White Paper

Self-Healing Networks: Optimizing Networking Economics

Sponsored by: AT&T

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IDC OPINION

A key challenge for enterprises in today's complex networking environment is to ensure predictable networking performance while mitigating uncontrolled increases in networking cost. Adoption of SD-WAN architecture is predicated on the assumption that it optimizes networking economics and improves business agility. The self-healing capabilities of AT&T SD-WAN with Silver Peak have proven to optimize networking economics by integrating capabilities that improve last-mile performance, accelerate access to software-as-a-service (SaaS) applications, and enhance support for custom user applications. These key capabilities will help enterprises address challenges related to increasing traffic capacity, unpredictable traffic peaks, and cloud adoption.

SITUATION OVERVIEW

The interplay of several market forces including continued adoption of cloud services, the shift to hybrid and remote work environments, and continued growth of streaming video is impacting the economics of enterprise networks. Enterprises more than ever are seeking networking solutions that optimize access to cloud-hosted applications, manage a highly distributed workforce, and deal with growth of ecommerce. At the core of this is the need to ensure predictable performance while mitigating uncontrolled increases in networking costs.

SD-WAN has emerged as a leading solution to address these challenges. Recent U.S. enterprise survey data by IDC confirms that a majority of respondents (72%) want to deploy SD-WAN in the coming two years (see Figure 1). SD-WAN brings several architectural benefits and allows enterprises to deploy direct access connectivity to the cloud. A network that is self-healing is a key enhancement that promises to provide optimized network performance that in turn improves line performance and minimizes the impact of adverse network conditions such as line failures or errors. The result for enterprises could be significant savings in networking cost and substantial performance increase, both resulting in improved customer experience.

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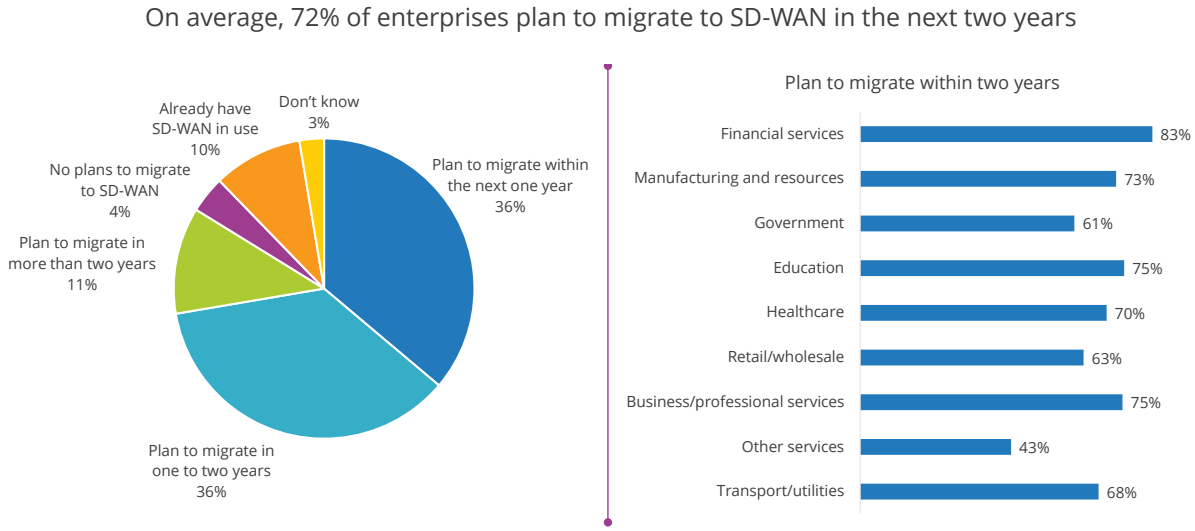
FIGURE 1

SD-WAN Trends

Q. Does your company plan to migrate any of your existing WAN/network connections to a SD-WAN alternative?



n = 600

Base = all respondents

Source : IDC's *Enterprise Communications Survey,* June 2021

Traffic Growth Challenges Network Economics

Network economics are being challenged in today's environment due to increasing traffic, nonlinear behavior of application bandwidth, and the shift of compute to the edge. Underlying these forces is the realization that customer experience is a critical differentiating factor in the digital economy. With these factors in mind, it is imperative for enterprises to seek solutions that optimize network economics and are resilient to the unforeseen demands of the digital ecosystem.

IDC predicts there will be a continued increase in network traffic exceeding 40% CAGR over the next five years. The key drivers for this network traffic demand increase include:

- **Strong consumer appetite for on-demand video.** This trend was further underscored in the early months of COVID-19, with unprecedented 30% growth on a month-to-month basis. This is augmented by video streaming, both linear and live. CDN traffic is projected to reach 80% of all internet traffic by 2024, dominated by video streaming (around 65% of CDN).
- **Growth of global ecommerce to support the digital economy.** The shift to global ecommerce has accelerated with the pandemic as more enterprises discovered that omni-channel reach to customers across the sales and supply value chains is critical to survival and competitive advantage.
- **Emergence of the distributed enterprise.** The unprecedent growth of remote and hybrid work environments is exacerbating the pressure on wide area network (WAN) traffic, especially to support video communications.

