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# 2019 AvidThink SD-WAN Report

RESEARCH REPORT

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## About AvidThink™

AvidThink is a research and analysis firm focused on providing cutting edge insights into the latest in infrastructure technologies. Formerly SDxCentral's research group, AvidThink launched as an independent company in October 2018. Over the last five years, over 110,000 copies of AvidThink's research reports (under the SDxCentral brand) have been downloaded by 40,000 technology buyers and industry thought leaders. AvidThink's expertise covers Edge and IoT, SD-WAN, cloud and containers, SDN, NFV, hyper-convergence and infrastructure applications for AI/ML and security. Visit AvidThink at [www.avidthink.com](http://www.avidthink.com).

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## Introduction – New Year, New Challenges

Software-Defined Wide Area Networking (SD-WAN) is undoubtedly one of the hottest IT trends today. It's rare that a technology can generate as much interest across both enterprise and service provider markets. For enterprises, SD-WAN represents an opportunity to upgrade legacy WANs, increasing bandwidth and resiliency without breaking the bank. And SD-WAN for service providers is the next wave of value-add services, one that potentially helps save them from being just commoditized bandwidth providers.

The beginning of 2019 has seen most of the industry buzz shift from the original network functions virtualization (NFV) movement with vCPEs, to a decidedly enterprise-centric SD-WAN market. In fact, most of the market interest today is driven by corporations looking for a better solution to their existing WAN deployments.

Whether it's enterprise IT trying upgrade their WAN, communications service providers (CSP) enhancing basic connectivity with value-added services, or managed service providers (MSP) rolling out new managed WAN services, network users are tired of complicated, proprietary networks that require complicated configurations. In this report, we'll explain how the edge is being upgraded with SDN technology that is more intelligent and agile than past proprietary customer premises equipment (CPE).

AvidThink (formerly SDxCentral Research), has spent the last few years covering SD-WAN and the related virtual CPE (vCPE) market. To gather material for our industry reports, we spend time talking to CSPs, MSPs, enterprise end users, technology vendors, and other community members.

The goal of this updated report is to educate enterprises and service providers on the overall market and assist in the selection of the appropriate vendor and managed SD-WAN offerings. The report is split into two sections. The first section provides a primer on SD-WAN for readers who might still be coming up to speed on the technology. It also serves as a quick refresher for those who want a more current overview of SD-WAN. The second section provides an update on key events in the SD-WAN market and our analysis of the trends.

We hope you find this report useful. As always, the AvidThink research team welcomes feedback on our work. We can be reached at [research@avidthink.com](mailto:research@avidthink.com).

## SD-WAN Primer

### What is SD-WAN?

With all the hype around SD-WAN, one would think that the term would have been well-defined by now, unfortunately, that's not the case. Just about every vendor with a WAN-related offering has pushed their own definition of SD-WAN into the marketplace. In 2019, SD-WAN has come to mean any enterprise-edge WAN connectivity solution with a centralized controller that manages multiple edge locations.

Regardless, let's start with some basic terms in the SD-WAN taxonomy, so that we're all on the same page.

### SD-WAN, uCPE, vCPE Terminology and Taxonomy

The term SD-WAN started at the enterprise edge. However, there's a related set of platforms and technologies that CSPs are also rolling out to both consumer and business wireline services. As we will see later, there are two main ways of consuming SD-WAN. One is the do-it-yourself (DIY) approach where enterprises take on the full installation, deployment, configuration, and ongoing management of CPE devices in remote offices, running the SD-WAN solution on their own. The other is to consume SD-WAN as a managed offering, where a third-party — either a networking vendor, MSP or CSP — handles all the complexities of the service, from deployment to ongoing management. Sometimes, these managed SD-WAN services provide enterprises with simple self-service portals that cover everything from configuring add-on services, such as security and routing, to purchasing new CPEs and provisioning new locations.

In both types of consumption model, the terminology and taxonomy will be similar, so let's start with some of the commonly used terms:

- **SDN:** Software-defined networking (SDN) is a movement that began in the early 2010s. It advocated the separation of the control plane of network devices from the data plane, allowing a centralized approach for networking control that provided simplification and potential global optimization for the routing and switching of network packets. SDN also advocated open APIs and a programmatic approach to networking. The principles of SDN are embedded in just about every SD-WAN solution in the market.
- **NFV:** Network functions virtualization is an approach first put forth by a set of leading global CSPs that pushed for the use of virtualization to replace proprietary networking equipment in the carrier core. The premise was that the use of standard commoditized data center servers coupled with the use of virtual machine (VM) technology would result in increased flexibility and agility as well as reduce overall CapEx and OpEx.
- **vCPE:** vCPE technology is used to allow proprietary hardware and software to be replaced with virtualized instantiations that may run at customer premises — sometimes on lower cost equipment, in central offices (CO) or points of presence (POP), or in data centers. Many vCPE architectures provide hybrid approaches that allow different functions to run in different locations to optimize for latency, manageability, and cost.
- **uCPE:** The uCPE or universal CPE is essentially a white box, open hardware, platform that replaces the proprietary WAN appliances of today. Most often based on x86 or ARM platforms, it is a low-cost general purpose appliance that can run software VNF functions, replacing one or more proprietary boxes that play a role in traditional WANs.
- **VNFs:** Virtual Network Functions are the virtual embodiment of the physical network functions translated into an NFV deployment. Depending on how a vendor or CSP views the solution, SD-WAN might be treated as a VNF running on a uCPE with other network layer 4-7 VNFs. Another model is to treat SD-WAN as the base platform that can host other VNFs for more advanced capabilities.
- **SD-WAN:** SD-WAN is now typically used as an umbrella term that extends beyond the virtual CPE and into the core of the WAN or service-provider network. It enables service providers and enterprises to leverage existing physical CPE or vCPE technology to create fully managed multisite networks, which may integrate links using the internet and private

networks. Typically, SD-WAN architectures reflect disaggregation of the control and data plane and improved flexibility and programmability common across SDN solutions.

- **NaaS:** Network-as-a-Service (NaaS) is essentially a managed services offering that frees an enterprise up from dealing with the complexities of managing routers, firewalls, and even WAN provisioning. Some enterprises view managed SD-WAN as a class of NaaS offering while others view SD-WAN as a potential addition on top of a NaaS solution. Within the context of SD-WAN, we'll discuss some of the vendors, like Cato and Aryaka, that align well with the NaaS plus SD-WAN classification.

As a point of clarification, SD-WAN is usually used in the context of enterprise WAN edge solutions. There is a corresponding vCPE solution that can serve residential broadband deployment as well. However, the industry typically terms those simply as vCPE solutions and does not usually lump them in under the SD-WAN umbrella.

## Adopting SD-WAN

Businesses today are facing the need to transform themselves to provide more agility in dealing with customer and partner needs. It's been made clear that businesses who can adapt to the new digital economy will survive and thrive, like Amazon, and those that don't, like Sears, will not. With a looming recession, businesses are scrambling to ensure their IT platforms are both cost-effective and agile, while providing the necessary capacity and features to drive employee productivity.

