MPLIFY

Testing Guide

SD-WAN Certification Blueprint

June 2025 | Version 1.0

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Introduction

This document specifies the SD-WAN Certification test categories, descriptions, requirement IDs, test cases and requirements (TC & R) references, and scoring used as part of the SASE Certification Program – Phase 1, based on:

- MEF 70.1 *SD-WAN Service Attributes and Service Framework*
- MEF 90.2 Draft R3 *SD-WAN Certification Test Cases and Requirements – Phase 2*

Scope

SD-WAN Certification includes the following test categories:

- Routing and Access Control
- SD-WAN Virtual Connection (SWVC) Stability and Reliability
- Underlay Connectivity Service (UCS) Impairments and SWVC Application Assurance
- SWVC Performance

Out of scope:

Management and orchestration of SD-WAN Services, LSO APIs, IP forwarding paradigms other than longest prefix match-based forwarding, details about creation of Tunnel Virtual Connections and interconnection of SD-WAN Services to cloud services that do not provide SD-WAN UNIs.

SD-WAN Certification Framework

The SD-WAN Certification Framework is composed of the following six parts:

1. Test Cases & Requirements
2. Topology
3. Scoring Penalties
4. MOS Scoring Tables
5. Scoring Methodology
6. Scoring Example

1. Test Cases & Requirements

Category: Routing and Access Control			
Description	**SD-WAN Requirement ID**	**TC & R Reference**	**Scoring Impact**
For an IP Packet in an Application Flow to be forwarded directly from one SD-WAN Edge to another SD-WAN Edge, there MUST be at least one TVC between the two SD-WAN Edges.	MEF 70.1 R3	MEF 90.2 Draft R3 9.1.1	Yes
The SD-WAN Service MUST NOT deliver an ingress IP Packet to a UNI where the destination address is not reachable.	MEF 70.1 R6	MEF 90.2 Draft R3 9.1.1	Yes
If the value of the *vtType* is *rooted-multipoint* for a Virtual Topology in the SWVC List of Virtual Topologies Service Attribute, an SWVC End Point Identifier MUST appear at most once in either the list of root SWVC End Points or the list of leaf SWVC End Points.	MEF 70.1 R33	MEF 90.2 Draft R3 9.1.1	Yes
A unicast IP Packet in an Application Flow MUST NOT be forwarded to an Egress UNI unless the value of the ALLOWED-DESTINATION-ZONES Policy Criterion is *All*, or the Destination Address in the IP Packet maps to either: one of the Zones listed in the ALLOWED-DESTINATION-ZONES Ingress Policy Criterion; or the Zone of the source IP host, if the ALLOWED-DESTINATION ZONES Policy Criterion includes *Self*.	MEF 70.1 R57	MEF 90.2 Draft R3 9.1.1	Yes
This test verifies that test traffic generated at the SD WAN UNI connected to the Data Center is forwarded correctly based on Application Flow Specifications and Policies to the appropriate Branch Office	-	MEF 90.2 Draft R3 9.2.1	Yes
If the value of *vtType* is *multipoint-to-multipoint* for a Virtual Topology in the SWVC List of Virtual Topologies Service Attribute, the value for *vtEP* MUST be a list of at least two SWVC End Point Identifiers.	MEF 70.1 R31	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
If the value of *vtType* is *rooted-multipoint* for a Virtual Topology in the SWVC List of Virtual Topologies Service Attribute, the value of *vtEP* for the Virtual Topology MUST be a 2-tuple ⟨*rootlist*, *leaflist* ⟩, where *rootlist* is a non-empty list of SWVC End Point Identifiers of root SWVC End Points and *leaflist* is a non-empty list of SWVC End Point Identifiers of leaf SWVC End Points.	MEF 70.1 R32	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
If the Policy Criterion INTERNET-BREAKOUT=Enabled is applied to an Application Flow, IP Packets in the Application Flow MUST be forwarded to Internet destinations over an Internet Access UCS at a UCS End Point with the UCS End Point Breakout Service Attribute = Enabled.	MEF 70.1 R59	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
If the Policy Criterion INTERNET-BREAKOUT=*Disabled* is applied to an Application Flow, IP Packets in the Application	MEF 70.1	MEF 90.2	Yes

