TechTarget

Making Networks Virtual: The Latest on SDN Technologies

SDN and network virtualization may be new and unproven, but they're also the future. Learn the basics, how they intersect and how to put them to work in your network.

SDN and Network Virtualization Decisions Aren't Easy, But Here's Help

Let's face it, network virtualization and SDN are exciting technologies, but they're largely unproven and frequently misunderstood.

Every day, our editorial team reports on new developments in these technologies, but in many cases, enterprise network engineers don't yet understand the differences between SDN and network virtualization, or where the two technologies intersect.

Even worse, in many cases vendors are heavily marketing SDN and network virtualization, even though they've yet to release actual products, which only makes it more difficult for engineers to make solid buying decisions.

In this TechGuide, we lay out the basics of SDN and network virtualization, as well as how they complement each other. We first outline differences in SDN architecture and design, and present underlay and overlay network virtualization strategies.

In the second chapter, we explain how network virtualization could be used today in your existing network to support Layer 4-7 services and how it's useful for basic virtual network tenant provisioning across the LAN.

The final chapter examines the concept of hybrid networks that allow engineers to work with both legacy equipment and SDN. Here, you'll learn how vendors are releasing hybrid switches that support both OpenFlow and legacy protocols.

As editors and researchers, we can't tell you exactly what to buy—and we certainly can't make the vendors release products that are simpler to test and deploy. But we hope this technical guide helps you understand the fundamentals of these new technologies and the considerations necessary to make your initial investment. Good luck! ■

Rivka Gewirtz Little

Executive Editor, SearchNetworking

Evaluating Options for SDN Deployment

The Deployment of software-defined networking (SDN) and network virtualization (NV) technologies promises a number of key benefits to IT organizations, including the ability to rapidly provision network resources, lower operational costs and improve network visibility, policy and orchestration. The challenge for IT managers is to navigate the plethora of choices regarding SDN technologies to select a path that brings measurable benefits in the near term with the ability to grow into next-generation network architecture. This piece discusses some of the key considerations for IT managers concerning SDN/NV deployments.

DEFINING SDN/NETWORK VIRTUALIZATION

SDN is defined as having the following capabilities.

- **Separation of control and data plane.** That is, the intelligence of the switch/router is split out from the packet-forwarding engine.

- **Programmability.** The ability to centrally change traffic flows, partition the networks and provide application-level QoS improves network flexibility.

SDN technologies can be used in the data center, the wide area network and as part of the telecommunication (e.g., optical network) transport network.

Network virtualization (also known as virtual overlay networks) uses tunnels to create a virtual network on top of traditional (Ethernet) physical networks. NV leverages protocols like VXLAN or NVGRE to provide Layer 3 tunneling and allow for virtual machine (VM) migration across the network within the data center and data center to data center. Examples of NV technology include VMware's NSX, Microsoft,

PlumGrid, Midokura, Nuage and Juniper's Contrail.

SDN and NV are highly interrelated technologies with overlapping capabilities, especially in a data center context. Both SDN and NV have widely varied (and complex) cost models, including prices by software license, by VM, subscription (monthly fee), bundled with hardware/software, free software pay for support and open source. SDN and NV implementations should be driven by a specific use case and may require significant customization to work well in your environment.

For the purposes of this article, SDN and NV are considered together.

CURRENT SITUATION: PLENTY OF CHOICE, LACK OF CLARITY

IT managers have a tremendous number of options with regards to deployment of network virtualization and SDN technologies.

Specific vendor SDN/NV strategies vary widely. Some, like VMware, offer virtual overlays that require no changes to network hardware. Others, like Cisco, are heavily dependent on, and take advantage of, network hardware-specific features to improve performance. IT managers must consider if leading IT suppliers have the best vision or whether to select products from innovative software-defined networking startups.

