

Software-Defined Networking: On the Verge of a Breakthrough?

Sixto Ortiz Jr.



Many experts predict that software-defined networking, a technology that's been highly touted for several years, will soon finally begin gaining ground in the marketplace.

As developments such as cloud computing, virtualization, and massive datacenters make networking more complex, administrators are looking for smarter networks and new and better ways to control and manage them.

Enter software-defined networks.

SDNs separate the network's control plane from the data plane, noted Clark DeHaven, senior director of corporate strategy at networking vendor LGS Innovations, a subsidiary of Alcatel-Lucent that serves US government agencies.

Software on centralized general-purpose servers, rather than on individual networking devices such as switches, runs the control plane. As Figure 1 shows, SDNs have APIs that enable administrators to centrally program and manage network resources via applications and services, DeHaven explained.

This enables network administrators to program the entire control plane via a common API, easing the process and giving them more fine-grained, flexible control over traffic flows and the policies networks use to manage them. In the past, administrators have had

to program every network device to make systemwide changes.

In essence, SDNs transfer network control from various pieces of hardware that must be managed individually to a single programmable platform.

Nonetheless, said Douglas Gourlay, vice president of marketing at Arista Networks, SDNs haven't taken off as quickly as some predicted because they represent a new technology and they carry some risk. For example, he noted, network control could be lost if the single server hosting the control plane goes down.

However, some industry watchers believe SDNs are now ready to take off.

In fact, said Andrew Harding Sr., product marketing manager at SDN vendor Big Switch Networks, an increasing number of organizations are already purchasing SDN products.

UNDER THE HOOD

In the late 1990s, the rise of the Internet disrupted typical phone-network operations. Numerous new companies tried to take advantage of this by replacing the phone networks' hard-wired switches

with an IP fabric that separated the control and data planes.

Stanford University researchers explored SDN-related concepts in their Ethane project (<http://yuba.stanford.edu/ethane>), whose first deployment was in 2006.

SDN implementations by major companies such as Cisco Systems and Juniper Networks have been proprietary and thus don't work with equipment from other vendors. This has limited organizations' ability to engineer and manage traffic across equipment from multiple vendors.

According to Big Switch Networks' Harding, SDNs bring together three key elements: the switch, the network controller, and network applications.

In the past, both the packet-forwarding and high-level routing decisions occurred on the same router or switch. The SDN switch separates the two functions. The forwarding still occurs on the switch, but the routing decisions take place on a network controller, usually a server.

The switches use either a proprietary technology or the Open Network Foundation's (ONF's) OpenFlow protocol. OpenFlow manages

traffic in a way that lets the control-plane server tell the switches where to send packets, thereby moving this functionality from the data plane.

The controller runs the various policy, security, traffic-engineering, and other applications that control network elements via APIs, explained ONF executive director Dan Pitt.

These APIs make it much easier to add new functionality quickly, noted Harding.

READY TO BREAK LOOSE?

“As SDN technologies mature, we’ll see major networking vendors such as Cisco, IBM, Arista, Brocade, Juniper, etc. adopt SDN technologies into their product offerings, which will further give credibility to SDN and make it easier for customers to evaluate SDN solutions for their networks,” said Matthew Palmer, a partner at the Wiretap Ventures consultancy and at SDN-Central, an online source of SDN and network-virtualization information.

He said network service providers are conducting SDN trials but have made few production deployments.

The SDN market got a big push in July 2012, when VMware—a major provider of cloud and virtualization software and services—purchased SDN and network-virtualization vendor Nicira for \$1.05 billion. VMware says it wants to leverage the acquisition to develop applications that help organizations using SDNs manage their cloud-computing systems.

Demand for SDNs’ benefits

SDN adoption is increasing as its benefits become more important to organizations implementing approaches that make networking more complex, such as cloud computing, virtualization, and huge datacenters.

Via abstraction of the network, SDNs increase the automation and implementation speed of many processes and procedures—