The WAN edge has not received much attention in the past decade, and IT organizations are under pressure to improve WAN security, performance, and reliability. At the same time, WAN needs to be agile to respond to rapid business changes.

In addition, digitally transformed businesses are increasingly distributed with critical business operations in remote offices, home offices, and partner locations. And with the move to both public and private clouds, any WAN solution needs to accommodate not just the edge, but the clouds as well.

SD-WAN is a solution that can increase the bandwidth to remote sites while ensuring greater reliability. And a solution that can achieve this without increasing costs or overburdening IT staff. The ability of SD-WAN to take advantage of low-cost direct internet access links while maximizing use of existing private multiprotocol label switching (MPLS) networks makes it a favorite with enterprise IT. Plus the added benefits of centralized control and zero-touch deployment helps CIOs reduce costs while increasing compliance and security.

There are several options for bringing SD-WAN into an enterprise:

- Keep an existing CPE and install new software, for example, loading Cisco Viptela on existing Cisco ISR appliances.
- Keep an existing platform and put a separate device behind an existing router and run an overlay without impacting existing underlying connectivity.
- Replace existing edge devices with new uCPEs or SD-WAN appliances, often consolidating a few different legacy appliances.

Certainly, making a clean break and installing a new uCPE or SD-WAN appliance would reduce the complexity of ongoing maintenance. But the different options will fit different enterprise needs in terms of compatibility with existing brownfield installations, downtime risks, and overall costs.

With a looming recession, businesses are scrambling to ensure their IT platforms are both cost-effective and agile, while providing the necessary capacity and features to drive employee productivity.

## Managed SD-WAN vs DIY

Related to the question of adopting of SD-WAN is the choice between DIY or managed. Many enterprises today, aside from the largest multinationals with unique needs, are going the managed SD-WAN route. These enterprises are either purchasing SD-WAN offered by their existing connectivity provider, or from an MSP, or purchasing a NaaS offering with SD-WAN from a vendor.

The advantages of managed SD-WAN include:

- No need to hire specialized staff with deep network expertise to design, evaluate, and operate an enterprise SD-WAN.
- A reduction in vendor management overhead, since the managed provider will usually manage both connectivity circuits as well as the SD-WAN feature service.
- A single 'neck to choke' and a single number to call if there's an issue. The managed provider is responsible for the whole service: from the circuit to the SD-WAN feature-set. This also helps with ensuring that any overall service-level agreement (SLA) will be monitored and maintained at the SD-WAN level.

However, enterprises that choose to go the DIY route have:

- More control over SD-WAN configurations and deployment options. For instance, picking different SD-WAN connectivity options in different markets.
- Flexibility to potentially run more than one SD-WAN vendor in different geographies if needed.
- Ability to choose the most appropriate SD-WAN vendor for themselves.
- Potential cost-savings from scale economies if they have enough sites and can amortize their IT spend accordingly.

For those organizations who don't have, or shouldn't have, the necessary expertise to select, install and deploy, configure, and maintain a complex SD-WAN solution across disparate locations, the managed offering is a godsend. As such many SMBs will go the managed route. Even enterprises with the necessary expertise in-house, might opt for a managed SD-WAN offering because there's an opportunity cost with using these valuable resources on SD-WAN when there are other high-value items to service.

## Where to Adopt SD-WAN – Locations and Verticals

So where do SD-WANs fit best? We'll take a look at this in terms of two axes: location of deployment and select market verticals. Let's start with locations.

### Remote Offices and Branch sites

These sites include sales and support offices, retail and hospitality locations, or medical clinics that often lack on-site IT staff. Many of these sites cannot be easily serviced with MPLS circuits and such service is often prohibitively expensive when available. SD-WAN using business broadband, DSL and 4G/LTE can deliver MPLS-like performance, reliability, and security at a much lower cost. The ability of SD-WAN to be pre-configured and remotely administered is especially important since many organizations have consolidated IT infrastructure down to a handful of internal data centers or use centrally managed public cloud services. This means remote sites are reliant on WAN as their lifeline to enterprise applications and data. When the WAN goes down, business stops, thus, the inherent high-availability of redundant SD-WAN circuits is critical to maintaining remote operations.

### Remote Work Sites

All remote work sites like construction, resource extraction – mining, oil and gas, media – TV, movies, advertising, ocean-going cargo and passenger ships, and natural disaster response must be tethered to central IT operations for communications, enterprise applications, and data. Many of these are in extremely remote locations far from the nearest fiber

or coax connection and must be served by terrestrial or satellite wireless circuits. In these situations, SD-WAN is the only option for providing enterprise-class networking.

### Business Partners

Contract manufacturers, call centers, and professional services providers are frequently a continent away in areas without many data providers. Connections often must terminate at facilities in underdeveloped countries with few WAN options and where procuring conventional MPLS or private T-carrier circuits is both prohibitively expensive and painfully slow. As with remote worksites, SD-WAN can provide a virtual private circuit over consumer-grade broadband and bypass entrenched, regulated local telcos. Using SD-WAN via a NaaS provider is particularly beneficial in these situations since many have dozens of regional POPs and can often terminate a local broadband link in country, before routing the traffic over the provider's high-speed global private network.

SD-WANs will normally provide encrypted site-to-site access as VPN devices do, but **the promise of a centralized access and networking policy that stretches from the data center to the edge is appealing to enterprises.**

Regardless of the location, many organizations prefer SD-WAN even in situations where conventional circuits are widely available and already deployed because they want better WAN telemetry. The monitoring detail over aggregate usage, individual circuit traffic, path availability and performance provided by most SD-WAN products and services are a compelling feature for organizations that sometimes see conventional, carrier-provided WAN circuits as a black box.

### Private Clouds and Data centers

In addition to remote sites for SD-WAN, we are seeing the use of SD-WAN within private clouds and data centers. Where solutions previously entitled the use of firewall/VPN devices or software VPNs

for connectivity, enterprises are now contemplating the use of virtual or physical SD-WAN instances within private data centers. SD-WANs will normally provide encrypted site-to-site access as VPN devices do, but the promise of a centralized access and networking policy that stretches from the data center to the edge is appealing to enterprises — especially those in regular industries, who can benefit from the consistency and compliance.

### Public Clouds and Virtual Private Clouds (VPCs)

Just like private data centers, enterprises increasingly need connectivity into public clouds. Enterprises are running a good portion of their application infrastructures within public cloud VPCs like Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP). While VPCs typically provide gateways for external connectivity, and while FW/VPN virtual devices are an existing alternative, SD-WANs provide another option. The advantages of using SD-WAN are similar to those of private clouds, with the potential added benefit of WAN optimization — for SD-WAN solutions that provide it — resulting in improved application performance.

### Who Can Benefit from SD-WAN?

The benefits of SD-WAN will be felt by all market verticals. For instance, the improved reliability — through use of multiple links, increased bandwidth while keeping costs down — through use of direct internet access links, plus all the reduction in management overhead benefits will accrue to businesses both big and small.

