SD-WAN
Bringing scale, agility and robustness to enterprise networks

Wide area network (WAN) technology has evolved significantly over the last decade, with new products, technology and business models. Lately the dynamics of business have changed so fast that trusted networking applications, technologies and approaches are under significant pressure to adapt and evolve.

Today's enterprises have a completely different architecture as compared to businesses a decade ago. There's a much greater propensity towards automation and digitization, with a view to improving speed and performance. The availability of a wide range of technology options, both within the enterprise as well as in the cloud, allows enterprises to optimize almost every part of the business, including supply chain, HR, marketing, finance, procurement, training, customer support, payments, risk management, etc. The digitization of business models (for example, e-commerce, online banking, supply chain analytics, big data) has brought in new levels of agility, and traditional businesses are under pressure to stay in tune with the changing market.

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In particular, geographically distributed businesses need to develop stronger network capabilities, which incorporate the following characteristics:

Seamless
As enterprise networks grow and evolve, they need to have an extremely well-coordinated and standardized set of policies and processes. This allows seamless operations across the network, irrespective of environment and stakeholders.

Scalable
Businesses today need to scale at an unprecedented rate. This makes existing network architectures difficult to manage. The network of the future must allow easy and rapid scalability to handle business growth, addition of new locations, introduction of new products and services and large scale business fluctuations.

Simple
As businesses become more complex, managing the enterprise WAN needs to be kept simple and straightforward. This requires centralization of governance and control, while allowing distributed offices to manage their point needs through simple, easy-to-use interfaces.

Agile
With companies moving quickly towards hybrid cloud and multicloud environments, networks need to seamlessly connect applications and devices across a diverse set of infrastructure, platforms and operating environments. Enterprise WANs must have the agility to incorporate current IT needs as well as emerging technology constructs in an evolving multicloud environment.

To meet these business needs, traditional architectures, components and deployment models for WANs are undergoing a transformative shift. With software-defined networking (SDN) concepts at its core, software-defined WAN, or SD-WAN, is emerging as a much more robust, scalable and cost-effective way to deploy and manage a WAN across geographically distributed branches or enterprises.

Challenges with traditional MPLS-based networks

Scalability
Since MPLS is used on private infrastructure and not on the internet, it is difficult to scale or modify network operations without making significant investments in infrastructure. As data load increases, MPLS networks may experience quality of service issues and service level agreements (SLAs) may be difficult to manage.

Security
While MPLS is run on private networks, it does not require any encryption or IP security. However, business users today need to rely on the internet for a wide variety of transactional information, such as e-commerce sites or email servers. The challenge for businesses is to maintain security and consistency of data that runs across encrypted and non-encrypted networks.

Control
While MPLS-based networks can route traffic according to labels, the challenge arises when there are a large number of data types and scenarios. Traditional networks need to be manually configured to handle different data types. Also, the network parameters and policies cannot be centrally managed to accommodate new data types and needs.

Carrier dependency
Since MPLS-based WAN runs on a private network, there is a large dependency on a single carrier. This becomes a challenge when a new office is to be opened, or infrastructure needs to be scaled in an existing office. Because of the dependency on a carrier, there may be significant delays during set up and implementation.

Cost
To manage variability and fluctuating loads, companies often need to invest in more network infrastructure than they actually require. As the number of locations increases, the connections across the WAN start becoming more complex and it becomes very expensive to manage an MPLS-based WAN. Often, connecting to a wide network of partners through MPLS infrastructure becomes extremely expensive for the organization, to deploy and manage.

Geographical constraints
As organizations expand into new geographies, IT teams find it more and more difficult to deploy and manage WAN infrastructure. Given the multiple risks around manageability of private networks and human resource challenges often experienced in remote locations, traditional MPLS deployments start becoming more challenging and time consuming with every new remote office.

