



NETWORK VIRTUALIZATION: **Six Best Practices for Overcoming Common Challenges**

Many organizations that have realized the benefits of server virtualization are ready to move to network virtualization. By combining hardware and software resources and functionality into a single, software-based administrative entity, these organizations can reap the benefits of greater data center agility.

But network virtualization presents new challenges. The network is not a fixed platform like a server; it is a dynamic, fluid, multivendor environment that wasn't built with network virtualization in mind. To complicate matters, very few data centers will be 100 percent virtualized; many workloads will run only in physical environments. Thankfully, these challenges are not insurmountable. With a bit of planning—and the following best practices—organizations can overcome these challenges with a simple, open and smart approach.

BEST PRACTICE #1: ESTABLISH A SOLID FOUNDATION

The success of a virtualized overlay network rests on the health and stability of the underlying physical network. Before taking any steps to virtualize the network, make sure the physical network is in order. It should be application-location independent, and it must exhibit any-to-any connectivity with fairness and non-blocking behavior for deterministic performance. This will ensure network behavior will not vary based on the location of virtual machines. The physical network should also have low latency, low jitter, and no packet loss under congestion.

BEST PRACTICE #2: ENABLE UNIVERSAL CONNECTIVITY

Network virtualization will require connecting applications between virtual networks (often based on different encapsulation protocols like VXLAN or NVGRE), between virtual networks and physical networks, and between physical data centers. Universal software-defined networking (SDN) gateways provide advanced, flexible physical and virtual network routing and bridging connections and translations

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required for inter-, intra- and cross-virtual network communications—for example, when separate virtual networks are used for production and test environments. A universal SDN gateway lets compute resources move between networks, either within physical data centers, between physical data centers, or between a physical data center and a cloud environment.

BEST PRACTICE #3: BUILD THE SHORTEST BRIDGES POSSIBLE BETWEEN THE VIRTUAL AND PHYSICAL WORLDS

To reach a client application, virtual networks must connect to a physical device somewhere, along with legacy physical applications and database servers. Bridges, or Layer 2 gateways, between virtual and physical worlds support the connection of physical environments, and they should be deployed as close to the physical resources as possible. For larger pools of physical resources, gateways should be deployed in upper tiers of the data center network for efficiencies of scale.

For example, it may be necessary to connect to physical servers running bare-metal applications, or applications that don't run well in virtualized environments, like Hadoop. These gateways should be deployed at the access tier. When connecting to a large pool of physical resources, such as a physical data center or a large number of physical applications, the gateway should be deployed at the network's core/aggregation tier. Finally, when running multiple virtual networks within a single physical environment (as in IT as a Service or Infrastructure as a Service scenarios), the gateway should be deployed at the edge routing tier.

All gateways should also be automated—programmatically controlled so they can be built and torn down automatically based on where a virtual machine needs to connect between virtual and physical networks.

BEST PRACTICE #4: PREVENT VIRTUAL NETWORK PERFORMANCE, DEGRADATION AND RELIABILITY ISSUES

Virtual overlay networks are designed to imitate all aspects of the underlying physical network, subjecting the overlay network to performance, degradation and reliability issues when broadcast, unicast or multicast packets are flooded to all devices within a broadcast domain—standard network behavior that physical equipment is designed to handle. However, broadcast, unicast and multicast flooding place an exponential burden on the servers hosting the virtual network.

Hardware-based overlay replication offloads broadcast, unicast and multicast packets from the virtual network, allowing purpose-built hardware-based devices to convert these packets into standard broadcast, unicast or multicast packets. These packets are then forwarded to their receivers, delivering performance, scale and reliability.

BEST PRACTICE #5: ADOPT A SINGLE APPROACH TO SECURITY

Using a single security approach to protect both physical and virtual resources reduces errors and security gaps that can occur when multiple methods are used. A single approach will also simplify administrative tasks and prevent duplication of efforts, reducing overhead.

From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking.

BEST PRACTICE #6: ADOPT A COMMON APPROACH TO NETWORK MANAGEMENT AND AUTOMATION

This approach should be extended to network management and automation efforts as well. A single pane of glass providing consolidated visibility into the entire network will help identify and arbitrate where issues lie. For example, a common network management platform expedites troubleshooting by identifying where packets are flowing and where issues may exist—whether a physical network misconfiguration or an overloaded hypervisor dropping packets—and it also prevents finger-pointing.

It is also advisable to establish a single point of automation to achieve consistent behavior across physical and virtual networks.

» ACHIEVE NETWORK VIRTUALIZATION BEST PRACTICES WITH JUNIPER NETWORKS AND VMWARE

Juniper Networks MetaFabric™ Architecture—a simple, open and smart approach to data center design—accelerates the deployment and delivery of applications within and across multiple data centers.

Delivered via a comprehensive portfolio of switching, routing, orchestration, SDN and security solutions as well as technology partnerships, MetaFabric protects investments by allowing organizations to adapt to changing data center needs. Customers can optimally deploy, utilize and manage a unified pool of resources across multiple data centers with greater agility, cost efficiencies and end-user application experience.

