Utilizing SD-WAN to Optimize Application-Driven Policy Management

Sponsored by: Windstream

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October 2017

IN THIS WHITE PAPER

This document is the third in a series of SD-WAN white papers commissioned by Windstream. This white paper focuses on how SD-WAN can optimize application-specific policy management for a distributed enterprise seeking to drive sustainable competitive advantage through digital transformation.

IDC OPINION

Digitally transforming the business improves efficiencies, creates new revenue streams, and drives better customer/user engagement and experience. In today's world, digital transformation is a critical source of competitive advantage for any enterprise. Enterprises have no option but to adopt digital transformation to survive and thrive.

Cloud computing is a key pillar of the drive toward digital transformation. In some cases, enterprises have decided to make the shift to the cloud without a change to the wide area network (WAN) infrastructure. They have continued to use private connectivity options such as MPLS to connect enterprise users to cloud applications. This is not efficient, has a negative impact on application performance, and essentially offsets the advantages of moving to the cloud in the first place.

As applications move to the cloud, the wide area network needs to evolve to support the new paradigm. The WAN needs to address application-specific requirements, such as performance, security, reliability, and availability, and prioritize them for mission-critical applications irrespective of their location — the datacenter or in the cloud. Satisfying these policies for all applications is necessary not only to enable operational efficiency (rationalize WAN transport costs) but also to drive the desired customer or user experience that is so central to an enterprise's digital transformation goals.

As traffic across the WAN continues to grow unabated, more business processes are digitally transformed, and applications supporting these processes are increasingly delivered from the cloud, the need for optimized utilization of available network bandwidth assumes even greater importance. The ability to control and manage application traffic at a granular level to ensure applications critical to the enterprise's mission, regardless of location, receive the requisite priority in the use of available bandwidth over less essential applications is a nonnegotiable requirement for WAN infrastructure. In this regard, the capability to set, manage, and monitor application-specific policies and to implement them in an automated fashion across a WAN is critical for the enterprise. This dynamic application policy management — so critical for an enterprise's digital transformation goals — is what SD-WAN enables an enterprise to accomplish and helps drive sustainable competitive advantage.

WHAT IS SD-WAN?

SD-WAN, in conjunction with the associated concept of hybrid WAN, holds the promise of aligning the WAN with the application policy requirements of a digitally transformed enterprise.

A hybrid WAN includes at least two WAN connections from each branch office and leverages two or more different network transport options (MPLS, broadband internet, 3G/4G LTE, fixed wireless, etc.). The presence of a hybrid WAN in an enterprise is a precondition to the deployment of SD-WAN. SD-WAN helps optimize an enterprise's hybrid WAN strategy by extending, augmenting and, in some cases, replacing traditional transport options such as MPLS with broadband internet or LTE.

SD-WAN most often leverages hybrid WAN in an active-active configuration, and it also includes:

- A centralized, application-based policy controller
- Analytics for application and network visibility
- A secure software overlay that abstracts underlying networks
- An SD-WAN forwarder (routing capability)

Technically speaking, the SD-WAN solution promises the enablement of:

- Application-defined dynamic intelligent path selection across WAN links (MPLS, broadband internet, LTE, etc.) based on policies defined on the SD-WAN controller
- Flexible and agile policy definition across all dimensions (security, performance, prioritization, reliability, availability) for all applications, as well as by location, user, and time/date
- Dynamic application policy and traffic management leveraging the central controller

KEY BUSINESS BENEFITS OF A GENERIC SD-WAN SOLUTION

SD-WAN essentially helps an enterprise achieve dynamic alignment between business strategy, application policy, and the enterprise's wide area network configuration. The key benefits of this alignment across business, application, and network policy are:

- **Prioritization of mission-critical traffic**. Wide area network traffic associated with mission-critical applications can be prioritized over less important applications by ensuring that the performance, availability, security, and other requirements of mission-critical applications take precedence. This application-specific policy is specified in the SD-WAN controller, which implements this policy and ensures that application-specific network policy is executed per the business goals.