Category: Routing and Access Control			
Flow MUST NOT be forwarded to Internet destinations by the SD-WAN Service.	R60	Draft R3 9.4.1, 9.5.1	
If no Application Flows at a UNI are assigned a Policy that includes INTERNET-BREAKOUT=*Enabled*, then IP Packets from the Internet that are destined to the UNI MUST be discarded.	MEF 70.1 R62	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
If Ingress Policies for the SWVC do not include the INTERNET-BREAKOUT Policy Criterion, the behavior of every Policy MUST be as if INTERNET BREAKOUT *Disabled* were included in it.	MEF 70.1 R63	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
Application Flows MUST NOT be forwarded toward the destination UNI over a UCS End Point where the UCS End Point Backup Service Attribute=*Enabled*, if a Path to the destination egress UNI is available over a non-*Backup* UCS (i.e., where that Service Attribute value is *Disabled*)	MEF 70.1 R64	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
If the Policy Criterion BACKUP=*Disabled* is assigned to an Application Flow, then IP Packets in the Application Flow MUST be discarded if only Paths to the destination egress UNI over *Backup* UCSs are available.	MEF 70.1 R65	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
If the origin of an IP Packet destined for an Egress UNI matches any source specified in the BLOCK-SOURCE Policy Criterion, the IP Packet MUST be discarded (not forwarded across the Egress UNI).	MEF 70.1 R75	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
Each Ingress IP Packet MUST be assigned to an Application Flow based on the first Application Flow Specification in the value of the SWVC List of Application Flow Specifications Service Attribute whose Application Flow Criteria it matches, if any.	MEF 70.1 R83	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
Any Ingress IP Packet that cannot be associated with an Application Flow based on the value of the List of Application Flow Specifications Service Attribute MUST be discarded.	MEF 70.1 R84	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
The Application Flow Criteria supported by the Service MUST include the Application Flow Criteria listed in MEF 70.1 Table 7.	MEF 70.1 R85	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
If the Service Provider defines a named packet matching definition (either standard or custom) for use with the APPID Application Flow Criterion, the description provided to the Subscriber MUST include the following information: The Application Identifier Additional Arguments Required (beyond the Identifier) Details of the applications and application traffic matched by the APPID.	MEF 70.1 R86	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
If an entry in the value of the SWVC List of Application Flow Specifications Service Attribute includes the Application Flow Criterion *ANY*, that entry MUST NOT contain any other Application Flow Criteria.	MEF 70.1 R87	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes

Category: Routing and Access Control			
If an Application Flow is not assigned an Ingress Policy via any of the four methods discussed in MEF 70.1 [R97] through [R99] at a UNI, Ingress IP Packets mapped to the Application Flow MUST be discarded.	MEF 70.1 R100	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
If an Application Flow is assigned the reserved Ingress Policy name Block at a UNI, Ingress IP Packets mapped to the Application Flow MUST be discarded.	MEF 70.1 R101	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
If an Egress Policy is not assigned to an Application Flow at an Egress UNI, then Egress IP Packets that are in the Application Flow MUST be forwarded to the Egress UNI.	MEF 70.1 R102	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes
If the value of the SD-WAN UNI IPv4 Connection Addressing Service Attribute is None, IPv4 Packets MUST NOT be forwarded to or from the UNI.	MEF 70.1 R112	MEF 90.2 Draft R3 9.4.1, 9.5.1	Yes

Category: SWVC Stability and Reliability			
Description	**SD-WAN Requirement ID**	**TC & R Reference**	**Scoring Impact**
Passing Legitimate Traffic – Normal Load This test verifies that the SD-WAN Edge Vendor solution continues to pass legitimate traffic as the number of concurrent open sessions reaches 75% of the maximum capacity of TCP and HTTP connections.	-	MEF 90.2 Draft R3 11.1.1	Yes
State Preservation – Maximum sessions exceeded This test aims to determine whether the SD-WAN Edge Vendor solution maintains the state of pre-existing sessions as the number of open sessions exceeds the maximum capacity of TCP and HTTP connections by 110%.	-	MEF 90.2 Draft R3 11.1.2	Yes
Drop non-conformant Traffic – maximum sessions exceeded This test verifies that the SD-WAN Edge solution continues to drop all traffic not associated with existing sessions as the number of open sessions exceeds the maximum capacity of TCP and HTTP connections.	-	MEF 90.2 Draft R3 11.1.3	Yes

