and 2008 R2. Because the OneCommand Manager CLI is compatible with PowerShell scripts, highly customizable reporting and management is enabled for Emulex adapters.

Without PowerShell, the following steps would be required to save the attributes for all of the adapters in a SAN to a file:

- 1 Use an OneCommand Manager CLI command to output a list of all adapters (hbacmd ListHBAs).
- 2 Individually execute an OneCommand Manager CLI command to get the attributes for each adapter in the SAN (hbacmd HBAAttributes).
- 3 Individually cut and paste the output from the get attributes command into a file.

More than 40 steps would be required for a relatively small SAN with 20 adapters.

The same result could be achieved with a four-line PowerShell script that could be executed from the command line or from another PowerShell script.

References:

www.emulex.com/artifacts/0be0a4fe-68b9-4fdd-bd01-58fc44650e1a/downtime.pdf

www.emulex.com/files/solutions/windows_server_2008/pdfs/tb_managability.pdf

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Boot-from-SAN

Boot-from-SAN (BFS) is the capability of a server to load an operating system that has been installed on a LUN, eliminating the need for a local disk. BFS is useful for many scenarios, but is particularly applicable to blade servers that frequently have no local storage.

Emulex adapters typically ship with Universal Boot code that is loaded in the adapter's flash memory. (The exact boot code that is shipped may be different for specific OEM partners, and OEMs may have specialized procedures to set up BFS.) The Universal Boot code supports three system types:

- **x86 BootBIOS**—x86 and x64 BIOS-based platforms
- **UEFIBoot**—Intel® Itanium® processor platforms that use the Unified Extensible Firmware Interface (UEFI)
- **OpenBoot**—Sun® SPARC systems or IBM PowerPC systems running AIX or Linux OS

The only setup requirement is to specify the LUN that will be the boot device. This is done by entering CTRL+E or ALT+E while the server is initializing. The correct component is automatically executed from the Universal Boot code and a GUI or CLI utility is run to specify LUNs that can be used as boot devices and set other boot parameters. Windows Server 2008 and 2008 R2 (or any other operating system) can then be installed on the LUN.

Up to eight different boot entries can be made per port to support scenarios that require multiple boot paths. As an example, the system could be configured to boot from a mirror image if the primary LUN is down.

OneCommand Manager also supports specifying BFS settings while the server is online. The system will use the new settings when the server is rebooted. This feature works well when servers need to be repurposed for different uses.

Reference:

www.emulex.com/artifacts/fc0b92e5-4e75-4f03-9f0b-763811f47823/bootingServersDirectly.pdf

High Availability

Fibre Channel SANs are typically deployed for mission-critical applications and services. In this environment, high availability is mandatory. This becomes even more critical for virtualized servers when downtime of a physical server means downtime for all of the virtual machines (VMs) running on the server.

MPIO

Microsoft's Multi-Path I/O (MPIO) technology for Windows is a standardized solution for redundant physical paths (adapters, cables, and switches) to networked storage. For Fibre Channel SANs, MPIO works with a Device-Specific Module (DSM) that provides the information needed to define a storage device. MPIO supports both failover and load-balancing.

At least two HBAs or UCNAs must be installed on a server to use MPIO. For normal operations, all of the HBAs or Universal CNAs are used together to provide load-balancing and maximum total bandwidth. If an adapter link goes down, the other adapters will continue to work with no disruption in service. The SAN can also include redundant switches and array controllers to implement a fully fault-tolerant environment.

Prior to the release of Windows Server 2008, it was necessary to use a vendor-specific DSM that was unique for each Fibre Channel storage array or array family. However, Windows Server 2008 and 2008 R2 now includes a standard DSM from Microsoft that provides basic MPIO support for all arrays that are qualified for Windows Server 2008 and 2008 R2. An array-specific DSM may be used to provide additional capabilities if needed. Emulex HBAs and UCNAs are fully compatible with the Microsoft DSM and with other vendor-specific DSMs.

Failover clusters

Failover clustering is another key technology that helps ensure high availability with Windows Server 2008 and 2008 R2. A cluster is comprised of multiple servers, or cluster nodes. All of the cluster nodes share access to the same networked storage.

At least one of the nodes in the cluster is a passive, stand-by server that is used if an active server fails or goes offline. All of the applications that were running on the failed server are started on the stand-by server so that users experience minimal in disruption of service.

Failover clusters are especially critical for servers that are virtualized with the Hyper-V server virtualization technology that was released for Windows Server 2008. If a failure occurs on a virtualized physical server that is part of a cluster, all of the VMs will automatically restart on a standby physical server, ensuring continuity for all the VMs.

