WHITE PAPER

CDW PEOPLE WHO GET IT™

THE FUTURE OF NETWORKING ARRIVES

Software-defined networking offers plenty of promise, but to achieve its benefits IT leaders must understand several essential factors.

EXECUTIVE SUMMARY

Server virtualization has revolutionized data center operations over the past decade, and the technology is becoming increasingly commonplace in organizations of all types and sizes. Software-defined networking now brings similar capabilities to network operations. Although SDN adoption is still at an early stage, many experts expect SDN deployments to skyrocket over the next few years.

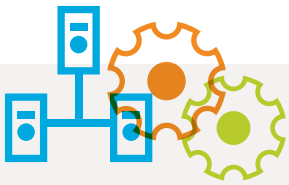
SDN delivers numerous benefits, yet organizations considering the technology's adoption must understand a variety of technical and other factors in order to make informed decisions about its deployment. Organizations contemplating a transition to SDN should consider a wide range of deployment options, including imperative and declarative SDN models, as well as the possible use of a software-defined network overlay. Potential adopters must also pay close attention to technology advancements and changes in market direction in what is still a rapidly evolving field.

Understanding SDN

The static architecture of traditional networks no longer meets the dynamic computing and storage needs of modern data centers. By decoupling the network control plane from the data plane, SDN makes networks more open and interoperable, leading to lower costs, increased flexibility and control, plus greater innovation.

Instead of requiring data center managers to add extra applications, hardware and floor space to meet spiraling bandwidth and data capacity needs, SDN uses cost-effective virtualization to increase network efficiency. Consequently, the SDN approach can also help reduce operating and capital expenses (OPEX and CAPEX) as well as power usage, and improve operational and support efficiencies.

In addition, SDN can give network administrators greater control over their infrastructure, allowing extensive customization and optimization while trimming overall capital and operational costs. SDN also enables adopters in many service-oriented fields to create new revenue opportunities at an accelerated pace through the development of software-based applications — as the PC, mobile and web industries have been doing successfully for many years. SDN can also optimize the performance of many applications running on a network.



OPENFLOW AND SDN

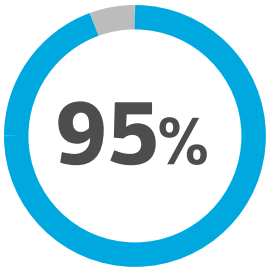
A programmable network protocol, OpenFlow manages and directs traffic between network components from various vendors.

Supported by the Open Networking Foundation, a user-based organization dedicated to an open-standards approach to software-defined networking (SDN), OpenFlow fits between an SDN architecture's control and forwarding layers. OpenFlow is used in SDNs that deploy the imperative model.

OpenFlow-based SDN technologies enable data centers to address the high-bandwidth, dynamic requirements of modern applications, adapting the network to rapidly changing needs and significantly reducing operations and management complexity.

Another important OpenFlow attribute is network intelligence that is centralized inside a software-based SDN controller that maintains a global view of the network and appears to applications and policy engines as a single, logical switch.

OpenFlow promises to simplify network design and operation, because instructions are provided by an SDN controller instead of multiple, vendor-specific devices and protocols. The protocol is directly programmable and agile, allowing administrators to dynamically adjust networkwide traffic flow to meet changing needs. OpenFlow also lets network managers configure, manage, secure and optimize network resources via dynamic, automated SDN programs, which they can write themselves, because the programs do not depend on proprietary software.



The network utilization rate achieved by Google after migrating to software-defined networking, compared with typical utilization rates of 60% to 65%*

In fact, the growing complexity of traditional networks has created a giant roadblock that seriously hinders on-time network service delivery and quality. Enhanced quality of service (QoS) for latency-sensitive applications such as voice and video is yet another benefit provided by SDN's open and automated approach.

SDN's open and programmable application programming interfaces (APIs) for policy-based management and security allow organizations to automate formerly tedious and time-consuming manual configurations, reducing the workloads of IT team members. Rather than requiring an IT staff member to manually configure each hardware component, SDN allows data centers to roll out network configurations and updates simply by sending out software updates.

