White Paper

Advanced SD-WAN: Accelerating Digital Transformation and Powering the Cloud-Connected Enterprise

Sponsored by: Silver Peak

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IDC OPINION

What's Driving the Need for SD-WAN?

Digital transformation remains an urgent imperative for enterprises and organizations worldwide. Consequently, infrastructure investments are increasingly made for strategic rather than tactical reasons. Indeed, nearly 72% of respondents to a recent IDC cloud study indicated that they were investing in IT to support digital transformation and growth. IDC also has found that organizations with digital-ready networks are realizing two to three times the revenue growth of organizations that lack such a network and that companies digitally connecting their distributed enterprises have boosted their profit margins by 30–50%.

Nearly 72% of respondents to a recent IDC cloud study indicated that they were investing in IT to support digital transformation and growth.

Cloud computing is foundational to digital transformation and integral to its realization. According to IDC's 2016 *CloudView Survey* data, about 37% of U.S. businesses are now using public cloud for production workloads, with many more using cloud for dev/test purposes. Furthermore, about 31% of enterprise IT expenditure is allocated to externally provided cloud infrastructure services. In addition, more than half of the *CloudView Survey* respondents are using multiple off-premises cloud providers, and about 65% of organizations report having a hybrid cloud strategy in place. These trends are expected to accelerate and intensify, with hybrid cloud strategies and multicloud adoption expected to reach broad enterprise adoption in the next few years.

Network Resources That Support Digital Initiatives Are Under Intense Scrutiny

In this context, network resources that support digital initiatives are coming under intense scrutiny. Increasingly, the focus has shifted to the wide area network (WAN), which provides essential connectivity and valuable network services for branch offices and remote sites – where organizations transact business and engage directly with customers daily. On the WAN, however, operational complexity has become intractable, driven by factors such as increased bandwidth usage, diverse requirements in WAN connectivity, and a growing number of cloud-based applications. Enterprises are seeking cost efficiencies amid rapidly evolving application delivery requirements, especially as they adopt SaaS and IaaS cloud offerings.

Traditional WAN Not Architected for the Cloud

The traditional WAN came of age in the client/server era, when applications resided exclusively behind the firewall in enterprise datacenters. As such, the traditional WAN was not architected for the cloud, nor was it intended to enable and support digital transformation. Instead, legacy WANs were designed and constructed to support branch-to-datacenter and branch-to-branch traffic, not to support increasingly critical branch-to-cloud application traffic. Furthermore, the traditional WAN is poorly suited to the security requirements associated with distributed and cloud-based applications.

An additional complication is that legacy WANs are complex to manage and inherently incapable of supporting the business agility that is prized in the context of digital transformation. Part of the problem is derived from the fact that the legacy WAN was architected to encompass disparate technologies and products — such as routers, firewalls, and WAN optimization appliances — that were neither designed nor intended to work together. As a result, they are onerous to configure, deploy, and manage. Indeed, on the legacy WAN, configuration occurs at the device level and is manual and time consuming.

What's more, it isn't directly related to the objective of connecting users to applications according to business intent. Instead of focusing on the realization of business policy, operational procedures on the legacy WAN are narrowly focused on manual, device-centric management. Consequently, bringing new sites online with a traditional approach based on MPLS and complex command-line configuration of legacy routers consumes significant IT resource cycles. Similarly, such an approach means that moves, adds, and changes — also done manually on a device-by-device basis — take too long to affect and are operationally suboptimal.

Finally, traditional hub-and-spoke WAN architectures typically necessitate backhauling internet-bound traffic from branch offices to the datacenter, then out to where applications reside in the cloud before going back through the datacenter and on to the branch. This is inherently inefficient, ultimately compromising application performance, business agility, and employee productivity — never mind the expense associated with using MPLS for this inefficient transport of cloud applications.