Category: UCS Impairment and SWVC Application Assurance			
Description	**SD-WAN Requirement ID**	**TC & R Reference**	**Scoring Impact**
If a PERFORMANCE Policy Criterion includes a reference to One-Way Mean Packet Delay in the *primary* or *secondary* element, it MUST be defined as follows for each Path *p* between UNIs *x* and *y*: Let Δ= {*δ1, δ2, δ3, … δn*} represent the One-Way Packet Delays of the n Qualified Packets sent from UNI *x* to UNI *y* across Path *p* during a time interval whose duration is the value of the *evalinterval* element of the SWVC Performance Time Intervals Service Attribute. Then the One-Way Mean Packet Delay for *p* over that interval is the arithmetic mean of the values *δ1 … δn*. If n=0 during the time interval, the One-Way Mean Packet Delay for that time interval is zero.	MEF 70.1 R149	MEF 90.2 Draft R3 8.2	No
If the PERFORMANCE Policy Criterion includes a reference to One-Way Mean Packet Delay Variation in the *primary* or *secondary* element, it MUST be defined as follows for each Path *p* between UNIs *x* and *y*: Let Δ= {*δ1, δ2, δ3, … δn*} represent the One-Way Packet Delays of the *n* Qualified Packets sent from UNI *x* to UNI *y* across Path *p* during a time interval whose duration is the value of the *evalinterval* element of the SWVC Performance Time Intervals Service Attribute. Let Δ′=*the set of all pairs of elements* {*δr, δs*} in Δ such that *s>r* and the difference in the arrival time at the Ingress UNI of packets *s* and *r* equals the of value the *arrivalinterval* element in the SWVC Performance Time Intervals Service Attribute. If Δ′ is *null*, then the One-Way Mean Packet Delay Variation for the time interval is zero. Otherwise, let v_{rs} be the absolute value of the difference in One-Way PacketDelay for each pair, {*δr, δs*} in Δ′, i.e., $v_{rs} = |\delta r - \delta s|$. Then the One-Way Mean Packet Delay Variation for *p* over that interval is the arithmetic mean of the values v_{rs} for each element in Δ′.	MEF 70.1 R150	MEF 90.2 Draft R3 8.2	No
If the *primary* or *secondary* element of the PERFORMANCE Policy Criterion includes a reference to One-Way Packet Loss Ratio, it MUST be defined as follows for each Path *p* between UNIs *x* and *y*: Let s represent the total number of Qualified Packets sent from UNI *x* to UNI *y* across Path *p* during a time interval whose duration is the value of the *evalinterval* element of the SWVC Performance Time Intervals Service Attribute. Let *r* represent the total number of unique (not duplicate) Qualified Packets received from UNI *x* at UNI *y* on *p* that were sent during the same period. Then the One-Way Packet Loss Ratio over that interval for *p* is defined as follows: If *s=0* then the One-Way Packet Loss Ratio is 0. If *s>0* then the One-Way Packet Loss Ratio is *(s-r)/s*	MEF 70.1 R151	MEF 90.2 Draft R3 8.2	No

Category: UCS Impairment and SWVC Application Assurance			
This test determines the impact of Packet Loss on the SD-WAN Edge to carry Voice and Video traffic accompanied by other protocols and applications such as HTTP, FTP and SMTP. Record Audio and Video MOS scores.	-	MEF 90.2 Draft R3 10.3.1	Yes
This test determines the impact of Inter-Packet Delay Variation on the SD-WAN Edge to carry Voice and Video traffic accompanied by other protocols and applications such as HTTP, FTP and SMTP. Record Audio and Video MOS scores.	-	MEF 90.2 Draft R3 10.3.2	Yes
This test determines the impact of IP Packet reordering on voice and video MOS. Record Audio and Video MOS scores.	-	MEF 90.2 Draft R3 10.4.1	Yes
This test determines the impact of IP Packet duplication on voice and video MOS., Record Audio and Video MOS scores.	-	MEF 90.2 Draft R3 10.4.2	Yes
This test measures the impact of both queueing and transmission delay on IP Packets traversing the UCSs between SD-WAN Edges. Record Audio and Video MOS scores	-	MEF 90.2 Draft R3 10.5.1	Yes
This test verifies the ability of policers within the SD-WAN Edge to limit the data rate of a network stream to ensure that it does not exceed the specified limits. Record Audio and Video MOS scores	-	MEF 90.2 Draft R3 10.5.2	Yes
This test verifies the ability of policers within the SD-WAN Edge to limit the data rate of a network stream to ensure that it does not exceed the specified limits. Record Audio and Video MOS scores	-	MEF 90.2 Draft R3 10.5.3	Yes
This test determines the impact of all impairments on IP Packets traversing the UCSs between SD-WAN Edges in the test configuration. The SD-WAN Service should manage traffic according to configured QoS policies. Record Audio and Video MOS scores	-	MEF 90.2 Draft R3 10.6.1	Yes
This test determines the impact on forwarding due to a power failure of a redundant device. Record Audio and Video MOS scores	-	Industry Best Practice 1	Yes
This test determines the impact on forwarding when SWVC Manager is unreachable. Record Audio and Video MOS scores	-	Industry Best Practice 2	Yes
This test determines the impact on forwarding due to failure of a UCS link. Record Audio and Video MOS scores	-	Industry Best Practice 3	Yes

