



# Accelerating network convergence in virtualized and cloud data centers

By Saleem Muhammad

Unifying disparate storage and data networks is a natural progression in many virtualization and cloud deployments. Dell™ converged networking innovations offer advanced switching capabilities and intelligent traffic management for these environments.

## Modular, unified networking



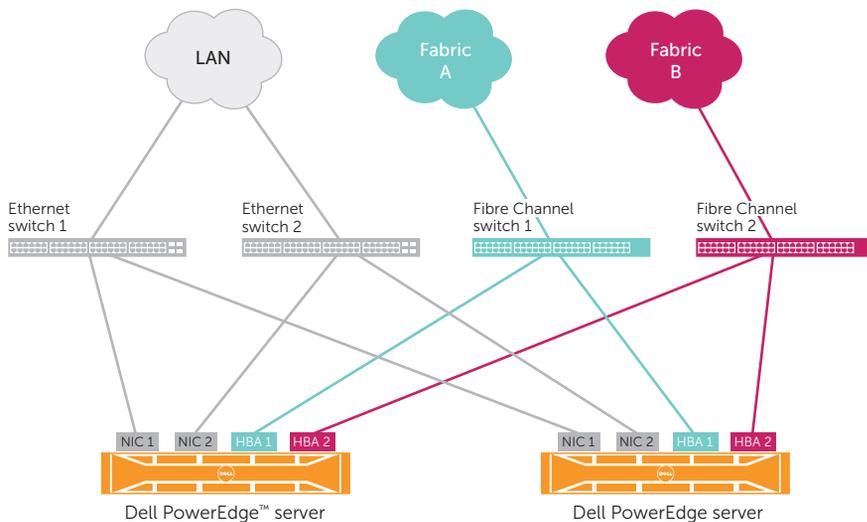
The Dell Networking S5000 switch provides a comprehensive platform and modular design that supports leading-edge networking protocols — enabling IT organizations to converge LAN and SAN throughput in high-I/O, virtualized environments.

- Modular 1U top-of-rack form factor
- Integrated automation, scripting and programmability
- High port density

To meet escalating I/O workload demands for business-critical applications, many organizations are transitioning their data centers to virtualized environments on converged infrastructure. This approach enables significant strides toward increased performance levels and reduced latency beyond what IT teams have already achieved through resource consolidation and convergence — notably streamlining operations, enhancing efficiency and boosting return on investments in data center infrastructure.

Now, IT leaders are looking to apply similar convergence innovations to networking. Adopting a converged networking strategy enables organizations to traffic server and storage I/O workloads on consolidated data throughput channels. Intelligent software helps optimize management of separate network architectures in converged network channels.

Optimizing network traffic flow and bandwidth has important implications for IT staff and their organizations. Chief information officers (CIOs) and enterprise decision makers need to ensure that existing IT assets and investments work efficiently and reliably for ongoing business operations. Virtualization administrators need high-performance platforms for connecting multiple server racks to accelerate virtual machine mobility while maintaining management visibility. Storage administrators are looking to converge internet SCSI



Complex, costly connections in a traditional data center with separate LAN and SAN traffic

(iSCSI), Fibre Channel, Fibre Channel over Ethernet (FCoE) and network attached storage (NAS) traffic as well as manage it efficiently. And network administrators need to streamline capabilities for IT teams managing servers and storage without compromising the operational integrity of the organization's network architectures.

For these reasons, many organizations are looking to converge Ethernet-based local area network (LAN) and Fibre Channel-based storage area network (SAN) traffic within a single cable. Dell continues to develop modular, scalable solutions for virtualized environments and converged infrastructure that are based on open standards, thereby helping organizations enhance data center flexibility and avoid proprietary hardware and software lock in.

The Dell Networking S5000 1U top-of-rack switch offers innovative modular converged networking capabilities that use the recent FCoE protocol. The switch converges LAN and SAN traffic over a single 10 Gigabit Ethernet (10GbE) connection to help optimize server and storage connectivity in enterprise-scale data centers that deploy separate networks based on different networking protocols.

## Protocols for evolving data center infrastructure

Traditional data centers that deploy virtualization and cloud computing often support separate server layers for applications, databases and web-based content delivery. The Fibre Channel or iSCSI protocol is used to connect the servers to external, shared storage, and both protocols use separate, dedicated Fibre Channel or Ethernet SAN fabrics simultaneously. As a result, considerable networking components — adapters, optics, cables and switches — are deployed in data centers to maintain separate networking infrastructures.

IT organizations have for some time considered options to help simplify switching, cabling and connections within separate networks. Several protocols have emerged for networking servers and storage.