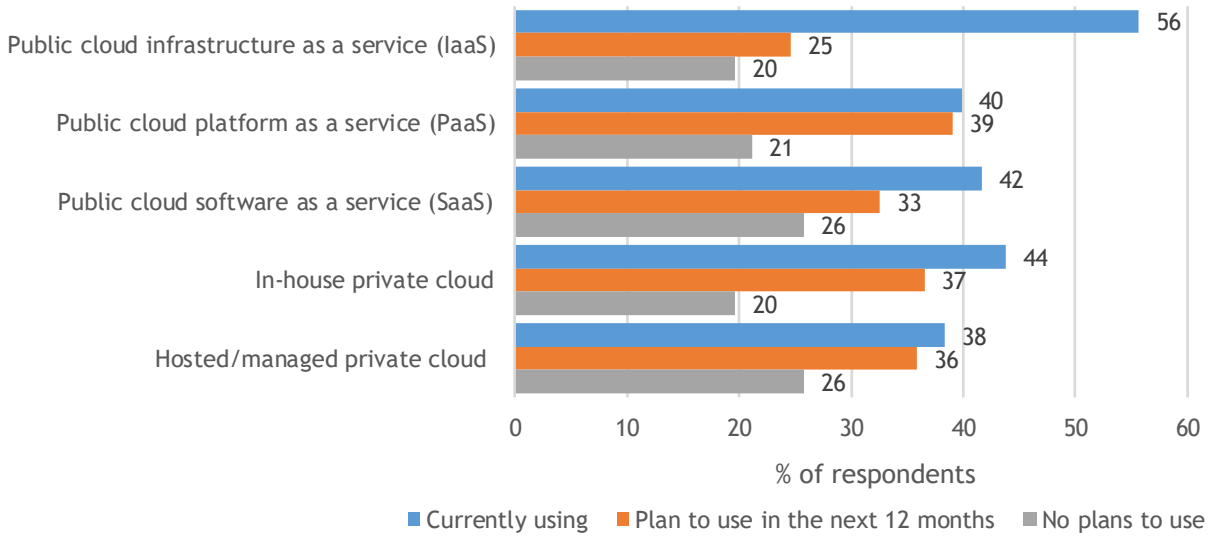
The role of the WAN seems simple — to connect users to applications, regardless of whether they reside in the enterprise datacenter, a colocation facility, or the cloud — but the task of configuring, deploying, and managing the legacy WAN has become anything but straightforward. In fact, the unwieldy management of the legacy WAN detracts from enterprise IT productivity and inhibits businesses from moving with agility on the cloud initiatives that directly support their digital transformation objectives.

There's no doubt that cloud initiatives are driving a reassessment of WAN architectures and strategies. In its recent *Software-Defined WAN (SD-WAN) Survey,* IDC found that most enterprise respondents are currently using or planning to use a range of cloud services, with nearly 56% indicating that they are using public IaaS, about 44% reporting the use of in-house private cloud, and nearly 42% indicating that they are using SaaS. By the end of 2017, about 80% will be using IaaS and in-house private cloud to some degree and approximately 74% will be using SaaS (see Figure 1).

FIGURE 1

Cloud Services Proliferation in the Next 12 Months

Q. What types of cloud services or resources is your organization currently using and plans to use in the next 12 months?



n = 605

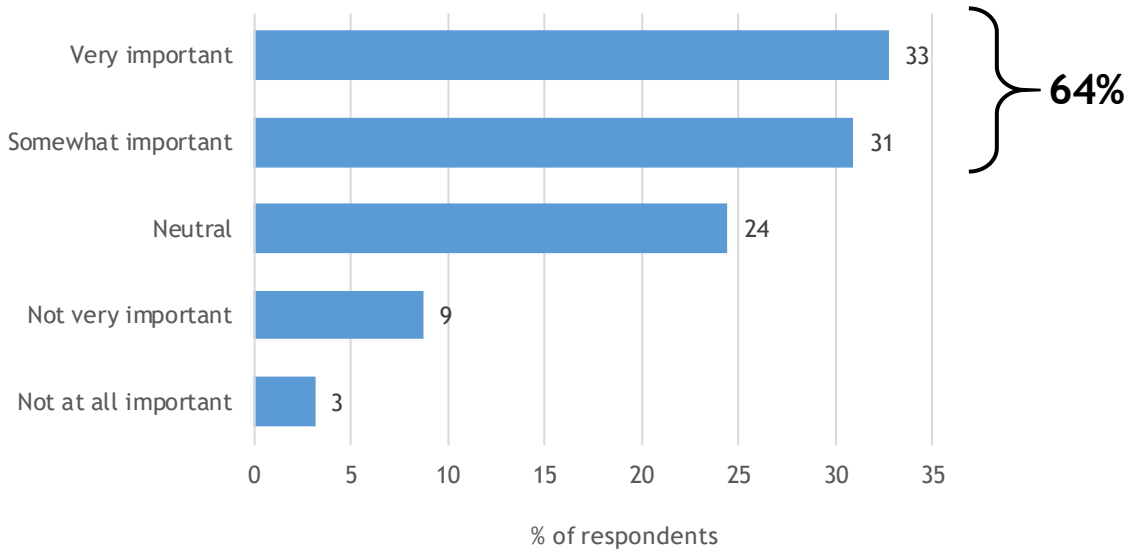
Source: IDC's *Software-Defined WAN (SD-WAN) Survey,* April 2016

