

# Software Defined Wide Area Network

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**Abstract** – The software defined wide area network (SD-WAN) is a specific application of software defined networking (SDN) technology applied to WAN connections, which are used to connect enterprise networks including branch offices and data center over large geographic distances. Software-defined WAN is an approach that aims to overcome the complexity and rigidity experienced when using legacy tools for managing modern networks. Software defined WAN is a new approach to network connectivity that lowers operational costs and improves resource usage for multi-site deployments to use bandwidth more efficiently. This allows service providers to offer their customers the highest possible level of performance for critical applications without sacrificing security or data privacy. A WAN might be used, for example, to connect branch offices to a central corporate network, or to connect data centers separated by distance. In the past, these WAN connections often used technology that required special proprietary hardware. The SD-WAN movement seeks to move more of the network control is moved into the cloud, using a software approach.

**Keywords-** Software define network sustainable migration SD WAN, SDN, Virtualization.

## INTRODUCTION

The software-defined wide area network (SD-WAN) is a specific application of software-defined networking (SDN) technology applied to WAN connections, which are used to connect enterprise networks including branch offices and data centers over large geographic distances. A WAN might be used, for example, to connect branch offices to a central corporate network, or to connect data centers separated by distance. In the past, these WAN connections often used technology that required special proprietary hardware. The SD-WAN movement seeks to

move more of the network control is moved into the cloud using a software application.

SD wan is the more flexible, more secure, open to everyone, and cloud-based technologies, rather than installing proprietary or specialized WAN technology that often involve expensive, fixed circuits, or proprietary hardware. This technology used the cloud to access the data to the business and the user. In this technology private as well as public cloud are used. SD WAN reduce the cost of installation. For making expensive legacy the SD WAN technology are used before this MPLS or T-11 are used. For Virtualization technology can apply security and virtual private networking (VPN) technology to broadband Internet connections, making them more secure.

SD-WAN also has the advantage of removing potentially expensive routing hardware by provisioning connectivity and services via the cloud. In the business or any government sector data are stored on the cloud if the data are stored on the cloud there is need of this technology which access the data on the cloud .through the SD WAN data are access the cloud. Emerging SD-WAN technology can also be more flexible. SD-WAN connectivity are controlled through the cloud software, a customer are able to access the data through the cloud.

The main goal of SD-WAN technology is to deliver a business-class, secure, and simple cloud-enabled WAN connection with as much open and software-based technology as possible. This can be used to deliver basic WAN connectivity, or it can be used for premium business services such as VPN, WAN optimization, and applications delivery control (ADC). Many new startups are going after the potential in the

SD-WAN market, which is likely billions of dollars. Many of these startups have slightly different approaches to the market. For example, Silver Peak has focused on accelerating Software-as-a-Service (SaaS) applications in the cloud, Pertino and VeloCloud are going after branch-office connectivity using SD-WAN, and Aryaka has built a global network so that companies can use WAN as a Network-as-a-Service (NaaS). More than \$360 million has been invested in SD-WAN startups, according to Rayno Report research. Incumbent WAN technology vendors such as Cisco and Riverbed, which make specialized appliances for WAN connectivity, are now focusing more on cloud-based WAN offerings in response to this new trend. Expect the trend to accelerate over the next few years. What started as a solution for branch-office and data-center WAN connectivity requiring less proprietary equipment appears to be expanding into a wide range of SD-WAN offerings and technologies including VPN, security, WAN optimization, NaaS, and application policy control.

#### A. Problem with MPLS technology:

There are various problems in the MPLS technology which has to be overcome with SD WAN technology. MPLS carry message from data center to local service with high bandwidth, low latency, and high performance needed to access cloud-based applications. There are many drawbacks in the traditional MPLS technology, less security in the MPLS technology. In the MPLS technology local service are used. Data are not stored in the cloud. MPLS technology are not complete the all today business challenges, marked by an increase in connected devices, mobility, cloud models, and security needs. The current infrastructure is unable to comply with the security requirements and current business models. These require fast response times that are unavailable over an inflexible network. All this makes the evolution of the network a priority, not just for the CIO, but the entire management structure.

#### B. Why there is need of SD WAN?

Today's data are stored on the cloud so there is need of technology that which handle the data on the cloud with security. First challenge is to overcome the security issue which is in the MPLS technology. Which handle the all the issue related to the security which fulfill the all requirements of the business. There is need to overcome Provide a uniform experience irrespective of where the connection is made.

The technology provide the best user interface with the changing time there is need of mobility to the business person. It also Provide more visibility to network managers, allowing them to eliminate potential conflicts in the network. SD-WAN use to integrate security into the network with multiple layers and multiple control points. It Rapidly provision applications and services in order to maintain the business competitive edge. Business needs and market trends drive network evolution a fact that can no longer be ignored by management. Enterprises need an intelligent network that can adapt accordingly.

