

Realize the full promise of network virtualization

Deliver greater competitiveness, security, efficiency and cost savings with Dell EMC Open Networking and VMware NSX



Introduction

The choice is stark. IT departments can make the most out of dramatic changes in the software-defined data center, or allow these historic changes to drag down the enterprise. Competitive organizations are meeting this connectivity challenge through a variety of techniques and new capabilities being used in enterprise data centers across a broad swath of industries.

The digital universe is doubling in size every two years,¹ intensifying demand on data center networks. Traffic going into and out of the data center is taking a back seat to traffic within the data center, and these new patterns create fresh bottlenecks.

Evolving security threats put everything at risk. Malware attacks alone nearly doubled to US\$8.19 billion in 2015.² Organizations today are striving for optimal network security, with approaches such as Zero Trust promoting “never trust, always verify” as its central tenet.

At the same time, as server virtualization proliferates and data centers shift to the cloud, IT’s ability to rapidly deploy new applications is outstripping its ability to provision network services in support of these applications.

Addressing critical enterprise challenges

The move to network virtualization is gaining momentum because it addresses areas of vital concern to IT leaders, including:

- **Competitiveness:** Rapidly introducing new applications and services is an essential differentiator in today's digital economy, but slow network provisioning thwarts agility and success.
- **Economics:** Costs of closed proprietary networking environments with expensive management and support requirements continue to increase unsustainably.
- **Security:** Protecting information is a strategic necessity, but inflexible and expensive security models make data center security against threats such as credentials-stealing and computer infiltration nearly impossible.
- **Efficiency:** Operational aspects of networking management continue to grow in complexity, with unacceptable levels of network downtime and unsustainable requirements for expert personnel with hard-to-find proprietary network management skill sets.

Combining two new networking paradigms

Network virtualization is all about escaping the confines of the past. It should free the enterprise to deliver innovative new services cost-effectively. It should open up the enterprise to solutions across the broadest range of software and hardware platforms. The last thing an organization would want to do is run virtualized networking in a restrictive, proprietary environment that undercuts this openness and costs more to manage and run.

That is why organizations are choosing Dell EMC Open Networking with VMware NSX®, combining the new paradigm of a virtualized network with a new paradigm for networking through disaggregation. These two new paradigms enable organizations to take full advantage of the greatest innovations in networking, drawing from a broad and growing ecosystem of solutions for future-ready networks based on open, flexible industry standards.

Together, Open Networking from Dell EMC and network virtualization from VMware empower data center operators to achieve levels of competitiveness, network economics, security and data center efficiency that were previously unattainable in physical networks (see figure).

Virtual networking with Dell EMC Open Networking

A new operational model for the new paradigm in networking



Based on the same tenets

- Abstract hardware and automate operations
- Simplify networking — easy to deploy and run
- Innovate based on collaborating with ecosystem
- Deliver based on open, flexible and industry-standard hardware

Open Networking model

Standard orchestration and automation tools

Optional third-party network virtualization solutions

Any networking OS

Open-standard hardware

Merchant silicon

Dell EMC Open Networking with VMware NSX

Increasing agility and competitiveness

Many organizations cannot change their networks fast enough to keep up with new applications and workloads. It may be months before a company can deploy new applications, and delays can result in opportunities lost to competitors.

Dell EMC Open Networking with VMware NSX decreases the time for workload provisioning. Organizations can bring workloads up in seconds or minutes using automated network provisioning. There is no need to make major revisions to the physical network every time the organization introduces an application or service. Changes can be quickly made through software and require few, if any, cabling updates. IT can programmatically create, snapshot, store, move, delete and restore entire networking environments with simplicity and speed. This automation of networking tasks benefits both new application deployments as well as changes to existing applications in the IT infrastructure.

To support the introduction of new applications, IT can tailor the environment to the specific needs of the workload and application. For example, organizations can use different operating systems in various parts of the network depending on the features required. Dell EMC Open Networking switches are tested with third-party operating systems to ensure this flexibility. The platform testing requires an extensive amount of work and provides important added value for Dell EMC Open Networking customers — value that is not included in bare-metal switches from “white-box” vendors.

In addition, Dell EMC Open Networking solutions enable IT teams to take advantage of Dell EMC’s end-to-end global support and services where available.

