Solution Brief

Cisco Nexus 1000V and Virtual Network Overlays

Date: July 2012   **Author:** Bob Laliberte, Senior Analyst

**Abstract:** Cisco recently unveiled its Open Network Environment, or Cisco ONE, to enable programmable or software-defined networks (SDN). A major part of that initiative is based on leveraging the Cisco Nexus 1000V to create overlay networks for highly virtualized environments. ESG believes that overlay networks will play a significant role in SDN initiatives in both enterprises and service providers.

Overview

To respond to rapidly changing business needs, enterprise IT environments have become highly virtualized. ESG research supports this, as increasing the use of server virtualization technology has been either the number one priority reported by respondents to our annual IT spending intentions survey, or tied for number one, for the last three years in a row[1]. As these highly virtualized environments continue to mature, organizations go beyond simple consolidation and mobility benefits and seek to create a more comprehensive automated or orchestrated environment. ESG research seems to bear out the fact that many enterprises are creating private clouds to achieve that goal. In fact, this initiative broke into the top 10 IT initiatives in 2012[2]. In order for these initiatives to be successful, the network needs to keep pace and change from its legacy manual processes to higher levels of automation and orchestration.

Another way organizations are responding to the business is by leveraging public cloud computing environments. Service and cloud providers are in many ways ahead of the enterprise in terms of creating highly virtualized multi-tenant environments. This marks the area of the biggest increase in IT budgets reported by ESG research respondents for 2012, with 74% stating they will increase spending on public clouds[3]. As organizations continue to build out their private clouds and increasingly leverage public clouds, they set the stage for hybrid clouds, in which the network will play a vital role.

To better enable the network to handle these transitions, Cisco introduced Open Network Environment, which offers three different approaches to enable higher levels of network programmability. The program includes:

- **onePK.** This is one programmable kit of APIs that covers all Cisco networking products, leveraging the IOS, NX-OS, and IOS-XR.
- **Support for OpenFlow**. This includes a series of agents and controllers but is primarily focused on education and research environments.
- **Virtual Network Overlays.** These are based on the Nexus 1000V and target highly virtualized or cloud environments.

The focus of this brief will be on the role of the virtual overlay network and the Nexus 1000V.

Analysis

If the goal is to become more responsive to the business, let's take a look at how virtual network overlays can help accomplish that. Virtual network overlays provide:

- **Multi-tenant capabilities.** VNOs enable organizations to slice up a shared physical network into multiple logically isolated networks, where each segment can be programmed and managed according to its own needs. While it might appear that multi-tenancy would be more prevalent in cloud and service provider environments, the enterprise is quickly following suit. A recent ESG survey on data center networking found

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[1] ESG Research Report: _2012 IT Spending Intentions Survey_, January 2012.
[2] IBID
[3] IBID

that 63% of respondents were consolidating data centers and of those, almost half (48%) reported that they were creating multi-tenant environments to support multiple business units[4]. As these virtualized environments continue to mature, expect the enterprise data center to look a lot more like a service provider environment.

- **Scale.** As mentioned above, the combination of increased use of server virtualization and consolidation of data centers is leading to much larger and more complex environments that are capable of rapid scale. As these environments scale, it is becoming more difficult for the network to keep pace. For example, in order to provide logical segmentation, organizations have traditionally leveraged virtual local area networks (VLANs). However, VLANs are limited in their ability to scale, so Cisco's Virtual Network Overlay takes advantage of VXLANs, which can scale up to 16 million partitions. That should be more than enough... for now.

- **Programmability.** A key component of next generation networking will be the ability to deliver higher level services or programmability. The Cisco Nexus 1000V was created leveraging separate control and forwarding planes—called the virtual supervisor module, or VSM, and the virtual Ethernet module, or VEM, respectively. The ability to access the VSM will determine the ability to add services. Part of the virtual network overlay announcement is the fact that the VSM will have REST APIs and OpenStack (Quantum) northbound interfaces. In addition, the Nexus 1000V leverages Cisco vPath technology, in which Virtual Service Nodes can provide a variety of L4-L7 network services, including virtual firewalls , load balancing, and WAN acceleration. Other integration points include the ASA 1000V cloud firewall, virtual security gateway (VSG), and the Imperva SecureSphere web application firewall (WAF), which was certified to run as a VM on the Nexus 1010.

- **Ability to leverage existing technology.** For many organizations, virtual switches, which play a key role in virtual network overlays, have already been deployed in their environments. Forty-six percent of enterprise respondents to ESG research have reported deploying virtual switch technology from their network vendors (see Figure 1)[5]. A quarter of the respondents (25%) leverage virtual switch technology from their server virtualization vendors and almost a quarter (24%) use a combination of both. It should be noted that the larger the organization, the more likely they were to use virtual switch technology from their network vendors.

