



LEVERAGING THE BENEFITS OF SDN TO IMPROVE AGENCY NETWORKING

INDUSTRY PERSPECTIVE

Introduction

Think of all the applications agencies use to communicate with the workforce, respond to citizen requests, and carry out daily operations. It's critical that those applications are readily available and maintained without disrupting the mission.

Government IT organizations must ensure their enterprise networks can support those applications and cater to evolving agency requirements. The challenge most technologists face is how best to support a dynamic network when many of their processes are not automated.

A promising solution to address this growing challenge has emerged in the form of software-defined networking (SDN).

At its core, **SDN is about using software to change the behavior of the network**, Andy Ingram, Vice President of the Center of Excellence-Data Centers at Juniper Networks, told GovLoop. Think of the network as the link that connects servers to storage and end users to application services. It's more or less the foundation of the data center, similar to the foundation of a home.

"If you get the foundation wrong, the house will never be quite right," Ingram said. As federal professionals today are focused on creating greater data center efficiency, he noted, "It's important to get that foundation correct."

IT shops in the public and private sectors are exploring the benefits of SDN. No need to fret if these discussions haven't permeated your agency yet, as SDN adoption is in its infancy.

"It's being used in places where people are building public clouds, places like Amazon, Google, Facebook, and eBay," Ingram said of SDN adoption. "These places have been using some form of this technology for a long time now."

But the technology has not yet been widely adopted by government organizations.

Considering the eventual impact SDN will have on the network, it's inevitable this emerging technology also will affect the thousands of federal data centers. Inside those data centers are a host of applications and cloud-based services that will be impacted.

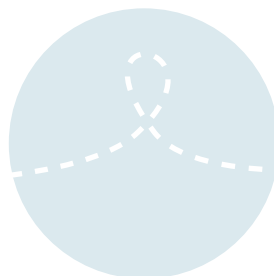
One of the promises of SDN is the ability to set up applications and make changes more rapidly than is possible with traditional data center management strategies.

Scott Ormiston, Director of Solutions Architecture at Affigent, put it this way: "If you think of the cloud as a big network or railroad track, SDN is the actual steel track that everything runs on."

With this in mind, GovLoop teamed with solutions integrator Affigent and network innovation leader Juniper Networks to help you better understand:

- The basics of SDN
- The simplicity and efficiencies that SDN offers
- How you can follow a path to implementation and avoid roadblocks

Review this industry perspective for a better understanding of SDN and how it can support your agency computing environment, and key considerations to make your SDN migration successful.



What Is SDN, & Why Should You Care?

SDN is about using software to change the behavior of the network.

"In some ways, SDN is not a new concept," Ingram said. "We have been using software to modify the behavior of the network for many years. Today, the term SDN primarily applies to a new approach to provisioning virtual network overlays."

Virtual overlays allow agencies to create multiple virtual networks out of one physical network. The purpose of the virtual network is to enable multiple end users to share the network while maintaining proper traffic separation and security.

What the new overlays promise is a more effective way of creating virtual networks within the data center, which is a big deal. In the past, we have used virtual local area networks (VLANs) to virtualize the data center network. However, VLANs have two shortcomings: We are limited to 4,000 VLANs in a single network, and the endpoint of a VLAN is a network device rather than being connected directly to the application. Thus, establishing the VLAN was generally a separate task from the provisioning of the application, adding time and complexity.

With the new SDN overlays, there is no practical limit to the number of virtual networks, and the endpoint of the virtual tunnel is now connected directly to the virtual machine containing the application. Thus, the virtual network is automatically manifested when the application is deployed. Further, services like security, load balancing, and network stitching can be predefined and automatically deployed with the application.

In the end, SDN can eliminate many of the time-consuming manual configuration tasks required to deploy or update an application, reducing errors and time to deployment. Thus, it becomes easier to create cloud environments and share resources and services internally and externally, Ingram explained.

SDN TAKEAWAYS

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What SDN promises for most agencies is an improvement in orchestration, or the ability to deploy applications. In the orchestration process, the goal is to get the various parts of the infrastructure — servers, storage, networking, firewalls, security tools — properly configured and ready to support applications.

"In the past, when an agency wanted to deploy a new application and host it on a physical server, it would take about two months to order the server, receive it, install it, and test it," Ingram said.

Spinning up a virtual server used to take months, but now it takes only a few minutes.

Increasingly, virtual servers are replacing physical servers. Yet, IT departments that rely heavily on manual processes still must orchestrate various parts of the data center and network to ensure existing and new applications run properly.

Among the required changes are

- ▶ Setting up the virtual network for each new application
- ▶ Establishing security and network services, and
- ▶ Implementing load balancers to distribute application traffic.