Multiple SDN models and standards are evolving in different areas. Yet the technology is primed for widespread adoption and network dominance. SDN adopters can feel confident that the technology will always be based on open, interoperable multivendor ecosystems embracing either key open-source technologies or standardized protocols.

Major SDN Delivery Models

Any organization considering a move to SDN should be aware of the two main delivery models: imperative and declarative.

- **Imperative SDN:** A centralized controller (typically a clustered set of controllers) functions as the network's "brain" in the imperative SDN model, with a protocol such as OpenFlow explicitly telling network switches precisely what to do and how to do it.
- **Declarative SDN:** In this model, the intelligence is distributed out to the network fabric. While policy is centralized, policy enforcement isn't. A central controller is used to pass policy and configuration commands to network devices, with the infrastructure responding dynamically to applications' needs. Cisco Application Centric Infrastructure (ACI) and the OpFlex protocol are used to implement declarative SDN.

The discussion about which SDN model provides the best approach is ongoing. Imperative proponents maintain that their model enables a high degree of network flexibility, because the software that governs the model can be created by both organizations and external vendors in everyday software environments. Imperative advocates also note that their model can provide a standardized way of conveying flow-table information to network devices, which encourages the formation of an open and active vendor market.

***SOURCE:** Webtorials, "The 2015 Guide to SDN and NFV," November 2014

Imperative backers note that their model also promotes rapid service introduction via customization, because adopters can implement the features they need in software they control instead of waiting for a vendor to offer a specific capability.

Declarative model supporters counter that their approach separates application, operation and infrastructure requirements, allowing each to be specified independently. This separation can accelerate application deployment by allowing a system, rather than an administrator, to unite these requirements.

Another benefit is that systems based on the declarative model can achieve high performance at scale with strong resiliency by moving complexity to edge devices, which do most of the processing. Additionally, declarative systems, which allow policies to be specified in abstract terms, tend to be highly interoperable. Multiple vendors can support the same policy without the need to offer identical hardware configurations or software versions.

Software-Defined Network Overlay

Another point to consider when planning an SDN deployment is the use of a network overlay, which is a popular method for implementing an SDN architecture. An overlay is an SDN deployment approach that creates a logically separate network to run on top of the existing infrastructure.

Overlay networks, incorporating the ability to combine network resources by dividing available bandwidth into channels and then assigning each channel to a specific device or service in real time, represent a type of network virtualization. An overlay network separates the virtual network configuration and topologies from the physical networks lying underneath. The virtual network handles most of the higher level policy, allowing the underlying physical network to focus on delivering packets to their destination.

Deploying a software-defined network overlay allows an organization to reconfigure and upgrade its physical network as needed without affecting the virtual topology. The virtual network also provides significantly more flexibility for the rapid creation, updating and deletion of networks. Another key benefit of this type of network virtualization is the enhancement of efficiency and productivity by allowing tasks typically performed by a network administrator to be handled seamlessly and automatically.

NETWORK VENDORS: MODELS AND STANDARDS

While all major network vendors now offer SDN solutions, the market leaders are settling on different, and sometimes competing, models and standards.

Cisco Systems is firmly committed to the declarative model. Cisco's Application Centric Infrastructure (ACI) inserts network intelligence into both the central controller and the switches. The controller declares exactly which network requirements the switches need while the switches dynamically apply policy to meet requirements based on the current traffic flow.

VMware, meanwhile, has thrown its support behind the imperative SDN model. VMware's NSX sends instructions from the controller to the devices implementing the policy, a different approach from Cisco's ACI, which has the controller declare requirements but then allows the devices to implement these policies in whatever manner they determine is appropriate. NSX doesn't depend on any underlying network infrastructure, allowing data centers to mix switches from vendors such as Cisco or Juniper Networks as well as hardware from various other vendors.

