



WHITE PAPER

NETWORK

The Future of Networking

Abstract

Networks are the most fundamental layer of IT infrastructure and that's not changing. What is changing are the demands placed upon that infrastructure, as well as the people who deploy and operate it. Network automation, orchestration, disaggregation, and virtualization

are the keys to enabling the agility, flexibility, feature velocity, and cost control required both today and in the future. Organizations of all sizes must start taking advantage of these new tools across data center, campus, and branch networks as soon as possible.

What is SDN?

SDN stands for Software Defined Networking, which is a concept that gained attention with the introduction of the OpenFlow protocol in 2011. Since then, SDN has grown far beyond any single protocol. Likewise, SDN is not a single product or even a suite of products. SDN is an architecture. It's a way of looking at networking that moves beyond manual, box-by-box administration to a more programmatic and agile interaction, leveraging open standards and APIs (Application Programming Interfaces). In other words, SDN is in many ways the inevitable progression of network management.

The two fundamental elements of network management have always been putting information into the network (configuration) and getting information out of the network (monitoring). Unsurprisingly, SDN has two core components: network automation and network telemetry. Automation is the use of software tools to make interactions with the network faster, easier, and less prone to error. Telemetry is the collection of real-time data from the network that provides the information you need to make informed decisions when planning, building, operating, and securing your network. Automation and telemetry enable orchestration and advanced analytics.

Network analytics uses telemetry and other raw data from or about the network to provide meaningful insights and actionable information. While network analytics is not a new concept, under the SDN umbrella it's based on better data (real-time telemetry vs polling), is more accessible and aggregable through the use of open APIs, and therefore can provide answers to more complex questions. Ultimately, SDN analytics should be predictive rather than purely reactive.

Orchestration is the use of automation to realize intent. Put another way, intent is what you want the network to do, orchestration is the automated coordination of the multiple systems needed to realize that intent, and automation is the method to quickly and accurately make the needed changes within those systems. This is a form of abstraction. A well-designed and implemented SDN hides network complexity so that changes can be made faster and more reliably than ever before.

Despite all this, networks cannot exist only in software. Even a fully virtualized SDN requires hardware to operate. SDN does, however, allow us to think differently about network devices. Disaggregation is the best way to describe this paradigm shift. To disaggregate is to separate into the component parts, and SDN does this in two distinct ways. First is the disaggregation of the forwarding, control,

management, and policy layers of the network. The separation of these layers is a fundamental trait of SDNs. Second is the disaggregation of hardware and software in network devices. This allows network functions to operate independent of specific hardware, wherever and whenever they are needed.



Why SDN Matters

The pace of innovation is accelerating. The demands on modern IT organizations are growing. The drive towards mobility, the rapid adoption of cloud, and the ever-increasing need for security are placing enormous pressure on all aspects of IT infrastructure. This is especially true for networks.

Networks are the foundation of any IT infrastructure. Every device, application, and user relies on the network to make the connections that allow them to function. In addition to ever stricter uptime requirements and mounting bandwidth demands, the ratio of network-devices-to-engineer continues to climb. This requires new methods to simplify operations and increase efficiency. Today, those solutions fall under the umbrella of SDN.

To serve an organization's employees, customers, and partners, the network must become a predictable and reliable platform upon which IT, and the overall organization, is built. SDN is the architecture required to operate the network as a single system capable of seamlessly supporting cost reduction, increased velocity, and an enhanced user experience, while simultaneously reducing risk.

SDN leverages abstraction and automation to reduce time to delivery, minimize human error, increase vendor leverage, accelerate innovation, maximize agility, and simplify network operations. Similarly, SDN uses telemetry and analytics to increase security, reduce time to resolution, and facilitate data-driven planning and optimization. Additionally, SDN takes advantage of orchestration, open APIs, and disaggregation to directly lower costs and increase flexibility.

Your organization relies on your network. With SDN, you can build a network that is simple, fast, reliable, and capable of meeting the demands of tomorrow without sacrificing anything today.

How to Deploy SDN

It should be clear that SDN is not a single thing that can be purchased, configured, or installed. Rather, SDN represents a dramatic transformation in the way networks are designed and built. The first step towards SDN is to change the way we think about networking.

Traditional networks are rigid and inflexible, which makes them fragile. Much of this is due to the manual, device-centric way in which they are designed, implemented, and operated. To break this cycle, we must think of the network as a system, not a collection of individual devices. We must stop relying on slow and error-prone manual CLI configuration and start leveraging automation and APIs. We must stop trying to piece network state together using a series of show commands (or worse, our memory) and instead create a reliable single source of truth. We must codify policy, process, and procedure into the system itself, and stop hoping that no one with network access will do anything ill-advised or malicious.

Once you've made the paradigm shift to SDN thinking, it's time to get started. A major component of SDN is automation, and standardization is the bedrock of automation. The more uniform you can make your designs, configurations, and policies, the simpler it will be to automate. Create reference designs and configuration templates. Layer in programmatic configuration management with policy control, integrated monitoring, and lifecycle management. The ultimate goal is intent-based orchestration, where the desired network state is enforced autonomously in most cases.

This can be done in any environment. The most fundamental question is whether to build or buy. The components that make up an SDN solution can be purchased or built in-house from disaggregated elements. At each level of disaggregation and abstraction, this choice presents itself. In general, you should build what you need for differentiation or to meet specific requirements and buy the rest; let the specialists do the work for you.

This isn't an all or nothing solution. Networks can be broken apart and combined in many ways. Take a "network of networks" approach to roll out SDN in phases, or use the specific tools needed for individual environments. Some classic boundaries are LAN/WAN, campus/branch, corporate/production, and metro/core, but you can compartmentalize much more granularly. Build out a new office using SDN or a single PoD in your data center, or a new MAN, etc. You can also layer SDN components and practices into an existing network. Add SD-WAN to enhance your interoffice connectivity, use virtual network functions (VNFs) to add capabilities in the data center or at a branch office, add an SDN controller and slowly ramp up the services it provides, or start with streaming telemetry and analytics to get a handle on how your network really works today. The options are plentiful and diverse enough to fit seamlessly into any organization's IT network.

Conclusion

SDN is the future of networking. Manual configuration is no longer scalable enough to be relied upon as the primary interaction with network devices. Hardware devices are still required to provide the raw forwarding, but networks need to be thought of as complete systems, as platforms that provide service to employees, customers, and partners.