- **Optimization of cloud/"as a service" applications by simultaneously improving performance and customer/user experience.** As more applications move to the cloud, WAN traffic flows can, for instance, be redefined to reduce or eliminate backhaul of cloud-based application traffic to headquarters from the branch, thus reducing WAN bandwidth capacity requirements. Similarly, non-mission-critical application flows can be routed over cheaper broadband internet straight to the cloud via application-defined dynamic intelligent path selection across all WAN links. Moreover, WAN links to a site can be configured to be active-active rather than active-passive, thus effectively enhancing the bandwidth utilization of the WAN. Besides the core function of dynamic WAN path selection based on application policy, SD-WAN further optimizes application traffic by remediating link degradation through forward error correction and by activating jitter buffering. All these optimizations can occur while improving the quality of experience for the user.

- **Greater flexibility and efficiency of network transport via cost-effective alignment of network connectivity options and bandwidth with application criticality.** Enterprises have the flexibility of choosing the right WAN link for each application and thus dynamically adding or changing bandwidth available for each application. Similarly, depending on the application-specific policy defined on the central SD-WAN controller, application flows can be routed over the most cost-effective connectivity option while ensuring application-specific performance (latency, jitter) requirements are met.

- **Improved branch IT agility and efficiency through automated and agile service provisioning and reduced complexity.** Centralized provisioning of WAN connectivity options per application per site ensures centralized automation and optimization across all traffic flows across WAN links and reduces the dependence on local IT resources at the branch to ensure a good application experience to users at the branch. The central provisioning also reduces the complexity of management of network equipment and functions at the branch, besides significantly increasing the speed of provisioning new sites.

- **Secure data traffic for all applications, especially those hosted in the cloud.** While traditional WAN connectivity options such as MPLS VPN guarantee reliability and security of data traffic, routing the application flows over cheaper connectivity options such as broadband internet or LTE does not offer the same assurance. SD-WAN solutions provide IPsec encryption and firewalls that provide security for internet connections.

- **Superior customer engagement (application reliability, availability, performance, security, etc.).** If SD-WAN is about enabling the cost-effective delivery of cloud applications to users in the pursuit of mission-critical digital transformation initiatives, it is important that the technology drives superior customer engagement. By enhancing cloud application visibility, reliability, availability, performance, and security, SD-WAN enables an improved application user experience and hence drives superior customer engagement for the enterprise.

These expected benefits were confirmed by the results of IDC's *U.S. Enterprise Communications Survey* published in March 2017 (see Figure 1). Interestingly, "reducing dependency on the MPLS network" was the lowest in priority in perceived benefits of an SD-WAN solution.

FIGURE 1

Key SD-WAN Customer Priorities

Q.   Which of the following attributes of an SD-WAN service or solution are the most important considerations when choosing an SD-WAN solution for branch office connectivity?
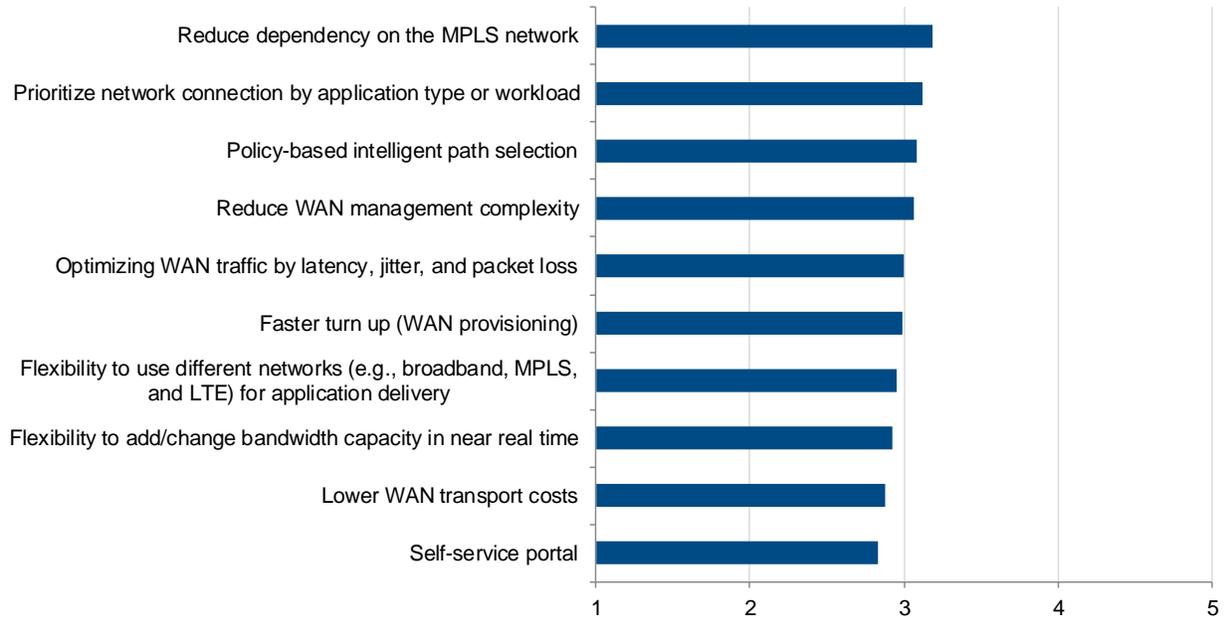
n = 772

