Virtual Reality

Virtualization has reached your network—now what?
Regain control through virtual network management.

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Seeking the Virtues of Virtualization in the Network

IT'S 2016. DO you know where your network is? It no longer lives only in your data center. But it's ... where, exactly? Today, your network lives in multiple data centers, and it's comprised of thousands—or tens of thousands—of disparate devices, both physical and virtual.

The days of being able to touch the network edge are definitely over. Static environments are ancient history. Today's network managers can't be idle—unless they want to abdicate the virtualized edge to systems and virtualization teams—because networks are becoming more opaque and complex than ever.

To reassert control, network pros must learn to corral this new, virtualized network infrastructure. As an aid to this effort, we've compiled this three-part technical guide on managing the virtualized network. It opens with an examination of contemporary network management and whether the notion of a "single pane of glass" has instead become a "glass of pain"—a dated concept in an era of the distributed network

This guide also tackles the issue of how to employ the latest virtualization platforms—including software-defined networking and network functions virtualization (NFV)—to build the foundation for a state-of-the-art network infrastructure. Finally, we end with an examination of how the arrival of the virtualized network has complicated visibility. Illuminating the network has never been so critical, and so challenging.

Virtualization and NFVs are remaking today's networks. Distributed resources make network oversight even more challenging. But there are tools and strategies that can help. We hope this guide will give you the information you need to make your mission easier to fulfill. ■

CHUCK MOOZAKIS
Executive Editor, Networking Media Group

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Is 'Single Pane of Glass' a Network Myth?

THE MODERN NETWORK has become the backbone for all IT infrastructure. Along the way, it evolved into a multiheaded beast—one that must be tamed to ensure the network is capable of supporting nearly any form of data, including application, cloud, compute, storage, video and voice traffic.

But some networking professionals have said the fabled weapon of choice—one network management tool to rule them all—is still more mythology than reality. And in some sense, that's okay.

That's because the need to understand multiple realms of technology means that the idea of a single tool for all network management functions is not something that entirely works for many organizations.

Some vendors talk about the holy grail of network management being a single pane of glass for visibility and control, but it's not an idea that IT pros like Ant Lefebvre buy into.

"Every tool has its purpose, but no tool can do everything," said Lefebvre, former senior systems engineer at Middlesex Hospital in Middletown, Conn. "The single pane of glass is really a single glass of pain."

Christian Renaud, a senior analyst at the 451 Group, agreed with the notion that there is no single tool that fits all needs for network management, and enterprises continue to grapple with the consequences of that. Networking professionals rated network visibility as their number one problem and the top issue that keeps them awake at night in a recent 451 Group survey.

Networks are considered a mission-critical resource in nearly every industry. In the case of Middlesex Hospital, the network is truly vital and plays a key role in how physicians and medical practitioners save lives. Having sufficient visibility and control over all the moving parts is essential.

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Middlesex's facilities include one major hospital, two emergency departments and approximately 30 off-site locations. There is a data center in the hospital, and there is also an off-site facility for disaster recovery purposes where some applications are also hosted. Overall, Lefebvre estimated that he managed 500 networking devices, which encompass switches, routers and other network infrastructure.

Middlesex Hospital also has deployed Wi-Fi extensively to enable voice over WLAN, or VoWLAN, which doctors and nurses use to communicate. All told, Lefebvre had approximately 3,000 users that he had to keep happy.

"The thing that makes it tricky is the amount of downtime we're allowed to have in a hospital environment—which is none," Lefebvre said. "In a hospital environment, there is critical stuff that is on the network [and] that is relying on the network, and any downtime is perceived as terrible."

NEW NETWORK MANAGEMENT CHALLENGES

Some vendor sales representatives might pitch the idea that there is, in fact, one network management tool to solve all challenges. But that's not quite how network management works in the real world.

Rick Drescher is often asked about what tool should be used to manage the network. In his role as managing director of the critical facilities group at Savills Studley, a commercial real estate advisory firm in New York City, he helps many enterprises figure out their data center needs. Network management is a concern for many clients, and the biggest challenge is that the network isn't a single entity anymore in an IT environment.

"A lot of people use the term network management software as the umbrella for seeing and viewing everything in an organization's IT deployment," Drescher explained. "The traditional network management platform is not going to give you that visibility."

A number of trends—including virtualiza-

Trends, like virtualization, have shifted enterprises' network management requirements.

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tion and the convergence of storage, networking and compute—have shifted enterprises' network management requirements. But while most network managers have a good handle on the basics like Cisco's NetFlow protocol, Drescher noted, they often struggle to fully understand how other factors like virtual machines and storage volume will affect network management.

The challenge of network visibility is further compounded by the added complexity of software-defined networking (SDN) and cloud computing. Simply having visibility into routers and switches doesn't provide a full picture of what is going on in a network. "There is no vendor that can say that they support every single virtualization startup or SDN overlay vendor and can see into all those pieces," 451 Group's Renaud said. "Network performance is the aggregate of many pieces and not just any one subset."

