The Critical Role of Hybrid Networks in SD-WAN Deployments

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INTRODUCTION

Software-defined WAN is revolutionizing the business WAN space with its ability to bring virtualization to the edge. In a recent Frost & Sullivan WAN survey, 7% of business IT decision-makers stated they have deployed SD-WAN; and 23% of them stated they plan to deploy SD-WAN in the next 12-24 months. 2017 revenues for the SD-WAN market exceeded $300 million globally, and are expected to grow at a CAGR of 38% to reach $1.5 billion in 2022. The managed SD-WAN market opportunity, which includes the SD-WAN overlay and underlying transport networks, is even larger, with market revenues forecast to exceed $3.0 billion in 2022.

Key reasons driving adoption of SD-WAN among businesses include cost savings, network agility, application-aware routing, optimized cloud connectivity, and enhanced application and performance visibility. The benefits of SD-WAN to branch internetworking are undeniable. The ability to dynamically route traffic on the most optimized transport path (public and private), based on pre-defined policies and the performance of the WAN connections, is dramatically different from the previous static hybrid WAN deployments. The keyword here is "hybrid," as the market gets crowded with the hype about broadband-only SD-WAN deployments. Frost & Sullivan believes that most businesses will retain private WAN services such as Multi-Protocol Label Switching (MPLS) and Ethernet as part of their WAN strategy.

Furthermore, SD-WAN technology is a subset of the broad software-defined networking and network function virtualization technology trends the market is witnessing as businesses plan their digital transformation strategies. Therefore, it is important to evaluate SD-WAN solutions in a holistic manner—one that fits into your business hybrid networking, and Software Defined Networking (SDN) and Network Functions Virtualization (NFV) strategy.

In this paper, we take a look at the trends driving SD-WAN deployments; the significance of the convergence of SDN, NFV and SD-WAN; and how AT&T's integrated, hybrid approach to SD-WAN can help your organization.

WHY SD-WAN AND WHAT IT MEANS TO YOUR ORGANIZATION

An SD-WAN architecture uses SDN principles to separate the data plane from the control plane in the WAN. It abstracts the underlying transport networks (MPLS, Internet, Ethernet, wireless); and shifts control intelligence from customer premises equipment (CPE) or edge devices into a centralized, software-based controller. A graphical user interface (GUI)-based management platform enables network administrators to define application-specific business policies, which the controller translates into routing policies enforced in the edge devices.

Key business benefits of an SD-WAN deployment include:

- Reduced network costs as they no longer need to rely on static, expensive, private links only; and instead can use a combination of private and public links

- Increased agility as network policies can be centrally defined in a software manner and applied to edge devices

- Faster deployment of branch sites as the edge device comes with zero-touch orchestration that can be set up in minutes, and the branch can be operational using wireless links

- Application-aware routing feature of SD-WAN enables businesses to optimize cloud connectivity, as the edge device recognizes traffic that can be sent directly to the Internet over Internet links, versus that which is intra-network and can go over public or private links

Figure 1 summarizes the compelling reasons businesses deploy an SD-WAN, as captured in a recent Frost & Sullivan SD-WAN end-user survey.