In the worldwide SD-WAN survey conducted in April 2016, about 70% of respondents indicated that they would adopt SD-WAN during the next 18 months. Not surprisingly, survey respondents indicated that increasing demand for cloud connectivity and internet access at the branch were driving the need for SD-WAN. Indeed, about 50% of respondents said SaaS was important to their organization's WAN technology choices and planning, and nearly 64% believed that SaaS would be important to their organization's WAN technology choices within the next two years (see Figure 2). The survey also revealed that nearly half of enterprise applications were accessed using the internet. In a traditional WAN architecture, these SaaS applications would consume bandwidth on private MPLS circuits, failing to respond adequately to the need for cost-effective incremental bandwidth.

FIGURE 2

Importance of SaaS in the Next 12-24 Months

Q. Please rate the importance of SaaS/cloud services in your organization's WAN technology choices and planning currently and in the next 12-24 months.



n = 605

Source: IDC's *Software-Defined WAN (SD-WAN) Survey,* April 2016

SITUATION OVERVIEW

The Current State of SD-WAN

Borrowing from the principles of software-defined networking (SDN) in the datacenter, SD-WAN decouples the application from the underlying network transport, providing the flexibility to run any application over any transport or combination of transports, including MPLS, business- and consumer-grade broadband internet, and LTE. Consequently, SD-WAN is about WAN transformation for the cloud era, helping ensure that branch offices and remote sites are configured consistently to connect users to applications while also assuring security and optimizing network and application performance and lowering complexity and costs.

SD-WAN has emerged as the solution for modern enterprises dependent on the cloud and on a workforce requiring "anytime, anywhere" application access. IDC research indicates that the need for SD-WAN is acute for a growing number of enterprises, especially as they migrate to public cloud services and seek to strengthen their degree of customer engagement. In fact, IDC forecasts that by 2020, the worldwide SD-WAN market for infrastructure and services will exceed $6 billion.

SD-WAN builds on and leverages hybrid WAN, so it makes sense to describe both briefly. According to IDC's definition, a hybrid WAN includes at least two WAN connections from each branch office and leverages two or more different networks (MPLS, broadband internet, 3G/4G, etc.). As noted, SD-WAN 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 (virtual) overlay that abstracts the underlying networks; and an SD-WAN forwarder (routing capability). These technologies are combined in the SD-WAN to provide application-driven intelligent path selection across WAN links (MPLS, broadband internet, LTE, etc.) based on policies centrally defined on the controller. Some SD-WAN solutions are further differentiated and go beyond path selection by offering application-specific SLAs over hybrid links through tunnel bonding and dynamic path conditioning that utilizes forward-error correction and packet-order correction techniques.

SD-WAN Benefits

SD-WAN business benefits should include providing cost-effective delivery of business applications, satisfying the requirements of the modern branch/remote site, accommodating SaaS- and cloud-based applications and services, and improving branch-IT efficiency through automated service provisioning. Another critical benefit that should derive from SD-WAN involves meeting the demands of application SLAs, which directly results in greater enterprise productivity and business agility. To be sure, a well-architected SD-WAN solution can provide improved network and application performance and availability, especially in relation to cloud applications and services, while also providing cost-effective bandwidth. These benefits should not come at the cost of security, which must be maintained and heightened in the context of SaaS and other cloud applications.

SD-WAN solutions ought to offer compelling value for their ability to simplify and automate WAN operations, improve applications traffic management, and dynamically and securely deliver on the cost-efficiency benefits associated with intelligent path selection and tunnel bonding across the hybrid WAN.