Juniper delivers VMware NSX Layer 2 gateway services as part of the MetaFabric Architecture on select Juniper switches and edge routers to bridge virtual and physical environments in the data center. The combination of Juniper and VMware optimizes applications and data center efficiencies, allowing flexible workload placement and workload mobility while delivering a single pane of glass for configuring networks across hypervisors and physical switches. ■

To learn more about how Juniper can help you virtualize the network, visit www.juniper.net/datacenter.

ADDITIONAL READING

LAYER 2 GATEWAY SERVICES FOR VMWARE NSX

Juniper Integrates with NSX to Programmatically Connect Physical and Virtual Environments

VMware NSX, the industry's leading networking and security virtualization platform, decouples the virtual network from the underlying physical network to allow enterprises to rapidly deploy virtual networks securely for any application.

With network virtualization, simplified logical networking devices and services are abstracted from the physical network and exposed as logical networking objects across a fully distributed virtualization layer, consumable by third-party applications through northbound APIs. VMware NSX exposes these logical networking devices and services as logical ports, logical switches, logical routers, distributed virtual firewalls, and virtual load balancers, all with monitoring, quality of service (QoS), and security built in.

Juniper Networks leverages the NSX distributed service framework to integrate with the NSX platform. This integration delivers Layer 2 gateway services that allow virtual networks to be bridged to any physical network environment to provide a unified user experience. It also provides the ability to seamlessly integrate with any cloud management platform for greater data center agility and scale.

THE CHALLENGE

Virtual networks must connect to a physical device at some point, along with legacy physical applications and database servers, in order to reach the client application. In addition, most data center environments consist of multiple virtualized Layer 2 networks, whether to support separate production and development environments, business continuity/disaster recovery efforts, multiple tenants, or other unique business needs.

"Bridges" are required between physical and virtual networks, as well as between separate virtual networks. Agility and performance are impacted when bridges are placed in the wrong tier of the data center network. The placement of bridges is critical to delivering agility and performance and, if placed in the wrong tier of the network, will impact both. Ideally, bridges are placed as close to the physical element as possible—server, storage, or client application—to provide the greatest data center agility and scale.

Separate add-on bridges such as dedicated gateways increase operational complexities and expenses. Seamlessly bridging physical and virtual networks to optimize application and operational efficiencies requires physical-to-virtual gateways to be integrated into the physical

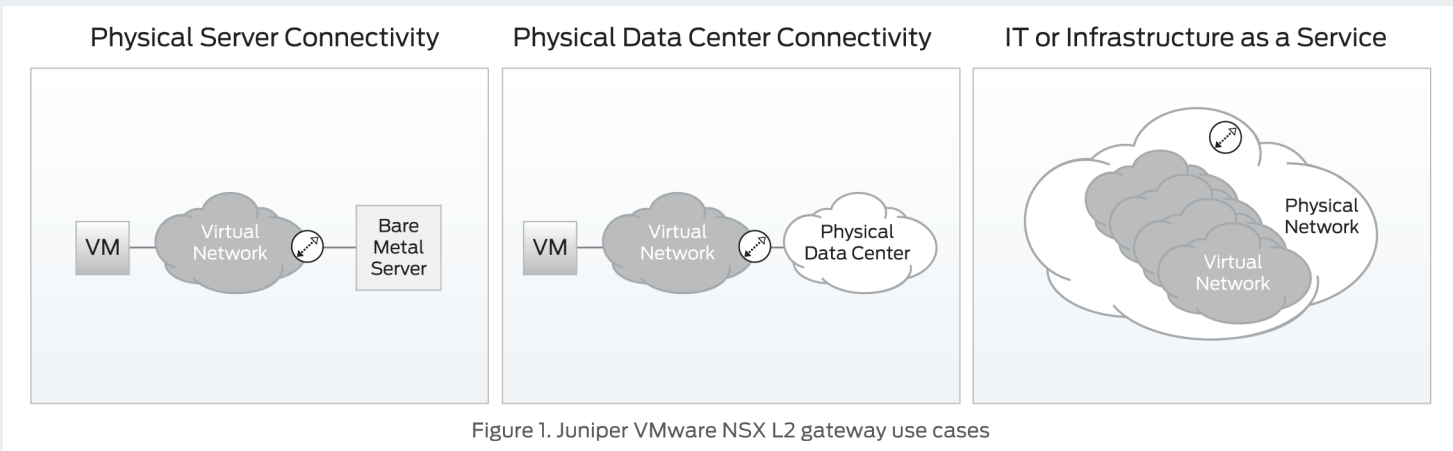
network. In addition, the physical infrastructure must be flexible enough to provide physical-to-virtual Layer 2 gateway services at any point in the data center network to provide on-demand connectivity between physical and virtual workloads.

JUNIPER NETWORKS LAYER 2 GATEWAY SERVICES FOR VMWARE NSX

The VMware NSX network virtualization platform delivers the operational model of a virtual machine for the network. Similar to virtual machines for computing, virtual networks are programmatically provisioned and managed independent of the underlying networking hardware. NSX reproduces the entire network model in software, allowing diverse network topologies to be created and provisioned in seconds. However, the challenge of connecting to the physical environment remains.

