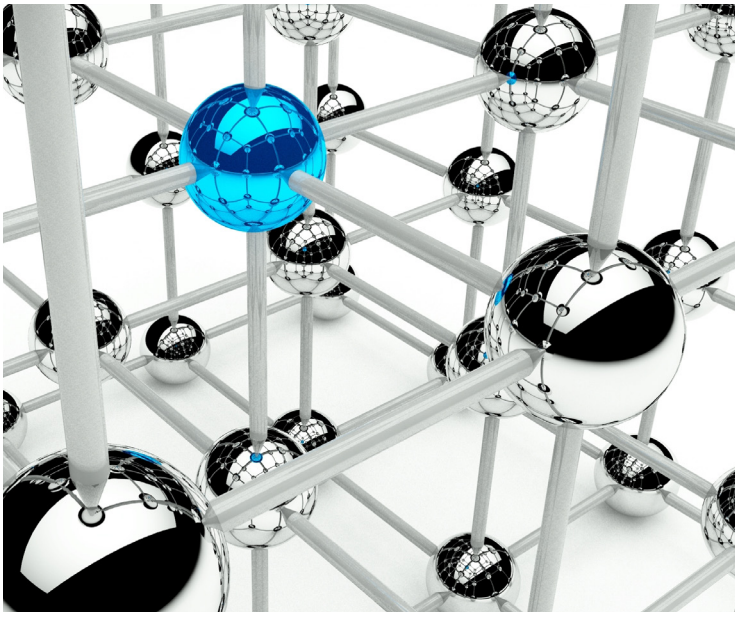
Government navigates to software-defined networks



Software-defined networking stands poised to transform public sector network infrastructure, making networks easier to manage and providing the flexibility to accommodate changing workloads.

By John Moore

Over the past decade, virtualization and the cloud have reshaped the way government organizations acquire computing resources, store data and deploy software applications. But networking has remained largely unchanged during this transformation of the IT enterprise.

The arrival of software-defined networking (SDN), however, has the potential to dramatically revise traditional network architecture and free it from its hardware-centric past. How does SDN liberate networking functions from hardware?

SDN revolves around a software layer that absorbs core networking tasks traditionally locked within hardware devices such as switches and routers. In a conventional network, the component that determines how data will travel, called the control plane, and the component that actually transmits data, the data plane, are both baked into hardware. An SDN recasts the control plane as a software function that operates independently of networking hardware.

"Through the logical separation of the network control and data planes, SDN technologies are enabling the creation of a new form of distributed infrastructure that can support advanced applications in the scientific, research and commercial world," according to the Department of Energy and National Science Foundation in a recent report, *Operationalization of Software Defined Networks (SDN): Program Review.*

Network administrators usually configure individual network devices to accommodate shifting traffic patterns. SDN, in contrast, lets administrators program a network's myriad devices through the centralized SDN controller. The big picture: an SDN deployment employs a software layer that assumes many of the complexities of managing a network.

SDN's software focus makes networks more flexible and much easier to manage, according to the technology's adopters. SDN also promises to simplify and automate labor-intensive network management chores, saving administrative time.

WHY SDN MATTERS

SDN's ease of management is one of the technology's main attractions for government agencies. An Infonetics Research report, *SDN Strategies: North*

American Enterprise Survey, published in July cited "improving management capabilities" as a top driver for deploying SDN among mid-sized and large North American organizations. The market research company surveyed 101 purchase decision makers deploying SDN or planning to evaluate the technology by the end of 2015.

Clifford Grossner, an analyst of data center, cloud and SDN at Infonetics, said SDN's upgraded management capabilities stem from the ability to program a network via software. But improved visibility is another management plus, he noted. SDN can help organizations unify network management as opposed to using multiple, fragmented management platforms.

Government agencies can also benefit from improved application performance, which Infonetics identifies as a leading motivator behind SDN adoption.

Applications have different bandwidth requirements, and "traffic shaping" via SDN lets networks respond to the varying needs. Grossner said SDN bolsters an organization's ability to shape network traffic from end to end.

In the past, networks would try to react to spikes and fluctuations in traffic already put on a network. The thinking behind SDN, Grossner said, is to register applications with a network so their bandwidth requirements become known before the traffic hits the network. "In some sense, [SDN] gives the network a chance to adapt to the application in a proactive way," Grossner said.

In contrast, a conventional network "has no visibility into what the application is or what it will do," he added.

SDN – and its advantages – also build upon current technology trends, while providing a stepping stone toward future advances.

THE CASE FOR SDN

Government agencies involved in scientific and engineering applications in particular stand to gain from the flexibility of SDN, according to the members of the scientific community. Science applications produce enormous data flows, and SDN is expected to help them route those streams to the optimum network tier within an organization.

SDN also fosters tighter security, noted Rob Vietzke, vice president of Network Services at Internet2, a member-owned advanced technology community that has been using SDN since 2012 as the sole transport layer for its research and education network.