Looking at real-world deployments, we see that VMware-Velocloud — now VMware NSX SD-WAN — has customers like Bayclub, STAR financial bank, All-tile CCS, and Café Rio among others. While Cisco-Viptela calls out First American, GAP, and Fifth Third bank. SD-WAN vendor, SimpleWAN, boasts of names like Domino's Pizza, Meineke, Supershuttle, and Farmers Insurance. India-based Lavelle Networks counts commerce giant Flipkart as one of its top customers. Flipkart was successful because it grew up in the cloud world, getting to huge scale with little investment in traditional data centers, and yet SD-WAN adds value to them in cloud connectivity. An example supporting the importance of cloud connectivity is Nuage

Networks' recent win with SciSports, a cloud-based analytics company. SciSports uses Nuage's technology to provide an overlay on top of redundant high-speed internet links, straight into Google's Cloud Platform for real-time analysis.

With so many different examples, we'll pick a couple of market verticals to highlight and explain how SD-WAN can add value given their unique requirements.

## Retail Stores

Retail stores' needs center around compliance and scalability, including the payment card initiative (PCI) to protect customers' credit card information. Encryption of traffic and network segmentation to ensure credit-card-information-carrying networks are restricted and protected is paramount. Added features including malware and breach detection, often found in security-centric SD-WAN solutions, can help retailers avoid or mitigate embarrassing and damaging leaks of customer information.

The seasonality of retail and the rise of popular pop-up retail establishments within unconventional physical locations can also benefit. SD-WAN's ability to leverage direct internet access and 4G LTE backhaul options can provide the quick provisioning needed in unexpected locations.

QoS and application prioritization can also help ensure that retail applications and credit card traffic get on the fast lane, reducing wait times and improving customer experience. Similarly, tracking or customer interaction information can be given appropriate priority to ensure that real-time analytics for omni-channel optimization remains real-time.

## Healthcare

As another regulated industry, healthcare could see great benefits from SD-WAN too. Healthcare is becoming increasingly distributed to facilitate proximity to patients and improve overall access. SD-WAN can provide value with large data transfer sets for electronic health records and diagnostic imaging as well as protecting key patient information and ensuring Health Insurance Portability and Accountability Act (HIPAA) compliance through encryption and segmentation.

In addition, healthcare's use of more Internet of Things (IoT) medical devices, including smart monitors, adds to the bandwidth demands on both the LAN and the WAN. The same networks also carry business-critical traffic for patient scheduling, payments, and other key functions.

SD-WANs that provide sophisticated policies for segmentation can add significant value here, as can SD-WANs with visibility and security analytics to help detect breaches and potential extraction of sensitive patient data.

In the future, as we move to telemedicine, where remote surgery or remote diagnostics become part of the overall healthcare offering, the security, reliability, and quality of connection that SD-WAN platforms can provide will be critical to the success of these initiatives.

SD-WAN's ability to leverage direct internet access and 4G LTE backhaul options can provide the **quick provisioning needed in unexpected locations.**

## Financial Services

Financial services organizations like banks and brokerages continue to engage at their retail locations and local branches to serve their customers while simultaneously building their online engagement model. These branches are measured by customer growth, balances, and churn. They are seldom equipped with tech savvy personnel yet require reliable, secure communications with central data centers as well as the cloud. Traditional users of leased line and MPLS, they are now migrating to using SD-WAN to improve security, reliability, and performance and cost. Improved bandwidth management can translate into an overall better quality of experience for their customers. At the same time, SD-WAN provides for improved security with fine-grained policy and segmentation rules. These rules can be used to segregate different lines of businesses, ensuring compliance and privacy.

Similarly, insurance companies have many and varied locations with a need to ensure security across local offices with a diversity of connectivity types. SD-WAN's ability to use direct internet access with 4G LTE backup allows new agent and broker locations to be set up faster with more reliability than traditional solutions.

## Manufacturing

Most manufacturing organizations have been transforming themselves from independently controlled and managed operational systems to more centrally managed and controlled networks that tie back to centralized data centers. With the rapid advancement of IoT, more sensors, data, and control will become the norm. This requires network segmentation to isolate specific production lines, facilities, or regions, and a secure, reliable, scalable, and cost-effective connection back to the central command and the cloud — all capabilities that SD-WAN can provide.

## Key SD-WAN Capabilities

SD-WANs are now converging in terms of their capabilities. As we will describe later, many SD-WAN vendors came from adjacent markets of firewall, routing, and WAN optimization, which helps define their initial platform strengths. However, regardless of their legacies, we see SD-WAN platforms aiming for a common set of features. These capabilities will include:

Category	Description
Basic SD-WAN	Fundamental capabilities like centralized cloud management and multilink handling
Platform	Zero-touch provisioning (ZTP), trusted platform, and diverse connectivity types
Routing	Support for static routing as well as routing protocols including BGP and OSPF
Security	Centralized access policies, stateful firewall, next-gen firewall, and breach detection
QoS and WAN optimization	Application-specific improvements for common enterprise applications, TCP and HTTP/S optimization, forward-error correction, and advanced QoS
Branch extension	LAN and access control plus wireless integration
Cloud integration	Local cloud breakout and fast on-ramp to popular SaaS and IaaS platforms
Advanced SD-WAN	VNF chaining and programmatic access
MSP features	Multi-tenancy and other MSP-relevant capabilities

## Basic SD-WAN

**Software control plane with physical circuit agnosticism** by laying a virtual network over any type and combination of WAN circuit, whether traditional MPLS, carrier Ethernet, cable, or DSL broadband or wireless LTE.

**Central management and cloud-based control** of all WAN paths in an enterprise using a single admin console that sets configurations and policies for each virtual circuit. The SD-WAN controller also logs performance metrics and error conditions that can be summarized in reports, used to trigger alerts, and forwarded to other IT functions like trouble ticketing systems. Performance measures include things like aggregate performance for virtual circuits and individual physical paths, circuit, path and application-L7 traffic and utilization.

**Multipath support with dynamic path selection** that handles multiple links and routes traffic over the different paths, taking into account the link characteristics. The solution should also dynamically monitor path performance and adjust traffic flows between available physical circuits to load-balance and reduce congestion and oversubscription.

### Platform

**Zero-touch provisioning** capabilities allow fast deployment of SD-WAN solutions into remote locations without a lot of overhead. ZTP systems include the ability for SD-WAN instances to call home to their central cloud control centers to retrieve the latest configurations as well as necessary software updates.

**Support for multiple link types** including ethernet, DSL, cable, mobile (4G LTE, 5G) connections, and in some situations older circuits such as T1/E1. This is necessary to provide the link flexibility in different locations, especially in places where only legacy connectivity exists or where only wireless may exist.

**Flexibility of CPE platform support** including x86 or ARM-based systems with the option to take advantage of trusted platform module (TPM) capabilities if provided on the system for more secure deployments.

### Routing

**Basic routing capabilities** that support enterprise network routing needs including static routing as well as common routing protocols such as BGP and OSPF. Increasingly though, advanced and complex routing has become less of an issue as the centralized control planes can form the appropriate packet-forwarding rules and push out packet-handling policies to the remote locations. However, to the extent that these devices need to play nicely with existing enterprise networks, support of these common protocols is important.