Base = respondents who indicated that their organization plans to migrate existing WAN/network connections to an SD-WAN alternative within two years

Notes:

Ranking is based on a scale of 1 to 5, with 1 being the most important and 5 being the least important.

The survey is managed by IDC's Quantitative Research Group.

Data is not weighted.

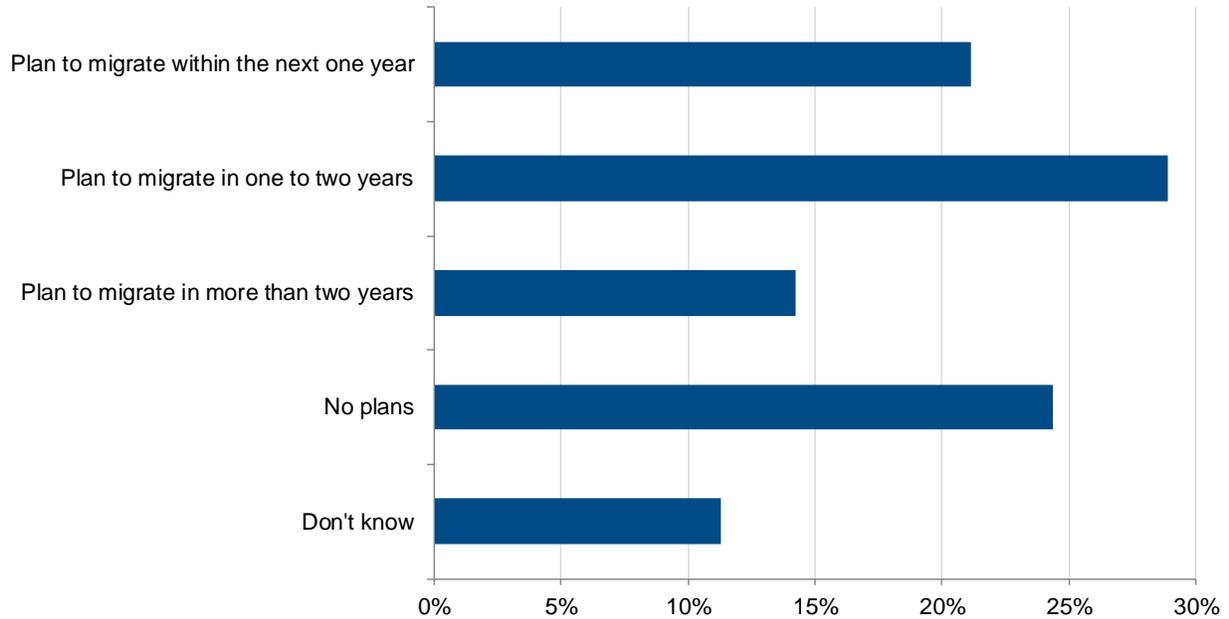Use caution when interpreting small sample sizes.