Improving network economics

Network virtualization built on Dell EMC Open Networking helps lower total cost of ownership (TCO) just as server virtualization does. In the same way server virtualization has resulted in efficient utilization of computing assets, networking virtualization is able to more effectively use both computing resources and the hardware network. This reduces data center space, power, cooling and network hardware costs.

Disaggregated Dell EMC Open Networking switches enable organizations to combine best-of-breed components regardless of vendor or manufacturer. As a result, IT can make decisions about their network unhampered by vendor lock-in. For example, if an organization requires specialized capabilities not found in a typical network operating system, it can make the necessary changes while using the same hardware. This reduces deployment time and capital expenses related to the upgrade.

Avoiding vendor lock-in between hardware and software has additional benefits. It allows organizations to leverage common infrastructure across IT silos — for example, using the same tools for the networking and computing sides of the data center. The same people who manage the servers and the cloud can manage the physical network underlay, reducing the need for scarce, highly skilled network specialists. IT managers can leverage open source tools and expertise to help cut costly engineering overhead.

This approach also diminishes costs because organizations do not have to rip and replace their existing physical network to realize the benefits of network virtualization technology. A nondisruptive solution allows IT to incrementally implement virtual networks at a pace they choose, without impacting existing applications and network configurations. The Dell EMC solution also extends visibility to existing network monitoring and management tools.

Modeling the network ecosystem of the future

Through Dell EMC, organizations can take advantage of complete, best-of-breed networking solutions that are tested, approved and supported globally. This approach represents the emerging model of the future, which includes the following key characteristics:

- Ecosystems are built to aggregate a complete network solution.
- An organization can select software, hardware and management solutions from multiple vendors, similar to what occurs today in the server space.
- Using open solutions, organizations can create a homogeneous platform based on the specific requirements of their applications and respond quickly and flexibly as needs change.
- Simplified, software-based network management means personnel in many cases do not need to understand in-depth details of hardware to make a troubleshooting judgment.
- Organizations can create new services quickly by using the same tools to manage resources on networks and servers, freeing up time and money.

Enhancing security with Zero Trust

With the Dell EMC Open Network platform utilizing VMware NSX for network virtualization, organizations protect data through embedded security, including security against lateral movements related to credentials-stealing and computer infiltration for both the physical and virtual layers. The platform enables visibility of trends using analytics available in operating systems that offer insight into switch traffic.

Virtualization of the network with VMware NSX offers software-based data center security using micro-segmentation and Zero Trust protection that is pervasive and granular — helping the organization become twice as secure at half the cost.³

Micro-segmentation lets organizations define security policies and controls for each workload based on dynamic security groups, helping to ensure immediate responses to threats inside the data center and enforcement down to the individual virtual machine (VM). Since virtualization abstracts networking from the underlying hardware, security policies are attached to their associated workloads and travel with them.

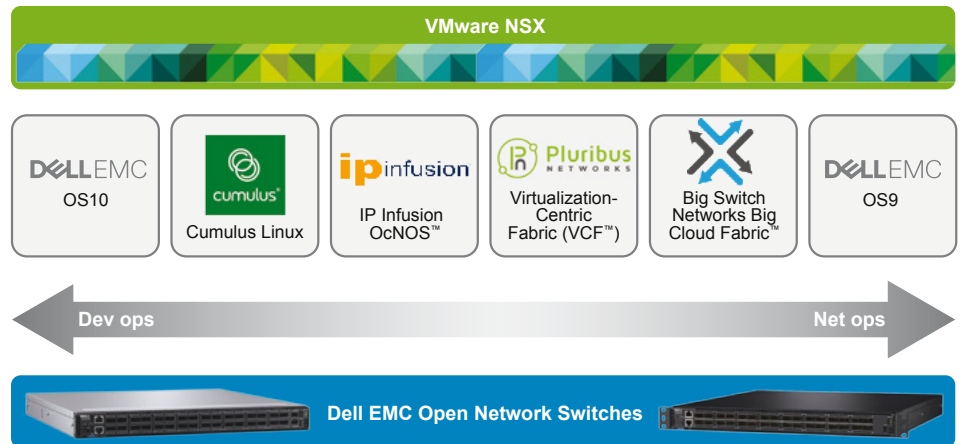
Boosting efficiency and meeting business goals

Reduced complexity starts with fast deployment. Dell EMC Open Networking utilizing VMware NSX network virtualization provides a complete set of logical networking elements and services, all easily provisioned through cloud management platforms leveraging open application programming interfaces (APIs).