### Security

**End-to-end encryption** is a capability that most SD-WAN solutions provide. Security IPSec, or other encryption, tunnels automatically protect private virtual WANs traversing public, shared networks. In addition, encryption on private MPLS networks is sometimes viewed as necessary in today's breach-sensitive world, especially within regulated industries.

**Security and firewalling services** are key capabilities that enterprises seek. Most SD-WAN platforms will provide some level of firewall and security capabilities, ranging from simple TCP/UDP-port-based blocking to sophisticated malware detection and prevention. Providers might use third-party modules, or external appliances, to achieve such security capabilities or have them built into the platform.

### QoS and WAN Optimization

**Quality of service traffic prioritization** usually includes application categorization with traffic management to provide bandwidth guarantees for different classes of service. This capability can improve performance in certain latency- and loss-sensitive applications like unified communications and collaboration. Some solutions will use path redundancy and error correction techniques such as forward error correction (FEC) that add redundant data to the original packets to help detect and correct errors to avoid performance-sapping data retransmissions.

**Path conditioning and WAN optimization** area capabilities aren't always present in an SD-WAN platform. However, some enterprises might find WAN optimization features necessary for their businesses. These capabilities include data compression and deduplication, traffic shaping to control contention and latency, client-side caching, and TCP and HTTP protocol optimization. They can also include the ability to handle LAN protocols and reduce chattiness over higher-latency WAN circuits.

### Branch Extension

**WLAN integration** is a branch extension feature provided by some SD-WAN platforms, although some of these vendors label it SD-Branch. For remote office and branch office deployments, IT will find it convenient if the SD-WAN platforms include

configuration and monitoring of the WLAN and wired LAN in that branch office. The other benefit of an integrated WLAN and LAN is the central set of access and network policies that can be configured centrally and pushed out to the edge for a seamless, unified network policy across the enterprise.

## Cloud Integration

**Local breakout for cloud services** allows for local inspection and direct routing of traffic destined for trusted cloud services like Box.com, removing the need to backhaul all traffic to a centralized location for inspection. This saves on bandwidth utilization and maximizes the use of cheaper local direct internet access without compromising security. In addition, some SD-WAN solutions, most notably those provided by NaaS vendors, provide expedited access into public SaaS solutions like

Dropbox or Salesforce, improving the overall latency and performance and boosting productivity.

**Programmatic API access for control and automation will be important to enterprises that are looking to integrate their overall SD-WAN offering into their network automation initiatives.**

**Cloud express lanes** provide SD-WAN platforms with the ability to conveniently connect via pre-linked express lanes such as AWS Direct Connect into Amazon and other public cloud infrastructure. This allows for expedited access to enterprise applications that might be running in these clouds.

**VPC support** is a feature we discussed earlier, and most SD-WAN implementations, by their software-centricity, should support installation within VPCs, but it doesn't hurt to have this explicitly on the list of capabilities when evaluating SD-WAN solutions.

## Advanced SD-WAN Capabilities

**Policy-based controls and service chaining** provide intelligent policy-based routing of traffic and the ability to insert virtual network services (VNF) like firewalls, content filters, proxies, and other L7 network functions into the traffic flow dynamically without disrupting the underlying network.

**Programmatic API access for control and automation** will be important to enterprises that are looking to integrate their overall SD-WAN offering into their network automation initiatives. In particular, this capability will be important for deploying SD-WAN into cloud workloads as connectivity endpoints and for general automation.

## MSP Features

**Multi-tenancy** is critical for MSPs rolling out SD-WAN to a large number of disparate customers. The ability to support more than a single tenant from the cloud control platform enables MSPs to scale and gain cost efficiencies. Solutions that dictate an installation per tenant will likely not work for MSPs in the long term. Advanced capabilities here might include control over resource consumption to ensure fairness between tenants, especially if there is cloud-based processing of network traffic.

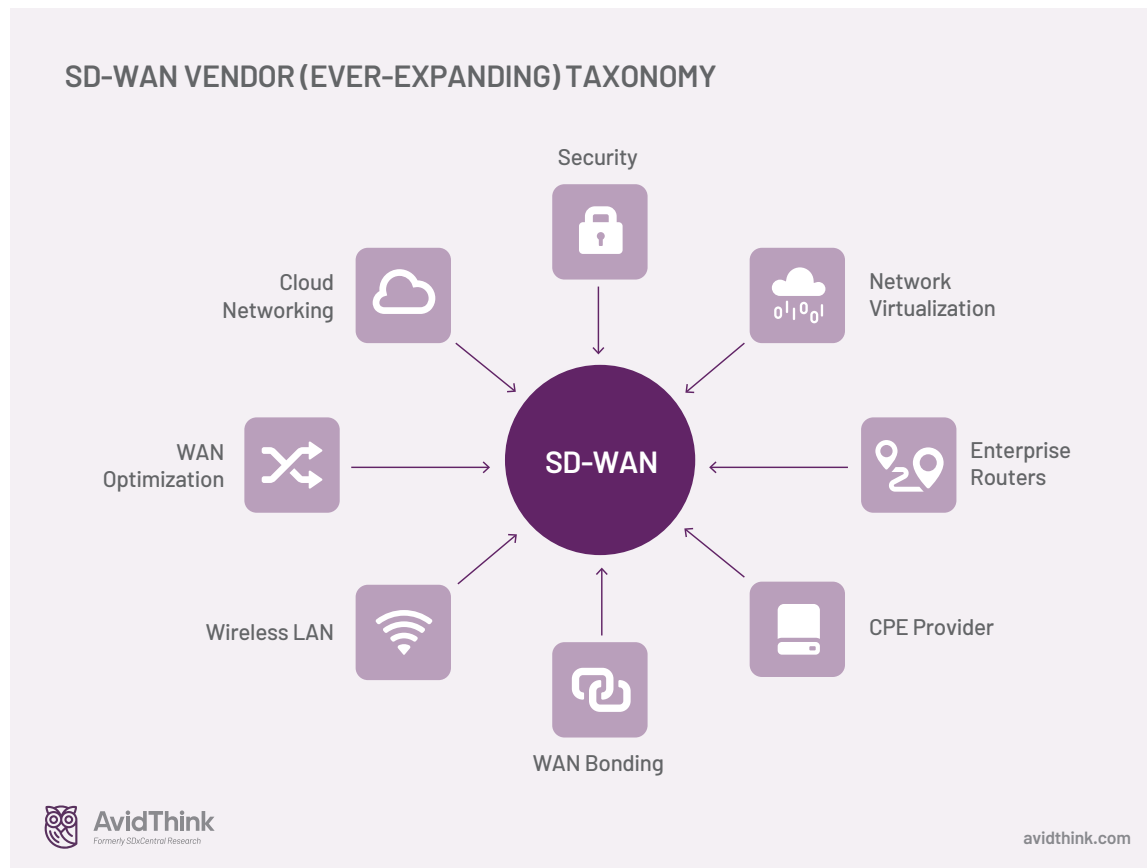
**White-label branding** will help the MSP build its brand and provide private-label SD-WAN offerings to its customer base. This capability includes supporting different color schemes, logos, and custom messages to the enterprise end user.

