

How to Begin the Journey to an SD-WAN

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Introduction

The twenty-year period that began in the early 1980s saw the development and deployment of several new WAN technologies. This included TDM, Frame Relay, ATM and MPLS. Unfortunately, until recently there hasn't been a fundamentally new WAN technology or solution introduced into the marketplace for over fifteen years.

While the WAN remained staid, WAN use cases have evolved significantly. In the early 2000s the primary WAN use case was to enable employees in remote facilities to access the applications they needed. Until recently those applications were hosted in one of the company's data centers, but now it is increasingly likely that they are either hosted by an Infrastructure-as-a-Service Provider (IaaS) such as Amazon AWS or provided by a Software-as-a-Service (SaaS) vendor such as Salesforce. In addition to having to provide connectivity to both internal and external data centers, the enterprise WAN must now also support a very large and growing number of mobile workers as well as the burgeoning deployment of the IoT.

Until recently all networking was based on hardware-centric network elements that were proprietary and evolved very slowly. To overcome these limitations, over the last few years there has been an industry-wide shift away from hardware-centric solutions and to software-centric solutions based on SDN. This shift has resulted in the deployment of a new class of WAN solution that is typically referred to as a Software Defined WAN (SD-WAN).

This is the first in a series of short white papers that will help network organizations with their journey to SD-WAN adoption. This paper will address three key questions that network organizations must answer at the beginning of their journey:

- What are the triggers that would drive my organization to re-examine their WAN?
- If my organization were to implement a new WAN, what type of improvements should we be looking for?
- What are some of the high-level considerations we should use when evaluating an SD-WAN?

What triggers justify re-examining the WAN?

Evaluating new WAN solutions takes a lot of resources that could be used to respond to other challenges and opportunities. As a result, there must be one or more compelling opportunities that network organizations need to respond to in order justify starting the process of evaluating new WAN solutions. Three such opportunities are:

- **BYOD**

A challenge that network organizations have always had to respond to is supporting applications that they didn't know about. Part of the challenge of supporting unknown applications is ensuring that they don't create any significant security vulnerabilities. Another part of the challenge is making sure that they perform well and don't unnecessarily consume large volumes of bandwidth.

Now that most companies have adopted a BYOD philosophy, this challenge is at least an order of magnitude more difficult. The reason for that is because every employee's mobile device has tens of applications which can be, and usually are run over the company's WAN. The result of the continued deployment of new applications by the company's IT department combined with the rapidly growing use of SaaS-based applications combined with each employee having tens of applications on each mobile device is that many enterprise WANs now support thousands of

applications.

- Cloud Computing

Over the last decade cloud computing has changed and continues to change. For example, one of the primary initial use cases for cloud computing was for small and mid-sized businesses to access a SaaS provider. As previously noted, in the current environment organizations of all sizes [access public cloud providers](#). In addition to SaaS providers, this includes accessing IaaS providers as well as Platform-as-a-Service (PaaS) providers such as Microsoft Azure.

The initial way that network organizations enabled users in branch offices to access cloud resources was by backhauling the traffic over MPLS to a corporate data center where it was handed off to the Internet. This approach increases both cost and delay, but is acceptable if the amount of cloud traffic is relatively small. However, in the current environment most WAN traffic is destined for the Internet. As a result, backhauling Internet traffic is no longer acceptable.

- Internet of Things (IoT)

IoT is a phrase that refers to the internetworking of a wide range of physical devices that are embedded with electronics and/or sensors. In those instances in which the *thing* is a fixed object such as a building, it might be economically and physically feasible to connect to the thing using a wireline WAN service such as MPLS. However, it is increasingly common that a thing is a sensor inside of a traffic light, or a package being shipped, or a car or bus. In situations like this, wireless services are the only feasible option.

In a [report](#) published in early 2017, Gartner forecasted that 8.4 billion connected things will be in use worldwide by the end of 2017, up 31 percent from 2016, and that there will be 20.4 billion connected things by 2020. As discussed in a recent [blog](#), the IoT impacts every industry with applications poised for dramatic growing in many verticals including retail, healthcare, agriculture and transportation.

What WAN improvements are network organization looking for?

[The 2017 Guide to WAN Architecture and Design](#) contained the results of a survey in which the respondents were asked to indicate the factors that would likely cause their organization to make changes to their WAN over the next year. Their responses, which are shown in Figure 1, show that the top factors driving change in the WAN are:

- Increase security

According to an [IBM report](#), by 2019 cybercrime will become a 2.1 trillion dollar problem. Given the ever-increasing breadth and impact of cyber-attacks it isn't surprising that increasing security is the most important factor driving change in the WAN.

- Lower cost

Because of the way that Communications Service Providers (CSPs) charge for WAN services, the WAN runs at megabit speeds while the LAN runs at gigabit speeds. Part of the opportunity to reduce the cost of the WAN stems from that fact that on a bit/second basis an MPLS circuit costs between [1 and 2 orders of magnitude](#) more than the cost of Internet access.

- Improve performance

In contrast to the LAN, the WAN has several characteristics which negatively impact performance;

e.g., high levels of delay, jitter and packet loss. While these characteristics negatively impact the performance of all applications, the business impact of degraded performance is greatest if the application is real-time or is critical to one or more business processes.

- Support new use cases

As noted, over the last few years there has been a broad and extensive adoption of public cloud computing services and applications. The WAN needs to support this new use case with cost-effective, highly performant services. In addition, the WAN must be agile enough to effectively support other new use cases such as BYOD and the IoT.

