TechTarget

Ready to 'Software Define' Your Wide Area Network?

If SDN is networking's femme fatale, SD-WAN is the girl next door. Time to get better acquainted.

SD-WAN: Networking's Approachable Girl Next Door

IF SOFTWARE-DEFINED NETWORKING (SDN) in the data center is the femme fatale of the networking world—mysterious, complex and a little scary—software-defined WAN (SD-WAN) is the approachable girl next door. And lately, it's Jennifer Aniston, not Angelina Jolie, dominating network industry buzz.

As network users' appetite for bandwidth continues to skyrocket, SD-WAN promises to revolutionize the wide area network, using virtualization and network overlays to deliver better connectivity, reduced complexity and lower costs. With a relatively clear business case, the technology is enjoying the kind of rapid, real-world adoption that has so far eluded data-center SDN.

But, as skeptics caution, we should hesitate before hailing a single approach as a panacea: SD-WAN, like any technology, has its pros and cons. In this three-part guide, you'll learn about both, as we explore how SD-WAN works

and whether it could work for you. We'll hear from networking experts who argue that the newest thing about SD-WAN is its marketing hype and others who say it could meet your most pressing branch-network needs.

Ready to move forward with SD-WAN? In the concluding chapter, John Burke offers practical advice for evaluating the plethora of vendor offerings, with tips for selecting and implementing the best product suite for your enterprise.

This is likely not the first time you've heard about software-defined WAN, and it almost certainly will not be the last. We hope this guide will help you cut through the hype and develop a clearer understanding of the technology as you weigh SD-WAN's potential to improve your wide area network.■

ALISSA IREI
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Hype or Help? What SD-WAN Is and Is Not

EAGER TO BREAK away from the crowds at the Interop trade show in Las Vegas, John Mulhall stepped into a quieter aisle of the expo hall back in 2010.

The booths in that row weren't glitzy—no sign of hourly iPad raffles or other crowd-pleasing gimmicks. They were populated by vendors that Mulhall, an IT director at Sno-Isle Libraries in Washington state, had never encountered before. One of them was a startup called Talari Networks, which back then billed its technology as "adaptive private networking." The company claimed its appliances could supplant a costly MPLS network by aggregating multiple Internet connections and dynamically selecting the best path for traffic, based on the real-time conditions of those links.

Sound familiar? It's one of the basic premises of what is now marketed as software-defined WAN (SD-WAN) by a growing pool of vendors that come from all corners of the networking market. It includes routing giants like Cisco, WAN optimization specialists like Silver Peak Systems, niche players like Talari, and a handful of startups like CloudGenix and Viptela.

SO, WHAT IS SD-WAN?

SD-WAN is an alternative approach to designing and deploying enterprise WANs that aims to replace traditional branch routers with appliances that use virtualization, application-level policies and network overlays to make several consumer-grade Internet links behave like a dedicated circuit. The intention is to simplify setup so that the only thing branch office personnel need to do is plug in a cable for the appliance to "phone home" and automatically receive its configuration from a central controller.

The ultimate goal is to eliminate or reduce the need for private WAN technologies like

MPLS—plagued by long provisioning times and expensive contracts—while also making the WAN more responsive and less complex. But as many large companies [hesitate to fully abandon](#) the guaranteed control, reliability and performance of MPLS, SD-WAN is expected to be deployed mostly in [hybrid WAN](#) architectures that use a combination of public and private connections.

"It's a technology that I think is going to begin replacing MPLS if MPLS doesn't get cheaper," says John Shaffer, CIO of Greenhill and Co., an investment banking firm based in New York that's in the process of deploying Vitpela's SD-WAN boxes at its 15 offices. "A lot of our offices work independently of each other aside from email. You start wondering what you're using MPLS for and why you're paying so much money for it."

IS IT HOPE, OR IS IT HYPE?

Yet not everyone believes SD-WAN is the panacea to all the world's WAN woes. The degree of abstraction these appliances use makes network engineers like Ivan Pepelnjak nervous.

He contends the same ends can be—and have been—achieved with technologies that have been around for at least a decade. They do, however, require more manual labor.

"People always want to believe in Santa Claus and magic," says Pepelnjak, an independent network architect in Slovenia who operates [ipSpace.net](#) AG, a consultancy that provides software-defined networking ([SDN](#)) training and services. "They want to believe that there is new stuff that you can just deploy and it works—and then the reality sets in, unfortunately."

But whether it's new and transformative or simply an old bag of tricks going by a catchier name, one fact about SD-WAN is undisputed: It has [rapidly attracted interest](#) over the past year as users increasingly access applications via the cloud, diminishing the need for dedicated pipes to enterprise data centers.

