Research Report on

WAN Virtualization

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Introduction

WAN Virtualization aka **SD-WAN**(or Software Driven) is a technology which logically bonds multiple network services such as MPLS, Ethernet, DSL, cheap cable internet , 4G wrapped with a layer of hardware and software intelligence to deliver cheaper, higher bandwidth capacity and more reliable WAN connectivity with sub-second convergence(order of a few milliseconds or even less). (SearchSDN, 2015) SD WAN achieves this super-speed by performing real-time traffic monitoring and finding the right service and path for each network packet. (Metzler, J. and Taylor, S., n.d.) SD-WAN not only improves availability, but is ultra-reliable, cost-effective and has superior support for real-time application traffic like VOIP and video-conferencing when compared to any of the available WAN technology. (David Mahler, 2014) It solves three of the most important complexities of any network- management, configuration and control and hence adding new components or functionalities is easier than before as the network management is more flexible and more adjustable now. (SearchSDN, n.d.)

Current Corporate Infrastructure

Our company has more than 12 branches all over the world connected by WAN services such as MPLS, local internet connection, VPN, backdoor links.

Flaws in the current Infrastructure

1) MPLS is very expensive (20 to 100 times more than public internet connections in price/bit) and takes a large amount of time to deploy. (Gottlieb. A, 2011)

2) Local Internet connections generally does not have an end to end SLA guaranteeing good quality services. (Gottlieb. A, 2012)

3) Since more and more applications are moving to cloud, there is no easy way to do so in an incremental manner without forklifting upgrades i.e. ripping out and replacing infrastructure which would be very expensive for the company. (Riverbed, n.d.)

4) Current Infrastructure responds well to blackouts (since it can be checked easily if there is a link which is down or is not responding to ping) but brownouts can still be a challenge to tackle

since there is no easy way to check as the link would still be up and it still does respond to pings.

5) Since the company is expanding its ties with various other companies, more and more bandwidth is required and it must be cheap, fast and with zero-convergence.

SD-WAN to the rescue
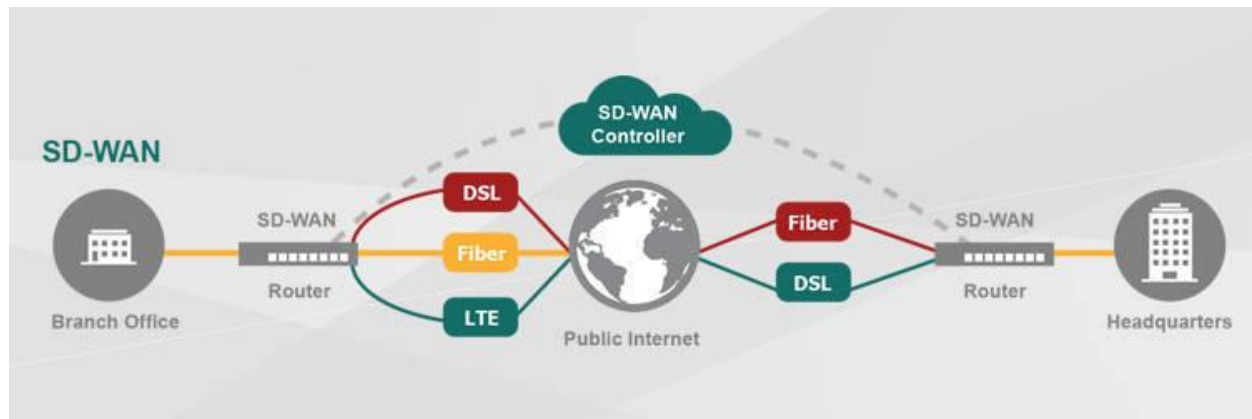
(Amanda Dark, 2016)

Advantages

1) It constantly measures the quality of network path for latency, jitter and packet loss while measuring performance to the destination. It then relays the information to the application to enable dynamic, real-time traffic engineering that supports mission-critical applications. (Gottlieb. A, 2011) (Viptella, 2017)

2) It aggregates multiple WAN links to scale bandwidth for applications and migrates application traffic seamlessly with sub-second convergence. It can, then respond to a brownout by sending traffic over more reliable paths than the ones experiencing congestion. (Gottlieb. A, 2011)

3) Real-time applications like VOIP and videoconferencing, WAN Virtualization can deliver ultra-reliable, cost-effective, support, choosing network paths with the least packet loss and lowest jitter and switching sub-second to a better path in the face of high-loss or jitter. (Citrix, 2015)

4) Where sufficient bandwidth is available, some WAN Virtualization solution can provide still greater reliability by replicating real-time traffic flow along a second path, suppressing duplicates at the receiving end, and delivering perfect sound and voice quality even in the face of failure/congestion on one of the connections. (Citrix, 2015)

5) SD-WAN works over encrypted flows without sharing any confidential information. (SSL Acceleration) (Citrix, 2015)

6) It offers segmentation of traffic for guest Wi-Fi and PCI Compliance for Credit Card transactions. (Omniconvert.com, n.d.) (Citrix, 2015)