Figure 1: Key Reasons Compelling Businesses to Adopt SD-WAN
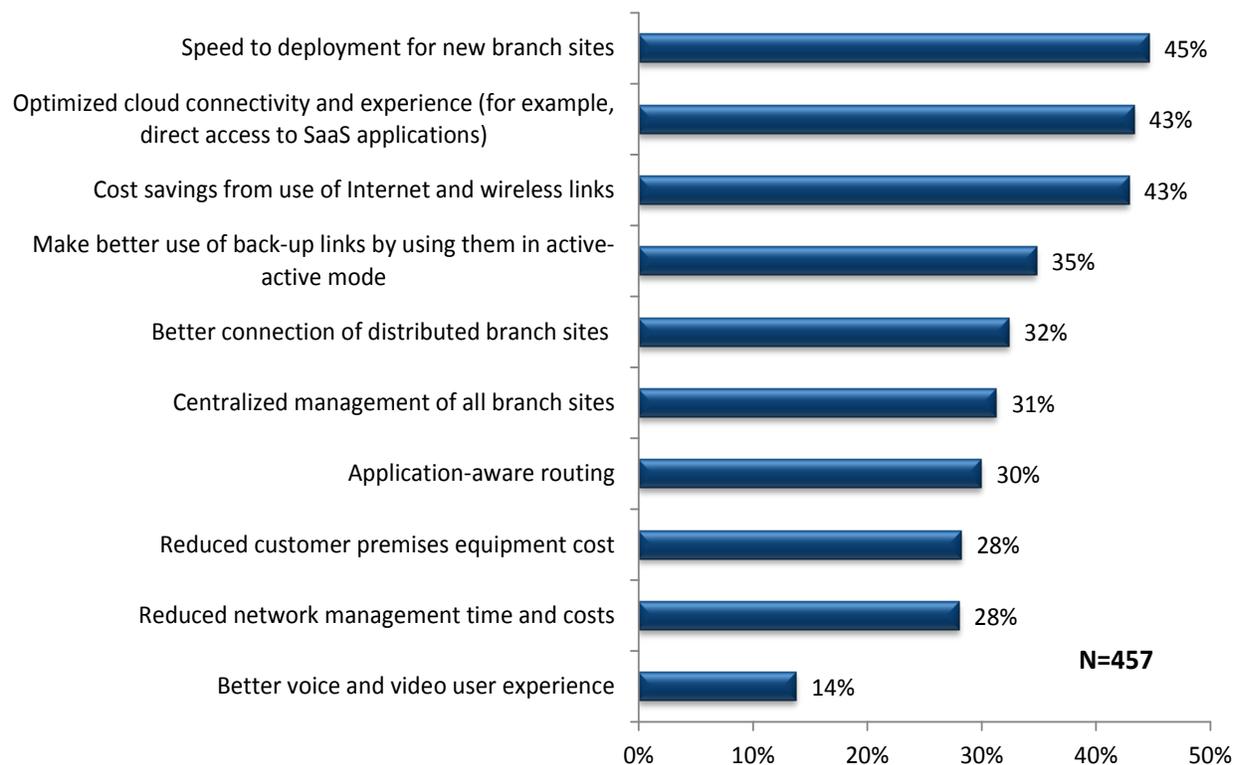
Source: Frost & Sullivan SD-WAN End User Survey

As SD-WAN adoption continues to grow, businesses are increasingly showing a preference toward managed SD-WAN services versus the do-it-yourself (DIY) approach. In a recent Frost & Sullivan SD-WAN survey, nearly 50% of the IT decision makers stated they would buy SD-WAN from their existing MPLS VPN service provider if they can procure, deploy and manage the SD-WAN and hybrid access services. This is because the WAN links are a critical part of the SD-WAN solution. While the ability to software-define the WAN is a revolutionary approach to WAN deployments, compared to the hardware-centric approach in the past, deploying and managing the underlying WAN infrastructure involves some heavy lifting from the IT departments. This is especially true as hybrid networks will continue to be an integral part of SD-WAN deployments.

THE VALUE OF HYBRID APPROACH TO SD-WAN DEPLOYMENTS

The introduction of SD-WAN technology challenges the status quo of MPLS-only WAN deployments. The ability to aggregate multiple high-speed broadband links, and apply QoS on traffic routed on Internet links, reduces the reliance on expensive, private links. However, the argument about SD-WAN completely replacing MPLS links in the business WAN is far from the reality. Frost & Sullivan believes that private WAN links, MPLS and Ethernet, being the most dominant services in business WANs today, will continue to coexist alongside Internet and wireless links in SD-WAN deployments.

The reason is that some business applications, especially real-time apps such as VoIP, need the reliability features offered by MPLS links. MPLS supports traffic prioritization by allocating different types of traffic into different Class of Service (CoS) buckets to ensure network and application performance. This is critical for real-time enterprise applications such as voice and video services. Additionally, MPLS VPNs enable businesses to simplify network management, allocate bandwidth dynamically, support remote user connectivity, monitor network performance through a customer portal and take advantage of the managed WAN offering from the service provider. MPLS offers the highest level of service level guarantees for network availability, packet loss, congestion, jitter and latency, as the service provider has complete visibility and control over how the data packets get routed.

