



SD-WAN COMPARATIVE REPORT

NSS Labs Value Matrix™

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Tested Products

Barracuda Networks NextGen Firewall F-Series F80 v7.1.1

Citrix Systems NetScaler SD-WAN v10.0.0.207

Cradlepoint AER2200-600M v6.5.0

FatPipe Networks MPVPN/SD-WAN v9.1.2

Forcepoint NGFW 1101 vSMC 6.3.6, engine 6.3.6.19302

Fortinet FortiGate 61E v6.0.1 GA Build 5068

Talari Networks Adaptive Private Networking (APN) Software APN 7.1

Versa Networks FlexVNF v120

VMware NSX SD-WAN by VeloCloud Edge v3.2

Unverified Products¹

Cisco

Silver Peak

Environment

NSS Labs Software-Defined Wide Area Network (SD-WAN) Test Methodology v1.2

¹ NSS was unable to measure the effectiveness and determine the suitability of SD-WAN products from Cisco and Silver Peak and therefore cautions against their deployment without a comprehensive evaluation.

Overview

Empirical data from individual Test Reports and Comparative Reports is used to create the NSS Labs Value Matrix™. The Value Matrix depicts the *Total Cost of Ownership (TCO) per Mbps (Value)* and the Quality of Experience (QoE) scores for the VoIP quality and the video quality of tested products. The terms *TCO per Mbps* and *Value* are used interchangeably throughout the Comparative Reports.

Test Reports are available for each product tested and can be found at www.nsslabs.com. Comparative Reports provide detailed comparisons across all tested products in the areas of performance and TCO.

