Open networks: Turning the vision into reality

Today's growing ecosystem of open networking technologies helps IT leaders deliver exceptional agility, scalability and manageability to their data center networks.

Dell Inc.

IT organizations have taken advantage of open ecosystems ever since proprietary mainframe architectures and tools gave way to client-server architectures. The advent of x86-based servers fostered an open computing ecosystem that allowed enterprises to choose applications and operating systems based on specific business and organizational requirements. Now, a similar transformation is sweeping across data center networks.

An emerging, open networking ecosystem allows IT organizations to choose from industry-standard networking hardware, software and tools to help simplify network management, orchestration and automation. In particular, disaggregated switches that support a choice of network operating systems and a variety of software-defined networking (SDN) solutions are now available. For IT professionals and network architects, the shift to open network standards is both welcome and long overdue.

This white paper describes how the open networking ecosystem can benefit organizations and discusses the part Dell is playing to help turn the open networking vision into reality.

"This is a great example of innovation coming from the new Dell. Networking is an industry crying out for disruption. We've done this before with PCs and servers, putting us in the best position to offer a choice of network operating systems. Networks are like human minds — they work better when open."

Tom Burns
Vice president and general manager
Dell Networking

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Shift away from proprietary

Proprietary technologies, still dominant in networking, are no longer the most efficient or effective approaches for today's software-defined data center paradigm. Increasing amounts of data — structured, semistructured and unstructured — are now coming into the data center and need to be transported. Conventional north-south (client-server) data traffic is taking a back seat to growing amounts of east-west (server-to-server) traffic.

Data centers are also shifting toward virtualization and the cloud. As virtualization proliferates and data grows exponentially, bandwidth requirements are expanding dramatically. At the same time, emerging workloads are changing data center traffic patterns, creating new bottlenecks. Organizations have attempted to meet these challenges using legacy network infrastructures, but the traditional approach has resulted in ever-increasing complexity, making network management and maintenance more burdensome and costly.

With these factors in mind, organizations are looking for network solutions that are less expensive to build and maintain, while delivering greater levels of agility, scalability and manageability. To achieve these goals, IT leaders and network architects have an opportunity to deploy open solutions and partner with vendors that are committed to an open networking environment.

SDN networking model

New models driven by software-defined networks and disaggregation offer a promising path to the future. With the SDN approach, the data-forwarding function of a switch is decoupled from the network control function. This decoupling enables centralized network control, making it easy for administrators to program and change the network to meet specific business and organizational needs.

As a result, the network can be designed to heighten manageability, cost-effectiveness and adaptability. Implementing SDN through an open, industry-standards-based model allows organizations to incorporate best-of-breed network infrastructure and technology.

Three main approaches are available for implementing SDN. The OpenFlow™ standard, a secure communications protocol, enables remote programming of data plane functions in switches. Network virtualization overlay (NVO), a hypervisor-based network virtualization model, uses virtual switches to run multiple virtual networks on a single physical network. The third approach, programmable frameworks, uses an application programming interface (API) to control local switches. Implementing any of these SDN approaches requires installing switches that support SDN-based technologies and open standards.

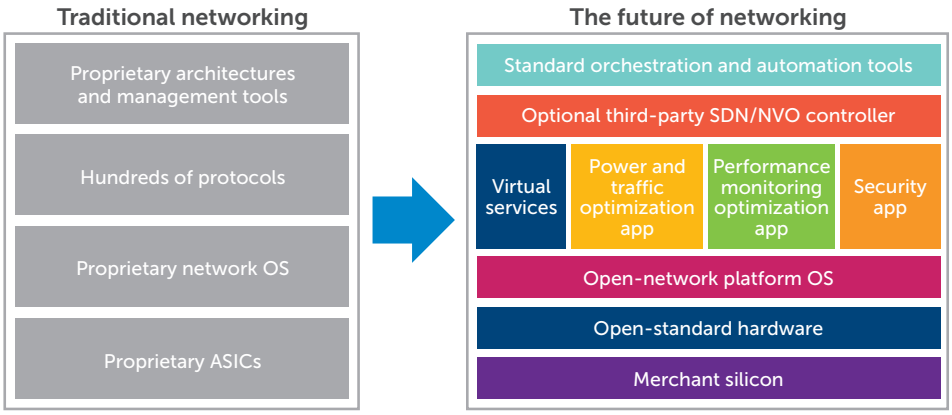
Disaggregated networking

Dell's vision of the new data center networking model is an open ecosystem in which organizations can take their pick from innovative, industry-standard network applications, network operating systems and network hardware. For the past 20 years, data center networks have been a proprietary, three-tier hierarchy built for pre-virtualized, client-server implementations using chassis-based switches. New dynamics — brought on by the shift in networking patterns from north-south to east-west, resource pooling, cloud and the need for server-like automation — have led to high-capacity Ethernet fabrics designed to simplify and automate physical switch networks.