Juniper and VMware jointly address this challenge by delivering VMware NSX L2 gateway services to bridge the virtual and physical network environments on select access switches, core/aggregation switches, and edge routers to allow optimal NSX deployments for all data center network topologies.

ADDITIONAL READING



There are three typical use cases for the VMware NSX L2 gateway, as shown in Figure 1.

USE CASE 1: Physical Server Connectivity The NSX L2 gateway service on a top-of-rack (ToR) access switch delivers a unified L2 domain experience by bridging between virtual machines and physical servers, allowing applications on these servers to talk to each other. For example, one tier in a multi-tier application architecture could consist of physical or bare-metal servers that host databases. The Juniper NSX L2 gateway ToR access switch bridges communication between the servers and the database applications in the physical tier with the virtualized servers and applications in the other tiers. Reliability is greatly enhanced by In Service Software Upgrade (ISSU) capabilities and by multi-homing connections for both virtual and physical servers required to terminate an overlay tunnel connection (VXLAN VTEP) for NSX.

USE CASE 2: Physical Data Center Connectivity The NSX L2 gateway capabilities on select Juniper switches or edge routers provide the necessary bridging between physical and virtual data center segments, assets or services for workload mobility. While businesses evolve towards a private or hybrid cloud model, they can have a mix of physical and virtual data centers; they must be able to connect between or within these data centers and also move workloads. Juniper's NSX L2 gateway can bridge and enable workload migration between physical and virtual assets, services or applications both within and across data centers. These core switch- or edge router-based NSX L2 gateways can stretch local physical VLAN or logical VXLAN segments across data centers for seamless connectivity. The ToR access switch can provide local physical-to-virtual bridging within the data center.

USE CASE 3: IT or Infrastructure as a Service (ITaaS) Deploying the NSX L2 gateway on the edge router or select switches in the network allows a single physical environment to be shared between multiple virtual networks. Traffic that enters the data center is directed to the appropriate virtual network, optimizing utilization and costs while maintaining a separation of virtual domains. Such a scenario is well suited for an ITaaS environment

FEATURES AND BENEFITS

The combination of Juniper and VMware optimizes applications and data center operational efficiencies by:

- Enabling programmatic connection of VLANs to logical networks
- Offering the choice of NSX L2 gateway services across access switches such as the QFX5100, core/aggregation switches such as the EX9200, and edge routers such as the MX Series to bridge virtual and physical networks in any data center topology, multi-hypervisor environment or fabric architectures
- Providing foundation for hardware accelerated VXLAN routing to support virtualized network multi-tenancy and enable virtual machine mobility within or across data centers for business continuity/disaster recovery and resource pooling
- Enabling automation through Zero-Touch Provisioning (ZTP), Junos scripting, Python scripts, and integration with Puppet and Chef significantly increases agility
- Allowing flexible workload placement and workload mobility
- Delivering a single pane of glass (NSX API) for configuring logical networks across hypervisors and physical switches
- Eliminating the need for IP multicast for physical networks

SOLUTION COMPONENTS

Juniper is delivering VMware NSX Layer 2 gateway services on the QFX5100, EX9200 and MX series. In addition, Juniper is delivering inter-VxLAN routing on the EX9200 and MX series.

- The joint solution offers seamless physical-to-virtual connectivity via integration with NSX through the data plane (VXLAN) and control plane (OVSDB) while unifying the management plane. NSX acts as a single pane of glass for managing and operating IT workloads that span virtual and physical systems.
- Whether bridging between the virtual network and physical hosts, between remote sites, or between external networks, Juniper L2 gateway services for VMware NSX provide programmatic connec-

ADDITIONAL READING

tions of VLANs to logical VXLAN networks throughout the data center, providing support for different fabric architectures such as Virtual Chassis Fabric and IP CLOS, optimizing applications and data center operational efficiencies.

- The Juniper NSX L2 gateway supports high availability through mechanisms such as ISSU and multi-homing beyond two ToR access switches.

SUMMARY

Virtual networks created through VMware's NSX allow enterprises to rapidly deploy networking and security for any application by enabling the fundamental abstraction of networks from networking hardware.

Juniper Networks leverages the NSX distributed service framework and SDK to integrate with the NSX platform and provide Layer 2 gateway services that allow the virtual network to be bridged to any physical network environment. This integration provides a unified user experience and the ability to seamlessly integrate with any cloud management platform.

NEXT STEPS

To learn more about bridging physical and virtual data center environments, or about other Juniper solutions for VMware environments, please contact your Juniper Networks or VMware representative.

ABOUT VMWARE

VMware is the leader in virtualization and cloud infrastructure solutions that enable businesses to thrive in the Cloud Era. Customers rely on VMware to help them transform the way they build, deliver and consume Information Technology resources in a manner that is evolutionary and based on their specific needs. With 2012 revenues of \$4.61 billion, VMware has more than 500,000 customers and 55,000 partners. The company is headquartered in Silicon Valley with offices throughout the world and can be found online at www.vmworld.com.

ABOUT JUNIPER NETWORKS

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net.