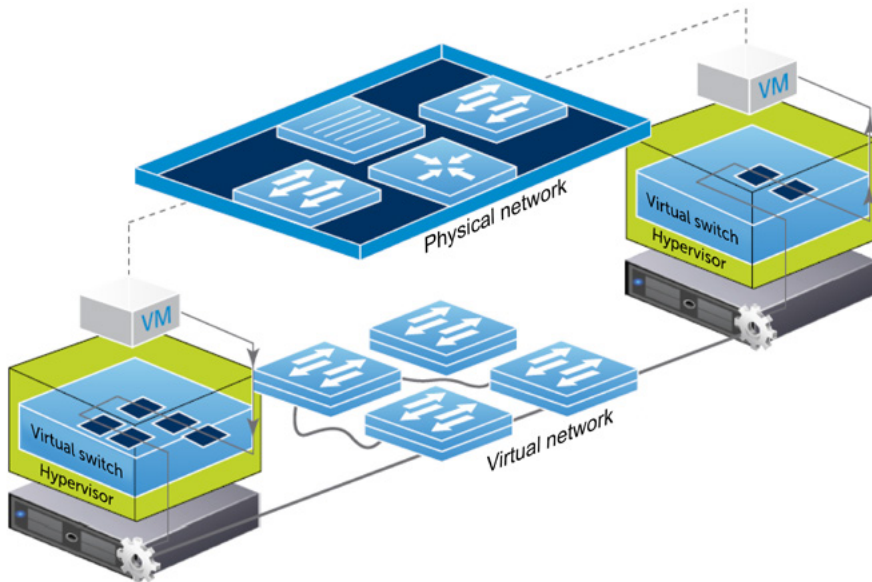
This joint technology also simplifies and accelerates private and hybrid cloud initiatives. Organizations can rapidly develop, automatically deliver and manage all their enterprise applications, whether they reside on-premises or off-premises, from a single unified platform. IT can easily replicate entire application environments to remote data centers for disaster recovery, move them from one corporate data center to another or deploy them into a hybrid cloud environment — all in minutes, without disrupting the applications or touching the physical network.

Making connections that drive competitiveness

Organizations can connect to OS and software options from Dell EMC and third-party vendors for a variety of powerful capabilities that run on a Dell EMC Open Networking solution with VMware NSX (see figure).



OS and software options from Dell EMC and third-party vendors



Physical network with virtual network implemented

Looking under the hood at Dell EMC Open Networking and VMware NSX network virtualization

Dell EMC Open Networking and VMware NSX network virtualization enable organizations to eliminate the drawbacks of traditional networking by applying the basic server virtualization model to the entire data center. The virtual network consists of transport tunnels that overlay the physical infrastructure (see figure).

The physical network is greatly simplified and can be treated as a pool of transport capacity to be consumed and repurposed on demand. Policies are defined at the virtual level for application continuity, including quality of service (QoS), uptime and performance. The virtual level also enables software-based data center security using micro-segmentation.

Designed to reproduce all the network services from Layer 2 – Layer 7 in the Open Systems Interconnection (OSI) model, VMware NSX provides a comprehensive set of logical networking elements and services, including:

- **Virtual switching:** Virtual Extensible LAN (VXLAN)–based network overlays that enable logical Layer 2 overlay extensions across a routed Layer 3 fabric within and across data center boundaries
- **Virtual routing:** Dynamic routing between virtual networks performed in a distributed manner in the hypervisor kernel, and scale-out routing with active-active failover to physical routers
- **Distributed firewalling:** Distributed stateful firewalling embedded in the hypervisor kernel for up to 20 Gbps of firewall capacity per hypervisor host
- **Load balancing:** Level 4 – Level 7 load balancer with SSL offload and passthrough, server health checks and app rules for programmability and traffic manipulation
- **Additional services:** VPN, QoS and monitoring

Dell EMC Open Networking supports the hypervisor-centric VXLAN virtualization method. Network virtualization using VXLAN is achieved by encapsulating the original Layer 2 frame coming from the VM with a VXLAN header and physical network IP header, adding up to 50 bytes of additional information that needs to be encapsulated.