### METHODOLOGY

A new approach called software-defined WAN, or SD-WAN, offers a solution to this dilemma. This technology logically binds multiple MPLS and broadband paths into a single logical path. The software-defined wide area network (SD-WAN) is a specific application of software-defined networking (SDN) technology applied to WAN connections, which are used to connect enterprise networks including branch offices and data centers over large geographic distances.

A WAN might be used, for example, to connect Branch offices to a central corporate network, or to connect data centers separated by distance. In the past, these WAN connections often used technology that required special proprietary hardware. The SD-WAN movement seek to move network control is moved into the cloud, using a software approach. We are going to do smart work not hard work. Today's technology moving towards fastest and reliable network.

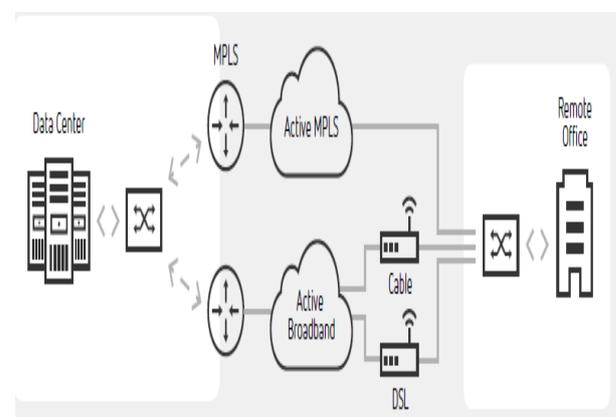


Fig.1. In a typical datacenter-to-branch scenario, broadband is used only for backup or low priority applications because it is not reliable

Before looking forward how SD-WAN technology works, let's look today's situation in between branch office and data center how the networking is done. How they complex, and what is speed of that networking. Most traffic, including all traffic for business critical applications, which is run through an MPLS connection. One or two paths through the public Internet have been added, primarily for backup in case the MPLS link goes down or slow in between failure occur.

### 1. Drawback in this arrangement:

#### A. There is wasted of bandwidth:

The broadband paths are kept in reserve in case the MPLS link fails, if the MPLS path reaches capacity, there is no easy way to move MPLS traffic over the broadband connections to reduce contention on MPLS's.

#### B. When a connection goes down it can take several time or few seconds:

A short outage can be extremely annoying to employees, who may be forced to restart sessions or log in again so it can result a loss of data or leakage of data.

#### C. MPLS network are good quality but still they can loss of packets:

MPLS network good quality but they can packet loss, they can impact on sensitive applications, causing more employee frustration and lost business.

#### D. Networks are becoming more complex:

With the use of separate application for routing, firewall and WAN the network become complex. Multiple appliances increase the cost per branch and add complexity to maintaining and troubleshooting the branch network.

#### E. Network administration can be complex and time consuming:

Application traffic needs to be configured and monitored differently for each path. If paths to a remote office or user take more than one "hop" across different network types, then it is extremely difficult to manage end-to-end monitoring and quality of service.

Fig 1 only shows a single datacenter and one branch office. The issues mentioned above will be greatly magnified in an enterprise with multiple datacenters and dozens or number of offices. We are looked at the problems that are common with a typical WAN, let's look at the basic capabilities and features of a

software defined WAN and then see how SD-WANs tackled these problems.

Fig 2 shows the same headquarters to branch office scenario as Fig 1, except with NetScaler SD-WAN appliances. In this figure we include NetScaler SD-WAN at each location. The source (sending) appliance adds tags to each packet with information about the time sent and its order in the packet flow. The destination appliance reads these tags and uses the data to measure transmit time, congestion, jitter and packet loss. These techniques allow the WAN appliances to continuously measure and monitor the performance, quality and health of every MPLS and broadband connection in WAN, then apply that knowledge to providing quality of service, path selection, traffic shaping, sub second failover and other services.

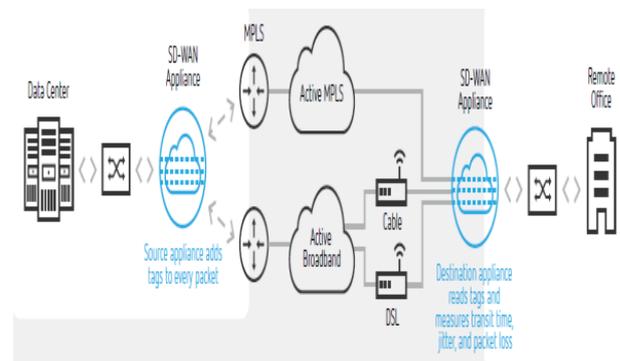


Fig.2. NetScaler SD-WAN Appliances measures transmit time, jitter and packet loss.