**A self-service portal** with fine-grained controls will be helpful in restricting the feature set for end users to those that are either currently supported or licensed for. Ensuring that each feature module is self-contained without external dependencies between modules will be important in ensuring a seamless experience.

In addition, the programmatic access described earlier will be important to tie the SD-WAN platforms into an MSPs existing orchestration system.

## SD-WAN Vendors and their Roots

Most of the SD-WAN vendors in today's market originated from adjacent markets, as we depict in this diagram:



Understanding how each vendor evolved into the SD-WAN space is important in the vendor selection process, as we generally find their feature set to be mature, and sometimes overly so, in one area, while lacking in others. Most vendors are working towards the complete feature set we described in the last section, so it's a matter of time before all of them achieve some parity, but until then, it's key to know where they came from.

- Cloud networking:** These vendors, think VMware NSX SD-WAN/VeloCloud, Cisco/Viptela, and Versa, will tend to have strong centralized cloud management with a platform that's a natural fit for SD-WAN. Sporting cloud-based controls and often starting with a clean slate, these vendors are able to focus on providing a centralized set of policies and building a foundation upon which L4-7 services can be inserted, either in the cloud or closer to the edge. For these vendors, the focus will be on building or partnering to obtain features and capabilities, such as WAN opt or security, that they don't already have.
- Network virtualization:** Some vendors, like Nuage Networks, started out focusing on network virtualization in the data center and extended their architecture to the edge. The benefit of such an approach is a more unified networking model that spans both data center and remote branch networks, allowing a uniform network and security policy to be placed on top of basic network connectivity. Similar to cloud networking providers, these vendors are building and partnering to provide rich L4-7 capabilities.

- **Enterprise routers:** Enterprise router manufacturers such as Cisco, Huawei, and Juniper will have SD-WAN platforms that provide a richer set of L3 routing capabilities, as well as more options in WAN connectivity. Solutions such as Gluware, formerly Glue Networks, which provide a control and management layer over existing branch routers will tend fall into this category as well. They may initially offer weaker centralized cloud or policy controls, but most of these solutions have been improving over the course of the last year. And Cisco is turning its existing ISR router pool into an advantage by allowing the installation of its SD-WAN Viptela solution onto a large number of existing platforms.
- **WAN optimization and WAN bonding:** Many of these vendors, like Aryaka, Citrix, Riverbed, Silver Peak, and Oracle/Talari, began by providing solutions to optimize the links between enterprise data centers and their edge networks. With sophisticated application classification and treatment of traffic – compression, local proxies, latency reduction – these vendors are leveraging their capabilities to build a richer SD-WAN solution by adding centralized cloud control, improved routing, and security capabilities.
- **Security, including Next-gen Firewalls and Unified Threat Management (UTM):** Many of the security vendors, like Juniper, have realized that moving into the SD-WAN space allows them to further consolidate their controls and integrate a larger portion of the enterprise WAN value chain. While we'll have a more detailed discussion around this later, we'll note that most firewall vendors, such as Fortinet, Barracuda, and Watchguard, are now claiming SD-WAN features. And those like Checkpoint and Palo Alto Networks who have not entered the SD-WAN space are partnering or positioning their solution as a good fit for SD-WAN deployments. By mixing in better L3 and routing capabilities and improving their centralized policy management, these platforms offer a good secure base upon which to build an SD-WAN solution.
- **Wireless LAN:** When wireless LANs extended past campus networks, WLAN vendors such as HPE/Aruba and Cisco Meraki added the ability for remote provisioning and network overlays. Over the past few years, these WLAN solutions have become more sophisticated with the addition of improved L3 routing and the insertion of L4-7 security and other services. In many branches such as for retail shops, or in SOHO, the WLAN is the single network service that forms the basis of their branch connectivity and as such, a natural candidate to build SD-WAN services on.
- **CPE Provider:** Traditionally a hardware centric solution, CPE providers whether optical or wired, such as ADtran, ADVA Optical, TELoIP, and RAD, are finding that entry into the SD-WAN market, either via partnering or by adding a software stack, could be lucrative for them. Many of these started software initiatives years ago to create value-add HW platforms and have refocused these efforts towards an SD-WAN feature-set. For these HW providers, understanding how to operate in a software and cloud world will be critical to their successful expansion into the SD-WAN market.

For more complex enterprises, SIs might be a good route as they can manage one or more SD-WAN solutions deployed across different service providers in different regions.

Regardless of their product roots, all these vendors have made and are making significant investments in their platforms to better address the SD-WAN requirements that enterprises are asking of them. The convergence between the vendors will ensure that when we re-examine the market, we'll see a closing of the gap between the capabilities of each of these platforms today and where they need to be for a comprehensive and competitive SD-WAN solution.

## SD-WAN Market Analysis

With that introductory primer on SD-WAN out of the way, we'll examine the latest in the SD-WAN marketplace in 2019, starting with the size and growth of the market.

### Sizing the SD-WAN Market

Numerous analysts have published market sizing reports, including **one from IDC** that shows the SD-WAN market will grow at a compounded annual growth rate of 40.4 percent rising from \$833 million in 2017 to \$4.5 billion in 2022. IDC also indicates that Cisco holds the greatest share in this market with its combined Viptela acquisition, Meraki, and likely the previous iWAN/ISR deployments. This is followed by VMware counting its acquisition of Velocloud, and then Silver Peak, Riverbed, Aryaka, Nuage Networks from Nokia and Versa.

At the same time, IHS Markit, another analyst firm, indicates that SD-WAN revenue reached \$284 million in the third quarter of 2018, a 23 percent sequential increase on the previous quarter. Their ranking placed VMware first with a 19 percent share, Cisco moved from 3rd to 2nd place with 13 percent revenue share while Aryaka, dropped to third. The top three were followed by Silver Peak, Huawei and Nuage Networks from Nokia.

And from a competitive standpoint, Gartner published its magic quadrant for the WAN Edge Infrastructure market, which includes SD-WAN, placing VMware on top in the leader quadrant, followed by Cisco, and then Silver Peak. However, Gartner's focus on feature-set was weighted heavily towards enterprise-centric features, as opposed to product fit for the MSP or CSP market. In general, there has been no clear research on the penetration rate nor revenue earned by the CSPs or MSPs offering managed SD-WAN.

### Ongoing Barriers to SD-WAN Adoption

The size of the market and healthy CAGR indicates strong SD-WAN uptake. While we've seen slight consolidation of the SD-WAN market with Oracle buying Talari late last year, there are still a lot of vendors in the space in early 2019. Even though recent surveys indicate positive returns from early SD-WAN deployments, there remains significant confusion about the different vendor SD-WAN offerings and their benefits. And unsurprisingly, there are continued concerns around the lack of skilled IT professionals who can effectively evaluate and deploy SD-WAN solutions.

The lack of in-house expertise is a significant issue, as it impacts the ability to choose the right vendor. These challenges point to the difficulty in taking the DIY approach. Even when enterprises employ in-house experts, there may be a sizable opportunity cost in applying in-house network talent to solve the SD-WAN problem when they could be applied to other more pressing issues. In conversations with enterprises, we have discovered that in-house talent with DevOps, WAN transport and mobile networks experience is extremely rare, again lending weight to the managed services approach.