Software alone isn't enough to manage a network faced with these demands, Drescher said. Outsourcing network monitoring to a cloud provider works best for businesses with smaller networks that don't have much data to export, he said. Enterprises with a large number of ports and devices need to have a device physically attached to the network to be able to grab all of the data.

It was a lesson Drescher learned after a project intended to outsource network monitoring to the cloud failed because he didn't have full visibility into the environment. There were recurring, giant, grayed-out areas in the bandwidth reports, indicating data from the network simply wasn't making it to the data collector at the cloud provider's location.

"We did not have an on-premises piece of hardware on site to collect the data," Drescher said.

CHOOSING THE RIGHT TOOL SET

If there isn't a single platform, then what tools are in play for this era of network management? The quick answer: There is no shortage of options. At Middlesex Hospital, Lefebvre used a lot of different monitoring tools that trigger alerts if a service is interrupted and there's an issue that needs to be addressed.

"We have a menagerie of tools. Some of them

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we spin up and leave alone, then others we actively manage," he said.

Although the hospital doesn't have one centralized dashboard for all network management tasks, it does use Splunk to provide a centralized view for troubleshooting network management issues. Splunk functions as a central correlation engine for log data, which can then be searched.

"So if something happens that isn't part of normal day-to-day operations, we can search in Splunk to see where the issue is," Lefebvre said. "It's a Swiss Army knife tool for me to [use to] investigate when someone says, 'Hey, go look at this.'"

Lefebvre also used ExtraHop's wire-data analytics hardware for getting the necessary information from the network. It comes in handy, he said, because when IT disruptions or outages pop up, the first thing application vendors do during the troubleshooting process is point a finger at the network. With the ExtraHop tool, Lefebvre said he was able to obtain visibility into the network to understand the issue, refute those vendors and help keep the network running smoothly.

Additionally, he used WhatsUp Gold as a ping monitoring tool that lets Middlesex Hospital know when devices go down, along with a platform from PathSolutions to monitor bandwidth use.

Networking professionals first need to take a step back to understand what it is they are actually trying to manage.

And despite so many new challenges in network management, some old-school methods are still best. The most fundamental part of network management has always been knowing exactly what networking equipment is in place. And for as long as there have been networks, one of the most common ways to track network devices has been the use of a spreadsheet. That's still true today.

In his work with enterprises, Drescher said he still sees many hands-on networking professionals track network assets in a spreadsheet.

Lefebvre acknowledged that even amid all his

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collection of specialized network management tools, he too used a spreadsheet—in his case, Google Docs in the cloud—but he also had a few other tools to help keep track of the locations of his physical networking gear. He had all of his switches listed in SecureCRT, a Secure Socket Shell client.

AT THE CORE? PROBLEM SOLVING

Given that the single-pane-of-glass tool approach isn't likely the best approach, what should network managers actually do? Drescher suggested that networking professionals first need to take a step back to understand what it is they are actually trying to manage.

"The reason why network management fails is that people don't have a good grasp of their entire environment before they go out to deploy," he said.

According to 451 Group's Renaud, it is important that both enterprises and the vendors that support them understand that modern network management is about more than just protocols, speeds and feeds. Rather, it needs to be treated for what it is—a discipline built on solving business problems.

From a features perspective, Renaud emphasized that network management tools must have visibility into virtualized environments and the cloud.

"If the network operations person is measured by network uptime, it's critical to make sure the visibility and management tools can see the virtualized and cloud traffic—or else you're being given all the responsibility and none of the authority," Renaud said.

For Lefebvre at Middlesex Hospital, keeping the network always up was about using whatever tools make sense for the specific problem he was trying to solve.

Even more important, the network is designed in such a way that even without a single pane of glass for network management, service disruptions are minimized when there is a problem.

"We tried to develop a redundant network," Lefebvre said, "so if there is a failure, something else picks it up and the network doesn't go down." —*Sean M. Kerner*

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How to Lay a Foundation for the Virtualized Network

WHEN IT COMES to software-defined networking and network functions virtualization, there tends to be a great deal of confusion pertaining to the differences between the two. In this chapter, we'll examine the purpose of each, while also exploring which portions of NFV and SDN should be included in network infrastructure planning discussions. Also covered is what virtual network functions are in respect to NFV, and what opportunities you have today to implement VNFs within your infrastructure.

NFV is nothing more than the virtualization of applications and services that traditionally ran on proprietary appliance hardware. Virtualizing servers has benefited the server community tremendously in terms of flexibility, scalability and cost-saving benefits; many parts of the network are now seeking the same. Think of NFV as an overall structure that allows for the rapid provisioning, control and scaling of a virtualized network infrastructure—each individual service that becomes virtualized is considered a virtual network function.