- **Shift of compute to the edge.** IDC predicts that by 2023, over 50% of new enterprise IT infrastructure deployed will be at the edge rather than corporate datacenters, up from less than 10% today. By 2024, the number of apps at the edge will increase 800%. This shift will drive innovation in new services, especially latency-sensitive apps.
- **Continued adoption of the cloud.** Cloud adoption is transforming wide area networks as secure direct cloud connectivity replaces legacy WAN technologies.

Traffic patterns as experienced during the pandemic were unpredictable. Peak traffic patterns reached several multiples of normal patterns with material consequence on network infrastructure and the need to react in real time to these patterns. The move to hybrid WAN is exposing network traffic to anomalies of IP traffic, which could experience failures, resulting in degraded performance. Customer experience is highly dependent on the network to meet quality-of-service (QoS) parameters including latency, predictability, and traffic performance. Enterprises will face challenging choices to ensure the ability of the network architecture — particularly the WAN — to deliver a compelling customer experience.

The Case for Self-Healing Networks

Against a backdrop of double-digit increases in network traffic, unpredictable demand for application bandwidth, and a shift of computing to the edge, network decision makers will be compelled to seek solutions that simultaneously meet the desired quality of service while capping potential increases in network spend. Essentially, decision makers seek solutions that optimize network traffic performance within the constraints of existing infrastructure capacity.

A self-healing network will provide key capabilities that can achieve these goals. A self-healing network is intended to provide the following:

- **Autonomous operation.** With the proliferation of hybrid WAN, enterprises have a choice to route traffic on deterministic but potentially expensive MPLS connections or more cost-effective broadband Ethernet, prone to packet errors. A self-healing network employs monitors to constantly detect anomalies in path traffic performance and seeks to reroute traffic, thereby minimizing delays and downtime. The automated mechanism must be granular, be real time, and rely on an analytics engine that can be enhanced with artificial intelligence (AI)/machine learning (ML) technologies.
- **Routing on optimal paths.** Self-healing networks employ routing algorithms that steer traffic on least cost routes or alternative routes in case of error detection. The ability to utilize all available connections to maximize route performance is critical.
- **Minimized retransmission.** A key aspect of a self-healing network is the ability to minimize packet retransmission in case of error detection. Forward error correction is capable of correcting errors at the receiving side of the WAN and minimizes the need for retransmitting packets.
- **Extensive measurements.** Delivering a rich customer experience requires understanding of customer usage patterns. A self-healing network that provides extensive measurements on traffic patterns, application utilization, and peak traffic events will go a long way in developing algorithms that predict customer patterns and in allowing administrators to configure the network for optimal performance.

These capabilities of self-healing networks can achieve meaningful cost savings, improve traffic performance, optimize network infrastructure utilization, and ultimately deliver a rich customer experience.

Why AT&T with Silver Peak SD-WAN Solution

The AT&T SD-WAN with Silver Peak solution aims at improving WAN economics with self-learning features. It delivers three broad categories of benefits that aim to improve last-mile network performance, software-as-a-service application access, and support for custom user applications. These benefits have been validated to deliver measurable economic benefits. The unique benefits of AT&T SD-WAN with Silver Peak include:

1. **Improving last-mile WAN performance**

   AT&T SD-WAN with Silver Peak relies on four technical capabilities that reduce the impact of packet delivery errors with automated processes:

   - **Path conditioning:** The goal of path conditioning is to improve application performance during network anomalies or packet errors. It employs two key capabilities:
     - **Adaptive forward error correction.** This mechanism rebuilds packets lost in WAN transmission.
     - **Packet order correction.** This mechanism reorders packets that are delivered out of order due to unforeseen delays across multiple paths.
   - **Application protection and resilient packet delivery:** Parity packets are used to provide high availability and maintain high-availability mode traffic integrity during outages or brownouts by rebuilding lost packets. This protection and delivery feature helps recover from the loss of multiple packets and multiple parity packets. For example, parity packets 1, 2, and 4 are sufficient to reconstruct data packet 3.
   - **Automated real-time response:** Continuous real-time monitoring of path traffic can detect changing network conditions and trigger immediate adjustments. The goal of such monitoring is to provide the best voice and video performance over the internet by redirecting real-time traffic to the best available underlay network.
   - **Single pane, network visibility:** Network visibility is important to maintaining a healthy network by providing real-time information on network performance and configuration and identifying location and severity of network outages. The AT&T SD-WAN with Silver Peak Orchestrator's single-pane network administration provides an overall network heatmap, allowing network administrators to get a near-real-time view of the customer's network.

2. **Optimized SaaS application access**

   The AT&T SD-WAN with Silver Peak edge platform aims to optimize SaaS application traffic to ensure the highest cloud application performance and improved quality of experience for users. This is underpinned by key platform capabilities that include:

   - **Orchestrator.** This centralized management software provides automated daily updates with the latest application definitions and IP information to the appliance, enabling branch sites to automatically send traffic to the optimal SaaS destination using machine learning techniques. This optimizes SaaS application performance and ensures users always experience the best SaaS application performance.
   - **Domain name system (DNS) proxy.** With DNS proxy, customers can reach DNS servers near branch sites, eliminating backhaul of the DNS request to the remote datacenters where enterprise DNS servers are typically hosted. From the branch location itself, DNS requests can be made directly to global DNS servers, which reduce the impact of latency in establishing a SaaS application session, thereby improving SaaS application performance.