Source: IDC's *U.S. Enterprise Communications Survey,* March 2017

IDC surveys also suggest that the positive perception of the benefits of the technology is translating to interest in its adoption. As suggested by IDC's *U.S. Enterprise Communications Survey,* March 2017, a growing number of enterprises are prepared to consider SD-WAN alternatives and will be ready to purchase services or solutions from vendors within two years. Per the survey results, over 60% of enterprises plan to use SD-WAN (see Figure 2).

FIGURE 2

Migration Plans to SD-WAN

Q.   Does your company plan to deploy SD-WAN as an overlay framework on your existing WAN/network connections?

n = 1,201

Base = all respondents

Notes:

The survey is managed by IDC's Quantitative Research Group.

Data is not weighted.

Use caution when interpreting small sample sizes.

Source: IDC's *U.S. Enterprise Communications Survey,* March 2017

SD-WAN ENABLES ENTERPRISEWIDE APPLICATION POLICY MANAGEMENT

Enterprisewide application policy management refers to the ability to centrally define policies and priorities across all applications in the enterprise as they relate to network characteristics such as performance, QoS, availability, reliability, and security and to easily deploy policies remotely across the enterprise network. The foundation for this functionality is enterprisewide visibility of all application traffic and associated characteristics based on real-time application performance monitoring. Application policy management refers to the ability to define at an enterprise level the relative importance of applications to the enterprise and assign appropriate network resources to each application flow to deliver the desired application outcomes in terms of performance, security, and other characteristics on an ongoing basis. Mission-critical application flows can then be prioritized over less important applications. Appropriate security can be dynamically applied to specific application

flows. This prioritization can also be achieved for specific users and locations across dates and times and in real time in response to changing network conditions.

SD-WAN is designed to enable enterprisewide application policy management. Key to this capability is the centralized/cloud-based SD-WAN controller that can be used to define policies at granular levels for all applications in the enterprise. The SD-WAN controller then deploys a software overlay across all transport options (such as MPLS, broadband internet, or LTE) included in an enterprise's hybrid WAN and abstracts the physical network capacity into a pool of logical network capacity. This logical network capacity is then allocated to all enterprise applications to achieve the desired performance and security policy outcomes. A cloud-native application sees performance improvement for the user in the branch because traffic does not need to be hairpinned back to the datacenter before it goes to the cloud. This app can now directly access the cloud from the branch because SD-WAN creates the required IPsec tunnel through the overlay network to secure its traffic and send it over the physical broadband link at the branch.

Figure 3 shows the high-level SD-WAN architecture.

FIGURE 3

High-Level SD-WAN Architecture
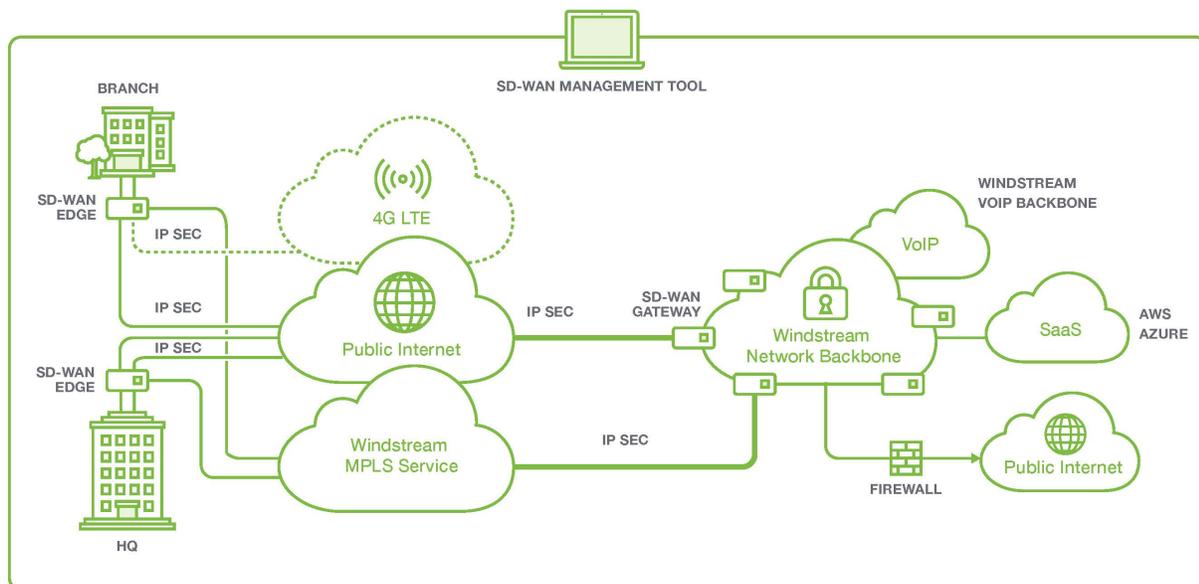
Source: Windstream, 2017