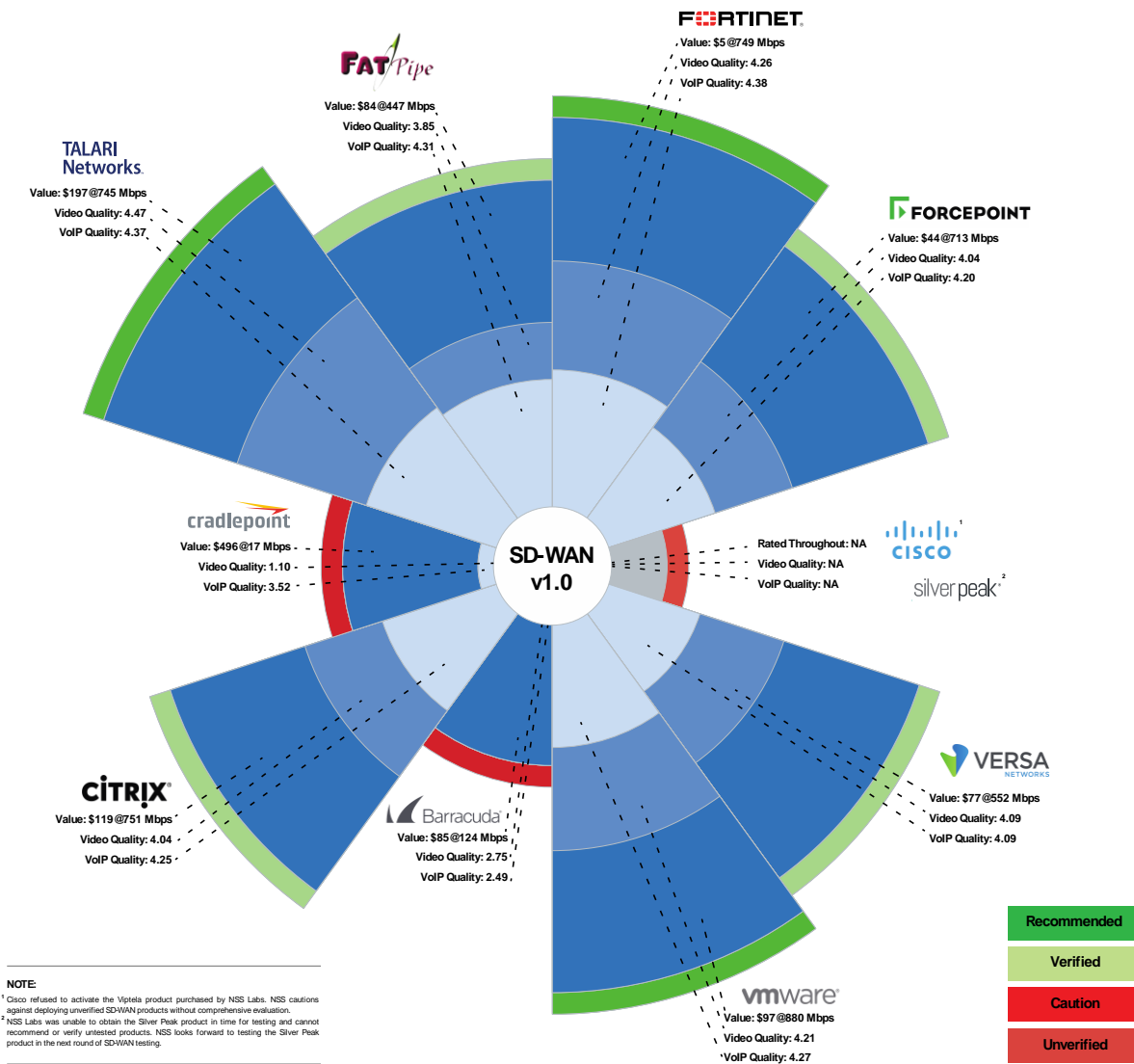


Figure 1 – NSS Labs’ 2018 Value Matrix for Software-Defined Wide Area Network (SD-WAN)

Key Findings

- On a QoE scale of 1 – 5 for VoIP, with 3.4 being the minimum viable NSS Labs considers to meet the use case for VoIP, and with a theoretical maximum score of 4.41, the tested range was 2.49 to 4.38 with eight of the nine tested products scoring above the minimum of 3.4.
- On a QoE scale of 1 – 5 for video, with 3.4 being the minimum viable NSS Labs considers to meet the use case for video, and with a theoretical maximum score of 4.53, the tested range was 1.10 to 4.47 with seven of the nine tested products scoring above the minimum of 3.4.
- One tested product scored below the 3.4 use case threshold for both QoE for VoIP and QoE for video.
- TCO per Mbps ranged from US\$5 to US\$496 with most tested products costing less than US\$100 per Mbps.
- The average *TCO per Mbps* was US\$134; seven of the tested products were rated as having above-average value, and two of the tested products were rated as having below-average value.

Product Rating

The Overall Rating in Figure 2 is determined by how each product scores for VoIP, video, and TCO per Mbps: *Recommended*, *Verified*, or *Caution*. *Recommended* and *Verified* products are great candidates for consideration, each having strengths and weaknesses. For more information on how the Value Matrix is constructed, see the How to Read the NSS Labs Value Matrix section of this document.

Vendor	QoE for VoIP		QoE for Video		TCO per Mbps	Overall Rating
Barracuda Networks	2.49	Below Use Case	2.75	Below Use Case	\$85	Caution
Citrix Systems	4.25	Above Use Case	4.04	Above Use Case	\$119	Verified
Cradlepoint	3.52	Above Use Case	1.10	Below Use Case	\$496	Caution
FatPipe Networks	4.31	Above Use Case	3.85	Above Use Case	\$84	Verified
Forcepoint	4.20	Above Use Case	4.04	Above Use Case	\$44	Verified
Fortinet	4.38	Above Use Case	4.26	Above Use Case	\$5	Recommended
Talari Networks	4.37	Above Use Case	4.47	Above Use Case	\$197	Recommended
Versa Networks	4.09	Above Use Case	4.09	Above Use Case	\$77	Verified
VMware	4.27	Above Use Case	4.21	Above Use Case	\$97	Recommended

Figure 2 – NSS Labs' 2018 Recommendations for Software-Defined Wide Area Network (SD-WAN)

This report is part of a series of Comparative Reports on performance, TCO, and the NSS Labs Value Matrix.