While network-based, site-to-site MPLS VPN enables businesses to connect headquarters and branch locations over a completely private IP network, they are expensive to deploy. IP VPNs offer an inexpensive alternative to connect remote locations or users to corporate resources over public Internet. IP VPNs are CPE-based VPNs that are provisioned using tunneling protocols for emulating a private network on public infrastructure (public Internet and private IP). The various tunneling protocols include IPsec, Secure Socket Layer (SSL), Layer 2 Tunneling Protocol (L2TP), and Point-to-Point Tunneling Protocol (PPTP).

IP VPNs provisioned over the ubiquitous Internet makes them a great choice for unmatched global network access to connect distributed locations and remote users. Businesses could either create site-to-site CPE-based IP VPNs to connect distributed locations and/or implement a remote access client on the end-user device to enable remote/mobile user connectivity to corporate applications. Businesses can also use a combination of MPLS VPNs and IP VPNs to ensure the security and reliability of corporate VPNs for remote users while they access cloud-based services.

The decision between private MPLS VPNs and public IP VPNs boils down to the level of security and reliable performance the CIO of a business wants from the network; some applications can be trusted to public IP, while others justify investment in MPLS. Both continue to coexist, with customers making the choice to use hybrid IP VPN/MPLS VPN networks to run their business applications, fully aware of the pros and cons of the two services.

The SD-WAN overlay functionality abstracts the transport networks and provides dynamic multipath VPN capabilities to the WAN. This means that businesses can benefit from the feature-rich capabilities and reliable performance of MPLS for certain applications, while using higher bandwidth, inexpensive Internet links for other applications, by embracing a hybrid approach.

As your organization chooses hybrid networking along with SD-WAN, it is prudent to consider evaluating a managed SD-WAN service, wherein the service provider acts as single point of contact for the complete

SD-WAN solution, including the SD-WAN appliance, software license, WAN services, and managed services. A Managed SD-WAN service can either be fully-managed, with the provider managing all aspects of the solution, or partially-managed/co-managed, with the internal IT team retaining control over some aspects.

SDN, NFV AND SD-WAN ARE CONVERGING

SDN and NFV technologies have been brewing in service provider networks and data centers for a long time. However, these two technologies have struggled to make inroads into business WANs. This is changing, as leading network service providers (NSPs) have launched SDN-based network services to offer dynamic bandwidth services. A number of NSPs in the market offer customers the ability to procure bandwidth on-demand across their MPLS, Ethernet and DIA footprint.

Additionally, NFV-based services, which allow SD-WAN administrators to dynamically choose and deploy network functions such as router or WAN optimization in software, are slowly making their way into business WAN deployments. The virtual network services are delivered using a universal CPE (uCPE), which is an x86 based hardware appliance that can host multiple virtual network functions (VNF), thus eliminating the need for dedicated hardware for each network function. While SDN and NFV, combined, represent a compelling value proposition for business WAN architectures, SD-WAN enhances the value. With the convergence of SDN, NFV and SD-WAN, businesses can use SD-WAN technology to route traffic based on pre-defined policies, change the underlying bandwidth in real-time, and quickly deploy network functions (virtual firewall, virtual WAN optimization, etc.)

An SD-WAN can be deployed using a dedicated hardware appliance or as a VNF. Service providers with an advanced SDN and NFV strategy are currently embracing both hardware and software based models, with plans to offer SD-WAN as a VNF on their uCPE in the future. As you evaluate a managed SD-WAN service, it is critical to consider a service provider that offers a broad range of options to support your organization through the SD-WAN journey.

AT&T'S INTEGRATED APPROACH TO SD-WAN

AT&T announced its SD-WAN offering in October 2016, based on technology from VeloCloud. The company offers a broad range of choices for businesses at different stages of the SD-WAN adoption journey.

CPE-based Solution

The CPE-based offer is an over-the-top (OTT) managed SD-WAN service, which uses VeloCloud CPE and SD-WAN software to create an overlay network over any public or private MPLS network. Customers can use a wide variety of AT&T's services—MPLS, Dedicated Internet Access (DIA), Broadband, Wi-Fi, wireless—or bring their own networks to connect locations. The overlay network encrypts traffic over public links. The service is available globally in fully-managed or co-managed options.