Another key element of an SD-WAN solution is an SD-WAN management tool that monitors application traffic flows across all links on the network and performs proactive analytics to predict future network congestion and other issues. Utilizing this insight, the SD-WAN controller enables automated dynamic WAN path selection with path conditioning for all application traffic flows at each site on the network to ensure adherence to application policy requirements. If a WAN link begins to have performance degradation, the application packets using that path are simultaneously sent down an alternate path so that the applications continue to perform as expected. Moreover, as new branches

are added to the enterprise's WAN, application policy gets automatically implemented on those sites. As application requirements change, policy can be flexibly changed on the controller, and the changes automatically cascade to all locations on the network. There is no need to manually configure equipment at any of the sites.

In fact, automation is a key driver of operational expense reduction for the enterprise. Considering policies can be implemented instantly across all sites on the network, the reliance on support tickets and the need for sophisticated IT personnel at all locations are drastically reduced. Moreover, SD-WAN enables a significant increase in efficiency of network transport. Since application policy, flow prioritization, and security can be dynamically configured and hence traffic routed dynamically across available links, it optimizes an enterprise's use of valuable bandwidth across all transport options.

Considering cloud-bound traffic does not need to be sent back to the datacenter, this reduces the load on MPLS links and makes the network flow less complex. Lower-cost transport options such as broadband become viable as enterprise-grade WAN connectivity options can be used to augment or replace expensive MPLS capacity. Moreover, cloud-based apps are no longer less secure than datacenter-based apps and do not increase the load on the MPLS network. As more cloud-based applications are added, business policies can be set to automatically send less critical apps via the broadband connections but still have access to the MPLS connections when needed.

The bottom line is that SD-WAN enables an enterprise to achieve dynamic alignment across its business, application, and network policy. Applications critical to the business get the appropriate network priority and security. Moreover, as application policy can be dynamically configured in response to changes in business conditions, the network enables greater business agility for the enterprise. As applications central to the business receive the requisite performance and security posture, it leads to superior customer engagement — essentially enabling an enterprise to further the achievement of its digital transformation goals. As the enterprise continues to grow and add sites, new locations align automatically with businesswide policies.

In addition, the greater visibility afforded on application traffic flow allows IT to monitor shadow apps. Instead of outright banning their use (something that can be unpopular with millennial users), IT can rate limit these apps to a maximum percentage of available bandwidth to allow their use without putting the network in jeopardy. This potentially has a positive impact on satisfaction levels of an increasingly important and creative set of employees in the enterprise.

ENTERPRISE OPTIONS FOR SD-WAN DEPLOYMENT

IDC sees four categories of products and services that form the SD-WAN market landscape — WAN infrastructure (routing and WAN optimization), SD-WAN control and overlay (SD-WAN application-based policy controllers and overlays and related analytics), communication service provider (CSP) SD-WAN-managed services, and cloud-managed SD-WAN services, which can be provided by SD-WAN vendors, over-the-top (OTT) cloud service providers, or managed service providers (MSPs). IDC forecasts that the worldwide SD-WAN market for infrastructure and services will exceed $6 billion in 2020. IDC also estimates that the CAGR for SD-WAN will be 93% for the 2015–2020 period.

Among the four SD-WAN market segments, growth will be the strongest for CSP SD-WAN-managed services, with the category expected to grow at a CAGR of 211.8%, reaching a total value of $2.2 billion in 2020.