SDN improves security by promoting much more detail in the rules governing the partitioning of the network, which lets the community "write very specific rules and policies into the ways the networks work," Vietzke said.

SDN – and its advantages – also build upon current technology trends, while providing a stepping stone toward future advances, according to its proponents.

Accordingly, SDN's software orientation puts the technology in close alignment with virtualization. Server, desktop and storage virtualization have already left a mark in data centers looking for greater efficiency and higher asset utilization. Virtualizing networking functions in software continues that pattern.

In addition, SDN will help pave the way toward the software-defined data center, in which every IT resource will be virtualized and offered as a service. SDN, along with related technologies such as software-defined storage, will move organizations toward the software-defined data center over time.

"SDN is a critical element for moving toward a software-defined data center," Grossner said. "It's pretty hard to have a software-defined data center without a programmable network."

GOVERNMENT DEMAND CURVE

SDN's potential has piqued the interest of government agencies and public sector organizations.

Higher education, where much of the initial research on SDN took place, ranks among the earliest adopters. In the federal sector, science-centric agencies have taken the lead. The Department of Energy's Energy Sciences Network (ESnet), for example, has been exploring SDN, and the National Science Foundation funds research in that field. The NSF-supported

Global Environment for Network Innovation is also experimenting with SDN, while NSF's Campus Cyberinfrastructure – Infrastructure, Innovation and Engineering Program pursues SDN research.

Industry analysts predict early SDN projects will soon translate into broader adoption. Infonetics noted that the majority of respondents to its survey are currently running SDN lab trials or will launch trials this year. Forty-five percent of the respondents, meanwhile, plan to put SDN in production in the data center next year, a population that will grow to 87 percent in 2016.

International Data Corp., for its part, forecasts the worldwide SDN market for the enterprise and cloud service provider segments will expand from $960 million this year to more than $8 billion by 2018, with a compound annual growth rate at 89.4 percent. IDC views the enterprise sector as a "major driver of overall SDN growth over the next several years." Top use cases include network programmability, customization and security applications, according to IDC.

Grand View Research Inc., in research published in August, also cited enterprises as the largest end user segment for SDN in 2013, accounting for more than 40 percent of the global market.

GETTING STARTED IN SDN

Agencies seeking to deploy SDN will, at minimum, need an SDN controller, and one or more applications that make their network requirements known to the SDN controller. The Open Networking Foundation's OpenFlow serves as the communications protocol in many SDN deployments. Adopters will need to install network devices that support SDN protocols. Grossner suggested orchestration software can also be layered on top of a virtualized server, storage and networking environment.

The need to acquire specialized software and replace existing networking gear with SDN-compatible equipment makes the software-defined transition a potentially expensive and disruptive undertaking. A government agency, however, could wait for a networking technology refreshment cycle to replace its switches and install the SDN software components.

A pilot deployment involving a single application and a portion of the network is another – and perhaps more likely – path agencies may take.

Leveraging existing vendors may also make SDN deployment somewhat easier for agencies to swallow. According to Infonetics, 77 percent of the respondents to its SDN survey said they would be inclined to turn to their incumbent network vendor for SDN hardware and software. The respondents who said they would consider other sources of supply pointed to third-party SDN vendors (11 percent), existing virtualization vendors (8 percent), open source vendors (3 percent) and other vendors (1 percent).

But not all government entities are ready to begin piloting and deploying SDNs, however. The Energy/NSF report supports the idea of launching Software-Defined Exchanges (SDX) as part of the initial round of SDN deployments. The exchanges would interconnect different SDNs and provide an onramp for customers who want to use an SDN.

Inder Monga, chief technologist and area lead for ESnet, compared SDXs to Internet Exchange Points (IXPs), which he said were instrumental in getting a wider deployment of the Internet and allowing ISPs to exchange traffic. "SDXs are the SDN-based, policy-enforced, programmable equivalent of IXPs," Monga noted.

If SDXs were to be built, they could emerge as the initial method agencies outside of the community of early adopters could use to gain experience with SDN.

"SDXs are an easy way for an organization to experiment with SDN since they don't have to redesign, re-architect their network, while still getting the benefits of programmability for the traffic that enters/exits the organization," Monga said.

Another entry-level SDN option would be to use software-based SDN devices, such as platforms based on Open vSwitch (OVS) or Intel's Data Plane Development Kit (DPDK). OVS is a multilayer virtual switch available via the Apache 2.0 license. Intel describes DPDK as a set of libraries and drivers designed to speed up packet processing.

Monga said an OVS- or Intel DPDK-based platform "can be another way for an organization to use off-the-shelf servers to experiment with SDN and build a relatively full-featured campus network."

Agencies may pursue different routes to SDN, but the one thing they all will need is adequate time to work with the technology. Assigning personnel to study this rapidly evolving market may pay off down the road.

"Free up staff time to experiment," Vietzke advised. "This one [SDN] is moving fast, so having some time to let people explore is important." •

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