

Advanced Storage Networking in Windows Server 2012

Cavium Enables Reliable, Flexible, and High-Performance Hyper-V Virtual Fibre Channel



Fabric-based networks are a fundamental requirement in supporting highly virtualized data centers and private cloud environments. Fibre Channel SANs are the nucleus of the next-generation Windows Server 2012 data center.

BENEFITS OF A QLOGIC AND MICROSOFT VFC SOLUTION

- Unmediated Access to a SAN – provides VMs with direct individual access
- Distributed Guest Clustering with Fibre Channel – enables virtualization of clustered Microsoft SQL Server, Exchange, and other applications to leverage shared Fibre Channel SAN infrastructure. iSCSI is no longer the only shared storage option
- Simplified Live Migration – guarantees unhindered access to the SAN during migrations as two WWNs are configured for each virtual Fibre Channel and used alternately
- Workload Specific Multipath I/O (MPIO) – enables each virtualized workload to have a custom MPIO solution; the choice of a multi-pathing algorithm is no longer limited to what is configured in the hypervisor
- Virtual SAN (vSAN) Support – allows virtualized workloads to have their own identity on the SAN and be part of a vSAN independent of the vSAN of the hypervisor

INTRODUCTION

Fibre Channel remains the dominant storage networking architecture for next-generation server virtualization deployments and cloud architectures. It is known for its ultra-reliability and mission-critical high-performance capabilities. IT investments in Fibre Channel are at an all-time high with 10 million Fibre Channel ports shipped, \$10B invested in Fibre Channel technology, and 10 Exabytes (EB) of storage shipped.

To realize the full potential of Fibre Channel investments in server virtualization and cloud deployments, virtual machine (VM) resident workloads need to establish independent, reliable, and portable connections to existing SANs. Legacy Hyper-V deployments lacked the ability to directly connect Fibre Channel storage to VMs.

With the release of Windows Server® 2012, Microsoft® introduced Virtual Fibre Channel (vFC) technology. With vFC, Hyper-V VMs in conjunction with QLogic® Fibre Channel Adapters from Cavium™ can now be configured to have direct access to SAN targets and LUNs. vFC enables and simplifies the virtualization of several tier-one enterprise-class workloads like clustered Microsoft SQL Server® and Microsoft Exchange. In addition, cloud-based architectures can now leverage customizable multi-pathing, live migration, and high-performance capabilities of vFC to create a flexible and dynamic enterprise cloud.

TECHNOLOGY AND TRENDS

The adoption of server virtualization technology in the data center has led to an initial wave of tangible benefits by reducing the amount of physical resources that are required in a deployment. A second wave of benefits in conjunction with cloud-based architectures, resulting in logical improvements in the responsiveness, flexibility, and agility of IT as a service-oriented operation, are also achievable. The improved IT capabilities, which are based on the creation of a highly available, adaptive compute environment that scales to support elastic demands on IT resources, depend on extending virtualization services throughout the network and storage components of the network infrastructure.

The Microsoft next-generation virtualization and cloud operating system (OS)—Windows Server 2012—delivers a modern platform of products and services that helps enterprises transform their current infrastructure to a highly elastic, scalable, and reliable infrastructure. This enables organizations to quickly and flexibly build and manage modern applications across platforms.

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Virtualization solutions like vFC from Microsoft and QLogic Fibre Channel Adapters from Cavium deliver the reliability, performance, and flexibility necessary to manage the complexity and risks associated with virtualization projects.

VIRTUAL FIBRE CHANNEL FOR MICROSOFT WINDOWS SERVER 2012

Microsoft Windows Server 2012 provides vFC ports within a Hyper-V VM, allowing Fibre Channel storage to be connected directly from within the VM. vFC (also referred to as Synthetic Fibre Channel) presents up to four vFC Host Bus Adapter ports to the OS running in a VM, using T11 standards-based N_Port ID virtualization (NPIV) technology (see Figure 1).

NPIV lets multiple N_Port IDs share a single physical N_Port. This lets multiple Fibre Channel initiators occupy a single physical port, easing hardware requirements in SAN design, especially where virtual SANs are needed. vFC for Hyper-V guests use NPIV to create multiple NPIV ports on top of the host server's QLogic physical Fibre Channel port. A new NPIV port is created on the host each time a virtual Host Bus Adapter is created inside a VM.

TECHNOLOGY REQUIREMENTS

vFC support in Hyper-V requires the following:

- Windows Server 2012 with the Hyper-V role installed
- A server with one or more QLogic 2500 Series (8Gb Fibre Channel) or QLogic 2600 Series (16Gb Fibre Channel) Host Bus Adapters
- VMs with Windows Server 2008, Windows Server 2008 R2, or Windows Server 2012 as the guest OS
- A NPIV-enabled Fibre Channel Switch

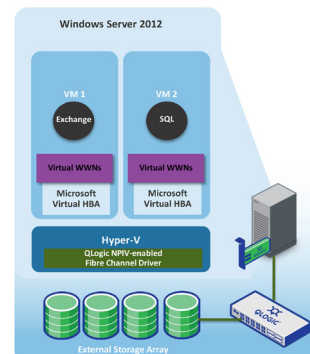


Figure 1. Microsoft vFC

TECHNOLOGY DEPLOYMENT USE CASES

vFC for Windows Server 2012 Hyper-V protects and leverages existing Fibre Channel investments for Hyper-V virtualized workloads and enables the use of any advanced storage functionality directly from the VMs. The following use cases describe the benefits of a joint Cavium and Microsoft virtual Fibre Channel solution.