Category: SWVC Performance			
Description	**SD-WAN Requirement ID**	**TC & R Reference**	**Scoring Impact**
This test determines the maximum SWVC throughput, up to 1000 Mbps	-	Industry Best Practice 4	No

2. Topology

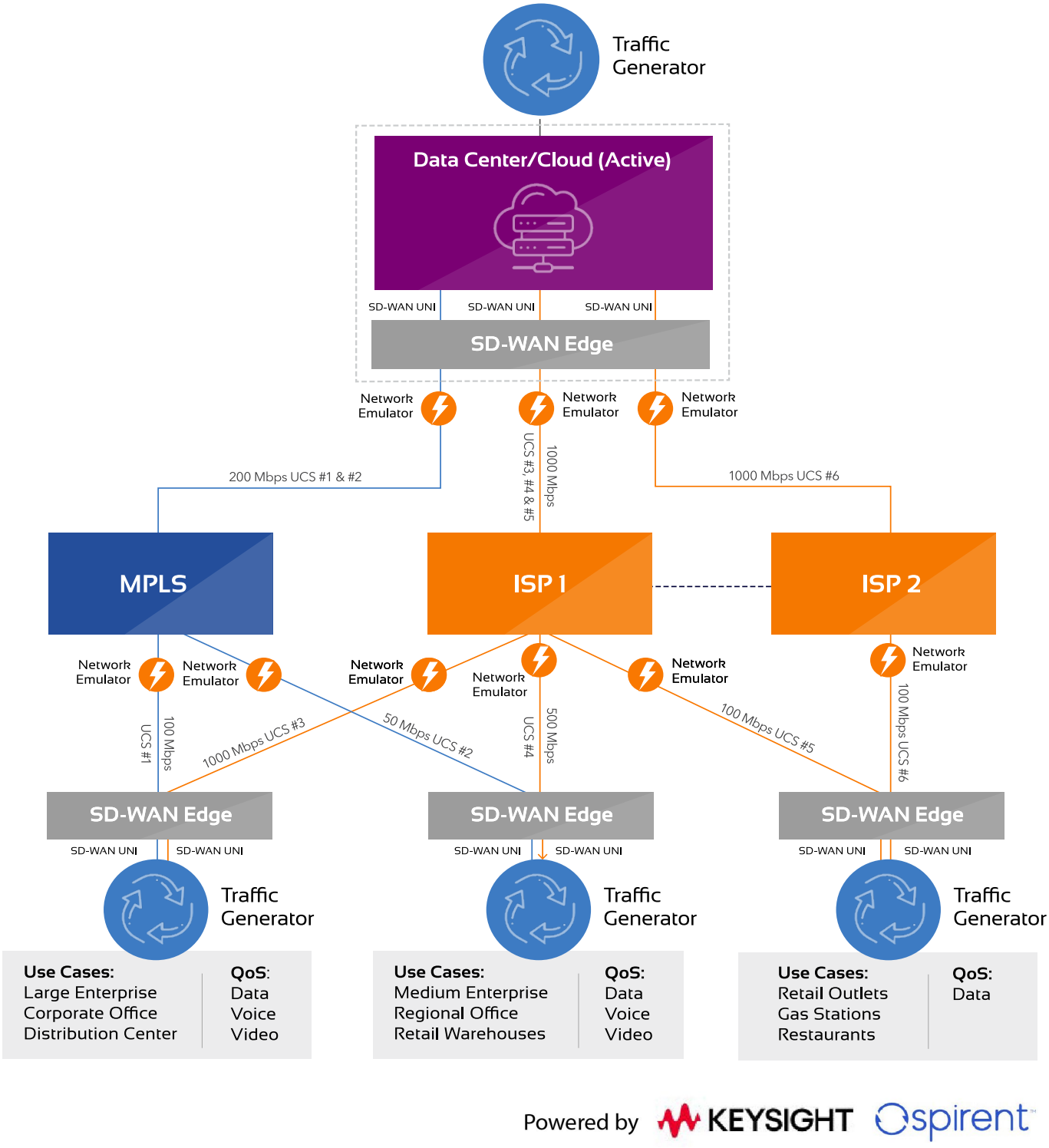

Figure 1 – SD-WAN Certification Topology

3. Scoring Penalties

Penalties: Routing and Access Control			
Section	**TC & R Reference**	**Description**	**Penalty**
1	MEF 90.2 Draft R3 9.1.1	IP Packet Forwarding	100%
2	MEF 90.2 Draft R3 9.2.1	SWVC Forwarding	25%
3	MEF 90.2 Draft R3 9.4.1	Simple SD-WAN Policy Support	100%
4	MEF 90.2 Draft R3 9.5.1	Complex SD-WAN Policy Support	50%

Note 1: A Penalty applies to any test case failed withing a given TC & R Reference section

Note 2: Routing and Access Control tests account for 20% of the Overall Score

Penalties: SWVC Stability and Reliability			
Section	**TC & R Reference**	**Description**	**Penalty**
1	MEF 90.2 Draft R3 11.1.1	Passing Legitimate Traffic	100%
2	MEF 90.2 Draft R3 11.1.2	State preservation	100%
3	MEF 90.2 Draft R3 11.1.3	Dropping non-conformant traffic	100%

Note 1: A Penalty applies to any test case failed withing a given TC & R Reference section

Note 2: SWVC Stability and Reliability tests account for 20% of the Overall Score

Penalties: UCS Impairment and SWVC Application Assurance		
TC & R Reference	**Description**	**Penalty**
MEF 90.2 Draft R3 10.3.1	Impact of Packet Loss	See MOS Scoring Table