IDC GUIDANCE FOR SELECTING AN SD-WAN COMMUNICATION SERVICE PROVIDER PARTNER

IDC considers the following attributes as key evaluation criteria for enterprises evaluating SD-WAN CSP partners:

- **Geographic coverage:** The first factor that an enterprise must investigate while choosing an SD-WAN CSP partner is whether the potential SD-WAN partner offers network coverage in the geographies that the enterprise operates its branch offices and datacenters in. Considering secure cloud connectivity is a key requirement of SD-WAN, it is also important to evaluate if the partner has the presence to connect all branch offices to the specific clouds that the enterprise connects to for its applications. Consider CSPs that have long-standing relationships with broadband providers, as they can provide third-party access and management as an alternative to bring your own broadband (BYOB).

- **Ubiquity and flexibility of implementation:** Enterprises today have a variety of options to implement SD-WAN services. They have the option of overlaying SD-WAN as an over-the-top service on its existing transport options versus ripping and replacing with a new bundle comprising both transport and virtual network services. An over-the-top service may offer a less disruptive option for the enterprise, whereas a bundled offering may be more economical in the long run.

- **Breadth of portfolio:** Another key criterion for enterprises to evaluate is the breadth of the services portfolio being offered by the CSP partner. While it is understood that SD-WAN is a transport overlay service running on top of various transport options such as MPLS, Ethernet, broadband internet, or LTE, the ability of a carrier partner to offer one or many transport options in addition to the SD-WAN and cloud connectivity, voice, and ancillary professional services allows an enterprise to potentially receive beneficial pricing for bundled services and have one throat to choke for support. While it is improbable for one CSP to own all possible transport options at every enterprise site, it is important that the CSP can offer an integrated SD-WAN solution that can overlay transport options from other CSPs and become a single point of contact across all components of the branch WAN solution. Also, important in this regard is the partner's ability to provide the appropriate monitoring and management tools for enterprise personnel to have the necessary visibility and control of the service across all WAN links.

- **Do it yourself (DIY) versus managed service option:** Certain CSPs offer a complete end-to-end turnkey solution to the enterprise inclusive of account management and professional services that may be a preferred approach for enterprises without sophisticated technical resources to make the right technology choices and implement the solution across the WAN. They may also offer the flexibility of a network management tools-based DIY option for an organization that may possess the technical resources. An enterprise may decide to go with a CSP partner that offers these options.

- **Partner's commitment to continue investing as necessary in a dynamic technology:** Enterprise networking technology is moving at a very rapid pace in response to a dynamic application paradigm. Thus investing in technology that can quickly become obsolete or that may require complex/costly upgrades can make a DIY strategy a risky proposition. Selecting a partner that will continue to invest as necessary in the technology to support application traffic is thus another important criterion that enterprises need to consider while evaluating SD-WAN CSP partners.

- **Service architecture:** It is also important for the enterprise to evaluate the partner's product or service architecture and its ability to scale and provide the necessary flexibility and agility of service at an acceptable cost.

- **Technology expertise and road map:** Telecom infrastructure today is fast evolving, with innovation constantly being brought to the market by service providers and technology vendors alike. It is important for an enterprise to evaluate the technology expertise of the partner and its ability to bring innovation faster to the market than others. It is also important to understand the vision of the partner in terms of future network edge services that the partner plans to bring to the market and how that expanded product and services road map may benefit the enterprise in terms of lower costs, greater flexibility and agility, and improved service performance.

- **Experience managing WAN infrastructure for wide variety of enterprise situations:** Every enterprise is different and has its own unique circumstances and requirements. While a hybrid WAN is a prerequisite to deploying SD-WAN, not all hybrid WANs are created equal and that creates its own challenges. Moreover, every enterprise is at a different stage of its digital transformation evolution and its adoption of the cloud. Enterprises should choose a carrier partner with the ability to service the needs of a wide variety of hybrid WAN configurations and digital transformation evolution.

- **Service excellence:** It is important for the enterprise to take the service provider's track record of service excellence into account. The ability of the service provider to design comprehensive SLAs and deliver on them in a reliable and predicable fashion is always going to be a very important criterion in choosing a partner. The support capabilities of the partner in terms of responsiveness to remote site connectivity or application networking issues are critical to the long-term customer satisfaction of the enterprise.