- **Management consistency.** As the networks, both physical and virtual, scale, it will be important to minimize the number of management tools for provisioning, operations, and common policy management. In fact when we asked why organizations chose to deploy a virtual switch from their network vendor, the most common responses were tight integration with servers and fabric and common network management across virtual and physical networks (see Figure 2)[6].

- **Mobility.** With organizations more dependent on outside partners and suppliers, it will be important for organizations to be able to connect easily. Cisco is developing a VXLAN-VLAN gateway that will allow organizations to seamlessly connect cloud environments to legacy VLANs and de-encapsulate the VXLAN headers to ensure success.
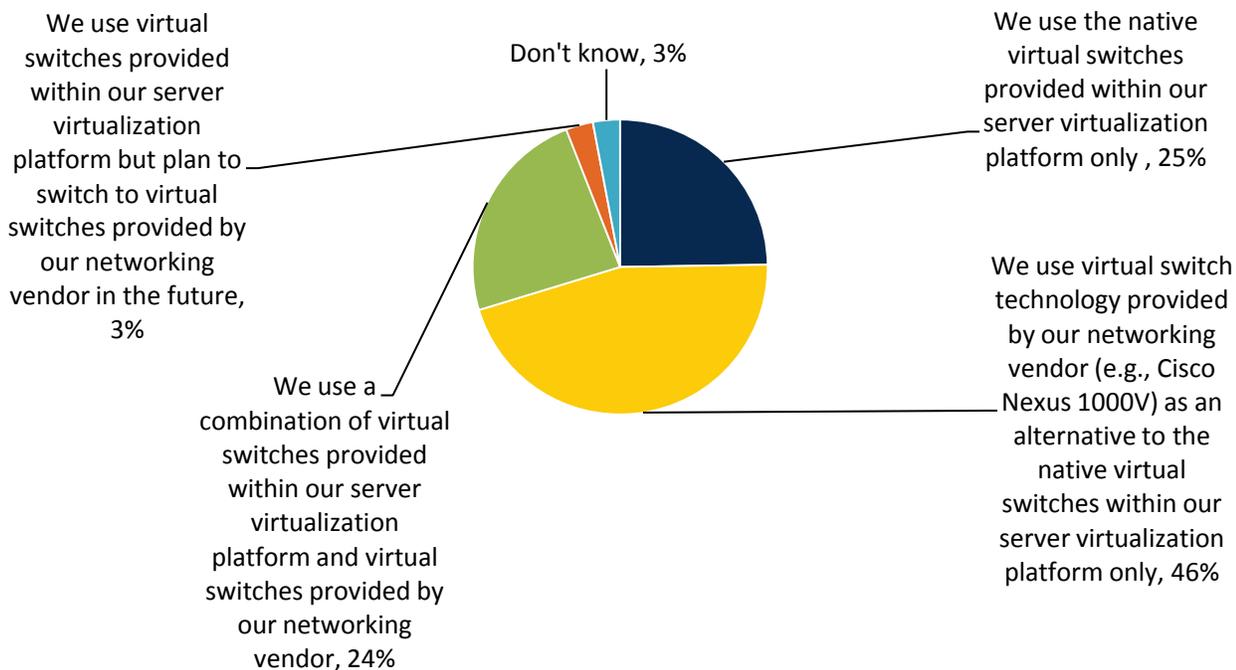
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[4] ESG Research Report: *Data Center Networking Trends*, January 2012.
[5] Ibid.
[6] Ibid.

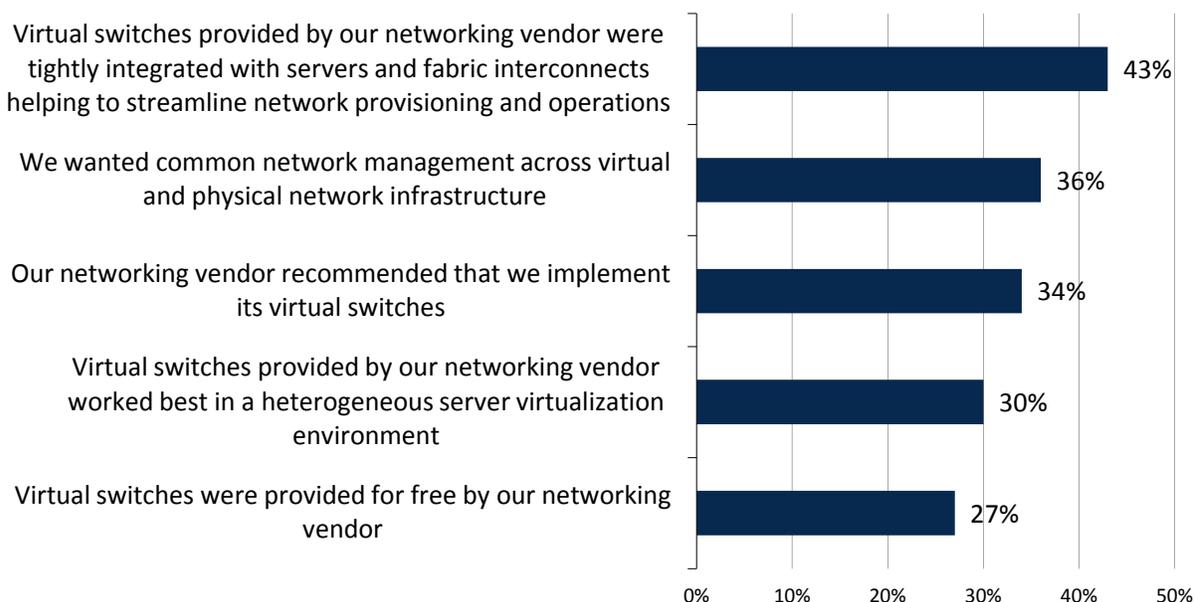Figure 1. Virtual Switch Implementation Strategy