From a requirements perspective, SD-WAN solutions should respond to several pressing enterprise needs. First, they should make it possible to run real-time and business-critical applications over cost-effective broadband internet services without performance or security compromises. Second, they should provide intelligent path selection on a per-application basis, secure zero-touch provisioning (ZTP), and centralized configuration and management. Through these capabilities, SD-WAN solutions should deliver significant cost reductions to the enterprises that deploy them. Operationally, SD-WAN offerings should facilitate a shift away from device-level configuration and management to application-driven to centralized networkwide management, allowing valuable IT resources to be redeployed to strategic business initiatives.

In the bigger picture, however, SD-WAN solutions should provide even more value. In addition to capex and opex cost savings, SD-WAN should respond to the increasingly urgent requirements for enterprise agility and enhanced business productivity. Through its ability to employ automation to consistently comply with and enforce business intent, an SD-WAN must securely and reliably connect users to applications regardless of where they reside, delivering an exceptional quality of experience while meeting SLAs.

SD-WAN Use Cases

While the number and variety of SD-WAN use cases is growing, six are emerging consistently. SD-WAN solutions should be able to address the following:

- **Hybrid WAN.** SD-WAN inherently facilitates hybrid WAN, so it's not surprising that enterprises strongly identify hybrid WAN as a primary SD-WAN use case. The ability to abstract underlying transport networks and leverage them based on application policy is highly prized by enterprise customers. Furthermore, application performance and availability are improved and costs are lowered by maximizing utilization of all available WAN links.

- **Simplifying WAN architecture.** Through application policy-based control and an overlay architecture that abstracts the underlying network transports, SD-WAN can bring much-needed architectural simplicity to provisioning, managing, and supporting the WAN. This simplification can also extend to removing or consolidating network functions at the branch — routers and security appliances, for example — while enhancing overall performance and operational agility.
- **Improving application availability.** By leveraging broadband internet and even LTE at the branch, SD-WAN can significantly enhance application availability and overall application performance. This can be achieved by bonding underlay links into a single, robust business-intent overlay to deliver high performance and availability. In the case of an underlying link failure, availability is maintained by sub-second failover to the remaining available links. In addition, an advanced SD-WAN can automatically and intelligently correct for errors resulting from dropped or out-of-order packets.
- **Reducing dependence on MPLS.** Through its capacity to use broadband internet and LTE at the branch, SD-WAN enables the reliable delivery of services over all available links, thereby reducing enterprise dependence on MPLS — lowering costs while keeping pace with changing business needs.
- **Increasing IaaS and SaaS performance.** The inherent ability of SD-WAN to support the hybrid WAN use cases means users can connect directly to cloud applications using the internet. The SD-WAN securely and automatically steers traffic on a per-application basis, eliminating the requirement to backhaul all traffic to the datacenter. This optimizes IaaS and SaaS performance at the branch by minimizing latency, and it also reduces the amount of bandwidth required to the datacenter.
- **Accelerating WAN deployments.** Through its centralized control and automated business-intent overlay provisioning, SD-WAN provides enterprises with the capacity to accelerate WAN deployments, speeding both time to revenue and time to value markedly.

In addition, as mentioned briefly above, an SD-WAN can give customers the option of removing routers from the branch, reducing costs and complexity. Organizations with multiple geographically dispersed locations can leverage an SD-WAN not only to achieve the aforementioned use cases but also to reduce their capex on branch-based network infrastructure.

FUTURE OUTLOOK

What's Next for SD-WAN?

Now that SD-WAN has become established and is growing into a significant market driven by genuine customer needs and clear use cases, how will it evolve to meet the needs of enterprises worldwide? Put another way, what's next for SD-WAN?

Automation

Further advances in automation will be key to the evolution of SD-WAN. Automation is how business intent is consistently applied to application delivery and network performance across the WAN. In the era of cloud and digital transformation, businesses are concerned with connecting users to applications according to business intent, not with the manual configuration and management of individual devices at each branch.

Automation can consistently and programmatically configure a constellation of network devices all at once, saving valuable time by eliminating tedious, repetitive tasks while also eliminating operational errors. An example of how SD-WAN can bring business intent to fruition on the WAN can be seen in zero-touch provisioning, where an SD-WAN edge device automatically contacts a central controller/orchestrator that automatically configures the device according to business policies. When changes occur to those policies, they are made once centrally, resulting in automatic reconfiguration of edge devices at each branch with no need for human intervention.

In and of itself, however, automation has its limitations. For example, it does not respond well to anomalies and real-time events. For obvious reasons, it would be impractical to devise and prepare automation scripts that anticipate every possible failure scenario.