The InfiniBand® protocol, for example, continues to be narrowly adopted. It generally requires procuring specialized physical media and is mainly applied to niche deployments necessary in environments that require ultrahigh performance and extremely low latency.

The iSCSI protocol, on the other hand, continues to experience growing adoption because it capitalizes on the ubiquity of Ethernet connectivity, and it adds a layer over TCP in the TCP/IP stack. After initial deployments in small and medium business environments, iSCSI is now increasingly used in enterprise-scale networking.

FCoE, a more recent protocol than InfiniBand and iSCSI, is generally used for SAN fabrics. By helping resolve challenges that arise because Fibre Channel is not easily ported to iSCSI, FCoE deployments enable organizations to preserve their existing investments in Fibre Channel. Many IT leaders today view the FCoE protocol as a cost-effective opportunity to transition from separate Ethernet-based LAN and Fibre Channel-based SAN connections to converged LAN and SAN networks that maintain separate data traffic functions.

## Convergence of separate networks

Traditional networking in a straightforward, conventional data center environment often requires servers to be equipped with both network interface cards (NICs) for LAN connectivity and host bus adapters (HBAs) to facilitate Fibre Channel connections to SAN fabrics. For example, if two Ethernet NICs are dedicated to the LAN and two Fibre Channel HBAs are required for separate SAN fabrics, then maintaining the necessary separation in this networking architecture requires multiple switches, optics, cables and adapters. Such connectivity considerations may add significant complexity and cost to an organization's networking infrastructure (see figure).

Alternatively, by converging LAN and SAN traffic on the same wire, the number of switches, optics, cables and adapters for server connections may be reduced by half. Each server utilizes converged network adapters to connect single cables to the two FCoE-aware Ethernet switches. The



converged LAN and SAN architectures are designed to maintain the same networking separation between the dedicated LAN and SAN connections (see figure).

Converging LAN and SAN traffic in this way promotes several important efficiencies. Decreasing the number of top-of-rack switches for each consolidated server rack helps reduce capital expenses and simplify the networking architecture. In addition, a decreased number of operating switches and adapters helps reduce the cost of cooling and power consumption. Moreover, deploying fewer physical components helps IT administrators simplify configuration and management.

An innovative, scalable design enables organizations to deploy modular networking technology based on open standards. This approach also enhances operational efficiency cost-effectively through intelligent software-based orchestration.

### Robust, scalable connectivity

The Dell Networking S5000 switch is designed to deliver converged LAN and SAN 10GbE, 40 Gigabit Ethernet (40GbE) and native Fibre Channel connectivity in a single networking platform for Layer 2, Layer 3 and storage throughput. Its modular design provides flexibility and pay-as-you-grow networking for non-blocking performance, low latency and stacking. The Dell Networking S5000 switch includes support for iSCSI, FCoE and bridging to Fibre Channel SAN in addition to NAS and Remote Direct Memory Access (RDMA) over Converged Ethernet (RoCE).

Open, multi-protocol standards for Ethernet and Fibre Channel fabrics enable enhanced flexibility and scalability. The Dell Force10™ OS (FTOS) provides a powerful, robust software platform, an industry-standard command-line interface (CLI) and smooth interoperability with open standards-based hardware and software from other vendors.

The switch's 1U form factor offers IT organizations a leading-edge, modular switch that is designed to optimize throughput even in data centers that do not need to converge LAN and SAN traffic. Organizations can deploy the Dell Networking S5000 switch for Ethernet-only traffic without needing to use the switch's Fibre Channel capabilities.

The switch is available with two connectivity options. One option provides a 12-port Gigabit Ethernet (GbE) and 10GbE module with a small form-factor pluggable + (SFP+) port interface, support for optics or direct attach cable and support for stacking ports. The other option offers a 12-port 8 Gbps Fibre Channel unified port module with a Fibre Channel interface for 2, 4 and 8 Gbps connectivity and support for optics or direct attach cable.