Distributed Guest Clustering

With Microsoft vFC and QLogic 8Gb and 16Gb Fibre Channel Adapters, Hyper-V enables the use of Fibre Channel SANs to virtualize workloads that require direct access to the SAN. This capability enables several new scenarios, such as running the Windows Failover Clustering feature inside the OS of a VM connected to share Fibre Channel storage or virtualizing clustering applications like Microsoft Exchange or SQL Server.

By enabling clustering high availability applications to run as VMs, vFCs and Fibre Channel Adapters allow workload balancing for increased utilization and efficiency, simplifying routine maintenance of individual VMs without interrupting the enterprise workload. Guest clustering has distinct advantages versus host-based clustering; it can leverage the live mobility features offered by the hypervisor.

Workload Specific Multipath I/O

MPIO is a SAN best practice and is frequently used to provide a redundant and fault-tolerant alternate path from an enterprise-class workload to the storage target and LUNs. With previous-generations of Hyper-V, because VMs were not SAN aware, they could not deploy custom MPIO algorithms and were dependent on the MPIO configuration used on the hypervisor.

With Windows Server 2012 Hyper-V vFC and QLogic NPIV-enabled Fibre Channel Adapters, VM MPIO configurations and choices can coexist with that of the hypervisor. This capability enables the following key deployment combinations:

- Provides the ability to virtualize workloads that use MPIO. This result can be achieved by deploying multiple vFC ports in a VM and using MPIO within the VM to provide highly available connectivity to the LUNs.
- Enables VMs to use a separate copy of MPIO within the guest OS to connect to the LUNs that the VM can access. This configuration can coexist with a host MPIO setup.
- Deploy different device specific modules (DSMs) for the host or each VM. This capability enables migration of the VM configuration, including the configuration of DSM and connectivity between hosts with existing server configurations and DSMs.

Simplified Live Migration

Live migration defines the ability to move a VM from one server to another without any effect on the virtualized workloads running in the VM. To support live migration of VMs across Hyper-V hosts while maintaining Fibre Channel connectivity, vFC technology along with QLogic NPIV-enabled Fibre Channel drivers use two distinct WWNs, Set A and Set B, that are configured for each vFC adapter. Hyper-V automatically alternates between the Set A and Set B WWN addresses during live migration. This helps ensure that all LUNs are available on the destination host before the migration and that no downtime occurs during the migration. The live migration process that maintains Fibre Channel connectivity is illustrated in Figure 2.

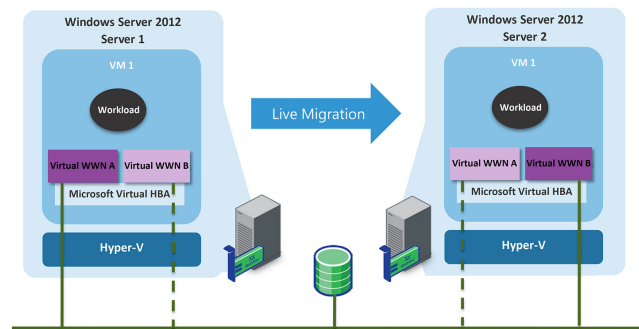


Figure 2: Alternately Used WWN's with vFC Enable Seamless Access to the SAN During Migration

Virtual SANs for VMs

A virtual SAN (vSAN) defines a named group of physical Fibre Channel ports that are connected to the same physical SAN. vSANs allow the logical segregation of the Fibre Channel fabric to enable the security and isolation required for enterprise workloads sharing the same physical SAN.

With Windows Server 2012 and QLogic Fibre Channel Adapters, vSANs are no longer limited to the segregation of physical hosts. Virtualized workloads running in Hyper-V VMs leveraging vFC technology now have a unique identity in the physical SAN and can be a part of multiple vSANs. This capability allows the VM to maintain its vSAN membership irrespective of the physical server hosting the VM and simplifies live migration.

As many as four vFC adapters per VM can be deployed and each associated with a virtual SAN.

THE CAVIUM ADVANTAGE

Cavium continues to be the industry leader in delivering high-performance I/O solutions to data center customers. The performance of the QLogic 2600 Series 16Gb Gen 5 Fibre Channel Adapter is best-in-class and provides superior scalability, unparalleled flexibility, and enhanced reliability.

ABOUT CAVIUM

Cavium, Inc. (NASDAQ: CAVM), offers a broad portfolio of infrastructure solutions for compute, security, storage, switching, connectivity and baseband processing. Cavium's highly integrated multi-core SoC products deliver software compatible solutions across low to high performance points enabling secure and intelligent functionality in Enterprise, Data Center and Service Provider Equipment. Cavium processors and solutions are supported by an extensive ecosystem of operating systems, tools, application stacks, hardware reference designs and other products. Cavium is headquartered in San Jose, CA with design centers in California, Massachusetts, India, Israel, China and Taiwan.



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