References:

<http://technet.microsoft.com/en-us/library/cc732181.aspx>

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Hyper-V Server Virtualization

Hyper-V is the next-generation hypervisor technology from Microsoft that provides highly efficient server virtualization, fully integrated with Windows Server 2008 and 2008 R2.

Emulex HBAs and UCNAs are particularly well-suited for virtualized server environments where there is an increased demand for scalable, high-performance storage. In fact, recent studies have shown that 60% of virtualized servers are connected to a Fibre Channel SAN.

Installation of Emulex adapters is unchanged with Hyper-V. The Storport Miniport driver is installed in the Windows Server 2008 or 2008 R2 root partition and is managed locally or remotely with the OneCommand Manager application. However, there are two typical use cases that affect how SAN access is managed.

High availability

Failure or downtime of a physical server running Hyper-V means failure or downtime for all of the VMs that are running on the server. When VMs are running mission-critical applications and services, use of high-availability technologies is often mandatory. For Windows Hyper-V, the key technologies are MPIO and Failover Clusters, which were discussed in the previous section.

Windows Hyper-V was designed to be highly integrated with Failover Clusters. If a physical server fails or goes offline, all of the VMs are restarted on a standby server with minimal disruption of services. VMs can also be individually configured for high availability.

There are no extra installation or setup steps to use Emulex adapters with Hyper-V, MPIO and Failover Clusters. The adapters are shared by all of the VMs on a physical server. However, the following requirements apply to failover clustering:

- All of the clusters nodes should have the same type of HBAs or Universal CNAs with the same version of firmware installed.
- All of the cluster nodes must be in the same Fibre Channel zone. The zone should have access to all of the LUNs used by applications running on VMs in the cluster. This ensures access to required storage in the event of a failover.
- Each cluster should be in a different zone. Servers from different clusters should not access the same storage.

NPIV

In some scenarios, it is important for each VM to have its own identity on the SAN. This allows each VM to have unique zoning and management of storage services. N_Port ID Virtualization (NPIV) is a T11 standard that was developed by Emulex and IBM to provide this capability.

NPIV can be used to virtualize HBA or CNA ports so that each VM connects to the SAN with a unique virtual World Wide Port Name (WWPN). NPIV support is required for both the adapter and switch. The following Emulex adapters support NPIV:

- **8Gb/s HBAs**—LPe12002, LPe12000
- **4Gb/s HBAs**—LPe11002, LPe11000, LPe1150, LP11002, LP11000 and LP1150
- **CNAs**—OneConnect Universal, LP21002 and LP21000

NPIV is also supported with the Microsoft's System Center Virtual Machine Manager (VMM), which can be used with the Storport Miniport driver and the OneCommand Manager application to create and manage VMs that have a virtualized storage connection.

The basic steps are:

- Use OneCommand Manager to create a Virtual Port (vPort) with a unique Virtual WWPN.
- Create a LUN using the storage array management software.
- Use Disk Manager to format the LUN and map the LUN to a mount point.
- Use VMM to create a VM on the LUN.

When needed, VMM can then be used to migrate the VM to a different server that is running Hyper-V with Emulex adapters. Because the storage connection is virtual, there is no requirement to transfer files or change zoning.

PRO Pack

Physical Resource Optimization (PRO) is a feature for Hyper-V and VMM 2008 that helps ensure that VM hosts and guests are operating in the most efficient manner possible. PRO leverages the alert capability in System Center Operations Manager 2007 to notify administrators when corrective action may be needed and offers a recommended solution that can be implemented manually or automatically.

The Emulex PRO-enabled management pack monitors I/O usage relative to the maximum available bandwidth. When the management pack detects that specified thresholds are exceeded, VMM provides an option to migrate VMs to reduce the I/O load and improve performance on the affected server.

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Performance and Scalability

MSI-X

Windows Server 2008 and 2008 R2 support Message Signaled Interrupts-eXtended (MSI-X), a technology that allows CPU interrupts from multiple devices to be processed in parallel. With MSI-X, CPUs can process multiple interrupts with minimum idle time spent waiting for individual interrupts to complete.

The benefits of MSI-X are realized on servers with more than one adapter. Each adapter will have its own interrupt process, so the interrupt from one adapter does not have to wait for the interrupts on other adapters to complete. MSI-X is supported with Emulex LightPulse 8Gb/s HBAs, OneConnect UCNAs and the Storport Miniport v2.10 driver. No new driver settings are required. The Storport Miniport driver automatically uses MSI-X with Emulex adapters and Windows Server 2008 and 2008 R2.