"The whole SDN movement opened up the market's eyes to the fact that there are better ways to solve longstanding challenges," says Andrew Lerner, a research director at Gartner. "Although SD-WAN is not SDN, that whole mindset and cultural shift brought in with SDN

had an impact on the entire market.

"And while all the early talk about SDN was in the data center, if you actually talk to end customers," says Lerner, "a big percentage of their spend on the network is typically on tele-com—in MPLS and branch connectivity."

ENABLING HYBRID WAN

At Sno-Isle Libraries, Mulhall says he continually looks for ways to cut costs and fulfill the library's goal of "being good stewards of public tax dollars." Shortly after visiting Talari's booth at Interop five years ago, he tested out the vendor's appliances at one of his branches. They worked exactly as advertised, even handling VoIP traffic without any major hiccups.

Mulhall deployed the appliances at all of the library's 23 locations and completely replaced his MPLS network with an assortment of standard Internet connections in 2011. The Internet-based WAN is supplemented by a few high-capacity dark fiber links for internal traffic between buildings.

"It was a little bit nerve-wracking," he acknowledges now. "As a matter of fact, the following year I was at Interop, and I was at one of the sessions where they were talking about new networking technologies. I talked about our move to Talari and mentioned that we ripped out all of the MPLS circuits. One person a couple rows back stood up and said, 'You're insane. That's crazy. Why would you do that?!'"

He answers that question now without hesitation: The library has not only saved at least $400,000 annually as a result, but it has also improved the performance and redundancy of its WAN. Whereas each branch previously only had one MPLS link that backhauled internal and external traffic to Sno-Isle's data center, a typical branch now aggregates four different Internet connections. The Talari appliance identifies traffic that doesn't need to be filtered to be in compliance with the Children's Internet Protection Act and sends it directly out to the Internet.

"It's allowed us to really use the intelligence of those appliances to say, 'OK, what kind of traffic is it?'" Mulhall says. "We did notice a performance improvement because with our standard MPLS network, everything goes back via the WAN to your headquarters and then

out to the main Internet connection. Now we can send it out to multiple routes."

While SD-WAN may be sufficient for guest Wi-Fi or processes that can be completed offline, the public Internet cannot be counted on as a completely reliable medium for critical services, cautions ipSpace.net's Pepelnjak. That makes it all the more important for network engineers to know which applications the business must have online at all times.

"It depends on how badly you want to fail—honestly. Are you willing to lose a remote office because the Internet is down? For some people, the answer is yes," he says. "There is no Bandwidth Fairy. You have as much bandwidth as you have, and if you want more, you have to pay more. It's always the magic triangle of fast, cheap or good—you only get to pick two. The only benefit of all these new offerings is that they are easier to consume."

SD-WAN can be deployed incrementally to minimize "the blast radius" in the event of a failure because it can be piloted in a single, isolated branch, says Gartner's Lerner.

"The beauty of SD-WAN versus SDN is that with SDN, if you apply it in a data center—even though you can do it in a rack or a switch—the reality is you're still in a data center and you could impact the full application environment. That's one of the reasons SDN adoption has just been so slow," he says.

> ## "There is no Bandwidth Fairy. You have as much as you have; if you want more, you have to pay."
> **—IVAN PEPELNJAK,** ipSpace.net

At Greenhill and Co., Shaffer operates a hybrid WAN that uses MPLS links as primary connections, supplemented by Internet links. Initially, he planned to use SD-WAN to reinforce his traditional WAN. But as he continues to deploy more Viptela appliances at his offices around the world, Shaffer says he expects that dynamic may shift—especially as he considers that $600,000 of his annual IT budget goes to MPLS.

Although it comes with a service-level agreement (SLA), MPLS historically has caused its share of headaches for Shaffer. Prior to his investment in SD-WAN, it took six months

for a new office in Brazil to obtain MPLS connectivity.

"An MPLS network doesn't guarantee 100% uptime, and we do have outages. We have SLAs attached to them, but an SLA doesn't mean anything when people can't get connected," Shaffer says. "If I can buy a 100-meg Internet link and know that I only get 20 megabits out of it, that's still really good."

A WAN ARCHITECTURE FOR CLOUD
Cost savings are the most visible benefit, but just as vital to SD-WAN's traction is that its architecture better suits the demands of cloud, mobile and real-time applications, says Nick Lippis, co-founder and vice chairman of the Open Networking User Group (ONUG).

"The concept of enterprise WANs is an old concept and a dead concept," says Lippis, who predicts most large enterprises will adopt SD-WAN within 24 months.

Giuseppe Genovesi, head of corporate IT at Interroll, a manufacturing company in Switzerland, adopted a hybrid WAN model five years ago when his company started increasing

its use of public cloud services like Microsoft Office 365 and built out its own private cloud. At the beginning of this year, 80% of Interroll's WAN consisted of MPLS links, and 20% of it was standard Internet connections. Today those are split equally, and based on his successes so far, Genovesi says he plans to reduce MPLS to just 20% of his WAN.