Figure 2, below, shows AT&T's OTT Managed SD-WAN Solution Architecture.

Figure 2: AT&T's Over-the-top Managed SD-WAN Solution Architecture
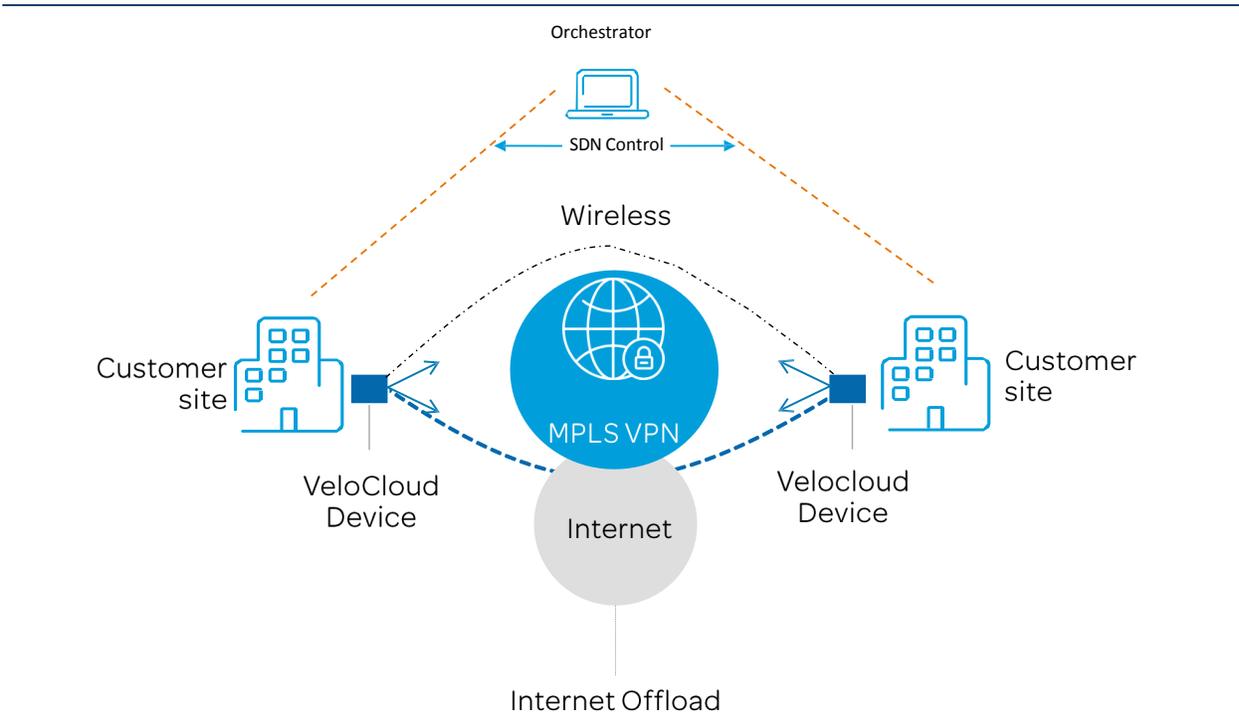
Source: AT&T

The OTT managed SD-WAN service is available through AT&T's global direct and indirect channels, in 52 countries. The service is available in a subscription model where the customer pays the monthly recurring charge for the managed SD-WAN service and applicable bandwidth fees. Customers have the option of making an outright purchase of the CPE. Contract length is typically a 1-3 year term.

Network-based Solution

The network-based solution utilizes AT&T's FlexWare device—a universal CPE that can run multiple virtual network functions (VNF)—to host VeloCloud SD-WAN VNF.

Key highlights of the network-based SD-WAN solution include:

- Customer edges can either do a direct Internet offload, or connect to the AT&T Integrated Cloud (AIC) for traffic to be securely routed on the AT&T MPLS VPN network. This ensures that core characteristics of MPLS—Class of Service and multicast features, for example—are retained, unlike the case in an overlay network.