### Intelligent management software

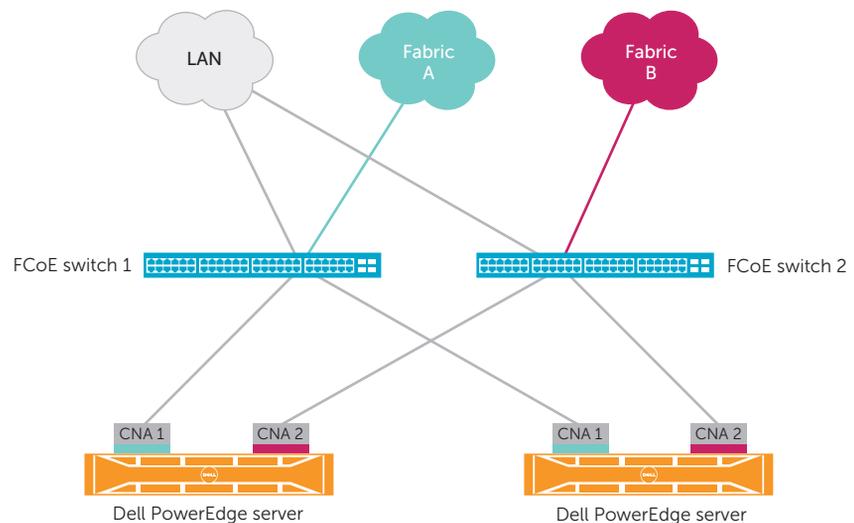
Customization of the networking infrastructure often complements customized server and storage networking configurations to help data center operations run efficiently. Intelligent software integrated into the

Dell Networking S5000 switch facilitates management through each part of the network architecture's lifecycle. It also helps simplify switch configuration and minimize the time necessary to deploy the network.

In addition, the intelligent software enables comprehensive visibility into network operations and helps simplify management tasks. The software also enhances scalability and broadens traffic monitoring capabilities to help optimize operations.

The modular design of the Dell Networking S5000 switch gives IT organizations the flexibility to customize networking environments to meet specific needs. The switch is also designed to facilitate the transition to next-generation I/O connectivity alternatives.

Moreover, the Dell Networking S5000 switch is a key component that augments the Dell Active Fabric initiative. (See the sidebar, "Creating an open, scalable networking fabric.") Active connectivity within highly virtualized data centers smooths the way for building next-generation-capable fabrics. The Dell approach to providing an open fabric for



Converged LAN and SAN connections that significantly reduce network components and maintain traffic separation cost-effectively

# Creating an open, scalable networking fabric

Deploying virtualization or provisioning virtual machines helps IT organizations run operations smoothly in virtualized and cloud computing environments. However, implementing networking services for a virtual machine can be complex and time-consuming. Proprietary networking systems may lock organizations into inflexible architectures that are difficult to scale — thereby limiting potential cost-efficiencies.

Alternatively, Dell offers an open, innovative platform designed to accelerate networking convergence in virtualized and cloud computing data centers. The Dell Active Fabric portfolio offers multiple rack and scale-out

connectivity options that advance network virtualization with software-defined networking (SDN). An Active Fabric Manager component provides advanced networking orchestration capabilities from a single console.

The Dell Networking S5000 switch augments the Active Fabric family with robust, modular switching designed to deliver converged networking. Modular hardware and software capability in Active Fabric enables administrators to cost-effectively scale out the network architecture and optimize emerging east-west — server-to-server — traffic flow.

The Dell Networking S5000 switch complements Active Fabric through

integrated automation, software programmability and scripting. Smart scripting enables network administrators to expose only the portion of the switch that is necessary in customized views for a storage or server administrator, or other IT staff member. In this way, network administrators can preserve the integrity of the networking infrastructure while providing relevant views for customizing throughput to meet specific needs.

Active Fabric is built on a foundation of robust components designed for SDN environments. It is well suited for stitching together server, storage and software in virtualized and cloud computing-based data centers.

active connectivity helps organizations avoid proprietary lock in to a single vendor.

The Active Fabric Manager component provides a single, easy-to-navigate console for end-to-end networking management, from the blade server I/O to the top-of-rack switch to the spine layer of the network. Active Fabric Manager is designed to simplify switch configurations, and it helps IT organizations significantly reduce the time required for network deployment.

In addition, the FTOS software platform is well suited to meet demanding networking requirements in virtualized and cloud computing environments. It is designed to provide highly dependable intelligent software support that helps meet the storage demands in large, enterprise-scale environments utilizing converged LAN and SAN connectivity.

## Scale-out infrastructure for converged networking

Many IT leaders have already completed a transition or are in the process of transitioning their data centers to virtualized or cloud computing environments. These advances

enable enterprises to take advantage of resource consolidation and convergence.

A logical next step calls for optimized networking to help meet the performance demands of intensifying I/O server and storage workloads for business-critical applications. Converging iSCSI Ethernet-based LAN traffic with Fibre Channel-based SAN traffic on a single 10GbE cable offers organizations tremendous opportunities for scaling out networking infrastructure quickly and cost-effectively.

The Dell Networking S5000 modular switch provides an innovative platform for converging LAN and SAN traffic over a single 10GbE connection. This top-of-rack switch complements the Dell Active Fabric initiative for accelerating networking convergence in virtualized and cloud-based data centers. 

## Author

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