IT managers can choose from dozens of (radically) different SDN/NV products, including:

- **Cisco:** ONE, API and OpFlex
- **VMware:** NSX network virtualization software
- **Open source software:** From standards bodies, including OpenFlow, OpenDayLight and OpenStack
- **Low-cost white box switches:** Broadcom or Intel silicon, with operating systems from Cumulus, Vello and Pica8
- **IT suppliers:** SDN offerings (often data-center-centric) from HP, IBM, DELL
- **Innovative startups:** ADARA, Big Switch, Embrane, Midokura, Plumgrid, Pluribus

- **Enterprise network suppliers:** Alcatel-Lucent, Arista, Brocade, Citrix, F5, Juniper, Riverbed

The variety of SDN and network virtualization offerings can confuse IT managers as to which (if any) solutions to evaluate and deploy. As a result, service providers (e.g., Google, Facebook, Amazon, Twitter, Microsoft and Rackspace) have driven the majority of SDN deployments with specific requirements (e.g., how to rapidly scale the network) and significant in-house development resources.

SDN DEPLOYMENT CONSIDERATIONS

For IT managers, the first consideration for SDN/NV deployment is having a clear understanding of its initial use case and the specific benefits an SDN/NV implementation provides. A number of SDN use cases are in current deployment, including NV overlays, network monitoring, network segmentation and optimizing WAN traffic flows. All of these initial deployments, deploying either NV overlays or SDN controllers, have focused on relatively narrow pieces of the network that have limited impact on the network underlay or physical network operations.

There are some additional aspects of SDN/NV deployment to consider.

- **Centralized vs. decentralized:** How do you plan to implement SDN? Will it be in a centralized (e.g., OpenFlow controller) architecture or a more distributed model with network protocols communicating with the physical network?

- **WAN, data center or network-wide:** Where (in what part of the network) will you target the SDN deployment?

- **Overlay/underlay:** NV technologies can be implemented without affecting the physical network. Do you want to logically separate your SDN/NV deployment or adopt a solution that is well integrated with the underlay network?

- **Open source vs. vendor-specific:** What is your willingness to implement open-source solutions (which require custom integration) compared to more integrated (and proprietary) vendor-specific solutions?

- **SDN resources:** What are your available resources (e.g., internal, system integrators and channel) to design, implement and support SDN deployment? How will you train your IT personnel and help them adapt to the changes an SDN/NV deployment enables?

- **Future vision vs. legacy migration:** What is the rate of change in your IT and network architecture? How will a potential SDN/NV implementation fit in to your longer-term IT architecture?

- **IT organizational structure:** Who in your organization will "own" the SDN/NV implementation? How will this affect the structure of, and communications between, network, server, storage and DevOps personnel?

CONCLUSION

SDN/NV implementations can offer significant benefits to IT organizations, including rapid provisioning on network resources, migration to modern network management systems (replacing scripts and CLIs), and reduced costs (both operating and capital expenses). Leading-edge organizations have successfully deployed SDN/NV and discussed their specific implementations at several conferences, including the Open Network Summit and Open Network Users Group.

The next round of SDN/NV deployments is taking place now as IT managers evaluate which use cases and technology options will maximize the return on investment and be part of a long-term architectural vision for their next-generation network. —*Lee Doyle*

What Network Virtualization Technology Does for the Network

THE SDN MARKET may be in its early days, but network virtualization technology has already reached general availability. This new product is making it possible to virtualize even very large networks.

As a result, enterprise IT teams can finally automate network provisioning and better integrate network resources into overall IT operations. Yet it can still be difficult to determine how to evaluate these new products and where to begin with implementation. The good news is that there are ways of using network virtualization in hybrid scenarios that don't require a complete rip-and-replace.

WHY BOTHER WITH NV TECHNOLOGY? THE BUSINESS DRIVERS

Operational efficiency is the major driver for network virtualization. While storage and server resources can be virtualized and automatically provisioned, the network has lagged behind. In today's network, the provisioning process is complicated and slow.

In order to make even a simple change, networking teams currently go through a lengthy process that includes planning the change and then submitting it for review through a "change control" system. That system requires other people to consider and approve (or disapprove) of the proposal. Then admins or engineers execute the change, and finally it must be verified to see if it is working as expected. This process is woefully inefficient and is more likely to lead to human error. It can also take days or even weeks to complete a change.

Network virtualization, however, enables the automated provisioning of network services like virtual LAN (VLAN) creation, Ethernet port provisioning, load balancing and firewall policy maintenance. With automation comes a reduction in provisioning time, as well as

a reduction in the potential for human error.

Network virtualization technology also has the potential to reduce network operational expenses and capital expenditure as well. With network virtualization, IT teams can make the most of their existing physical hardware because users can build multiple distinct environments on top of one physical infrastructure. Similar to the way service providers separate customer traffic across a common MPLS infrastructure, enterprises can use network virtualization to build virtual networks, each of which contains its own rich set of services, including routing and switching, plus Layer 4-7 services like firewalling and load balancing.