Reference:

www.emulex.com/artifacts/6570f9ef-86ea-49a6-822a-71431e05462f/msi.pdf

NUMA

Today's leading multi-core and multi-socket systems implement Non-Uniform Memory Access (NUMA) that provides separate memory for each processor, avoiding the performance degradation with older multiprocessor servers that share memory. NUMA-based servers achieve improved system performance when the instructions and data are in memory that is local to the processor that will use them.

Emulex support for NUMA processors is based on the MSI-X capability in Windows Server 2008 and 2008 R2. With NUMA systems, the Storport Miniport driver will automatically direct interrupt processing back to the processor node that initiated the I/O, reducing interrupt latency and improving cache effectiveness. No new driver settings are needed. NUMA is only supported with Emulex LightPulse 8Gb/s HBAs and UCNAs.

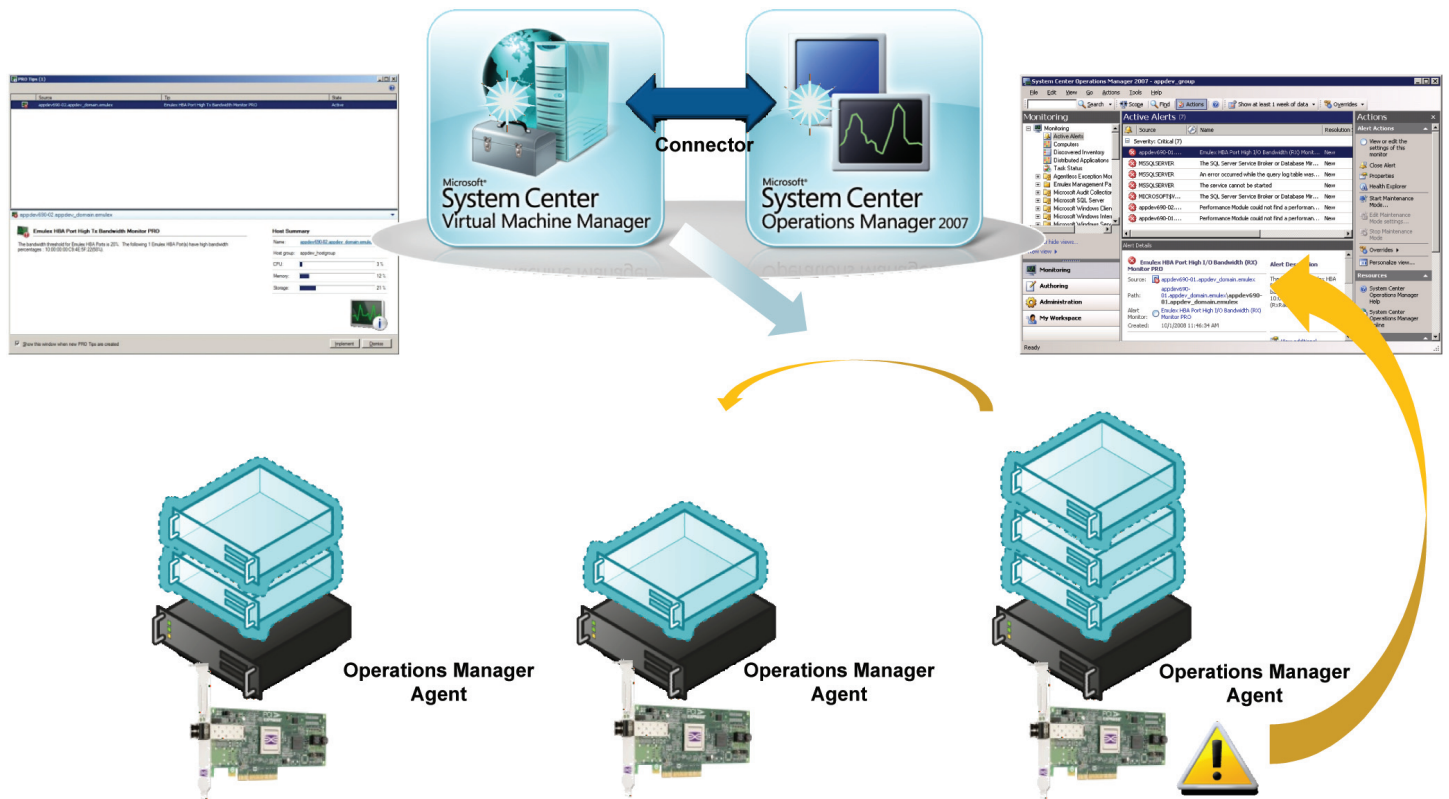


Figure 3 The Emulex PRO-enabled management pack installs with SCVMM 2008.