PARTIAL OR COMPLETE VIRTUALIZATION? IT DEPENDS

At this point in time, it is primarily large service providers that have, or are moving toward, a full VNF strategy to virtualize their entire infrastructure. It makes sense for them, as they have to be as flexible and dynamic as possible to provide the exact network functions the customer demands. And virtualizing each network function is a great way to accomplish both scalability and flexibility. But for most enterprises, virtualizing every aspect of the network doesn't yet make sense. For one, the cost to overhaul and replace an appliance-based infrastructure for a virtualized one would be immense. Second, enterprises don't require the

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level of scalability and rapid provisioning capabilities that a service provider would.

That being said, this doesn't mean enterprises shouldn't entertain the possibility of virtualizing parts of their network. In fact, in many cases, it makes perfect sense. This is especially true when you are at the point where you need to retire aging network appliances. In many cases, network vendors now provide a choice: You can either replace the old appliance with a new one, or you can buy a software-only version and run it on commodity server hardware as a virtualized appliance. Examples of network appliances and services that can be virtualized today include routers, switches, firewalls, intrusion prevention systems, load balancers, video conference gateways, and various security and management appliances. Basically, you can virtualize anything on the infrastructure you want. The next question then becomes, should you?

VNF CASES VARY

As stated previously, virtualizing appliances provides a number of advantages from a scalability and flexibility perspective. You also have to consider the potential savings of eliminating the upfront cost of purchasing proprietary hardware to run the network services. This is, of course, assuming you have a virtual server environment that can host the virtual network appliances. Nonetheless, virtualizing anything creates an added layer of complexity that can cause confusion when implementing and troubleshooting.

Additionally, the placement of the VNF, as it relates to data flow, must be considered when looking at virtualizing a formerly physical appliance. If data flowing in or out of your network must be significantly rerouted so it passes through a VNF residing in the data center, you may want to reconsider a virtualized network infrastructure. A benefit of physical appliances is they are point-based services that can be physically installed anywhere along the network path. Redirecting traffic into a data center can increase complexity—and potentially create network bottlenecks, as the amount of north-south data center traffic can increase exponentially.

Ultimately, enterprise organizations have

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adopted the approach of “virtualize when possible.” In most cases, network administrators are honing their VNF skills by learning on virtualized instances of services and appliances spun up in the infrastructure-as-a-service clouds their company leverages. Then, taking what they’ve learned in the cloud, the process of migrating parts of the in-house network that make sense from a financial and data traffic perspective can begin. And, over time, network architectures will change to the point where it makes sense to virtualize nearly all of the organization's network services.

—*Andrew Froehlich*

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Network management was never simple, but virtualized networking means it's now even more complex. Prior to virtualization, data transport was straightforward: Packets were sent from a server network interface card, across a cable to a switch, and then to another switch or destination NIC. Network configurations were relatively stable. Today, virtual switches can be created and deleted in a matter of seconds.

The services that use network functions virtualization—such as firewalls, encryption or deep packet inspection—are executed within a server rather than in a dedicated hardware device; this adds further complexity to virtualized networking. And network-overlay standards such as Network Virtualization using Generic Routing Encapsulation and Virtual Extensible LAN, which define ways to encapsulate an application's network links to isolate them from other applications' links, add yet another layer of complexity.

What's more, problems such as outages or overloads can occur anywhere along a network path. Hardware devices can fail; virtualized interconnections or functions can become backed up when an application moves to a new processing phase.

As a result, finding the source of a problem requires visibility into the entire path—not just physical devices, but virtual switches and functions and network overlays as well.

VIRTUALIZED NETWORKING AND A UNIFIED VIEW

Vendors have responded to these challenges by developing software that makes visible the entire network path, both virtual and physical components. Large system suppliers, among them Cisco, Hewlett Packard Enterprise (HPE), IBM and VMware, and software vendors such

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as BMC and CA offer their own sets of products. In addition, open source projects OpenStack and CloudStack have attracted both commercial vendors and open source developers that offer management tools for these environments

The ability to track packets through the network is necessary, but it's not enough. With virtualization, network and application management have become tightly interdependent. When an application starts up, virtualized networking management requires creation of virtual components and allocates network paths among application virtual machines (VMs). These VMs may execute on different servers, and may move from server to server in response to shifting loads. When a VM moves, network traffic must be redirected to support the new configuration.

In the meantime, performance monitors must report whether applications are meeting service-level agreements and track server and network utilization rates. They collect statistics that show use over time so managers can spot components that are nearing limits.

Many networks include components from multiple vendors. Recognizing this fact, vendors include support for other manufacturers' products. Cisco and VMware have formed an alliance for their products. HPE's Intelligent Management System supports VMware, Microsoft and Citrix virtualization products. IBM Cloud Manager supports Microsoft and VMware plus the KVM open source virtualization platform.

Virtualized networking requires other functions beyond network and application management, including security. To that end, management tools must be able to support both physical and virtual firewalls and perform such functions as intrusion prevention, deep packet inspection and user authentication.

Technology continues to evolve. Providing a unified network view will require continually enhanced and extended management platforms. —*David B. Jacobs*

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