### Role of Managed Offerings in Removing SD-WAN Adoption Obstacles

As a result, AvidThink expects the SD-WAN market to shift towards a managed model with enterprises turning to trusted service providers to manage SD-WAN deployments, selecting from pre-approved and integrated vendors offered by their CSP, from third-party system integrators (SI), or from a NaaS vendor.

For example, Viptela, now Cisco, calls out Verizon and Singtel as its service provider customers. VeloCloud, now VMware, names NTTData and Sprint among its customers. Nuage, which has reach into the CSPs through their Nokia roots, has BT, Telefonica, Telia, China Mobile International, China Telecom and more. Riverbed has Hong Kong-based Citic Telecom CPC's TrueConnect Hybrid service and Orange Business Services running on its platform, while SilverPeak claims Masergy, T-Systems and China Telecom as its customers.

This market has always been a sweet spot but has finally started to explode. The value proposition here is with small to medium businesses. They present a prime target for service providers, as typically they have no IT expertise but need to rely on consistent and secure connectivity for their digital assets and customer connectedness. One interesting nuance is most service providers are prone to a marketplace approach where they offer best of breed rather than a single vendor, so more

than one vendor will claim the same logo as their customer. Some SD-WAN vendors, like Versa Networks, started off with this target market as their primary focus. Versa now boasts Verizon, Century Link, Colt, KDDI, and Singtel as its customers.

For more complex enterprises, SIs might be a good route as they can manage one or more SD-WAN solutions deployed across different service providers in different regions. This can be particularly valuable to multinational organizations that need multiple carriers to mitigate infrastructure and business risk or have many diverse geographic locations. In addition, such complex organizations may have different divisions with different needs.

## SD-WAN Market Update – Key Changes Since Our Last Update

Beyond looking at obstacles to adoption, we're overdue for a quick update on the overall SD-WAN market since the last edition of this report 15 months ago. Much has happened, and we'll try to provide a succinct set of newsworthy SD-WAN highlights.

### SD-WAN M&A Activity

The acquisition of VeloCloud by VMware to the **tune of \$449 million** in November 2017 sent ripples through the networking market. When the acquisition was announced, VeloCloud boasted more than 1,000 customers using its SD-WAN, including many service providers such as AT&T, Sprint, DT, Telstra, Macquarie Telecom, and Windstream to name a few. Marquee enterprise customers included Brooks Brothers, which had deployed VeloCloud in **278 of its stores**. Since then, VeloCloud has become an integral part of VMware's network virtualization story as the rebranded NSX SD-WAN and is a key pillar in VMware's growth.

In June of 2018, Silver Peak announced a \$90 million strategic investment from TCV, an equity firm, who specializes in providing capital to growth-stage private and public companies in the technology industry and has backed Airbnb, Netflix, Splunk, Spotify, and Zillow.

Another SD-WAN and performance management vendor, Martello, sold \$7.5 million worth of shares in a non-brokered private placement in preparation for going public on Canada's TSX Venture Exchange.

On the service provider side, GTT Communications bought London-based Interoute, operator of one of Europe's largest independent fiber networks and cloud networking platforms, for \$2.3 billion in cash in February 2017. Both have managed SD-WAN services. GTT last year launched **its managed SD-WAN service** using VeloCloud's technology, while Interoute uses Silver Peak's technology for SD-WAN and WAN optimization.

And to cap off 2018, **Oracle acquired Talari** on November 15, 2018. Talari, which started out as a WAN multilink bonding vendor before moving into SD-WAN, had over 500 customers at the time of acquisition. Oracle intends to combine the Talari technology with its current session-border controller assets to help drive its telecom virtualization efforts.

### SD-WAN Strategies of Major Network Vendors



Since the **acquisition of Viptela** for \$610 million in 2017, Cisco continues to make significant product progress. In August 2018, **Cisco announced** that it was ready to upgrade more than 1 million of its existing routers to Viptela SD-WAN technology. The Cisco-Viptela software can run on all of Cisco's ISR and ASR routers, as well as ENCS 5000 routers that are younger than four years old. The company is also preparing for the next phase of integration, this includes adding the company's intent-based networking (IBN), called DNA Center, to Viptela. Once that occurs, SD-WAN customers will have additional capabilities such as software-defined access and will be able to extend security policy from the cloud, to the branch, to the LAN. In the meantime, Cisco has incorporated the OpenDNS Umbrella platform, acquired for **\$625 million** in 2015, and Viptela for unified SD-WAN security and is rumored to be wrapping its Meraki platform, **acquired for \$1.2 billion** in 2012, into SD-WAN as well.

On the customer front, at the time of its acquisition by Cisco, Viptela's technology was deployed with 200 customers. Since Viptela joined Cisco, that same SD-WAN product has been deployed to about 1,000 customers. SiFy, an Indian service provider that delivers telecommunications services over a common telecom data network infrastructure reaching more than 1,550 municipalities in India, launched an SD-WAN service built on Cisco's SD-WAN technology. Service providers are also starting to add third-party network functions onto their SD-WAN offering to build their own customized platform just as BT has done with Cisco.

## Juniper Networks



Juniper originally announced its Cloud Enabled branch strategy in 2016 but has shared no major announcements since then. More recently, it has been talking up Contrail SD-WAN. This consists of a variety of products: it uses Contrail Service Orchestration to design, secure, automate, and run the entire service life cycle across NFX Series Network Services Platforms, MX Series Routers, SRX Series Services Gateways, and vSRX Virtual Firewall.

Its first public customer, Alaskan service provider GCI, has deployed Juniper's Contrail SD-WAN as part of the carrier's virtual managed service platform, CloudFlex SD-WAN. And in September of 2018, **Vodafone added Juniper's offering** to its overall Ready Network SDN portfolio of multiple vendor offerings.

## Huawei



Huawei suffered politically in 2018 and the beginning of 2019 is not looking any better. Despite this their revenues carry on growing and market penetration continues across their networking product. The **IHS Markit Worldwide SD-WAN vendor revenue** report referenced earlier described Huawei's rollercoaster ride. Having recovered from a bad Q1 2018, which saw a 45 percent drop from Q4 2017, Huawei climbed to 5th position in Q3 2018 with almost five times the growth from the year before and a 98 percent growth on Q2 of 2018. Huawei also signed a **deal with Telecom Italia** to offer SD-WAN services, and in 2018 drove multiple partnerships with other vendors including **Riverbed, F5, and InfoVista**.

## Nokia



Nokia continues to push its Nuage Networks SDN offering across the globe. From expanding its footprint within Asia with **Globe Telecom** and **China Mobile**, to taking on Cisco and VMware with its **recent upgrade to SD-WAN 2.0**. Nuage Networks' strategy has always been an end-to-end play from the data center to the edge, and we expect to see continued progress by Nuage on that front, as well as with 5G and IoT, given Nokia's push into both. In addition, Nuage Networks' focus on carriers contrasts with some other SD-WAN vendors and it remains to be seen if they can effectively gain a stronghold through their managed service provider partnerships.