- The network-based service uses SD-WAN gateways distributed across AT&T's MPLS network in AIC nodes, and a cloud-based orchestrator to route traffic. This offers inherent resiliency in that each SD-WAN site will be assigned to primary and backup SD-WAN gateways and orchestrators. If the primary SD-WAN gateway fails, the traffic will be automatically rerouted to the backup SD-WAN gateway. Similarly, if the primary orchestrator fails, the customer can simply logon to the backup orchestrator.

- Additionally, the SDN-enabled AIC nodes ensure that the gateway bandwidth is automatically adjusted if site bandwidth changes. This is a co-managed service, with AT&T responsible for the installation of the FlexWare device and SD-WAN VNF, monitoring of those network elements, and trouble resolution. The customer would be responsible for the SD-WAN policy administration via the SD-WAN portal. AT&T makes available to customers training on the SD-WAN and policy management.

- With AT&T's SD-WAN Network Based option, customers can easily mix and match SD-WAN and non-SD-WAN sites. The ability to mix and match site types allows customers to gradually introduce SD-WAN into their networks.

- AT&T Network-based option is available for US sites as of January 2018. Availability for international locations will begin in March 2018. The company is planning on expanding SD-WAN gateways to 49+ global AIC nodes in 2018.

Figure 3 shows AT&T's network-based SD-WAN solution architecture.

**Figure 3: AT&T's Network-based SD-WAN Architecture**
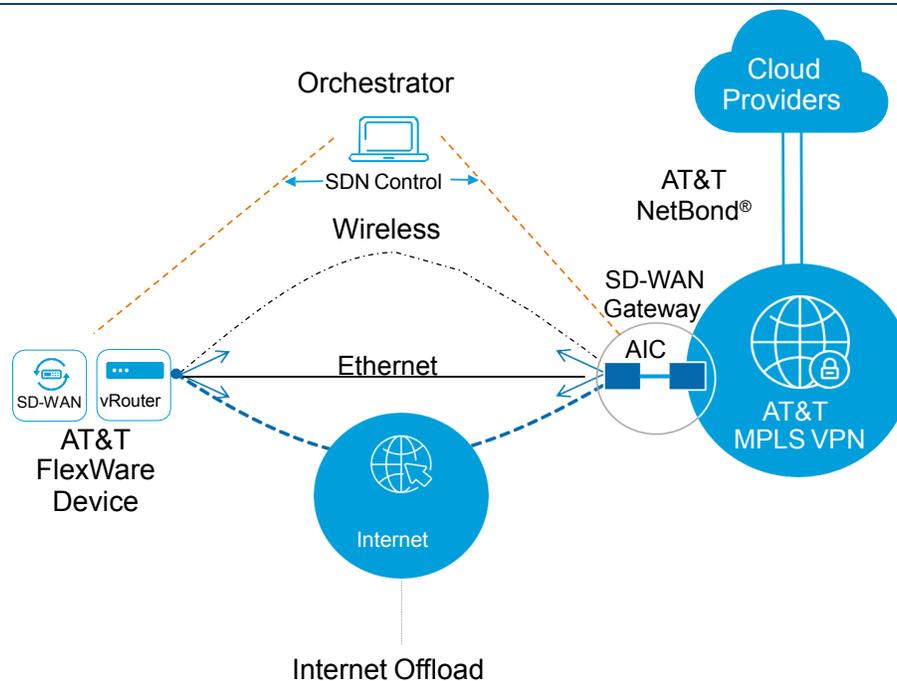
Source: AT&T

AT&T's network-based approach to SD-WAN builds upon the investments the company has made in SDN and NFV technologies. The company's SDN-based Network on-demand offering gives customers the ability to procure dynamic bandwidth across AT&T's Switched Ethernet and DIA services. The FlexWare service offers network functions on-demand through a catalog of best-of-breed solutions, and runs them as virtual machines on a universal CPE. The ability to run SD-WAN functionality as a VNF on the FlexWare device eliminates the need for a separate CPE, and allows business customers to seamlessly integrate SD-WAN functionality into their virtualization strategy.