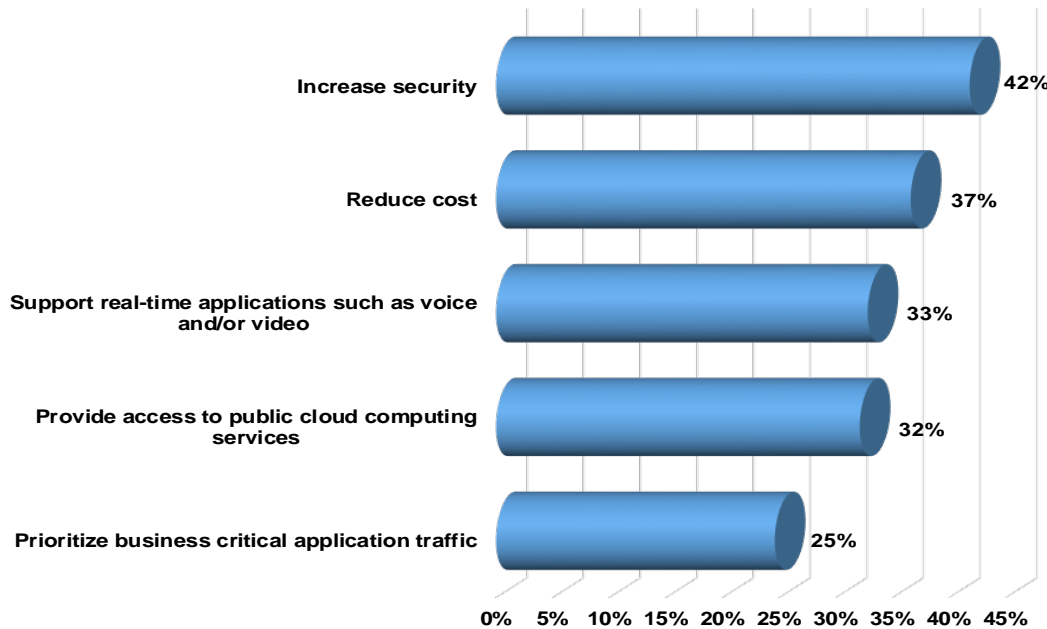


Figure 1: Factors Driving Change in the WAN

What are the key considerations when evaluating an SD-WAN?

As noted, after fifteen years in which there were no fundamental improvements in WAN technologies and services, a new class of WAN solutions, referred to as an SD-WAN, has entered the marketplace. When evaluating SD-WAN solutions, network organizations need to consider the following characteristics of those solutions.

- Cost model: Perpetual vs. pay as you go

The traditional way that network products are priced is based on a one-time, up-front cost and then an ongoing cost for maintenance. While that is still an option, an alternative cost model avoids the up-front cost and is based entirely on an ongoing cost.

- DIY vs. Managed Service vs NaaS

The last few months have seen several CSPs announce their plans either to offer a managed SD-WAN service or to provide a [Network-as-a-Service](#) (NaaS) offering based on the CSP's use of SDN. The interest that CSPs and others have in offering these SD-WAN services is matched by the interest that network organizations have in adopting those services. [The 2017 Guide to WAN Architecture](#)

[and Design](#) included the results of a survey question in which the respondents were asked to indicate which WAN implementation option their organization was likely to adopt. The options were: Do-it-Yourself (DIY), managed service and NaaS. Multiple responses to the question were allowed. The results of that survey question were DIY (54%), Managed Service (42%) and NaaS Offering (27%).

The survey results show that there is strong interest in each of the three implementation options.

- Location of key functionality

In a traditional WAN, functionality such as optimization is provided onsite. That's still a viable option. However, SD-WANs introduce several other viable options for where WAN-related functionality is located. This includes:

- At the customer's branch offices
- In a service provider's central office or POP
- At the customer's data centers
- In a cloud site provided by the SD-WAN vendor
- At a co-location facility
- At a public cloud provider's facility

- Breadth of functionality

The first wave of SD-WAN solutions focused on providing basic connectivity to branch offices. While that is still important, many current SD-WAN offerings have expanded that focus to:

- Include additional network functionality such as security and optimization;
- Support WAN end points in addition to branch offices; e.g., mobile workers and the IoT.

- Migration path

Due to a variety of issues, including contractual constraints, few if any network organizations will make a flash cut to a new WAN. Whether the cutover period is long or short, it is critical that the new SD-WAN solution can easily integrate with the existing WAN during the cutover.

Summary

After a fifteen-year period in which there were no fundamental improvements in WAN technologies and services, a new class of WAN solutions, called SD-WANs, has entered the market. Because evaluating new WAN solutions takes a lot of resources, the first step in the journey to an SD-WAN is to identify the compelling opportunities that would trigger starting the process of evaluating new WAN solutions. Three such opportunities are BYOD, Cloud Computing and the IoT.

Once the triggers have been identified, the next step in the journey is to identify the factors that would cause a network organization to implement a new WAN solution. While those factors vary by organization, the most common factors are:

- Increase security
- Lower cost
- Improve performance
- Support new use cases

Once those factors have been identified, the next step in the journey is for network organizations to examine the key characteristics of SD-WAN solutions to determine which solutions are the best fit with

what they are trying to accomplish. Those characteristics include the:

- Cost model: Perpetual vs. pay as you go
- Implementation option: DIY vs. Managed Service vs NaaS
- Location of key functionality
- Breadth of functionality provided
- Migration path