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How to Read the NSS Labs Value Matrix

The Value Matrix depicts the value of a typical deployment of three SD-WAN products. It represents how each SD-WAN is rated using three scores, VoIP QoE, video QoE, and TCO per Mbps. A QoE score of 4.41 for VoIP and a QoE score of 4.53 for video represent the best scores possible and excellent voice call/video stream. Any score below 3.5 represents a significantly degraded voice call/video stream. NSS considers a score below 3.4 as failing to meet the use case.

The mean opinion score (MOS) is used to calculate the QoE enterprises can expect when deploying SD-WAN products. Relative (video) MOS is an estimated perceptual quality score that considers the effects of codec, the impact of IP impairments (such as packet loss) on the group of pictures (GoP) structure and video content, and the effectiveness of loss concealment methods. Unlike speech codecs, video codecs have no limits on a maximum possible MOS.

The encoding specifications for video codec are used as guidelines and conformance, and vendors are free to design encoders to improve video quality and reduce the number of transmission bits. Simply put, MOS for video (relative MOS) can vary based on different advancements in the video estimation or encoding techniques. In the video used for the test, the maximum achievable QoE was 4.53. VoIP (real-time protocol [RTP]) MOS, on the other hand, measures the mean opinion score for VoIP calls based on the speech codec being used. The setup used a G711 codec, which produces a maximum QoE score of 4.41 for an excellent VoIP call.

Since no two network products deliver the same performance or TCO, making precise comparisons is extremely difficult. In order to enable value-based comparisons of SD-WAN products on the market, NSS has developed a unique metric: *TCO per Mbps*.

This metric incorporates the 3-Year TCO with the *NSS-Tested VPN Throughput (Mbps)* to provide a data point against which the actual value of each product tested can be compared. The following formula is used: $TCO\ per\ Mbps = 3\text{-Year}\ TCO / NSS\text{-Tested}\ Throughput$. The TCO incorporates capital expenditure (capex) costs over a three-year period, including initial acquisition and deployment costs and annual maintenance and update costs (software and hardware updates). For more details on performance and TCO, see the Comparative Reports on Performance and TCO at www.nsslabs.com.

A product's VoIP QoE, video QoE, and *TCO per Mbps* determine its rating on the Value Matrix as either *Recommended*, *Verified*, or *Caution*:

- **Recommended:** These products provide a high level of quality and value for money and consistently score equal to or above the market in NSS testing.
- **Verified:** These products provide a high level of quality and value for money and provide a good experience relative to the market in NSS testing.
- **Caution:** These products provide limited value for money since their three-year TCO for the use cases and their measured quality of VoIP and/or video is below the market.

SD-WAN deployments have varying requirements for performance and value that can extend beyond throughput and voice and video QoE. NSS clients can schedule an inquiry call with NSS analysts to discuss other value metrics and normalized values for other deployment use cases.

Analysis

Each tested product may fall into one of three categories based on its rating in the: *Recommended*, *Verified*, or *Caution*. Each tested product receives a single rating. Vendors are listed alphabetically within each section.

Recommended

Fortinet FortiGate 61E v6.0.1 GA Build 5068

VoIP QoE and Video QoE Scores	Using the recommended policy, the FortiGate 61E achieved a VoIP QoE score of 4.38 and a Video QoE score of 4.26 out of maximum achievable scores of 4.41 and 4.53, respectively.
NSS-Tested VPN Throughput	The FortiGate 61E is rated by NSS at 749 Mbps VPN throughput, out of a maximum achievable of 1,092 Mbps per the SD-WAN Test Methodology.

Talari Networks Adaptive Private Networking (APN) Software APN 7.1

VoIP QoE and Video QoE Scores	Using the recommended policy, the APN SD-WAN achieved a VoIP QoE score of 4.37 and a Video QoE score of 4.47 out of maximum achievable scores of 4.41 and 4.53, respectively.
NSS-Tested VPN Throughput	The APN SD-WAN is rated by NSS at 745 Mbps VPN throughput, out of a maximum achievable of 1,092 Mbps per the SD-WAN Test Methodology.

VMware NSX SD-WAN by VeloCloud Edge v3.2

VoIP QoE and Video QoE Scores	Using the recommended policy, the VMware NSX SD-WAN achieved a VoIP QoE score of 4.27 and a Video QoE score of 4.21 out of maximum achievable scores of 4.41 and 4.53, respectively.
NSS-Tested VPN Throughput	The VMware NSX SD-WAN is rated by NSS at 880 Mbps VPN throughput, out of a maximum achievable of 1,092 Mbps per the SD-WAN Test Methodology.

