Network's Next Sea Change, the SDN WAN

It's an exciting time to be in networking—if you're prepared.
Brace yourself as software-defined networking hits the enterprise WAN.

SDN WAN Promises a Paradigm Shift

In the words of network engineer and blogger Greg Ferro, software-defined networking in the data center is "so last year"; now SDN in the wide area network (WAN) is stepping forward to steal the spotlight. IT decision makers are wise to pay attention to the escalating buzz.

The software-defined WAN appears poised to catalyze a sea change in the enterprise space, transforming WANs from inflexible and expensive to agile and cost-effective, and dramatically altering network engineering career prospects and job descriptions in the process. This guide tackles these issues and more.

First, founder of Nemertes Research Johna Till Johnson examines the skillsets that engineers will need in this brave new world of dynamic network environments, and the ideal ratio of "deep" technologists to application programmers in a networking team.

Next, John Burke considers the most compelling use cases for software-defined WANs and why every organization with a WAN should have SDN on its radar.

Finally, Lee Doyle, an intelligent networks expert, explores the potential applications of SDN in the WAN and the challenges involved in implementing it. The increasing connectivity demands posed by cloud technology, software as a service (SaaS) and bring your own device (BYOD) policies pose new questions, to which SDN may well be the answer. However, significant hurdles remain.

Inevitably, uncertainty accompanies a paradigm shift. One thing is sure: It's an exciting time to be in networking. We hope this guide helps you navigate the waters of SDN in the WAN and provides both a big picture look at the emerging technology and practical insight into how it might perform in your enterprise. ■

Alissa Irei
Site Editor, SearchSDN

An SDN Sea Change: Transforming WAN Operations

As software-defined networking evolves from a strategic vision to an engineering reality in the WAN, network professionals are focused on plenty of challenges: How do the different vendor architectures stack up? What are the limits of interoperability? And what about software-defined security?

What network professionals are likely not thinking about—but should be—is the operational and organizational sea change that SDN brings. Just as server virtualization dramatically modified the job function and career prospects of sys admins, SDN changes the job function and career prospects of network engineers. And it forces their managers to rethink how to organize and staff their teams.

RETHINKING JOB FUNCTIONS

Start with the basics: roles and responsibilities. Today's network engineers are responsible for setting up routing topologies, configuring quality of service (QoS), and troubleshooting routing and switching errors. The underlying assumption, though, is the concept of a static network: Once routing domains are set up, they don't change. So the job fundamentally requires depth of knowledge of routing protocols and device configuration.

With the advent of SDN, the assumption of a fixed environment no longer holds. Instead, routing architectures can shift with changes in traffic flows, which in turn result from dynamic workload changes. In other words, the job functions shift from setting up, managing and troubleshooting the network to defining network configurations for a range of application and workload use cases. From a skills perspective, this means having a much deeper understanding of both application dynamics and out-and-out programming, including programming languages and frameworks (Python, Ruby,

SOAP and the like).

For managers, this shift in required skills poses several challenges. The first is how to acquire the combination of network and programming expertise: Is it better to teach network engineers programming skills, or teach programmers the fundamentals of routing? There's no right answer—you can make a solid argument either way—but the fact remains that the required skill set is a blend of expertise that's currently rare.

TEAM REMIX

A second, weightier challenge is the team mix. While it's important to have networking expertise, and a few individuals blending networking and programming expertise, what's the right ratio of "deep" network engineers to more software-oriented SDN specialists? Again, there's no right answer, although experience from the server-virtualization transition suggests there's likely to be a dramatic reduction in the number of "deep" network engineers, compared to their more software-focused counterparts.

There's also the question of how much security expertise, and what sort, should be represented on the team. Although it doesn't yet get a lot of press, software-defined security (SDS) is the natural outgrowth of an environment in which most infrastructure (servers, storage and networking) is virtualized. This requires, once again, a shift away from hardware-oriented expertise (the ability to configure security devices such as Palo Alto and Check Point firewalls, for instance) to more of a software focus.