The disaggregated model, which decouples switch hardware from the network operating system, is a further step in innovation on the software side. As an early global end-to-end technology company that supports a choice of third-party network operating systems, Dell enables organizations to tailor networks for their specific applications. This disaggregated networking model disrupts the traditional paradigm by helping free organizations from being locked into proprietary technology and by fostering an open networking ecosystem.

Disaggregated networking hardware supports different network operating systems through use of the Open Network Install Environment (ONIE), which enables zero-touch installation of network operating systems onto open network switches. In addition to open-standard hardware, a complete open networking ecosystem includes the following components (*see figure*):

- Off-the-shelf chips, or *merchant silicon*, that can be used in a variety of standards-based network switches instead of today's proprietary, application-specific integrated circuits (ASICs)
- Third-party network operating systems built for particular environments, enabling organizations to purchase hardware from their preferred switch vendor and then load a third-party network operating system onto that switch
- A rich ecosystem of open-source, standards-based tools, applications and expertise, which help advance innovation and future-proof networking investments
- Optional SDN/NVO controllers for building a true SDN infrastructure, while providing the flexibility network managers need as SDN evolves
- Standard orchestration and automation tools that leverage the Linux® operating system and other open-source, standards-based frameworks



Key elements of the transition from traditional networking to open networking

> "In this new open, multi-vendor ecosystem that's becoming all the more prevalent, customers finally get to choose exactly the components they need to build the software-defined data center of the future without having to worry about vendor lock-in."
>
> *JR Rivers*
> *Co-founder and CEO*
> *Cumulus Networks*

How early adopters are making the transition

Data center networks must evolve to meet intensifying enterprise demands for rapid innovation as cost-effectively as possible. The following two use case examples show how organizations can deploy leading-edge solutions now to bridge the gap between traditional networking and software-defined networking (SDN) as they move toward open networking.

Linux-rich open networking environments

Components:

- Dell disaggregated open networking switches designed for flexibility, performance and third-party network operating systems support
- Open Network Install Environment (ONIE)
- Cumulus Networks™ Linux OS, the industry's first full-featured Linux operating system for networking hardware

Benefits:

- Enter the open networking era with best-of-breed solutions
- Gain a consistent view across compute and network resources
- Leverage Linux and open-source, standards-based tools and expertise