#### 1. Measure and monitor network paths:

The most important aspect of SD-WAN technology is the knowledge it gathers regarding the underlying network connections.

#### 2. It provide application awareness:

The NetScaler SD-WAN solution provide IT organization to make prioritize solution for each application using very granular application classification. Each application assigned three level of category „real time”, “interactive”, and “bulk”. If the network is congested, each application can continue to function and high priority applications can't be crowded out and with NetScaler SD-WAN, the bandwidth is reserved on the first and last mile.

#### 3. Combine network measurements with application policy to intelligently route traffic:

The NetScaler SD-WAN solution uses several techniques to ensure excellent, reliable performance for

critical applications. This performing intelligent load balancing within a network session to use the optimal WAN path or paths. Based on information from the map of available network links, a high-priority application is assigned to the lowest latency WAN path available at that moment. If the bandwidth requirements of the application exceed the bandwidth available on that path, part of the application traffic is sent through the next-best path, and if necessary through a third or fourth. The paths can be a mix of MPLS and broadband links. This aggregation allows high-priority applications to take advantage of the fastest paths available, without overloading any single path. The path selection process is dynamic.

## 2. Packet duplication:

An additional enhancement technique is packet duplication. Duplicate copies of each packet can be sent along different, independent paths. The packet that reaches the destination appliance first is used and the second one is discarded. This approach uses extra bandwidth, but it ensures the highest possible performance and zero packet loss. The NetScaler SD-WAN solution provides four types of service:

1. Virtual Path which is communication between two locations with NetScaler SD-WAN appliances
2. Intranet which is communication between allocation with a NetScaler SD-WAN appliance and another corporate WAN location that does not have an appliance
3. Internet which is communication from a location with a NetScaler SD-WAN appliance to destinations on the public Internet
4. Pass-through which is traffic that administrators want to transit unchanged through the NetScaler SD-WAN appliances, for example troubleshooting traffic.

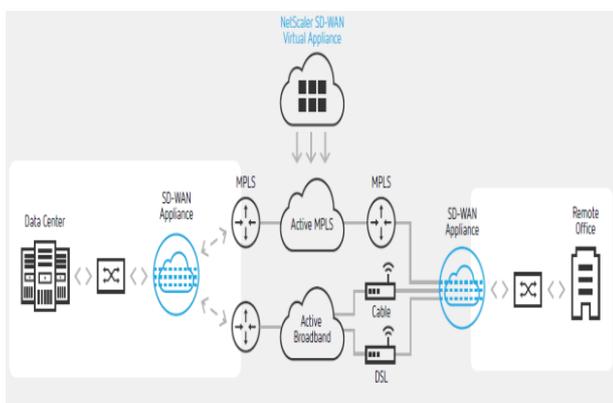


Fig. 3. A virtual appliance provides visibility and control for traffic SaaS applications.

The NetScaler SD-WAN appliances provide four types of services, of which two, the Intranet and Internet services, are designed for communication between locations with an appliances only one side. The use of SD-WAN is applications running in public and private clouds. Unfortunately, when application traffic enters a cloud-based data center, it effectively leaves the WAN boundary and becomes invisible to the enterprise IT organization to address this issue, the NetScaler SD-WAN solution offers a virtual appliance that runs in Amazon Web Services (AWS) regions this effectively expands the WAN boundary to the edge of the cloud. NetScaler SD-WAN. Appliances and virtual appliances can aggregate multiple broadband and Amazon Direct Connect links, and provide latency aware path selection, packet duplication and seamless failover for users accessing cloud data and SaaS applications.

Netscape SD-WAN offers a complete all in one solution that includes application-aware virtualized WAN connectivity, dynamic routing, WAN optimization, secure data segmentation, and secure Internet breakout. This limits the number of separate appliances that need to be deployed in a branch, and provides a single centralized management system for configuration and reporting. This approach drives down the cost of the branch network, not only by limiting the number of appliances that have to be individually purchased, but by lowering the technical support Costs per branch. A single configuration system means that IT staff doesn't have to learn multiple technologies and coordinate changes across multiple systems. This means that the time and cost of configuration is less and lowers the risk of errors that can result in network downtime.

The Command Center automatically discovers all NetScaler SD-WAN appliances in the network, and allows administrators to push out configuration changes to all appliances in a very short time window. NetScaler Insight Center includes a customizable dashboard with charts, maps and diagrams that display key facts and events showing the health and performance of WAN paths across the network. A unique replay feature shows traffic flows over time and highlights changes resulting from changes in network conditions and application demand.

The NetScaler SD-WAN solution is the only SDWAN offering that provides this level of insight into

application traffic over wide area networks. NetScaler SD-WAN addresses all of these issues.:

1. *No wasted bandwidth:*

Path selection across all connection types ensures that all bandwidth is available at all times. This dynamic path selection is performed automatically, without requiring network administrators to analyze or monitor network links or assign applications to paths.