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Configuration Tips

The Storport Miniport driver is configured by default to achieve the best performance for most conditions. Although there are many driver parameter settings that can be modified with OneCommand Manager, there are only a few that might interest a typical user:

- **Link speed**—Emulex adapters are capable of running at different link speeds. For example, an 8Gb/s HBA can also run at 4Gb/s and 2Gb/s. The default behavior is to set the speed automatically. In this case, a query is done to determine the link speeds that the switch supports and the highest mutually supported link speed is used. In unusual cases, excessive errors may occur at the maximum possible speed. These errors are resolved by resending the data, but the overall effect could be a reduction in throughput. In these cases, the link speed can be set to a lower speed to reduce errors and re-transmissions. For standard OneConnect UCNAs the link speed is always 10Gb/s (the only speed supported by the optics or copper connection).
- **Interrupt coalescing**—The Storport Miniport transfers data to the CPU by doing an interrupt, which notifies the CPU that data is available. With interrupt coalescing, multiple interrupts can be batched together so that transfers can be done more efficiently. This is particularly beneficial with higher I/O rates where more data can be transferred with each interrupt. With lower I/O rates, it is better to send the interrupts sooner rather than wait for more data to arrive for transfer. By default, auto-coalescing is turned on and recommended, enabling the driver to process interrupts based on the I/O rate. However, in some cases it may be advantageous to specifically set the parameters that control interrupt coalescing. See the OneCommand Manager User Manual for full details.

Benefits of 8Gb/s HBAs

The 8Gb/s LPe12000 (single-channel) and LPe12002 (dual-channel) are the newest generation of Fibre Channel HBAs from Emulex. In addition to doubling the data transfer bandwidth, the LightPulse® LPe1200x family offers other important advantages for Windows Server 2008 and 2008 R2 users.

The following benefits apply with Windows Server 2008 and 2008 R2, even if the rest of the storage network has not been upgraded to 8Gb/s:

- **Reduced I/O latency**—Every I/O sent or received from the server will be completed significantly faster. This is especially beneficial for applications that are response-time sensitive such as SQL Server 2008 and Exchange Server 2007.
- **Better CPU efficiency**—LP1200x HBAs require fewer CPU resources to process I/O than previous HBAs, leaving more CPU resources to process applications. This raises the transaction ceiling as much as 33% and provides better throughput for applications with high I/O burst levels.

- **MSI-X and NUMA support**—As described previously, MSI-X and NUMA help lower total server CPU utilization and more effectively use multi-core servers, making more system resources available for applications.
- **PCI Express 2.0 support**—Enables the capabilities of next-generation servers that are likely to be used with new Windows Server 2008 and 2008 R2 deployments.

Benefits of UCNAs

The OneConnect UCNA is based on a single-chip, high-performance 10Gb/s Ethernet (10GbE) architecture. The UCNAs support optimum CPU efficiency with CPU offloads for TCP/IP (stateless and stateful), FCoE and iSCSI.

The following benefits apply for data centers using Windows Server 2008 and 2008 R2:

- By consolidating traffic for traditional Ethernet and storage networks, data centers can reduce capital expense (CapEx) for adapters, switches and cables, and operating expense (OpEx) for power, cooling and IT administration. Based on the Emulex Convergenomics™ Cost Calculator, Emulex OneConnect UCNAs provide up to:
 - 28% savings on switches, adapters and rack space
 - 42% savings on power and cooling
 - 80% savings on cabling
- Higher CPU efficiency combined with the highest virtual adapter port count and granular Quality of Service (QoS) capabilities per VM enable the Emulex OneConnect UCNA to offload processing from Hyper-V and thus enable more VMs per server. Dynamic QoS bandwidth allocation gives data centers the flexibility and performance they need for greater VM consolidation.

Conclusion

The goal of this document is to provide an overview of how to maximize the benefits of using Emulex adapters and management application with Windows Server 2008 and 2008 R2. More information is available on each topic in the user documentation available on the Emulex Web site and references that were provided to other sources. Emulex is committed to providing products that will enable SAN and LAN connections that are truly scalable, flexible and reliable and fully integrated with Windows Server 2008 and 2008 R2.



www.emulex.com

World Headquarters 3333 Susan Street, Costa Mesa, CA 92626 +1 714 662 5600
Wokingham, UK +44 (0) 118 977 2929 | **Munich, Germany** +49 (0) 89 97007 177
Paris, France +33 (0) 158 580 022 | **Beijing, China** +86 10 68499547
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