SKILLS APPLICATIONS

Finally, one of the biggest challenges in a software-defined-everything world lies in rethinking the current "horizontally portable" skills and recognizing the value of more "vertically focused" skills. What I'm getting at here is this: In the old (pre-SDN) days, network architecture was a horizontally portable skill. A routed network for, say, a financial services firm wasn't significantly different from one for a pharmaceutical company. The important depth to acquire was in technical competence, not in the specific company or vertical industry.

But SDN's ability to deliver specific use cases means that infrastructure engineers need to think longer and harder about what those use cases might be—and use cases are typically specific to a vertical or a particular company. A retail company might shift traffic flows to cloud-based data centers for increased capacity at specific times of the week, month or year, for instance.

So just as former sys admins moved from configuring servers to match technical specifics to crafting various computing solutions for internal customers, network professionals will move toward developing a library of SDN use cases that meet specific business needs. Much of the value of SDN technologists will be encapsulated in that use case library.

The bottom line? Network professionals at all levels (engineers, architects and managers) need to prepare for a sea change in their job functions. Some takeaways:

- Network engineers and architects should decide whether they want to become "deep technologists"—the go-to folks for understanding the finer nuances of routing and network design—or more general SDN specialists, with both coding and networking expertise. Will their team most need the deep skills or general SDN ones?

- Network managers should think about how to acquire the right blend of expertise. Do they want to train their current networking teams in programming, or hire programmers and teach them networking? (The decision will also affect the career advancement possibilities for architects and engineers.)

- Network managers will need to fine-tune the composition of their teams. As noted, the SDN-centric networking team is likely to include a very limited number of deep networking technologists (often only one); a handful of SDN specialists with both networking and software expertise; and at least one individual with expertise in SDS.

- Finally, all professionals should think about taking a structured approach toward developing and managing a library of SDN use cases.

—Johna Till Johnson

Practicalities: How Network Pros Can Apply SDN to the WAN

IT'S EASY TO see the role of SDN in the data center context, where it is an adjunct to the evolution of private clouds and of data center virtualization generally. For years, the network has been the sticking point there, slowing or making more difficult efforts to fully virtualize, automate and orchestrate data centers.

SDN brings the network fully up to speed. It separates control decisions (about how to handle network packets and flows) from actual packet handling. By putting a standard interface between the two functional units (controller and data plane), SDN simply fulfills the promise hinted at when chassis-based routers first separated controller cards from line cards. By putting an API in front of the controller, SDN makes the network fully susceptible to programmatic control, automation and orchestration.

SDN won't stop in the data center, though, and why should it? The enterprise faces network traffic challenges outside the data center as well as inside it. The most expensive gear may be in the data centers, but in most environments the bulk of the gear is not. When an organization relies on having lots of branches, each specialized network device added to the standard "branch stack" can represent both a significant capital expense and an impediment to growth, thanks to the overhead of configuring, deploying, maintaining and operating the device in every location.

THE APPEAL OF SDN

For the WAN, then, the appeal of SDN rests as much on the ability to consolidate branch-stack services onto a smaller number of cheaper, more manageable generic devices as it does on the idea of programmatic control. Smaller stacks are needed because SDN allows a data-plane device to simultaneously

implement policies in security, optimization and other roles. SDN brings in cheaper and more manageable devices, because each is essentially the same: a generic switch without much native intelligence. But it's not restricted in function to switching ready-to-move packets according to whatever rules the controller passes down. In this way, each device requires little or no unique configuration of its own and becomes easier to maintain.

The SDN branch, then, instead of being composed of a router and a unified threat management device and WAN optimizer and a DLP appliance, would contain generic data-plane devices. Each would be the same as the others; companies could equip them for higher or lower bandwidth, or greater or lesser port density. They would be distinguished by whether an external link is plugged into them (making it a WAN edge device), or into servers or users or some combination of the two.

COMPELLING USES

Security and optimization provide two of the most compelling use cases for SDN in the WAN. On the security front, for example, a security application would tell the SDN controller things like "Subnet A cannot talk to the Internet, but subnet B can" or "No device on the desktop VLAN should be talking directly to any other; if they try to, sound an alarm."