AT&T's Hybrid Networking and SD-WAN

As detailed in the earlier section of this paper, most businesses have some form of hybrid networks (any combination of MPLS, Ethernet, and IPsec VPNs) in place already. To ensure a phased approach to SD-WAN, AT&T encourages its MPLS & IPsec customers to use hybrid networking alongside SD-WAN, instead of a rip-and -replace approach. Existing AT&T MPLS VPN (AVPN) and AT&T Network-Based IP VPN Remote (ANIRA) service customers can continue to keep MPLS and IPsec sites, and add SD-WAN at select sites, thus making the evolution to SD-WAN easy. Figure 4 shows AT&T's hybrid networking and SD-WAN solution architecture.

Figure 4: AT&T's Hybrid Networking and SD-WAN Approach
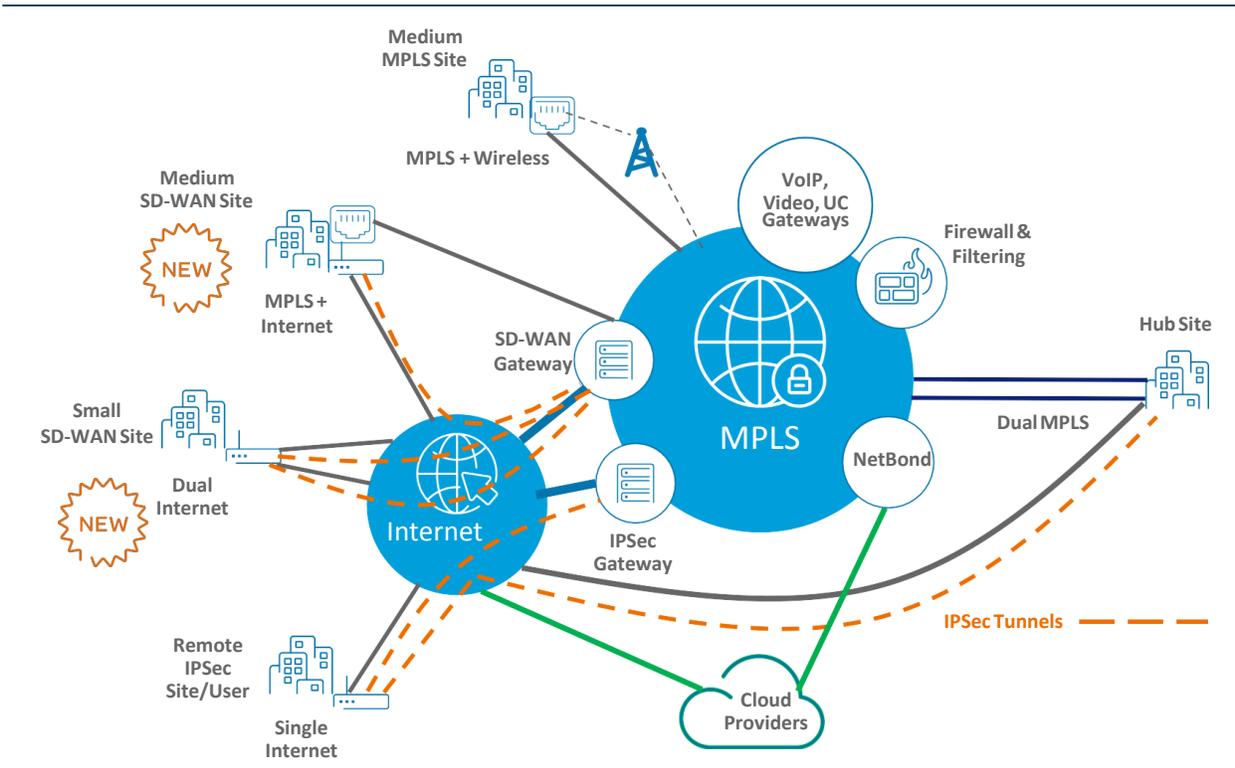
Source: AT&T

AT&T offers management & visibility into all the services via Business Center online portal. For customer sites using AT&T MPLS VPN and SD-WAN, FlexWare device is available for customers that are ready to make the move to a virtual edge. The hybrid approach, with pricing ranges from low priced IPsec sites, medium priced SD-WAN sites, and higher priced MPLS sites, offers customers the choice to deploy services that best suit their price points and application requirements.

To learn more about AT&T SD-WAN, please visit www.att.com/sdwan.

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