WINDSTREAM'S SD-WAN BRANCH CONNECTIVITY STRATEGY

Overview of the Windstream Strategy

Windstream has partnered with VeloCloud to offer an SD-WAN-managed service targeted at serving the needs of a midmarket distributed enterprise. The service packages VeloCloud's differentiated SD-WAN solution with Windstream's own exclusive Concierge service, which IDC views as its key differentiator. The Concierge service provides the human touch to VeloCloud's technology and ensures that Windstream understands its customer's site-by-site needs better and tailors a solution best suited to those needs. The Concierge service entails personalized service management and expert professional services for network diagnostics, design, and implementation.

The Windstream SD-WAN solution contains the following key features:

- **Application visibility and control.** Applications can be prioritized based on business policies, leveraging the visibility provided through the centralized cloud-based network management application.

- **Dynamic WAN selection.** Business priority and minimum performance benchmarks can be set on a per-application basis and can be adjusted in the SD-WAN management tool. This is the basis for the dynamic selection of the appropriate WAN transport path at the branch edge for each application.

- **Application optimization.** The service provides continuous monitoring to automatically optimize network paths for each application based on performance benchmarks set for each application. Further application-specific optimization is achieved through path conditioning, which includes forward error correction and jitter buffering.

- **Secure network deployment.** The solution automatically sets up IPsec tunnels with end-to-end encryption, enabling dynamic branch-to-branch connectivity.

- **Stateful firewall.** An integrated stateful firewall allows for deployment and management of security policies that can be managed centrally with options for edge overrides by location. In addition, application layer filtering provides next-generation firewalling capabilities.

- **Network analytics.** Real-time analytics allow for policy creation and troubleshooting and provide insight into application utilization and bandwidth consumption.

Windstream SD-WAN Differentiators

Windstream brings expertise from years of experience in serving branch networks to VeloCloud's SD-WAN technology to create a differentiated offering for distributed enterprises. Windstream believes its SD-WAN differentiation derives from four essential capabilities, as mentioned in the following subsections.

Concierge Service

Windstream's SD-WAN Concierge offering is a fully managed service and is designed to be a turnkey SD-WAN solution for the distributed enterprise. The customer's WAN is monitored continuously in a proactive manner and optimized for peak performance by Windstream's experts. An assigned technical service manager provides personalized guidance, analyzes network and application performance, and recommends actions needed to get the greatest possible value from customers' network environment. Professional service support options include network diagnostics and design as well as SD-WAN integration/implementation.

A key value proposition of the Concierge service is that it ensures application policies are set, managed, monitored, and implemented in an automated fashion across a customer's WAN. Windstream's SD-WAN specialists create, adjust, and deploy application and security policies based on real-time analytics and ongoing consultation with the company's customers. Concierge also provides priority triage for customers and a dedicated 1-800# team that helps customers resolve issues with the service. Concierge is designed to be affordable so that it can be leveraged by enterprises of all sizes. For customers that possess experienced IT and network teams, Windstream also offers a self-service DIY option that gives them the ability to manage the SD-WAN solution through Windstream's SD-WAN management tool.

Business Aware Cloud Network

Windstream's Business Aware Cloud Network uses a proprietary Cloud Core Network Architecture with 14 strategic cloud core nodes, which include SD-WAN gateways and redundant low-latency connectivity links to leading cloud platforms and additional Windstream-provided services. It brings cloud-hosted applications closer to end users for superior performance and optimizes access to additional Windstream cloud services such as UCaaS and security and other services in the future.

The solution enables dynamic and real-time WAN path selection and traffic steering to provide flexibility, agility, and reliability needed to deliver superior application performance with high availability and a consistent differentiating customer experience. Windstream believes its ISP heritage, including its deep experience in last mile access options and managing hybrid networks for customers of every

size, is a key advantage over other network service providers. For mission-critical applications that must run continuously, a Windstream SD-WAN with dual access connections provides an active-active network configuration that includes a five-nines SD-WAN service availability SLA.