Interroll uses Silver Peak's WAN optimization appliances with Unity EdgeConnect, the vendor's SD-WAN product, as a replacement for branch routers at its 31 global offices. Genovesi still tags and prioritizes different types of traffic with MPLS, but the SD-WAN platform determines the best path to send it at any given moment.

"The Silver Peak device decides dynamically, 'Now you have more demand for this type of traffic. Let's increase the priority of this, put it in this class or delay this other thing.' And that is something that was not possible with just a router and MPLS," Genovesi says. "The router and MPLS can tell you what traffic is prioritized or what is skipped, dropped or just really slow. But you cannot have this dynamic approach." —*Jessica Scarpati*

The Ins and Outs of How SD-WAN Works

How exactly does SD-WAN work? According to Andrew Lerner, a research director at Gartner, SD-WAN takes more of an application-centric approach to networking than the traditional hop-by-hop routing according to a destination IP address.

"You can group things together and define applications based on some set of characteristics, which may include an IP address but also say, 'This application, YouTube, goes this way,'" Lerner says. "So it's no longer just, 'YouTube has this IP address and goes this path.' It becomes, 'This is YouTube traffic. YouTube traffic has this policy associated with it, so we're going to forward it in this mechanism.'"

When OneCloud Networks, a unified communications as a service provider based in Frisco, Texas, first launched its cloud-based voice and video conferencing services, providing each customer with redundant, dedicated circuits seemed like the only way to guarantee

service, says OneCloud CEO Haider Mirjat. It was an expensive approach, however, and didn't supply sufficient bandwidth.

As Mirjat learned more about the concept of hybrid WAN, the idea was appealing. But the execution was problematic. He used Cisco's Meraki MX Series firewalls to terminate WAN links, and while they had the ability to load balance multiple connections, Mirjat said the configuration was complex, manual and static.

He eventually supplied customers with CloudGenix's SD-WAN platform on commodity hardware and redundant, consumer-grade Internet connections. The device is able to fingerprint different types of traffic and adapt its routing dynamically, based on real-time network conditions.

"It understands which applications are reliable on what connection and at what time— and it learns it all in real time," Mirjat says. "That's really what helps us to say, 'OK, you

know what? We don't need to do all dedicated circuits for redundancy.'"

SD-WAN VS. DIY

Despite the recent surge of interest around SD-WAN, its ability to [support a hybrid WAN](#) is not based on a new technology.

"Smart people were always trying to use whatever bandwidth they had available," says ipSpace.net's Ivan Pepelnjak. "There was no hype around it because it was just network engineers doing our stuff, but the concept of using [VPN](#) over the Internet in parallel with your private WAN to get cheaper bandwidth is, as a concept, at least a decade old."

One function that cannot be achieved without SD-WAN is dynamically shifting traffic across multiple links based on link quality, Pepelnjak acknowledges. But the ability to aggregate and load balance multiple WAN connections can be achieved with Cisco's dynamic multipoint virtual private network ([DMVPN](#)) technology, he says.

"If you want to deploy a DMVPN network, you have to know actually how it works. You have to do a proper design. You have to think about what you're doing. Maybe you even have to go to training, God forbid," Pepelnjak says. "With this new stuff, you just plug it in and it automatically registers with the controller. You click three buttons in the Web interface and it all works—until it stops."

ONUG's SD-WAN working group will perform interoperability demonstrations for several vendors' SD-WAN products at ONUG's conference in November 2016.

Prior to deploying Talari's appliances at Sno-Isle Libraries, Mulhall's networking team attempted to implement a hybrid WAN using DMVPN. But the technology proved too complex.

"If you have a whole fleet of network engineers on staff, I suppose you could do it yourself. But I don't know if that's a cost-effective way to do it," Mulhall says. "In fact, one of my network engineers swore up and down, 'By God,

we'll just do it ourselves.' They tried with some limited success, but it just didn't make sense. And certainly if you're going to have all your data services rely on that, I'm not sure a whole roll-your-own approach would be a smart way to go. It's nice to have a vendor to point your finger at and say, 'It's your fault.'"

MISSING LINKS

Meanwhile, some say the commercial products need further testing—a task that members of ONUG's SD-WAN working group have been working on. This past spring, the group performed feature verification testing for several vendors' SD-WAN products. It will perform interoperability demonstrations for them at the organization's New York conference in November.

ONUG members, who are enterprise IT pros, have two main items on their wish lists for SD-WAN products: an open way to perform service chaining and more rigorous performance testing, says Nick Lippis, the group's co-founder.

"A lot of the [SD-WAN vendors] have been shy to test their equipment at scale for performance, so clearly they're not ready for it, and then that's going to slow down the pace of deployment," Lippis says.