MEF 90.2 Draft R3 10.3.2	Impact of Packet Delay Variation	See MOS Scoring Table
MEF 90.2 Draft R3 10.4.1	Impact of Packet Reordering	See MOS Scoring Table
MEF 90.2 Draft R3 10.4.2	Impact of Packet Duplication	See MOS Scoring Table
MEF 90.2 Draft R3 10.5.1	Impact of accumulated packets and burst	See MOS Scoring Table
MEF 90.2 Draft R3 10.5.2	Impact of branch congestion	See MOS Scoring Table
MEF 90.2 Draft R3 10.5.3	Impact of data center congestion	See MOS Scoring Table
MEF 90.2 Draft R3 10.6.1	Impact of all impairments	See MOS Scoring Table
Industry Best Practice 1	Impact of power failure	See MOS Scoring Table
Industry Best Practice 2	Impact of SWVC manager unreachability	See MOS Scoring Table
Industry Best Practice 3	UCS link failure	See MOS Scoring Table

Note 1: UCS Impairment and SWVC Application Assurance tests account for 60% of the Overall Score

4. MOS Scoring Tables

Video MOS Scoring Table		
Rating	**MOS Recorded**	**Scoring Range**
AAA	4.39 ≤ MOS Value ≤ 4.53	96.88% - 100%
AA	4.08 ≤ MOS Value < 4.39	90.00% - 96.87%
A	3.74 ≤ MOS Value < 4.08	82.50% - 89.99%
BBB	3.34 ≤ MOS Value <3.74	73.75% - 82.49%
BB	3.06 ≤ MOS Value <3.34	67.50% - 73.74%
B	2.72 ≤ MOS Value <3.06	60.00% - 67.49%
CCC	2.38 ≤ MOS Value <2.72	52.50% - 59.99%
CC	2.04 ≤ MOS Value <2.38	45.00% - 52.49%
C	1.70 ≤ MOS Value <2.04	37.50% - 44.99%
D	0 ≤ MOS Value <1.70	0% - 37.49%