The controller would instruct the branch devices on how to move packets by setting up flow tables and make decisions about any new flows as needed. In optimization, an application could, for example, dynamically prioritize voice packets going from data center to branch endpoint, or from one endpoint in one branch to another endpoint in a different branch, then tear down prioritizations when the call completes.

Given the possibilities for making the WAN and branch networks both more functional and less expensive, every organization with a WAN should be keeping its eyes on developments in SDN applications, controllers and switching gear, and planning to test possible new WAN architectures within the next two years.

—John Burke

The SDN WAN Addresses the Demands of Cloud, SaaS and BYOD

THE LATEST TECHNOLOGY trends, including cloud computing, software as a service and BYOD (bring your own device), have dramatically changed the requirements for the enterprise wide area network, or WAN. But on the positive side, emerging SDN technologies will enable WANs to address these challenges in several ways: with automated network provisioning, links between data centers and secure remote access to files and applications.

Even before challenges arose from BYOD and the cloud, WAN connectivity was challenging for IT professionals.

High-speed WAN links are expensive and difficult to manage. But it's even more difficult to deliver highly reliable secure WAN links with low latency now that IT must manage applications and data that reside on a combination of public and private cloud data centers and are accessed remotely by a range of devices.

SDN WAN: PRIORITIZATION AND A NEW LEVEL OF QOS

SDN technologies allow IT to prioritize key applications and assign specific quality of service and latency parameters. New levels of flexibility, network programmability and manageability help address the following key WAN requirements:

- Automated provisioning of new sites and new connections;
- Ability to dynamically prioritize traffic types;
- Data transfers between remote data centers;
- Improved security (e.g., encryption) of WAN links;
- The ability to program applications to the WAN via open APIs;
- Real-time traffic monitoring; and
- Flexible VPN access, improving secure remote access for a distributed workforce.

SDN WAN APPLICATIONS

One interesting SDN WAN application is the ability to offer continuous availability between remote data centers. Many IT managers would like to move to an active-active data center model, where the network can synchronize compute and storage resources. The WAN is critical to ensure organizations can immediately migrate key applications to a geographically separate data center in the event of a failure (e.g., a natural disaster) at one data center. In order for IT to achieve continuous availability with the active-active data center model, the SDN WAN can provide the following capabilities:

SDN standards are evolving; IT pros need to ensure interoperability with their existing LAN and WAN and evaluate SDN products by their ability to improve their unique environment.

- Predictable performance (latency)
- Improved reliability
- Automated failover
- Performance monitoring and management
- Application visibility

SDN WAN CHALLENGES

Some of the challenges of WAN SDN include the difficulty of linking SDN control across dissimilar environments, multiple protocol types and limits of public networks (e.g., the Internet). SDN technologies are new and lack the maturity of proven WAN products. What's more, SDN standards are still evolving and customers need to ensure interoperability with their existing LAN and WAN.

SDN is providing new network capabilities to enable IT professionals prioritize critical traffic, link active-active data centers, improve automation and monitoring, and increase security. IT professionals should evaluate SDN products by their ability to improve their unique WAN environments. —*Lee Doyle*

JOHN BURKE *is CIO and a principal research analyst for Nemertes Research, where he advises key enterprise and vendor clients, conducts and analyzes primary research, and writes thought-leadership pieces across a wide variety of topics. Burke's expertise lies within the realm of virtual networks and software-defined networking technologies, standards and implementations.*

LEE DOYLE *is principal analyst at Doyle Research. Doyle Research provides targeted analysis on the evolution of intelligent networks: SDN, NFV, Opex and COTS. Doyle has over 28 years' experience analyzing the IT, network and telecom markets.*

JOHNA TILL JOHNSON *is president and chief research officer of Nemertes Research, where she sets research direction and works with strategic clients. She has decades of experience in IT structure, processes, and organizations and has worked closely with senior IT executives at leading organizations across a broad range of industries.*

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dolender@techtarget.com

TechTarget, 275 Grove Street, Newton, MA 02466
www.techtarget.com

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