This means jumbo frame support is required on physical switches. The Dell EMC physical network with Dell EMC OS9 or third-party software for open networking switches takes this additional data encapsulation into consideration. Dell EMC Open Networking switches fully support IP-based physical networks and can support jumbo frames at line-rate speed.

The physical network provides a tunnel transport connectivity highway from resources such as switches, routers, storage and servers, and enables these elements to communicate with each other. Dell EMC Open Networking supplies the key underlay capabilities critical for a successful virtual networking implementation, including:

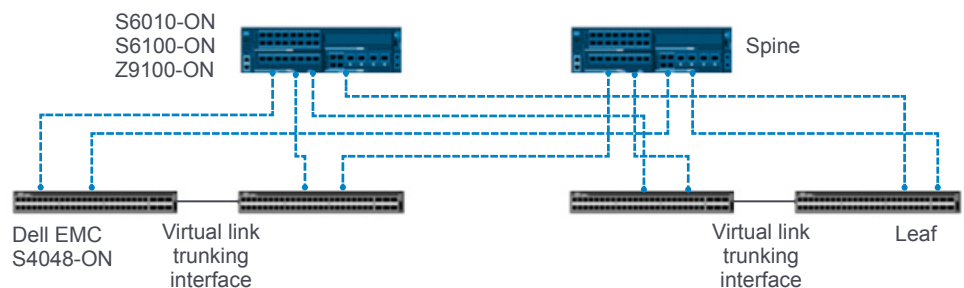
- **Non-blocking fabric:** The fabric created by the underlay can switch data at line rate and use all fabric interlinks ranging from 10GbE–100GbE speeds.
- **Dynamic scalability:** The underlay can scale on demand depending on the type of overlays being created on top of it. As new services are added or deleted, the infrastructure can grow or shrink.
- **Open architecture:** As an open architecture, Dell EMC Open Networking can accommodate change and support a mixed set of products from different vendors instead of a one-size-fits-all approach from a single proprietary networking vendor.

Dell EMC Open Networking provides a dynamic physical layer based on a highly distributed Clos architecture — defining a two-layer, spine-and-leaf switching topology that provides a full non-blocking switching fabric, where the leaf and spine switches are interconnected (*see figure*).

To succeed, network technologies must have the ability to co-exist and interoperate with legacy network infrastructure without compromising flexibility or increasing complexity. VXLAN technology provides a network virtualization approach designed to meet these criteria. In addition, the Dell EMC solution extends network visibility and ease of management to include both legacy and emerging technologies.

Exploring Dell EMC Open Networking and VMware virtual networking reference architecture

A reference architecture is available to organizations looking for a pretested, scalable solution using Dell EMC technologies, including Open Networking running Dell EMC OS9 software and the VMware NSX network virtualization solution. The three-tier, multi-tenant reference architecture is deployed on top of Dell EMC end-to-end infrastructure using Dell EMC Open Networking switches and Dell EMC servers.



A simple spine-leaf architecture with high availability

This reference architecture is built using Dell EMC servers to provide management, compute and edge cluster resources. The physical network fabric is deployed in Layer 3 spine-and-leaf architecture using Dell EMC Networking switches. A Dell EMC Open Networking switch helps bridge logical networks using Layer 2 gateway functionality to bare-metal servers. Virtual link trunking (VLT) is used at the Dell EMC Open Networking leaf layer to provide active-active network interface card (NIC) connectivity, leaf switch redundancy and uplink to spine switches.

The open shortest path first (OSPF) routing protocol is used to enable VXLAN tunnel endpoint (VTEP) connectivity across racks through leaf-spine switches.

The Dell EMC solution provides a hardware VTEP solution that is designed to create a stronger connection between virtual and physical networks than software VTEP solutions alone.

With Dell EMC, organizations also have a single point of contact for Dell EMC networking virtualization deployments. Dell EMC provides expert help in deploying virtual networking from initial planning to implementation.

Learn More

For more information on Dell EMC Open Networking and VMware NSX, visit Dell EMC.com/vmware and select the Network tab.

¹ IDC, *The Digital Universe of Opportunities: Rich Data and the Increasing Value of the Internet of Things*, April 2014, <http://www.emc.com/leadership/digital-universe/2014iview/executive-summary.htm>

² Dell Security, *Annual Threat Report, 2016*

³ Chris King, VMware, *Organizations can be twice as secure at half the cost*, September 2015

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