It's a concern Pepelnjak shares.

"Let's see how well they actually work in practice because right now everyone is in, more or less, early pilots," he says. "When someone deploys 5,000 nodes in production all over the globe, connecting weird countries like Kazakhstan and Mongolia and 1,000 nodes in China, then we'll see how well things really work."

The question is, if that scenario comes true, and SD-WAN proves its value, does that mean it's time to 'software define' your company's wide area network? —*Jessica Scarpati*

To SD-WAN, or Not to SD-WAN…

SD-WAN AIMS TO make WANs simpler and less expensive to design, build and operate—to offer simplified, application-centric, centralized management of a complex pool of WAN links. To decide whether SD-WAN is right for their network, IT staff need to consider several factors:

- hard and soft costs associated with managing their network
- the need for and degree of resilience
- the need for and ability to deliver excellent WAN performance for all apps
- whether they want to hand management over to a service provider

HARD COSTS …

Hard costs come down, typically, to router and MPLS costs; these need to be compared to SD-WAN appliance and broadband costs. Device costs can be significantly lower in the SD-WAN space, when compared to multifunction branch routers, or can be about the same as router costs. It is only when the SD-WAN device (or managed service) is replacing multiple devices—say, a router and a WAN optimizer—that you can be fairly certain of hardware cost reductions. Connectivity costs, on the other hand, can come down by 80% to 90% on a per-Mbps basis when IT swaps broadband Internet links for some or all MPLS links in a given location. In fact, costs can come down that steeply even when IT puts in massive increases in bandwidth and redundant broadband links. Most business cases for making an SD-WAN shift rest on the reduction in connectivity costs.

… AND SOFT COSTS

Soft costs center on engineer hours needed to manage the various use cases of the WAN and

maintain the WAN at a given level of perfor-mance. By abstracting away many of the details of routing traffic intelligently across multiple links (and multiple types of links) to meet ser-vice and performance targets, SD-WAN can greatly ease WAN management.

Likewise, SD-WAN can reduce the amount of work needed to deal with link failures or transient link performance issues by automat-ing the rerouting of traffic and rebalancing and reprioritizing across the remaining links. This reduces or eliminates down time from the user perspective as well, another source of soft-dol-lar costs. Soft-dollar savings can be as high as hard-dollar savings, or higher when downtime has been a significant problem. However, soft-dollar savings can be a more difficult sale than hard-dollar savings—though it is important to document what soft savings can be expected, it is usually not enough to build a business case.

WAN RESILIENCE, PERFORMANCE
As noted, SD-WAN can make having multiple links into any site both affordable and easy to manage, thus making WAN resilience a reality

for many sites that could not previously afford it (and much more affordable for those who already have it). As businesses find it less and less acceptable to have downtime anywhere for anyone, resilient connectivity is increasingly important even for small and remote facilities.

In choosing a product, IT staff should be looking at a variety of factors:

■ **The way in which it aggregates capacity:** Is all the bandwidth available to any application?

■ **The way in which it manages traffic across links:** Can it split traffic for one application across multiple paths for better throughput? Assure packet delivery with multipathing or error correction?

■ **Its flexibility in controlling performance and adding security.** How many factors can it use in defining a policy for network traffic, beyond protocol and port information. Fac-tors to consider include application function (e.g., printing vs. data input); user; location of endpoints of traffic stream; time of day, week,

month and year; cost associated with different link types.

- **Form factor and position in the network:** Does it replace the router—or does it sit in front of, behind, or next to the existing router? Is it a physical appliance (and if yes, is it custom silicon or x86 base?). Or is it a virtual appliance, and if so, is it running on-site—and if so, where? Or it is in cloud?

- **What about WAN topologies supported?** Is it always a mesh, a hub and spoke, can it assign a topology per policy based on application-specific needs?

And, of course, IT should be looking at a shift to SD-WAN as another point at which to ask: Do they still want to manage the WAN at all, or is this a good time to look for a managed SD-WAN provider instead?

BOTTOM LINE: DO YOU NEED SD-WAN?
SD-WAN is appealing because it abstracts

away and automates some of the most complex aspects of making use of mixed, redundant network connections. In addition, that abstraction makes it easier and more effective to incorporate broadband Internet links into the WAN.

But how to know if you really need SD-WAN? You can answer that question by answering these. An organization should seriously consider SD-WAN:

- if it is spending a lot more time and money on providing connectivity than it can afford, on an ongoing basis.
- if it is not getting the resilience it wants everywhere it wants.
- if it is having trouble getting good performance on demanding applications.
- if it is having trouble getting the WAN to serve the needs of divergent applications—not just with respect to performance, but also with respect to security and compliance.

If *yes* is your answer to most or all of these questions, then now is a good time to look at SD-WAN products and tools. —*John Burke*

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