Verified

Citrix Systems NetScaler SD-WAN v10.0.0.207

VoIP QoE and Video QoE Scores	Using the recommended policy, the NetScaler SD-WAN achieved a VoIP QoE score of 4.25 and a Video QoE score of 4.04 out of maximum achievable scores of 4.41 and 4.53, respectively.
NSS-Tested VPN Throughput	The NetScaler SD-WAN is rated by NSS at 751 Mbps VPN throughput, out of a maximum achievable of 1,092 Mbps per the SD-WAN Test Methodology.

FatPipe Networks MPVPN/SD-WAN v9.1.2

VoIP QoE and Video QoE Scores	Using the recommended policy, the MPVPN/SD-WAN achieved a VoIP QoE score of 4.31 and a Video QoE score of 3.85 out of maximum achievable scores of 4.41 and 4.53, respectively.
NSS-Tested VPN Throughput	The MPVPN/SD-WAN is rated by NSS at 447 Mbps VPN throughput, out of a maximum achievable of 1,092 Mbps per the SD-WAN Test Methodology.

Forcepoint NGFW 1101 vSMC 6.3.6, engine 6.3.6.19302

VoIP QoE and Video QoE Scores	Using the recommended policy, the NGFW 1101 achieved a VoIP QoE score of 4.20 and a Video QoE score of 4.04 out of maximum achievable scores of 4.41 and 4.53, respectively.
NSS-Tested VPN Throughput	The NGFW 1101 is rated by NSS at 713 Mbps VPN throughput, out of a maximum achievable of 1,092 Mbps per the SD-WAN Test Methodology.

Versa Networks FlexVNF v120

VoIP QoE and Video QoE Scores	Using the recommended policy, the FlexVNF achieved a VoIP QoE score of 4.09 and a Video QoE score of 4.09 out of maximum achievable scores of 4.41 and 4.53, respectively.
NSS-Tested VPN Throughput	The FlexVNF is rated by NSS at 552 Mbps VPN throughput, out of a maximum achievable of 1,092 Mbps per the SD- WAN Test Methodology.

Caution

Barracuda Networks NextGen Firewall F-Series F80 v7.1.1

VoIP QoE and Video QoE Scores	Using the recommended policy, the NextGen Firewall F-Series F80 achieved a VoIP QoE score of 2.49 and a Video QoE score of 2.75 out of maximum achievable scores of 4.41 and 4.53, respectively.
NSS-Tested VPN Throughput	The NextGen Firewall F-Series F80 is rated by NSS at 124 Mbps VPN throughput, out of a maximum achievable of 1,092 Mbps per the SD-WAN Test Methodology.

Cradlepoint AER2200-600M v6.5.0

VoIP QoE and Video QoE Scores	Using the recommended policy, the AER2200-600M SD-WAN achieved a VoIP QoE score of 3.52 and a Video QoE score of 1.10 out of maximum achievable scores of 4.41 and 4.53, respectively.
NSS-Tested VPN Throughput	The AER2200-600M SD-WAN is rated by NSS at 17 Mbps VPN throughput, out of a maximum achievable of 1,092 Mbps per the SD-WAN Test Methodology.

Unverified

NSS was unable to assess and determine the suitability of these products for SD-WAN deployments and therefore cautions against their deployment without comprehensive evaluation.

Cisco

Cisco refused to activate the Viptela product that NSS purchased, which prevented NSS from validating the product’s capabilities as delivered to customers. NSS looks forward to receiving a functioning Cisco SD-WAN product and recommends enterprises compare the Cisco SD-WAN product to other well-qualified products before making any purchasing decisions.

Silver Peak

NSS was unable to obtain the Silver Peak product in time for testing and cannot recommend or verify untested products. NSS looks forward to testing the Silver Peak product in the next round of SD-WAN testing.

Test Methodology

NSS Labs Software-Defined Wide Area Network (SD-WAN) Test Methodology v1.2

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