- **First-packet iQ.** This capability identifies and classifies application traffic using the first packet, enabling granular traffic steering. Utilizing the Orchestrator, AT&T can define the customer's custom traffic steering policies for each class of application. For example, point-of-sale (POS) traffic can be directed to the headquarters-based datacenter where a next-generation firewall performs security inspection since transaction handling software is hosted in the datacenter. Application-aware traffic steering minimizes latency, resulting in better application performance while ensuring enforcement of appropriate security policies.
- **Microsoft 365 REST API integration.** With Microsoft 365 REST API integration, the SD-WAN platform continuously learns and discovers new Microsoft 365 endpoints and/or IP addresses and automatically reconfigures if a new, closer Microsoft 365 endpoint becomes available. By doing so, users always achieve optimal Microsoft 365 connectivity and performance by reducing the round-trip time.
- **Intelligent cloud breakout.** Connections between branch locations and the cloud benefit from path conditioning and optional WAN optimization. This "ruggedizes" the first mile between the branch and the cloud, providing improved network quality as well as application performance and availability. AT&T SD-WAN with Silver Peak intelligent cloud breakout not only improves the performance and reliability of traffic across the "first mile" from the branch office to the internet-as-a-service (IaaS) platform but also provides an opportunity to leverage a local high-speed backbone connection over the "last mile" to the unified communications-as-a-service (UCaaS) or SaaS provider.

3. **Support for customer user-defined applications**

   Utilizing the Orchestrator, AT&T can configure a custom application definition that enables the SD-WAN platform to identify that application on the first packet. The application definition may include parameters such as the destination IP address and TCP port number, protocol type (TCP or UDP), and other application identifying information within the packet header. Once the application signature has been programmed, AT&T SD-WAN with Silver Peak identifies and steers traffic as defined by the applicable business intent overlay (BIO). For instance, a policy can be created that steers custom application traffic to the datacenter across an MPLS underlay as the primary transport service with broadband configured as the backup. This flexibility allows enterprises to manage the QoS and security policies for custom applications in the same manner as cloud applications, ensuring the highest performance and availability.

The question arises whether these mechanisms do deliver on their objectives to optimize network performance and high-quality customer experience. Studies conducted by third-party testing company Miercom provided the following proof points:

- Compared with basic SD-WAN, high-quality voice connections were established with 20% loss on both links. Without AT&T SD-WAN with Silver Peak, voice calls would have failed with 1.75% packet loss.
- AT&T SD-WAN with Silver Peak can handle four times the packet loss than basic SD-WAN.
- The combination of packet-by-packet load balancing with path conditioning and packet order correction resulted in superior application performance and delivery of high-quality customer experience.

Additional enhancements by AT&T to provide increased visibility and self-control add flexibility in terms of providing a comanaged to a fully managed solution. Overall, the self-healing capabilities of the AT&T SD-WAN with Silver Peak solution can resolve significant challenges related to last-mile WAN performance, access to SaaS, and providing control over user applications.

FUTURE OUTLOOK

Connectivity and networking are fundamental capabilities to the delivery of rich media customer experience. Surveys conducted by IDC confirm that enterprises expect digital transformation to deliver high customer experience. Straddling virtual and physical environments will require a network that provides parity in terms of customer experience across the omni-channel and supply value chain. In the new omni-channel world, success will depend more extensively on digital interactions conducted globally, in real time, and integrated with high-fidelity video streaming.

Advancements in video streaming technologies to provide low-latency protocols such as low-latency HLS and DASH require a network that can perform under adverse conditions. Further development of self-healing networks to meet expectations of low-latency streaming protocols will be needed. Self-healing networks need to consider the adoption of AR/VR technologies, which will entail higher demands on the WAN in terms of latency and performance.

Understanding customer behaviors through analysis of application consumption patterns will become more important in the globally interconnected digital ecosystem. Integration of AI/ML into the overall networking value chain including self-healing capabilities will be mandatory. In the end, the future development of self-healing networks should result in superior customer experience.

CONCLUSION

Several market forces including continued adoption of cloud services, the shift to hybrid and remote work environments, and continued growth of streaming video are impacting the economics of enterprise networks. As a result, enterprises are challenged to deal with increasing traffic, nonlinear behavior of application bandwidth, and the shift of compute to the edge. SD-WAN has emerged as a leading solution to address these challenges.

The AT&T SD-WAN with Silver Peak solution goes beyond traditional SD-WAN implementations to improve WAN economics with self-learning features. It delivers three broad categories of benefits that aim to improve last-mile network performance, software-as-a-service application access, and support for custom user applications. AT&T SD-WAN with Silver Peak delivers measurable economic benefits manifested through superior application performance and delivery of high-quality customer experience during suboptimal link conditions.

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