Completing these tasks may consume weeks of network management time when multiple systems are involved and much of the work is accomplished manually.

"The promise of SDN in the network is to shorten that time period from weeks to minutes," Ingram said. SDN allows agencies to configure the servers, storage, network, security, and load balancing in an automated fashion, eliminating the tedious and time-consuming manual approach.

The focus is on automating the simple, repetitive tasks, Ingram said. As networks and their complexity continue to grow, SDN delivers automation options that can save agencies time and costs associated with routine network operations.

Identifying SDN Roadblocks & Benefits

So far, we've explored the benefits of SDN, including how it simplifies networking and improves agencies' ability to share resources across multiple users and groups. But for some agencies, the path to SDN will require more preparation given the state of their installed IT infrastructures.

It's no secret that government data centers are full of legacy systems and technology that cannot be easily adapted to more modern computing architectures. Some of these legacy systems will never make the leap to new and modern technological alternatives. Federal Chief Information Officer Tony Scott often uses this example when talking about the challenges of adding modern capabilities, such as additional security features, to older systems: It's like trying to put airbags on a 1965 Mustang. It isn't impossible, but it is extremely difficult.

Adding new features to a legacy environment isn't the only challenge. The other concern is that introducing change can create new risks. There are two shortcomings to the SDN overlays. First, like all new and innovative data center technologies, maturation of the software and operational practices will take some time. "The most important thing about the data center is that it has to be up and running. Reliability is paramount," Ingram said. "So introducing new technologies into this environment brings with it some risk. Because it is new technology, there is a requirement for network professionals with a certain level of technical sophistication to be able to implement and initially operate SDN-enabled systems."

Often this change requires internal IT staff to learn new skills and work alongside qualified contractor staff to transition to this kind of new technology.

The second shortcoming is not all servers can participate in these new virtual networks. The SDN overlay networks are

designed to run between virtual machines and can operate across any physical network. However, most servers deployed in the majority of data centers are still "bare metal." That is, they are not virtualized and thus cannot directly participate in the new virtual networks. Instead, they rely on the

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Ultimately, SDN provides a new way to rapidly create virtual networks, deploy applications, and improve timely, secure, and reliable services.

traditional VLAN technology for network virtualization. To address this issue, the new overlay networks can provide "gateways" to automatically stitch the new virtual networks to traditional VLANs. It is possible to run this gateway function in a server, but it is faster and more cost efficient to run the gateway in the physical switch or router.

"We are able to run a virtual network over any set of network equipment, but unfortunately not all equipment supports the VXLAN Tunnel End Point [VTEP], capability to act as a gateway," Ingram said. "Even if you are not ready to deploy SDN, you should make sure that all new switching and routing installed is SDN-ready."

The reality is virtual networks operate at peak performance when virtual servers are in place. Most of the government's servers today are physical, not virtual. Those servers were not designed to support the use of SDN to create virtual overlays, or multiple virtual networks out of one physical network.

Virtualization of physical servers is the beginning. SDN takes the concept of virtualization beyond the server to the network.

"Similar to the way you take a server, separate the running of all the hosts on that server, virtualize them, and use a central controller to manage multiple servers and move them from one to another, the SDN controller also acts as a central control," Ormiston said.

SDN enables agencies to take the physical hardware of the network and the standard hardware or software running at different points on the network and separate that from the overall management and control of the network.

"The SDN controller then is able to orchestrate across all those network devices," Ormiston said.

For the private sector, competitive advantage is the driver for their shift to SDN. For government, it's about enabling agency business and mission objectives.

Not all agencies require the leading edge of technologies; some just want reliable, resilient, and trusted applications to support daily operations, Ingram stated. Conversely, many in the intelligence and military communities proactively seek the latest hardware, software, and computing strategies to improve their mission performance and expand their operational capabilities.

What SDN provides the Department of Defense and other agencies is a new way to rapidly create virtual networks, quickly deploy applications, and ultimately empower employees and improve timely, secure, and reliable information and services to public and private sector constituents. As more of those services are hosted in the cloud, SDN also provides a means to control cloud networks and rapidly create virtual networks to other public, private, and hybrid clouds.

The Great Migration

Let's assume your agency is open to the concept of SDN adoption. What do you need to know to ensure a successful migration?

The first step is to simplify the data center network and develop an architecture, or blueprint, that provides the right topology and building blocks to prepare for an enterprise SDN migration. Why act now? Because a simplified network is more efficient, reliable, and helps to lay the groundwork for automation of simple, repetitive tasks.

The second step is to secure the network. What makes the security process complex is the fact that there are hundreds or thousands of applications to secure.