Deployment of SD-WAN
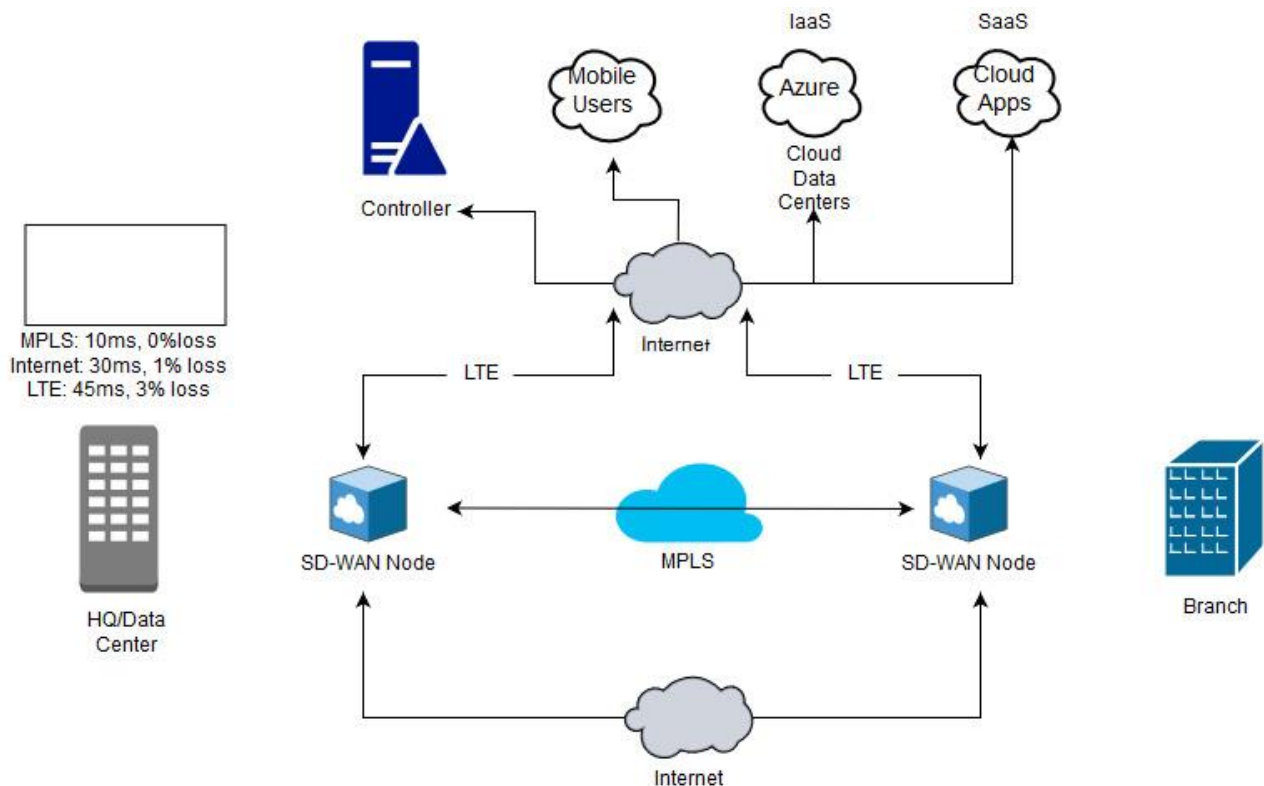
Deployment Diagram (Cato Networks, 2017)

Basic Deployment Strategy

Every router in WAN has two planes- first one is **data plane** for sending and receiving data and the second one- **control plane** which determines where data goes or basically the network traffic. We build an encrypted overlay of VPN tunnels across our underlying data services whether it's MPLS, broadband, internet, LTE, point to point. The SD-WAN nodes basically collects all the information from various connections about the loss, latency, jitter etc. and it uses that data to decide which circuit to send the data to. We have separated the underlying WAN from application because the application ran on MPLS and now it has the software layer sitting in between. SD-WAN uses *zero-touch provisioning-* it does not need an engineer to setup since the configuration is done in the controller. The SD box node is plug-in and it gets the IP address from the internet service provider and then it talks with the controller which downloads the configuration and the box is ready to operate. The setup is extremely easy to configure and the time taken to deploy is fairly less than MPLS. This ensures more bandwidth to increase scalability and that too at a very low cost. The sub-second convergence property of SD-WANs enables even a single application to be load balanced across multiple paths in case of link failures or if there is a decrease in the performance. (Cato Networks, 2017)

Challenges

1) Cloud Deployment in AWS could be a problem since most of the SD-WANs doesn't have any provision for it. (Cato Networks, 2017)

2) Since we already have a firewall for VPN access, it would be a very tedious task to incorporate the SD-WAN's firewall into the existing architecture. (Cato Networks, 2017)

3) Most SD-WANs do not have a method to work with the IOT (Internet of Things) devices which could be a big problem, since most of our users resides in smart cities. (Cato Networks, 2017)

4) The deployment of SD-WANs also depends on the region of deployment, the condition of the network in that region and also what is available in that particular region. For example: in one of our branches in Costa Rica, the public internet is actually faster than the MPLS and the performance of MPLS in that region is very sluggish. (Cato Networks, 2017)

5) Although SD-WANs provide segmentation of traffic, their encryption and firewall is very elementary and the machines running could be susceptible to malware and other application-layer attacks. (Purple, 2016)

6) The SSL-acceleration in SD-WANs is still facing many issues today and is not fully operational. (Cato Networks, 2017)

Conclusion

In conclusion, I think that instead of bearing the high amount of costs for different MPLS connections, the company should incorporate SD-WANs, thus employing a mixture of different services already available. This would increase the performance of the WAN and minimize the expenses for the company.

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