With regard to server virtualization, which of the following best describes your organization's implementation of virtual switches? (Percent of respondents, N=280)

We use virtual switches provided within our server virtualization platform but plan to switch to virtual switches provided by our networking vendor in the future, 3%

Don't know, 3%

We use the native virtual switches provided within our server virtualization platform only , 25%

We use virtual switch technology provided by our networking vendor (e.g., Cisco Nexus 1000V) as an alternative to the native virtual switches within our server virtualization platform only, 46%

We use a combination of virtual switches provided within our server virtualization platform and virtual switches provided by our networking vendor, 24%

Source: Enterprise Strategy Group, 2012.

Figure 2. Why Virtual Switches from the Network Vendor

Why does your organization use or plan to use virtual switches provided by your networking vendor? (Percent of respondents, N=138, multiple responses accepted)

Response	Percent
Virtual switches provided by our networking vendor were tightly integrated with servers and fabric interconnects helping to streamline network provisioning and operations	43%
We wanted common network management across virtual and physical network infrastructure	36%
Our networking vendor recommended that we implement its virtual switches	34%
Virtual switches provided by our networking vendor worked best in a heterogeneous server virtualization environment	30%
Virtual switches were provided for free by our networking vendor	27%

0%   10%   20%   30%   40%   50%

Source: Enterprise Strategy Group, 2012.

Things to Consider

As with all technologies, each organization needs to consider many things to determine whether this technology is right for them. For virtual network overlays, the most important consideration is an organization's current or planned level of virtualization. The more highly virtualized the environment, the better the fit. Other areas to consider include:

- **Hybrid clouds.** If an organization is considering the use of a hybrid cloud to accommodate bursty or seasonal traffic, it needs to make sure the public cloud can accommodate VXLAN traffic or that the VXLAN-VLAN gateway will be sufficient to handle traffic needs. Also, the ability to potentially optimize traffic that is going outside the data center will be required as well.

- **Ecosystem of programmers for the Nexus 1010.** Cisco is off to a good start with its own virtual security offering and the inclusion of Imperva. Look for additional companies to join this ecosystem and build out additional services for virtual network overlays running as VMs on the Nexus 1010. The key will be developing solutions that solve real problems for the enterprise.

- **Orchestration and automation.** The ability to tie into higher levels of automation and orchestration will be important to enable private cloud environments. The northbound interfaces from the Nexus 1000V VSM will enable application developers to build cloud automation tools, and because the Nexus 1000V will use open APIs like OpenStack, these application developers may be able to port their orchestration applications to other SDN and virtual overlay infrastructures. Alternatively, organizations could deploy a turnkey Cisco-solution like the Cisco Intelligent Automation for the Cloud to enable automation and orchestration.

The Bigger Truth

Virtualization technology enables IT to be more responsive to the business. However, the legacy network is rapidly becoming a bottleneck. Organizations are looking for innovative ideas to help transition the network into a more flexible and adaptable environment to enable cloud environments. Programmable or software-defined networks hold a tremendous amount of promise in advancing and enabling networks to deliver the requisite services for cloud environments.

The recently announced Cisco Open Network Environment provides organizations with a choice of how to build out a highly virtualized network through programmable network devices, agents, controllers, and virtual network overlays. Clearly in highly virtualized networks, the Virtual Network Overlay can play a major role. However, for a complete solution, organizations will likely need to deploy a combination of these technologies to cover virtual and physical environments.

Cisco is a network market leader with a strong foothold in large enterprise accounts. This established presence and trust that has been built up over a number of years delivering quality products and services places them in a good position to educate and engage with customers on programmable networks and Virtual Network Overlays. In particular, the combination of their extensive Nexus 1000V customer base (over 6,000 as of July 2012), layer 4 through 7 services, and security services will provide Cisco with a strong go-to-market advantage in deploying virtual network overlays versus other network vendors.