SD-WAN: leveraging internet and cloud technologies

SD-WAN can potentially address most of the key challenges faced by traditional MPLS-based networks, since it uses the internet and cloud infrastructure to communicate with various branches of the enterprise. Since many companies today already use cloud-based applications (SaaS based tools and software) or infrastructure (AWS, Netmagic, Microsoft Azure), using SD-WAN becomes much easier today as compared to a few years back.

Gartner mentions that, to be defined as an SD-WAN, a network must have the following characteristics:

- Support for different types of connections such as MPLS, frame relay and high-speed LTE wireless communication.

- Dynamically select the most optimal path to ensure that loads are managed effectively.

- Easy configurability and manageability through simple user interfaces.

- Support for VPNs and other services such as WAN optimization controllers, firewalls and web gateways.

Key advantages of SD-WAN

Network automation
A key feature of SD-WAN is automated network deployment and management, which provides significant advantages in terms of load optimization, performance and latency management. SD-WANs have the ability to measure key metrics such as availability, packet loss and traffic, which allows the system to auto-optimize the network (maximize performance, minimize latency). They generally offer strong capabilities around application aware routing, business analytics and traffic shaping.

Centralized governance
SD-WANs allow all network resources to be controlled, provisioned and de-provisioned, scaled, ramped-down and configured centrally. With the availability of central data repositories and analytics, SD-WAN makes it now possible to drive powerful analytics that can further enhance network performance. Also, a key improvement in SD-WAN, as compared to traditional private networks, is the ability to add a layer of intelligence to traffic management. Users can centrally pre-configure policies to define pathways based on different parameters such as location, port, quality of service needs, application types and data types. SD-WANs are able to dynamically select the optimal path, for load sharing and resiliency purposes.

Unlimited bandwidth
Since SD-WAN is internet based, it has the ability to aggregate a wide variety of cloud resources (including connecting to private and public clouds) to provide very high bandwidth. Enterprises can dynamically add or eliminate WAN connections, and scale up bandwidth, without the need to manual support at the branch or remote location.

Typically, companies choose to retain extremely sensitive and mission critical traffic on MPLS-based networks, while using SD-WAN for internet-based, high volume traffic, such as email exchange servers, websites, SaaS applications. Organizations on an SD-WAN are also able to dynamically add network resources to its MPLS and public infrastructure to manage sudden spikes in traffic.

Carrier flexibility
SD-WAN solutions enable organizations to connect with multiple carriers. This allows them to create a carrier-independent network and drive SLAs more effectively. Organizations can choose different carriers for different locations, depending on their specific performance needs.

Hybrid options
Almost every organization in its journey to SD-WAN will continue to use traditional MPLS and internet-based networks. This is where SD-WAN provides the flexibility to integrate easily with the company's current network, irrespective of the network architecture. In most cases SD-WANs can be deployed or overlaid with minimal changes to the current MPLS network to create an optimized combination of public and private network infrastructure. SD-WAN supports multiple connection types, such as MPLS, Internet leased lines, broadband, LTE wireless communications, VPNs, and third party NFV services.

Complete encryption
Since SD-WANs use the internet, they allows for complete encryption of all WAN traffic. In a hybrid network situation, this makes the network much more secure a compared to traditional MPLS based WANs. SD-WANs typically offer advanced security parameters such as 256 bit AES encryption.

Cost benefits
Typical internet based infrastructure (running on commodity hardware) is significantly cheaper than private infrastructure on which MPLS typically runs. This makes SD-WAN extremely cost-effective for organizations facing rapid growth that need to scale their network at an accelerated pace. Since there is minimal need for human intervention in deploying new devices, scaling to new locations is extremely quick and cost effective, as compared to traditional MPLS deployments. According to Gartner, provision network changes at a branch is 50% to 80% faster in an SD-WAN as compared to traditional WANs.