This means that future SD-WAN automation must be informed by machine-learning algorithms that continuously monitor network connections and combine error correction with multipath load balancing to ensure application availability and a consistent user experience. Indeed, IDC believes that greater intelligence will come to the WAN through advanced analytics and enhanced visibility. The advanced SD-WAN must become cognitive, proactive, and self driving. To embrace such intent-driven automation, the SD-WAN must incorporate network sentience and evolve to the point where it is capable of listening, learning, and continuously adapting to changing application and network requirements and real-time events.

In practical terms, what will that mean? For starters, it implies that the SD-WAN will be able to apply business intent to traffic steering. Policy-based dynamic routing is critical in this context, but this next-generation routing must take place without the need to manually provision and manage traditional routers. Instead, routing will be application centric and policy driven, based on business intent rather than on the discrete management of boxes.

Security

Security will be pervasive in this model too. Base-level security will be provided inherently, and additional layers of security will be afforded by automated traffic steering, which will ensure that applications traffic can be automatically identified on the first packet of each flow and automatically directed to the internet or to firewalls at regional offices or at corporate headquarters. Granular security policies will be driven by application profiles. For example, trusted business applications will be directed to the internet, lower-priority known and personal applications will be directed to a secure web gateway, and unknown or suspicious applications will be directed for further inspection to firewalls at regional offices or at corporate headquarters. Blacklisted applications would be dropped. As a result, known high-priority applications traffic will be delivered expeditiously, reliably, and securely, while less important, unknown, or potentially malicious traffic will be subject to additional inspection or outright blacklisting.

This sort of application-level security granularity should be enforced for all applications, enabling them to be automatically steered over the appropriate links and to the appropriate security devices based on business intent and security policy.

The "Thin Branch"

As it evolves, SD-WAN can and should facilitate the advent of the "thin branch," which involves a consolidation and architectural simplification of routing, security, and other network services at the WAN edge. The objective here is not just capex savings that accrue from the consolidation of network and security functions at the branch but also opex savings derived from a simpler operational model that

prioritizes policy-based automation and centralized management over manual provisioning of devices at branches and remote offices. As a concept, the thin branch is inherently amenable to connecting users to applications, irrespective of whether they reside in the cloud, the enterprise datacenter, or anywhere else.

Within the context of the "thin branch," an advanced SD-WAN obviously will still be capable of steering application traffic pursuant to business intent, but it also will extend into the branch to deliver an essential set of network and security services, such as routing, firewall, and WAN optimization. In this respect, the thin branch is a concrete manifestation of the evolving "WAN Edge," where devices are consolidated and functions are merged through virtualization.

Ultimately, the objective for the next iteration of SD-WAN is to harness artificial intelligence (AI) and machine learning to enable continuously improving application-centric visibility, which will then contribute to increasingly dynamic and responsive routing mechanisms as well as to pervasive security. It is through automation, AI, and machine learning that the self-driving WAN can be realized.

SILVER PEAK UNITY EDGECONNECT

The Silver Peak Unity EdgeConnect SD-WAN solution is positioned to address evolving SD-WAN requirements. EdgeConnect incorporates learning algorithms that monitor the quality of available paths – intelligently combining error-correcting algorithms with packet-by-packet load balancing – to deliver a consistent user experience, even when the underlying individual network underlays experience loss and jitter, brownout conditions, or when a complete outage of a transport service occurs. Indeed, EdgeConnect not only detects network changes but also responds to them proactively through techniques such as tunnel bonding, path conditioning, and dynamic path control.

EdgeConnect has been architected with the transition to the thin branch in mind. It features advanced application visibility and control, first-packet application classification, secure internet breakout, orchestrated granular security policies, integrated WAN optimization, service chaining, and BGP routing interoperability. It is designed to deliver the requisite routing and security within a streamlined architecture.

First-packet application classification, which is essential to automated application steering, identifies more than 10,000 applications and 300 million web domains based on the first-packet received. Without first-packet classification, customers wanting the same traffic-steering functionality would need to create custom commands for IP addresses associated with applications. Such an approach would be difficult to scale and would require that the customer's vendor of choice provide updates when new IP addresses were added to applications for which manual rules had been created.

First-packet application classification leverages a cloud-hosted internet map and geolocation database, as well as a DNS response cache, an HTTP get-request cache, and real-time machine learning. It applies deep-packet inspection to identify HTTP and HTTPS traffic, well-known TCP and UDP ports numbers, and IP protocols relating to voice, video, file transfer, and other applications.