On the SDN controller front, Brocade Communications Systems has declared its support of OpenDaylight for its Brocade SDN Controller. The OpenFlow-compatible OpenDaylight is a Linux Foundation Project that aims to unite industry leaders behind an open SDN platform in a vendor-neutral environment.

→ ***To learn more about advanced networking technologies, visit CDW's Next-Generation Networking web page.***

The Future of SDN

The SDN market has attracted a great deal of attention over the past few years, although real-world adoption has been relatively slow. Nonetheless, given SDN's ability to greatly improve performance and efficiency while cutting costs, all signs indicate that its growth will skyrocket over the next several years.

Most early SDN adopters have transitioned to the technology with the goal of improving infrastructure control — leading to optimization and customization — as well as trimming overall capital and operational costs. Yet SDN also opens the way to mission-focused benefits, such as improved customer service as well as the creation of new network capabilities and services simply by building the appropriate software applications.

SDN can also be a driving force for network innovation. Combining SDN with analytics, for example, can help administrators quickly identify and pinpoint lurking network problems. Furthermore, once an issue has been identified, SDN technology can be used to implement real-time fixes.

Although SDN offers many benefits, it is still a relatively new technology. Most organizations have yet to formulate a network transition strategy or even to start transition planning.

The first step for any organization planning a transition to SDN is to help its IT teams gain complete familiarity with the technology and its various components and processes through research and training. The next step is to create cross-functional IT teams in areas such as networking, applications and security to develop a transition strategy and investigate partners capable of delivering flexible and reliable SDN solutions that leverage existing network technology investments to the greatest extent possible.

CDW: A Network Partner That Gets IT

Keeping pace with technology is critical for survival in today's complex and fast-moving world. Organizations transitioning to next-generation SDN networks must surmount a series of obstacles before they can begin reaping the technology's benefits. With a dedicated team of networking experts, CDW and its partners have taken the lead on SDN deployments, helping organizations of all types and sizes move forward with this revolutionary technology. CDW solution architects offer expertise in designing custom SDN deployments, while advanced technology engineers can assist with implementation and long-term management solutions.

CDW takes a comprehensive approach to identifying and meeting the needs of every customer. Each SDN engagement includes five phases that help you identify the best ways to upgrade and improve the performance of your wireless network.

The CDW Approach

ASSESS

We start by conducting an online assessment of your existing network infrastructure to gain a better understanding of current pain points and to identify areas of opportunity in performance and security.

DESIGN

Our expert solution architects and engineers work with you to identify the best wireless and wired solutions, including site surveys and WAN optimization. They help you meet your specific networking goals within your budget and timeline.

DEPLOY

We can fully or partially implement your new networking solution to help ensure successful integration and optimization for future traffic and bandwidth growth demands.

MANAGE

With our available management support for hosted network services and remote managed services, you'll have more time to explore next-generation solutions and focus on critical tasks.

To learn more about CDW's SDN solutions, contact your CDW account manager, call 800.800.4239 or visit CDW.com/networking.

You and CDW

Cisco® Application-Centric Infrastructure (ACI) reduces TCO, automates IT tasks and accelerates data center application deployments. It accomplishes this using a business-relevant, software-defined networking policy model across networks, servers, storage, security and services.

CDW.com/cisco

Juniper® has developed a set of Universal SDN Gateway capabilities that run on MX Series routers to connect all devices and resources in the data center and across the WAN. These gateway functions build upon the rich Layer 2 and Layer 3 VPN capabilities already in the MX Series routers, including standards-based protocols for Data Center Interconnect (DCI) such as EVPN, VPLS and MPLS.

CDW.com/juniper

Brocade's software-defined networking controllers and applications make it possible to address data center needs with an open architecture that enables programmable network control and an abstracted underlying infrastructure. Results include streamlined operations, simplified service provisioning, real-time data center visibility, increased flexibility and risk free change management.

CDW.com/brocade

HP software-defined networking provides an end-to-end solution to automate the network from data center to campus and branch. Expanding the innovation of SDN, the HP SDN ecosystem delivers resources to develop and create a marketplace for SDN applications.

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