> **'SD-WAN uptake to grow from less than 1%** of enterprises to 30% of enterprises by the end of 2019'
>
> Gartner, *Market Guide for Software-Defined WAN*

Key focus areas for SD-WAN management

While the benefits of SD-WAN are clear and well understood by IT decision-makers, there are still certain concerns regarding implementing and managing a different kind of WAN. This is partly because the traditional MPLS-based WAN has proven to be robust and effective over a long period of time. Secondly, the market for SD-WAN is still evolving, with several leading players still coming out with new products devices and services. Some of the key focus areas for SD-WAN implementation are:

WAN blueprinting

Organizations with legacy IT environments and distributed networks generally have a side range to tools, software components and network connectors across its landscape. This makes the typical WAN extremely complex, and difficult to define a clear, singular WAN strategy for the whole organization. SD-WAN implementation involves creating an organizational blueprint of all business needs, policies, network components, devices and applications. This allows IT teams to define the right policies across all branches, organizational processes and stakeholders.

Integration
SD-WAN appliances must be effectively integrated with WAN optimization appliances, routers, security devices and other network components. IT teams need to be very aware of data types, formats, application compatibility, security and network features while carrying out any integration initiatives.

Policy management
Business teams must define a clear, well-articulated set of policies that meet all stakeholder needs across the network, while ensuring the highest levels of data governance and security. As business needs change, policies will need to be constantly updated and managed to ensure optimal levels of performance, security and availability.

Architecture
Today's hybrid IT environments demand a high degree of flexibility with respect to network management. SD-WANs are generally better suited to manage hybrid and multi-cloud ecosystems. When deploying SD-WAN, the architecture needs to factor a wide variety of on-premise, hosted and cloud resources.

Skills
IT teams need to build new skills and capabilities to manage the new SD-WAN based environment. Key skills that need to be developed include performance analytics, network optimization, device configuration, policy management, provisioning and de-provisioning.

SD-WAN: key capabilities

- Optimized bandwidth and increased availability.

- No compromise on data loss or security issues.

- Seamlessly integrate with MPLS, broadband, mobile networks (4G or LTE).

- Seamless public and private cloud connect.

- No dependency on individual telecom service providers.

- No geographical coverage issues.

Conclusion

While there are many approaches to SD-WAN implementation, organizations need to create a customized, tailored plan for their own SD-WAN implementation journey. CIOs need to have a clear SD-WAN strategy with a few key aspects in mind:

Taking a use-case centric approach
It is necessary to take a step by step approach instead of adopting an all-out or end-to-end approach. This allows teams to identify the high-priority and low-risk use cases for SD-WAN implementations.

- Typically, organizations need to start by deploying a hybrid network in which the SD-WAN can be deployed for certain workloads, in parallel with the existing MPLS setup. This helps companies optimize network traffic depending on criticality, availability and privacy needs.

- As companies start to grow in confidence with their initial SD-WAN deployments, they can gradually start extending the SD-WAN services to many other use cases across the organization.

Getting a clear view of network maturity
CIOs need to constantly have an aggregated view of network performance and maturity. This allows them to define and modify policies as per changing business needs and prioritize implementation based on workload types.

Our one-stop solution for SD-WAN

Design, implementation, management

Increased availability

Higher network performance

Cost savings

Ease and speed of configuration

Application visibility

Involving a managed service partner
To manage key challenges, IT teams to collaborate and build consultative engagements with their Managed Service Providers (MSPs).

Eventually, while MPLS driven architectures will continue to stay, organizations will need to work on hybrid strategies that involve a mix of MPLS, SD-WAN and NFC technology. At NTT we offer a proven mix of products and managed services to help organizations navigate the transition to SD-WAN.

Business environment is changing rapidly
Industry consolidation through mergers and acquisitions are creating new, complex challenges for network managers. Rapid site expansions have necessitated the need for quick turnaround to connect remote sites and set up new sites.

Companies and consumers are embracing the cloud
Modern organizations and discerning millennial user base is creating a new set of demands on corporate computing environments of digital traffic.

Companies need more agile networks
A new, more agile networking environment is necessary, which can adapt to new demands of varied and performance-sensitive application portfolio.

Consulting is key
SD-WAN is not a 'plug and play' proposition, and enterprises need to invest in consulting-led education staff so that they can take advantage of this new technology.