"Security is paramount, and it's a very complex topic because security is specific to the applications," Ingram said. SDN can contribute here in two ways. First, by making it easier to deploy virtual networks, the data center can now support a finer granularity of security zones. This makes it harder for an intrusion to propagate within the data center. Second, SDN makes it easier to inject and change security services for traffic running between zones. Policies can be defined for specific applications and deployed automatically when the applications are deployed.

Automation is the final step, and agencies can take one of two approaches to prepare for this time-saving network operations enhancement.

First is a bottom-up approach. Using state-of-the-art tools like Ansible, Python, Puppet, Chef, or Salt, agencies can identify and automate the 20 percent of the network op-

ervers, the storage, the network, and the security at the time we deploy the application."

Data Center orchestration begins with the selection and implementation of orchestration software such as VMware's vRealize Suite or OpenStack. It is in facilitating orchestration that the SDN overlay technology

makes its greatest contribution. By tying the SDN controller into the orchestration software, we can automate the orchestration of the virtual network and network security.

While the promise of SDN is great, the reality is not all agencies are ready to deploy this innovative technology. Legacy applications and equipment may not be compatible with SDN. Agencies may lack an overall orchestration or cloud strategy, and they may lack the time, resources, and expertise to implement a technology in the early stages of maturity. "In the end, the short-term business case may not justify the investment required to implement SDN today," said Ingram. "However, five years from now this technology will be mainstream, and agencies should be planning today to take advantage of SDN down the road."

SDN TAKEAWAYS

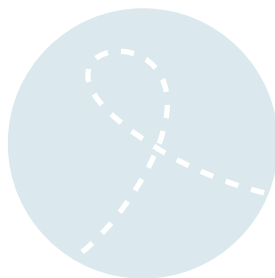
The first step of a successful enterprise SDN migration is to simplify the data center network and develop an architecture, or blueprint.

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erating tasks that take up 80 percent of their time and resources. This results in reducing operational costs, errors, and outages while freeing resources to work on higher level tasks. Juniper Networks has the tools and expertise to help agencies apply automation to handle those tasks.

The more powerful approach to automation is top-down, which involves orchestration, Ingram said. "Like a conductor in front of the orchestra, we want to orchestrate the



Conclusion

SDN implementation, in part, depends on whether the federal workforce and its industry partners are ready and sufficiently skilled to plan and implement the work. There are selected organizations that have successfully deployed SDN in their data centers, and many agencies are in the trial phase to see where SDN is feasible to support their computing demands.

“Organizations are trialing SDN today, bringing it to places where it’s not going to impact mission-critical applications,” Ingram explained. “Thus, if something goes wrong in a test system, the organization won’t have unhappy constituents or customers.”

The good news is agencies don’t have to wade through the nuances of SDN adoption on their own. Working together, Juniper Networks and Affigent are helping government professionals create an implementation road map for SDN by first evaluating their current networking and IT environments and identifying what is required for successful adoption of this next-generation networking approach.

Remember, SDN is about simplifying the network and inevitably the way government operates. As government information, services, and communications today are online, mobile, and cloud-based, the network is more important than ever. Simple,

open, and agile SDN solutions can help agencies future-proof their networks. While SDN offers the promise of reduced operating costs, the benefits extend far beyond budgets by making IT staff and investments more efficient and adaptable to emerging mission demands.



About Juniper Networks

As an industry leader in network innovation, Juniper Networks is focused on designing and delivering systems and software that fit the needs of our worldwide customers. For hundreds of U.S. federal government organizations, Juniper understands and implements high-performance, scalable, and cost-effective networking environments that meet security, efficiency, and mission objectives. Additional information can be found at www.juniper.net/federal.



About Affigent, LLC

Affigent, a 2015 Washington Technology Top 100 prime contractor, is an industry-leading small business that has been serving the federal market since 2003. In a crowded IT market, Affigent stands apart as a full life cycle solution provider that repeatedly demonstrates the right technology and process expertise. Our goal is to help our customers achieve the IT productivity and efficiency needed to make their missions a success and bolster their return on investment. For more information, contact Affigent, LLC at 866.977.8524, via email at info@affigent.com, on the web at www.affigent.com, or connect with us on [Twitter](#) and [Facebook](#).



About GovLoop

GovLoop’s mission is to “connect government to improve government.” We aim to inspire public-sector professionals by serving as the knowledge network for government. GovLoop connects more than 200,000 members, fostering cross-government collaboration, solving common problems and advancing government careers. GovLoop is headquartered in Washington, D.C., with a team of dedicated professionals who share a commitment to connect and improve government.

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