Voice MOS Scoring Table		
Rating	**MOS Recorded**	**Scoring Range**
AAA	4.27 ≤ MOS Value ≤ 4.41	96.88% - 100%
AA	3.97 ≤ MOS Value < 4.27	90.00% - 96.87%
A	3.64 ≤ MOS Value < 3.97	82.50% - 89.99%
BBB	3.25 ≤ MOS Value < 3.64	73.75% - 82.49%
BB	2.98 ≤ MOS Value < 3.25	67.50% - 73.74%
B	2.65 ≤ MOS Value < 2.98	60.00% - 67.49%
CCC	2.32 ≤ MOS Value < 2.65	52.50% - 59.99%
CC	1.98 ≤ MOS Value < 2.32	45.00% - 52.49%
C	1.65 ≤ MOS Value < 1.98	37.50% - 44.99%
D	0 ≤ MOS Value < 1.65	0% - 37.49%

5. Overall Scoring Methodology & Rating

The SD-WAN Certification Overall Score is calculated based on the credited percentages awarded in each category and category weight, as follows:

SD-WAN Certification Scoring Methodology		
Category	**Calculation**	**Weight**
Routing & Access Control	Calculated penalty percentage per section 4.3	20
SWVC Stability & Reliability	Calculated penalty percentage per section 4.3	20
UCS Impairment & SWVC Application Assurance	Calculated normalized video MOS percentage - Average of all video MOS measured divided by the theoretical maximum for video. Calculated normalized audio MOS percentage - Average of all audio MOS measured divided by the theoretical maximum for audio. Combined normalized MOS percentage - Averaged normalized Video MOS percentage and normalized Audio MOS percentage	60

1. Credited percentage for Routing & Access Control = (100% - Penalty%) x 20 weight
2. Credited percentage for SWVC Scalability & Reliability = (100% - Penalty%) x 20 weight
3. Credited percentage for UCS Impairment & SWVC Application Assurance = {[(Average of all Video MOS measurements)/4.53) + (Average of all Audio MOS measurements)/4.41)]/2} x 60 weight
4. Total Credited Percentage = Credited percentage for Routing & Access Control + Credited percentage for SWVC Stability & Reliability + Credited percentage for UCS Impairment & SWVC Application Assurance
5. SD-WAN Certification final rating is determined based on the Total Credited percentage – Overall Score, as per the SD-WAN Certification Rating table below

SD-WAN Certification Rating Table	
Rating	**Total Credited Percentage – Overall Score**
AAA	96.88% - 100%
AA	90.00% - 96.87%
A	82.50% - 89.99%
BBB	73.75% - 82.49%
BB	67.50% - 73.74%
B	60.00% - 67.49%
CCC	52.50% - 59.99%
CC	45.00% - 52.49%
C	37.50% - 44.99%
D	00.00% - 37.49%

6. Overall Scoring Example

The following example demonstrates the calculation of an SD-WAN Certification overall score and final rating.

Routing & Access Control and SWVC Stability & Reliability	Calculated Penalty	Weight
Routing & Access Control	25%	20
SWVC Stability & Reliability	0%	20

UCS Impairment and SWVC Application Assurance	Video MOS	Audio MOS
Packet Loss	3.11	3.98
Packet Delay Variation	4.32	4.20
Packet Reordering	4.52	3.99
Packet Duplication	4.42	4.36
Accumulated Packets and Burst	4.50	4.35
Branch Congestion	4.20	4.01
Data Center Congestion	4.40	4.32
All Impairments	3.58	4.11
Power Failure	4.31	4.43
SWVC Manager Unreachability	4.20	4.33
UCS Link Failure	4.39	4.13
Average	4.18	4.20
Normalized Percentage	92.27% (AA)	95.24% (AA)
Combined Normalized Percentage (60%)	93.76% (AA)	

In this example, the calculation for the SD-WAN Certification overall score and final rating is as follows:

Routing & Access Control	((100% – 25%) × 20 Weight) = 15%
SWVC Stability & Reliability	((100% – 0%) × 20 Weight) = 20%
UCS Impairment & SWVC Application Assurance	(93.76% × 60 Weight) = 56.26%
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Overall Score:	(15% + 20% + 56.26%) = 91.26%
Final Rating:	AA

Revision History

Revision History	Date	Revision
Version 1.0	June 26, 2025	SD-WAN Certification Blueprint Version 1.0

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