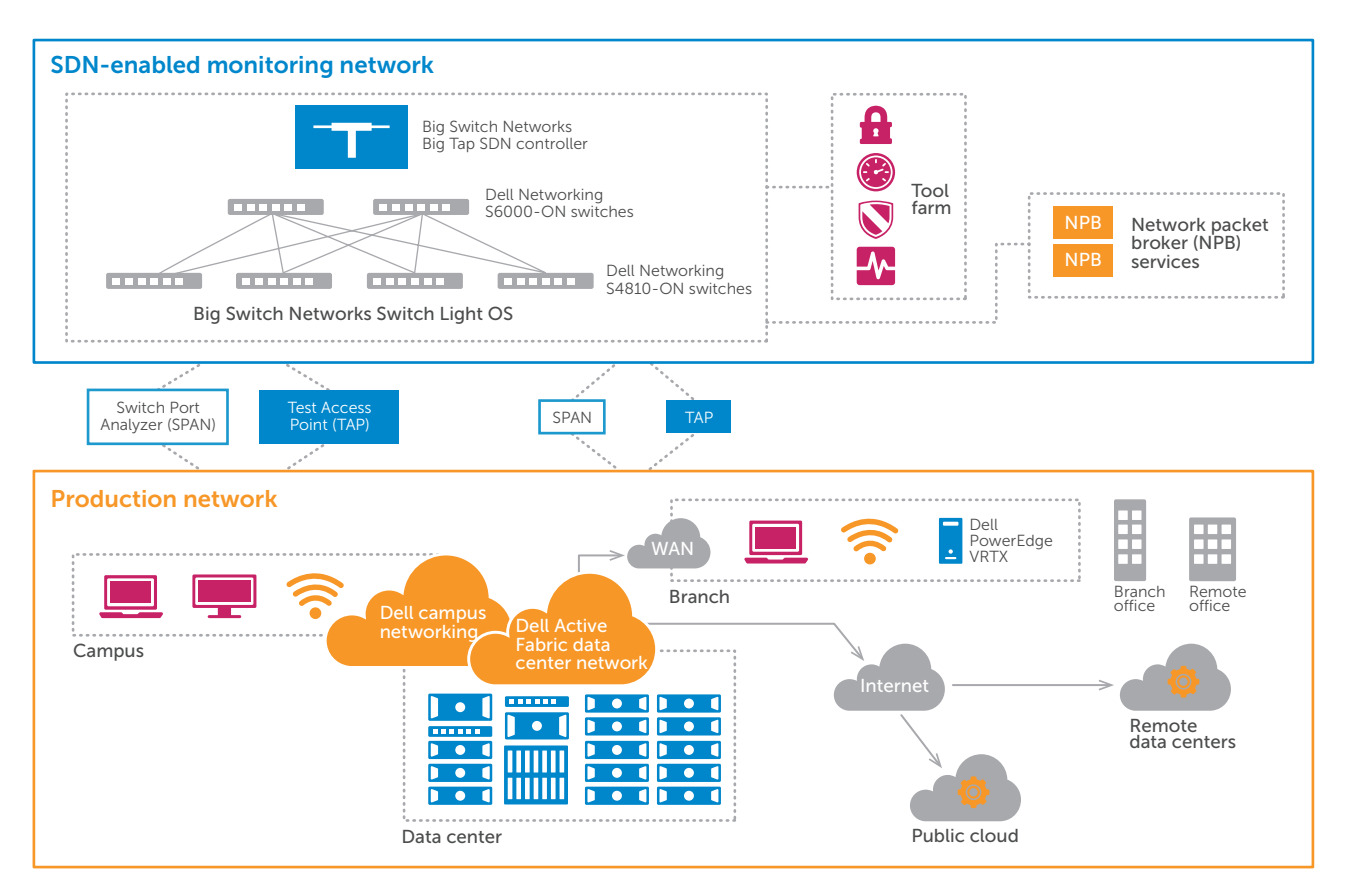
SDN-based open networking environments

Components (*see figure*):

- Dell disaggregated open networking switches with ONIE
- Big Switch Networks Switch Light™ OS, an SDN OS based on Open Network Linux
- Big Switch Networks Big Tap™ Monitoring Fabric, which leverages open-standard switches and SDN design principles to monitor traffic everywhere in the network and selectively deliver traffic to security and monitoring appliances

Benefits:

- Embrace the power of choice with best-of-breed solutions
- Start the transition to SDN with a practical network monitoring solution
- Manage all monitoring fabric components from a central place



Example architecture of an SDN-based open networking environment

Benefits of an open network ecosystem

Disaggregation, SDN and open standards have the potential to change the paradigm in network design from an environment that is dominated by proprietary technologies to one that is far more open and innovative. Opening the network ecosystem helps lower operational and capital expenditures because organizations are not locked into any one vendor and instead can leverage the large ecosystem of Linux and open-source applications. It also means organizations can use the same tools for the networking and computing sides of the data center, further helping to reduce complexity and cost.

Organizations can now enter the open networking era with a choice of effective technologies designed to deliver the flexibility they need to transform their networking and offer a clear path to a software-defined data center. (See the sidebar, "How early adopters are making the transition.") These solutions minimize the time and effort required to design, provision and manage networks and enable IT managers to leverage open-source tools and expertise to help reduce costly engineering overhead. In turn, organizations benefit from shortened innovation cycles. Dell believes that open networks stimulate rapid innovation leading to unprecedented levels of flexibility and efficiency.

Open networking vision for the future

Thirty years ago, Michael Dell helped change the PC industry by simplifying the buying process and selling directly to the end user. That change turned a daunting and expensive undertaking into an easier experience for many. Since then, Dell has continued the drive to make computing technology more affordable and available, and networking is the next industry segment poised for change. The company has earned a reputation for networking expertise with its award-winning Ethernet switches, which feature modern, fixed-form-factor architectures.

The Dell commitment to open platforms is evidenced by multiple product innovations:

- A family of out-of-the-box, SDN-ready Dell Active Fabric switches that allows organizations to choose an SDN implementation of NVO, SDN controller or programmable interface
- Best-of-breed open networking switches that enable organizations to run selected network operating systems from different vendors
- Third-party network operating systems for Dell switches built for particular environments, such as Cumulus Networks and Big Switch Networks
- An Active Fabric Controller programmable software-defined network and application services platform designed to deploy networking functionality simply and securely in cloud environments leveraging OpenFlow and advanced SDN features

A pioneer in building the PC industry on the open x86-based platform, Dell is now an inaugural member of the Open Networking Foundation, which helps define and drive open networking technologies and SDN-based concepts. Together, Dell and third-party partners are helping enterprises migrate to software-defined networks that meet specific business and organizational requirements, offering the scalability and manageability to take advantage of emerging opportunities quickly and flexibly.

Dell also supports this vision with comprehensive data center solutions for server, storage and networking; single-point accountability for global distribution and fulfillment; and a services portfolio spanning network planning, deployment and support.

Learn more

Dell Networking:
Dell.com/networking

> "Cloud-service providers and large-enterprise customers are thoroughly evaluating alternatives to their traditional data center network infrastructure. Developments such as network disaggregation reconfigure industry ecosystems."
>
> *Brad Casemore*
> *Research director,*
> *Datacenter Networks*
> *IDC*

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