Cloud-Based SD-WAN Management Tool/Portal

Windstream's cloud-based SD-WAN management tool provides complete visibility and control for the company's SD-WAN customers through a single interface. To develop this proprietary management tool, Windstream has added advanced network analytics capabilities to the standard VeloCloud orchestration tool. This puts application prioritization and security policy control at the fingertips of the customers and enables them to set policies at the level desired or in specific locations or even at the user level. Providing configuration control to the enterprise is a key differentiator for Windstream.

The management tool facilitates seamless, low-touch configuration for new locations, services, and security policies. It also provides control over business policies and enables application prioritization based on location, user, and time/date while allowing for real-time changes that can dynamically optimize application performance and customer experience. The real-time performance analytics and insights can be leveraged to enhance the overall business productivity while enabling management and control over other services, including voice, WiFi, and security functions such as firewalls.

Tailored Industry Solutions

Windstream delivers a suite of consulting and professional services specifically designed to amplify SD-WAN's impact on customer experience; this is in addition to cloud-based unified communications, security, and WiFi services. Windstream tailors each SD-WAN deployment to specific customer needs, beginning with the sales engineering process, and offers vertical-specific solutions. Windstream has developed deep expertise about the networking needs of enterprises in the retail, restaurant, financial services, healthcare, government, and professional services verticals.

Windstream contends that its consulting and professional services, which have helped several well-known brands initiate digital transformation initiatives to improve customer experiences, represent a key market differentiator. This is particularly true in the retail industry where Windstream's BRP retail consulting group (formerly Boston Retail Partners) gives the company a broad and deep array of consulting capabilities that also extend into day-to-day delivery operations.

Unique Partner Enablement Program

Windstream is also an ideal service provider for the agent channel considering its partner enablement program is the only such program offered by a network service provider. The partners' solution engineers are provided with a Windstream SD-WAN edge device to provide live demos for prospective customers.

WINDSTREAM SD-WAN USE CASE

Construction Materials Provider Builds New Network Infrastructure

Windstream SD-WAN's ability to optimize application policy was essential for a rapidly expanding nationwide distributor of construction industry products. To keep up with its fast-paced, acquisition-fueled expansion — from 20 to over 200 locations in a few short years — the company's IT team had deployed a fully virtualized, agile cloud-based environment.

The construction materials provider's decision proved timely, though it did have an unexpected consequence in the form of additional stress on the company's legacy MPLS network. To alleviate the concern without investing in costly added bandwidth, the company turned to Windstream. A live demo of SD-WAN Concierge – showcasing seamless failover provided by dual active-active connectivity, along with the ability to prioritize the company's virtualized environment for optimized application performance – made a strong impression on the customer. A pilot followed, with results including a substantial 15-20ms reduction in latency. A decision to expand networkwide, now installing at a rate of 1+ location per day, followed from there.

While adopting a new technology like SD-WAN introduced a degree of complexity above and beyond the legacy technology it had been using, the organization is confident in its choice. With the proactive support from Windstream's SD-WAN Concierge, and the ability to set and change policies based on evolving needs, the company's people will be empowered to keep building on their carefully planned success.

CONCLUSION

SD-WAN enables enterprises to achieve dynamic alignment across its business, application, and network policy. Applications critical to the business get the appropriate network priority to provide superior performance and deliver a strong customer and user experience while receiving the level of security the enterprise demands. Moreover, as application policy can be dynamically configured in response to changes in business conditions, the network enables greater business agility for the enterprise. As applications, central to the business, receive the requisite performance and security posture, it leads to superior customer engagement – essentially enabling an enterprise to further the achievement of its digital transformation goals.

Windstream has made dynamic application policy management and control a central pillar of its SD-WAN offering. Windstream's Concierge offering is a fully managed SD-WAN service and is designed to be a turnkey SD-WAN solution for the distributed enterprise. A key value proposition of the Concierge service is that it ensures application policies are set, managed, monitored, and implemented in an automated fashion across a customer's WAN. Windstream's ability to deliver dynamic policy management across all applications in any enterprise's environment is critical to the enterprise's ability to deliver on things that enterprise users truly demand – superior performance, bandwidth, reliability, and flexibility – all at a lower cost. IDC views the fully managed turnkey SD-WAN service of Windstream as a key enabler of its enterprise customers' ability to leverage cloud computing and to drive a long-term sustainable competitive advantage.

About IDC

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