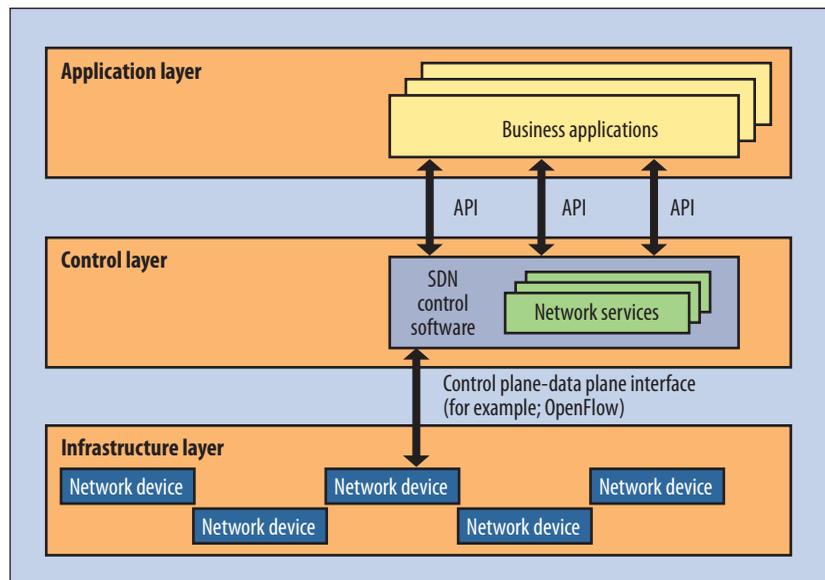


Figure 1. Software-defined networks (SDNs) transfer network control from individual routers and switches to a control layer that runs on a centralized server. This layer has APIs that let organizations use applications to centrally manage network services.

including physical- and virtual-network management and reconfiguration, and the introduction of new services—that often require a lot of manual work today, according to LGS Innovation’s DeHaven.

This lets network administrators respond more quickly to user demand and traffic spikes, said Prakash Sinha, vice president of ADC Solutions at Radware, a provider of application-delivery and security products for virtual and cloud-based datacenters.

Another key SDN benefit is reducing networking costs and improving network infrastructures and architectures, he added.

SDNs yield operational savings by letting companies effectively implement more sophisticated systemwide management applications, said Susan Hares, vice president of technology and strategy at Adara Networks.

SDNs further reduce operational expenses because they enable organizations to run only the software features in their networks that they really need, noted Stanford University professor Nick McKeown.

In addition, SDNs transfer control of programmability from the vendors who build network equipment to the administrators who actually run the network. The vendors, said McKeown, don’t run large networks and don’t fully appreciate what their customers need.

He added that SDNs reduce capital expenditures by transferring control functionality from networking hardware to a centralized controller, thereby enabling the purchase of simpler, less expensive, more power-efficient routers and switches.

Open Daylight

The Open Daylight Project is an industry consortium—which the Linux Foundation administers—that’s creating an open source framework and platform on which vendors could build SDN products.

Project members say their goal is to enable interoperability among products, stimulate SDN application development, and provide direction for future SDN technologies.

A lack of interoperability discourages SDN adoption by

the many organizations that run networks with equipment from multiple vendors.

The Open Daylight work is expected to yield code for an SDN controller and APIs, and protocols for controller federation.

Project officials expect to release their first code later this year.

Proponents say the work should increase confidence in SDNs and speed up adoption.

Skeptics say the project members, largely networking vendors such as Cisco, might be trying to either keep SDNs from gaining momentum or influence the technology's development to their benefit.

SOFTWARE-DEFINED BARRIERS

SDN technology faces several notable challenges.

For example, said Arista's Gourlay, centralizing the network control plane could compromise survivability and reliability.

Network control could be lost if the server hosting the control plane goes down or if the switch connecting the server to the network crashes, he explained.

Another challenge, noted Big Switch Networks' Harding, is that some vendors and customers are confusing the marketplace by categorizing products and capabilities—such as network-management software, and router or switch device programmability—as SDN-related.

A pervasive challenge is how to migrate to an SDN architecture while protecting expensive investments in existing networking equipment, said Marc Cohn, senior direc-

tor of marketing development for networking vendor Ciena.

Securing the controller from attack and detecting when it has been compromised are also issues, according to SDNCentral's Palmer.

He said another key challenge is companies' ability to prove to auditors and customers that a network with an external controller is just as secure as one in which control resides within network devices.

And some traditional network administrators may not be happy to have to learn new skills, said the ONF's Pitt.

SDNs appear to be gaining popularity. A study by SDNCentral, networking vendor Plexxi, and Lightspeed Venture Partners indicates the market will grow from \$1.5 billion in 2013 to \$35 billion in 2018.

However, Radware's Sinha warned that SDNs could remain a niche technology if organizations don't make highly programmable networks a priority.

The ONF's Pitt said that there has been a lot of interest in using SDNs for the datacenter but that he also sees the approach flourishing in service providers' networks, as it would enable them to optimally manage their many resources.

Big Switch Networks' Harding said SDNs will "fundamentally change the way we build and manage networks." He predicted that many organizations will realize the approach's benefits and begin widespread adoption. **■**

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