2. *Sub-second failover and failback:*

NetScaler SD-WAN appliances can detect path outages after just two or three missing packets, allowing seamless sub-second failover of application traffic to the next-best WAN path.

3. *Dramatically lower costs:*

That means enterprises can expand their WAN capacity using low-cost, flexible broadband connections, and have those connections work seamlessly with an existing MPLS network.

4. *Better quality for all application types:*

NetScaler SD-WAN appliances continuously measure and monitor the latency, jitter and packet loss of every WAN connection. They dynamically make routing decisions to use the best quality paths as much as possible.

5. *Simplified, end-to-end management and Monitoring:*

The NetScaler SD-WAN solution makes it simple to manage and monitor performance and quality on WANs that combine multiple MPLS and broadband connections. Administrators can configure WANs in their entirety, rather than as series of individual devices.

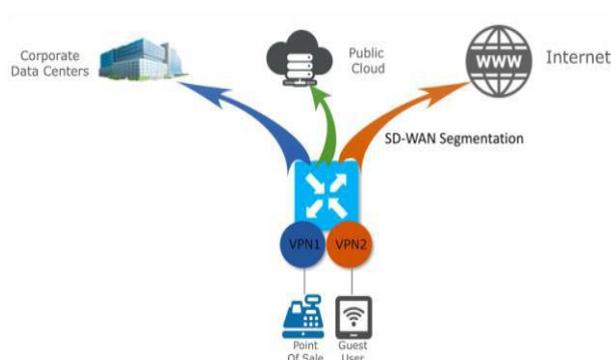


Fig 5. SD-WAN Segmentation

SD-WAN Business Drivers Enterprise customers are demanding more flexible, open, and

cloud-based WAN technologies, rather than installing proprietary or specialized WAN technology that often involve expensive, fixed circuits, or proprietary hardware. Many of the new SD-WAN offerings, for example, can be used to improve and secure Internet connectivity, making it more competitive with more expensive legacy WAN technologies such as MPLS. In some cases, SD-WAN technology uses Internet broadband connections to replace more expensive solutions. SD-WAN also has the advantage of removing potentially expensive routing hardware by provisioning connectivity and services via the cloud. Emerging SD-WAN technology can also be more flexible. For example, because SD-WAN connectivity can be controlled through cloud software, a customer might be able to scale up or burst connectivity during times of peak demand.

The main goal of SD-WAN technology is to deliver a business-class, secure, and simple cloud-enabled WAN connection with as much open and software based technology as possible. This can be used to deliver basic WAN connectivity, or it can be used for premium business services such as VPN, WAN optimization, and applications delivery control (ADC). For example, Silver Peak has focused on accelerating Software-as-a-Service (SaaS) applications in the cloud, Pertinoand VeloCloudare going after branch-office connectivity using SD-WAN, and Aryaka has built a global network so that companies can use WAN as a Network-as-a-Service (NaaS). More than \$360 million has been invested in SD-WAN start-ups.

## CONCLUSION

We finally conclude that SD-WAN technology is to deliver a business-class, secure, and simple cloud enabled WAN connections with as much open and software based technology. SD WAN also has the advantage of removing potentially expensive routing hardware by provisioning connectivity and services. SD WAN technology is more flexible, low cost. Today SD-WAN is use mostly. The software defined wide area network is a specific application of software defined networking applied to WAN connections. This technology remove the traditional way of WAN connection. Today the importance of cloud computing are increasing so the importance of SD WAN are increasing. SD WAN has also the advantage of removing potentially expensive hardware by provisioning connectivity and service via the cloud. SD WAN is the industry name for a set of networking function that are

commonly grouped together to give end user the ability to create private overlay network using low cost broad band connection sometimes arguments by traditional L3VPA/MPLS link. SD WAN is very useful technology.

#### REFERENCES

- [1] S. Ghobrani, C. Schlesinger, M. Monaco, E. Keller, M. Caesar, J. Rexford and D. Walker, "Transparent, Live Migration of a Software Defined Network", SoCC'14, Nov. 3-5, 2014 Seattle, USA.
- [2] Hyoung woo Park, IL sun Hwang, and Jongsuk Ruth Lee Study on the Sustainable Migration to Software Defined Network for Nation-wide R&E Network.
- [3] Miko Fratto "SD WAN 2015 Market Update :Vendor Snapshots Show A Crowded, Competitive Field Attempting To Diversify" 15 December,2015 in current analysis.
- [4] John wiley & sons "Software defined networking for dummies" ,Cisco special Edition, 2015, Inc. Hoboken, New Jersey.
- [5] Bruce page & Joel Stradling "Customer journey to SD-WAN: Functional, Technical, and Economics considerations", 2016 in current analysis.