As a result, EdgeConnect can facilitate automated internet breakout, steering trusted SaaS and web-based application traffic (such as Office365 and Salesforce) directly to the internet while shunting unknown or suspicious traffic to a regional hub or datacenter firewalls for further inspection. Direct internet breakout delivers benefits such as optimization of SaaS application performance, increased worker productivity, and enhanced business agility. By providing direct access to applications, it can mitigate latency, reduce the amount of traffic that is backhauled (thereby lowering costs), and conserve valuable WAN bandwidth.

With support for BGP routing interoperability, EdgeConnect allows customers to transition toward the thin branch at their own pace. For example, customers can implement an overlay to achieve an SD-WAN that is interoperable with existing routers, setting the stage for a subsequent move to a consolidated thin branch in which routing and network functions are integrated and architectures are streamlined for simpler provisioning and deployments.

Silver Peak EdgeConnect has been designed to deliver on the SD-WAN business benefits discussed previously in this document and to support SD-WAN's primary use cases. The ultimate objective, however, is to provide an SD-WAN solution that enables enterprises to shift from a device-centric WAN management model to one that puts applications in the driver's seat and that sets the stage for a self-driving WAN predicated on intelligent automation and granular application-level security.

CHALLENGES/OPPORTUNITIES

To meet the requirements of digital transformation, the WAN must be transformed. As noted previously, IDC forecasts that the worldwide SD-WAN market for infrastructure and services will exceed $6 billion in 2020. This represents a significant opportunity for technology vendors and service providers that provide SD-WAN solutions and managed SD-WAN services to enterprises. The ascent of cloud-based applications and the resultant need to re-architect the WAN have united in a perfect storm for robust market growth that hasn't been experienced in the networking industry for quite some time.

That said, competition in the SD-WAN marketplace is fierce. In recent months, IDC has counted more than 20 active vendors in the space. Large and small players — from established vendors whose origins are in routing and WAN optimization to venture-funded start-ups — all see the vast opportunity represented by the SD-WAN market. As a result, competitive differentiation will be difficult to achieve and sustain. Amid the crowded field of SD-WAN providers, enterprise customers often struggle to identify vendors and offerings that are best suited to meet their needs today and into the future.

Given the circumstances, it is incumbent on Silver Peak to clearly and cogently demonstrate that its EdgeConnect SD-WAN solution is differentiated not only technologically but also in its ability to deliver greater business value than competing alternatives. That means that Silver Peak must not only design, engineer, and build a superior solution — encompassing the capabilities and features discussed in this document — but also market its solution aggressively and skillfully to stand out from its rivals, at least some of whom have corporate resources that are equal to or greater than those possessed by Silver Peak.

CONCLUSION

Digital transformation is an undeniable imperative for enterprises worldwide. Indeed, across all geographies and vertical markets, it is a necessity rather than an option.

What's more, enterprises are embracing cloud computing and hybrid cloud strategies as foundational elements in their pursuit of digital transformation. This confluence of circumstances has led to heightened scrutiny on the network, and especially on the WAN, which provides essential connectivity and valuable network services for the branch offices and remote sites where enterprises transact business and engage directly with customers daily.

The traditional WAN, however, was not architected for the cloud, nor was it intended to facilitate digital transformation. Fortunately, SD-WAN has emerged as the solution for modern enterprises dependent on the cloud and on a workforce requiring "anytime, anywhere" application access.

SD-WAN offerings can deliver several compelling business benefits, principally in the form of reduced costs, greater operating efficiencies, improved business agility, and increased productivity. Common use cases include hybrid WAN, simplifying WAN architectures, improving application availability, reducing dependence on MPLS, boosting the performance of SaaS and other cloud applications, and accelerating WAN provisioning and deployments.

As the requirements of enterprises evolve, so too must SD-WAN technologies and capabilities. Further developments and enhancements are likely to occur in areas such as intelligent automation and security and enabling the "thin branch."

Indeed, an advanced SD-WAN should leverage artificial intelligence and machine learning to continuously improve application visibility, deliver increasingly dynamic and responsive application performance, and provide comprehensive application security. The ultimate goal is a self-driving WAN that responds proactively to changing network conditions to unfailingly deliver applications in accordance with business intent.

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