## VMware



By acquiring Velocloud, VMware has made its intentions of dominating this space very clear. In fact, the latest research from IHS Markit shows VMware's NSX SD-WAN leading the SD-WAN market and VMware intends to have it **stay that way in 2019**.

As part of its push of networking from data center to edge, NSX SD-WAN complements their strong data center footprint with a robust edge offering. This closely mirrors the Nuage Networks storyline and provides validation for the encompassing data-center-to-edge single-fabric, single-policy approach. The difference here is VMware's incumbency and dominance in the enterprise data center versus Nuage/Nokia's strength in its service provider market.

Regardless, the unified approach allows VMWare to talk now about simplified branch and end-point to facilitate access to cloud, private DC, and SaaS applications. It claims that its edge strategy includes blending hybrid cloud, multicloud, and native cloud technologies with new edge capabilities powered by its NSX SD-WAN offering. At VMWorld in August, CEO Pat Gelsinger announced a new product called Project Dimension. It will combine VMware Cloud Foundation with a hybrid cloud control plane to deliver software-defined data infrastructure as an end-to-end service that's operated by VMware. Project Dimension, which went into **beta in November 2018**, also uses NSX SD-WAN by VeloCloud to enable connectivity with other regions such as data centers or cloud. And in September, VMware **announced a partnership with Microsoft** to incorporate NSX SD-WAN into Microsoft Azure's Virtual WAN, enabling branch connectivity to the Azure cloud.

### SD-WAN Updates at Major Service Providers

Momentum at major service providers has not slowed with continued rollouts throughout 2018. At the same time, we notice that most mid-size to large service providers continue to offer more than one SD-WAN vendor in their marketplace, giving their customers choice.



For example, AT&T offers multiple flavors of SD-WAN. They support multiple solutions in order to match the appropriate technology to meet their customers' needs. In July, they announced an all-Cisco offering using Cisco's ENCS that will provide AT&T customers in nearly 90 countries and territories with a fully virtualized platform based on the Cisco Enterprise NFV architecture. And these customers will also get access to a library of VNFs with the first two VNFs provided by AT&T for routing and security.

This is in addition to FlexWare, AT&T's existing NFV platform for businesses, which is available in more than 200 countries. Unlike the ENCS platform which is all Cisco, the FlexWare platform is a heterogeneous offering with VNFs from many vendors. It offers routing VNFs from Juniper and Cisco and includes security VNFs from Palo Alto Networks, Check Point, Juniper Networks, and Fortinet. It also offers a WAN optimization VNF from Riverbed and SD-WAN from VMware.

The carrier's expansive approach to NFV can be rationalized from the projected cost savings they hope to recoup from their SDN, NFV, and 5G investments. AT&T hopes these investments will eventually allow the carrier to reduce capex that is currently running at an escalated clip.



Meanwhile, London-based BT is accommodating its larger enterprise customers who want to continue using Cisco hardware and software, even as they evolve toward virtualization. BT will provide Cisco's ENCS hardware and network services orchestrator software for large enterprises that want proprietary technology to deploy VNFs such as routing, acceleration, and security across their global footprints. This is in addition to the BT-managed service platform where it will continue to support VNFs from multiple vendors as well as **BT's original selection for global SD-WAN partner** on their Agile Connect platform, Nuage Networks.



CenturyLink began their **SD-WAN offering a couple of years ago**, by offering Versa Networks products. More recently, like many service providers around the world, they **added Cisco-Viptela as another option**. The goal in doing this was to improve vendor redundancy and increase customer choice. AvidThink expects that CenturyLink, like most other vendors, is working on its own uCPE multivendor strategy as well.

Comcast

COMCAST  
BUSINESS

Comcast continues to drive an offering to their broadband providers using the Versa product, although they do run it as a white-label offering. And they have hinted at adding VNFs from other vendors to their platform and launching **uCPE that they own** sometime in 2019.

SiFy Technologies

sify

India's SiFy technologies — as noted under the Cisco update — launched an SD-WAN service built on Cisco's technology in August. In September, they announced that Versa Networks was also a vendor they were adding to their Cloud@Core offering.

Sprint

Sprint

Sprint launched its managed **SD-WAN offering in May 2017** with VMware VeloCloud. However, they recently decided that they would bring in additional SD-WAN services from a candidate list that includes Fortinet, Cisco Meraki, Cisco-Viptela, and Silver Peak, indicating that a multi-VNF solution on top of a uCPE that they own and control would give them maximum flexibility and address multiple customer needs.

Telefonica

Telefonica

Telefonica has extended its existing Nuage Networks SD-WAN infrastructure to include SDDC as well. The Spanish service provider is using Nuage's virtualized network services (VNS) to connect users and applications at any location, including connecting branches to the data center. By adding the SDDC connection, the carrier can now extend the WAN to be able to establish that connectivity to more than just branch-to-branch but all the way from the branch, to the edge, to the data center.

Verizon

verizon

Verizon has engineered creative ways to entice customers to start experimenting with their NFV offerings, including SD-WAN. Verizon Enterprise Solutions has rolled out a pay-as-you-go pricing scheme for its virtual network services (VNS) platform. It offers a single line-item pricing model. This service relies on the carrier's universal customer premises equipment (uCPE) as the basis for service delivery. Previously, enterprises would need to order and pay for their applications, management, and CPE separately. The new offer consolidates the procurement and billing aspects into a single bill. And SD-WAN and security were two early favorite applications of enterprise customers.

Verizon continues to offer its Cisco-Meraki based SD-WAN service to wholesale customers. This is designed to allow wholesale customers more control over internal network operations and costs. Verizon can also capitalize on a new revenue stream based on the common SD-WAN platform.

Vodafone

vodafone

Vodafone also is working closely with Nuage Networks for its Project Ocean. It aims to bring SDN and SD-WAN technology to multiple networking initiatives to improve network automation, virtualization, and cloud infrastructure. The SDN deployments are part of the larger Vodafone Ocean framework for NFV transformation, and as mentioned previously, Vodafone have already incorporated Juniper's solutions into their Ready Network portfolio of products.

## Key SD-WAN Topics in 2019

In addition to the key market updates from the service providers and vendors, there are a number of hot topics in SD-WAN that enterprise and service providers making SD-WAN decisions need to be aware of. We'll cover the top items here:

### Security – NGFW vs SD-WAN

One of the key elements of discussions around SD-WAN is the topic of security. In survey after survey, enterprises rate security as one of the top features for SD-WAN, right after multilink support. As such, this creates a situation where edge firewalls, or next-gen firewalls, become viable platforms for SD-WAN deployment. In essence, next-gen firewalls (NGFW) that can handle multiple links, provide some QoS and routing, as well as deliver centralized cloud configuration and control become SD-WAN solutions. In many situations, for a specific platform budget, optimized security platforms can outperform uCPEs running VNFs, especially when measuring encrypted, inspected traffic. Unsurprisingly, just about every NGFW vendor has declared SD-WAN solutions, with a few exceptions like Checkpoint and Palo Alto Networks that have steadfastly maintained their role as a NGFW VNF partner to SD-WAN platforms. This sets up an interesting battle ahead between the security vendors and the SD-WAN vendors. For end customers, they need to decide whether an SD-WAN solution will provide enough security or a NGFW will support enough SD-WAN features to meet their business needs.