Going forward, network virtualization has the potential to reduce the cost of the underlying network hardware itself. The idea is that the underlay network can be simplified to be that of a high-bandwidth Ethernet fabric that is capable of ultrafast switching and routing, but doesn't require rich functionality beyond that. That richer functionality would be moved into the software layer at the virtualized network edge. In that case, the underlay network might not have to wear the badge of a premium network vendor. In fact, several startups are proposing alternatives, espousing a model of low-latency, high throughput, inexpensive white-box switches that focus on fast transport but leave the complex Layer 4-7 forwarding decisions to the virtualized network.

IS YOUR EXISTING TECHNOLOGY READY FOR NETWORK VIRTUALIZATION?

For those convinced that network virtualization would benefit their organization, the next step is perhaps the hardest: How does an organization begin moving towards virtualizing its network?

It's key to first understand that network virtualization is not an all-or-nothing proposition. While ultimately it has the potential

Network virtualization technology has the potential to reduce network operational expenses and capital expenditure.

to displace traditional technology, network virtualization can be introduced alongside an organization's existing infrastructure. There are a number of ways to implement this hybrid scenario.

Network virtualization could displace traditional technology and can be introduced alongside an existing infrastructure.

Organizations can start by investigating their existing network virtualization capabilities. Firewall and load-balancing vendors often offer a virtualized form of their hardware appliance. However, it is a mistake to think of simple virtualized appliances as actual network virtualization. In a true network virtualization environment, Layer 4-7 functions can be spun up at will, isolated to a specific virtual network and be part of a service chain.

Beyond that, though, network teams should realize that their existing networks are able to forward overlay traffic, such as what runs in Virtual Extensible VLAN tunnels. In addition, they could query their networking vendors about their virtualization offerings that are specifically aimed at hybrid scenarios. For example, network switches already in production might be OpenFlow-capable, making it possible to run both SDN and traditional traffic on the same infrastructure at once.

—Ethan Banks

What to Consider for Hybrid Network Virtualization Technology

WHILE SDN MAY eventually alter the way we architect networks, it is possible in the short term to implement network virtualization technology in a hybrid environment in which traditional and virtual technologies complement each other.

In some cases, enterprises can use hybrid switches, which will forward traffic both traditionally and using SDN instructions. It's important to remember that not all OpenFlow-capable switches also run traditional protocols; therefore, organizations must specifically inquire about switches' hybrid capabilities during their evaluation.

Another hybrid approach is to install a "greenfield patch" in the brownfield data center. Here, users build a new network segment supporting virtualization and bridge it back to the legacy infrastructure. As the greenfield virtualized segment is proven, the lessons and techniques learned could then be applied to the legacy infrastructure.

As mentioned in chapter two, overlay networks can be transported on top of the existing physical network, or underlay. Some view overlays as a transition mechanism to pure SDN. Whether overlays are transitional or here to stay, the fact that they are seen by the network as simply IP traffic means that organizations can introduce overlays to their legacy network with little difficulty today. In fact, several vendors count on the relative ease of overlay integration as a selling point for their network virtualization products.

Much of network virtualization is achieved in software, so it doesn't have to be costly to experiment. In fact, there is a variety of open source software that makes it possible for companies to try out network virtualization with nominal financial investment. Open vSwitch (OVS), an open source virtual switch with a rich set of capabilities has become quite popular.

Coupled with OpenStack and the Neutron plug-in for OVS, it is possible to build virtual networks running "as a service" inside a larger cloud.

MAKING THE MOVE

Moving to network virtualization is as much a mental and operational shift as it is a shift in networking itself. For years, network upgrades have been incremental, with little overall bearing on an organization's IT process, but network virtualization is a fundamental change. The long-term benefits for an organization include a tight integration of IT operations as network consumption is absorbed into the rapid provisioning processes already enjoyed by server and storage teams.

Clearly, the notion of network virtualization is here to stay; it's an idea that has many proponents, and the number of products in the space is growing. The challenge for IT teams is in evaluating the diversity of approaches in the context of specific business needs and taking into consideration rapid technological developments. —*Ethan Banks*

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