The carrier's expansive approach to **NFV** can be **rationalized from the projected cost savings** they hope to recoup from their SDN, NFV, and 5G investments.

### uCPE – Universality and Support Issues

As we discussed earlier, CSPs today are building out their uCPE strategies. The goal here is to own the underlying uCPE platform, preventing lock-in by any SD-WAN vendor and giving the CSP ability to offer different VNF offerings, including SD-WAN and other L4-7 functions. Unfortunately, the universal CPE is anything but. There are multiple vendors, including Intel and Dell, that are **trying to define a standardized uCPE platform**, as are the Open Compute Project. But the reality is that we'll see disparate platforms from these vendors and differing white box flavors from network equipment providers and the ODMs. There's also a lack of a unified uCPE OS. Linux Foundation and AT&T promised the release of DANOS based on AT&T's dNOS operating system in late 2018, but as of early 2019 we have yet to see anything.

A related issue has been surfaced by the ODMs and contract manufacturers. With proprietary or integrated platforms from networking vendors, troubleshooting, optimization, and support were completely managed by vendors. With the move to a uCPE, CSPs are finding themselves inadequately staffed and lacking the domain knowledge to perform this function. AvidThink's conversations with the ODMs indicate that they might be willing to step up to fill some of this role but will do so begrudgingly.

### SD-WAN Standardization and Orchestration

Along with uCPEs, and how to implement control and orchestration across these platforms, CSPs are also grappling with the **topic of SD-WAN interoperability**. The reality is that most enterprises don't yet see a need for data plane interoperability since they will be standardizing on a single SD-WAN vendor. At the same time, CSPs that are trying to build out their own uCPE platforms to prevent lock-in, need consistency and commonality around the management and control plane, so they can bring these platforms into their custom orchestration systems. There are efforts to standardize these northbound APIs by ONUG with its **Open SD-WAN Exchange (OSE)** and the **MEF's effort** on using the Lifecycle Service Orchestration (LSO) Presto API as a standard northbound. Their efforts are still far from complete and remain a work in progress. However, both of these efforts are important in achieving portability across and reusable automation for SD-WAN deployments.

## Multicloud Support – SD-WAN as Cloud Gateways

One of the key trends in cloud deployments today is the support of multicloud or cross-cloud applications and data transfers across VPCs. Historically, routing and NATing gateways or standard VPN gateways would perform the role of connecting external sources to these VPCs within public clouds. Now, **SD-WAN solutions are being considered for this role** because of their ability to create a consistent connection and access policy, as well as their potential WAN optimization capabilities. Whether SD-WANs end up the preferred connectivity platform for multi-cloud, and how serverless fits in is a topic to watch in 2019.

## SD-WAN Deployment Architecture and Topology Models

A topic which used to garner more attention was the configuration of where the control plane and data plane elements for an SD-WAN deployment were located. Whether the bulk of the work was done in a central cloud, or a central office/point-of-presence (CO/POP), or on premises was a key differentiator in vendor strategies. Today, some vendors have a flexible architecture that allows different functions to run in different locations. Some have collaborating applications that perform a subset of functions on-premises for lower latency while performing more CPU-intensive work in the central cloud, where economies of scale can be leveraged. The NaaS providers will tend to favor cloud deployments, while the CSP-friendly solutions will tend to offer both CPE-based VNFs as well as VNFs that can run in a CO/POP. Most of the solutions will run on premises on their own CPE or a uCPE. In addition, some SD-WAN solutions are not only offering express lanes to public clouds or SaaS solutions, but also their own improved private Internet backbone core that they claim can offer MPLS-like QoS using direct links. We'll see if these added capabilities sway enterprises users to pick SD-WAN solutions on the strength of enhanced features.

## SD-WAN, Edge, Mobile and IoT

Related to multi-cloud support is the extension of the network fabric all the way to the edge. Will SD-WAN technology become the universal fabric from the data center, to the enterprise edge, and all the way to the mobile device and IoT edge? And in a massive deployment like that, will the SD-WAN control layer scale sufficiently? AvidThink's expectations here is that SD-WAN vendors will have to invest in AI/ML to augment their telemetry and monitoring solutions on this space. Troubleshooting large SD-WAN fabric meshes could get quite gnarly without algorithmic and machine assistance. Likewise, the importance of an intent-based approach that focuses on the high-level business intent instead of trying to configure at the object level will be an important part of this capability.

## Ongoing Opportunities in the MSP market

As we've discussed, the **MSP market for SD-WAN** should be burgeoning. And in addition to just providing managed services, SD-WAN can also enable an OTT model, where say a CSP can offer managed SD-WAN in locations they don't have circuits in. However, even though SD-WAN enables an OTT model, incumbents might still have an advantage when it comes to physical deployment of the CPE. An SD-WAN deployment after all still needs a physical connectivity point in a remote location. Incumbents can offer a complete end-to-end solution that includes sending out and provisioning remote CPEs as well as bundling in connectivity. While OTT providers can send out their own pre-provisioned or zero-touch provisioning CPEs, they may be disadvantaged when it comes to troubleshooting connectivity problems or being able to provide end-to-end visibility across all connectivity layers. In any case, we see SD-WAN as a potential game-changer for service providers who can get their own infrastructure ready to deploy scalable solutions, and those further along with cloud architectures and NFV deployments will stand to gain.

There are certainly other topics relevant to SD-WAN that will likely become essential in 2019. Such topics include the co-evolution of the residential vCPE offering, as well as how the branch will integrate with SD-WAN. We'll continue to cover these topics on the AvidThink site as well as in our writings for other leading publications like SDxCentral.

## Conclusion – SD-WAN Continues Ramping in 2019

Since we published our last report 15 months ago, the SD-WAN market has experienced rapid growth. SD-WAN will continue to mature in 2019 driven by the technology's inherent benefits of improved reliability, increased bandwidth, and lower costs. And it's now clear that SD-WAN is favored by organizations of all sizes and across industries.

For enterprises looking at getting into SD-WAN, they should use our list of core SD-WAN attributes to develop a shortlist and benchmark offerings. Beware of SD-WAN-washing by vendors repackaging legacy offerings. Further, enterprises need to decide if they will be taking a DIY route or a managed route. For most, a managed route is likely the right answer.

For service providers and SIs selecting the right SD-WAN vendor partner or partners, our recommendations are the same. However, there are a list of other capabilities that we have not discussed at length that MSPs will need to be cognizant of. These include the ability to integrate the solution into their orchestration frameworks, the multi-tenancy capabilities, and white-label branding.

SD-WAN is a powerful and promising technology for IT teams at enterprises and service providers that can greatly improve the capabilities, performance, and reliability of WANs and will significantly broaden the number of locations that can be provided with enterprise-quality service. And with its ability to now reach into cloud platforms and eventually to the mobile and IoT edge, the future of SD-WAN is looking very bright.



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