
Configure MOS Score Monitoring



For supported software information, click [here](#).

Versa Operating System™ (VOS™) devices can calculate a mean opinion score (MOS) to represent the user experience of audio, video, and voice applications. The MOS score is a measure of the quality of voice data traffic. When the traffic quality falls below the defined MOS score value, an alarm is logged. You define acceptable MOS scores when you configure an SLA profile for an SD-WAN traffic-steering policy.

You can use the MOS score as an SLA parameter in a policy-based forwarding (PBF) policy that is used to select the best path on which to forward real-time traffic between two SD-WAN branches. The best path is the one with the highest-priority SLA-compliant path for the codec. To calculate the MOS score, the VOS application identifier (AppID) software intercepts real-time protocol (RTP) and real-time transport control protocol (RTCP) traffic and uses the information in these packets to determine a path's MOS score.

To enable Layer 2 or Layer 3 SD-WAN traffic steering that uses a MOS score, you do the following:

- Configure an SLA profile that includes MOS as the SLA parameter. Then, you associate the SLA profile with an SD-WAN forwarding profile, and you associate the forwarding profile with an SD-WAN traffic-steering policy. For more information, see [Configure SD-WAN Traffic Steering](#).
- Enable real-time flow monitoring. You can use real-time monitoring (RTM) to monitor real-time audio, video, and voice flows for quality and user experience. For more information and for a list of the applications and codecs for which MOS score-based monitoring is supported, see [Configure Real-Time Monitoring](#).

Note that MOS score monitoring for Layer 2 SD-WAN traffic-steering policy is available for Releases 21.2.1 and later.

You can also use the MOS score in an SD-WAN traffic-steering forwarding profile to re-evaluate an SLA-violated link.

MOS-Based Path Selection

To calculate the MOS for a codec over a path, a traffic stream must flow over the path. This means that MOS-based path selection is reactive and that the MOS value of a path for a codec cannot be known in advance.

If there is no traffic stream over a path, the path is considered SLA-compliant and is assigned a MOS value of 5. (A MOS value can be from 0 through 5, where the value 5 is assigned to the best traffic quality.) Any path with a MOS value greater than or equal to the configured threshold is also considered SLA-compliant.

The MOS value for the path and codec is recorded. New paths can be selected at intervals based on the value of the

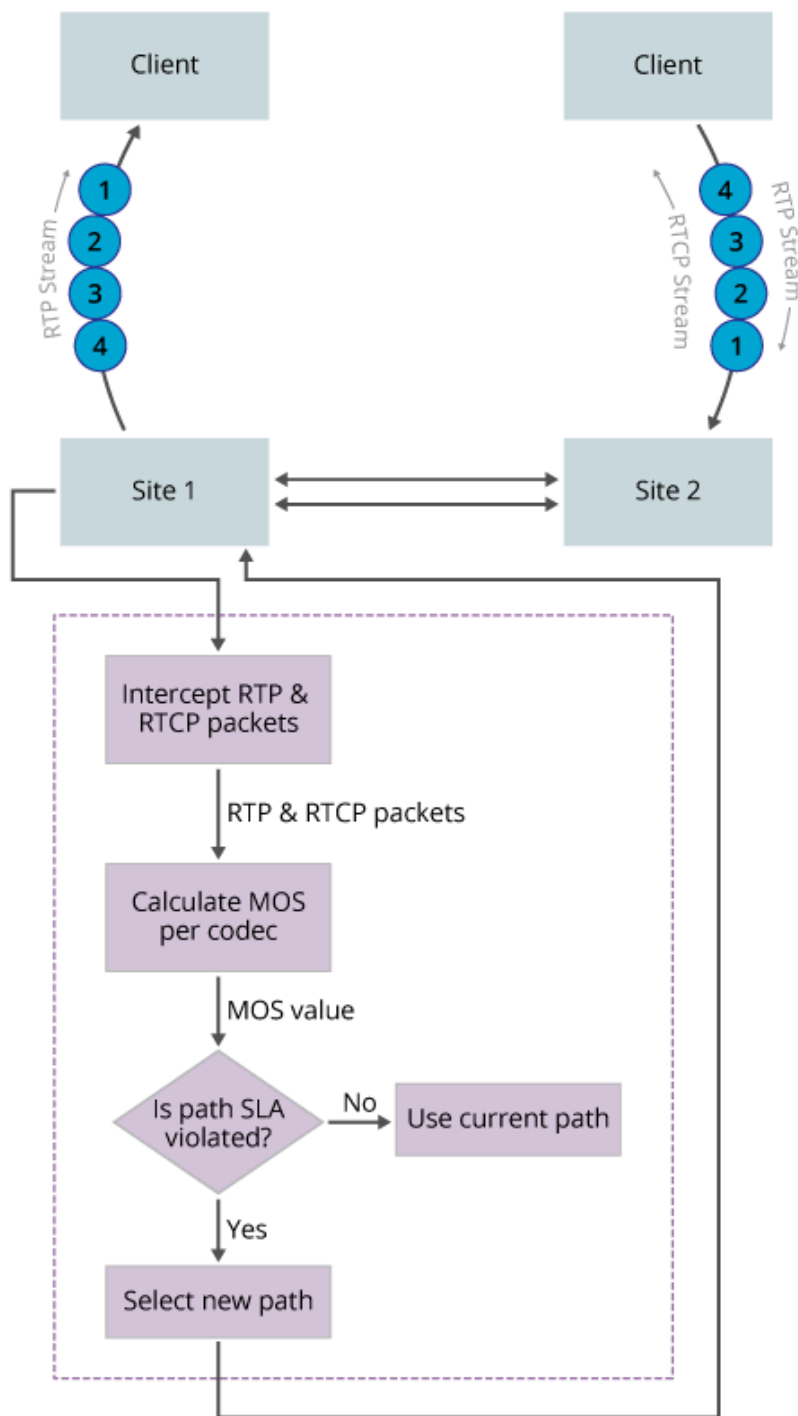
recompute interval. This is the traditional way in which PBF performs path selection for all other SLA thresholds.

When deciding whether to select a new path, the VOS software considers the MOS score of that path. It calculates the path MOS value using the simultaneous localization and mapping (SLAM) metrics collected over that path. If a priority bucket contains multiple SLA-compliant paths, the VOS software always selects a path with the highest path MOS. Otherwise, precedence is based on path priority, and the VOS software select an SLA-compliant path with the highest priority.

When a path for codec violates the configured SLA, the path remains in the SLA-violated state, and it is not considered for forwarding traffic for the codec. To have the path be considered once again for forwarding, you can configure a path reevaluation interval. Then, a path whose MOS value does not meet the threshold remains in SLA-violated state for the duration of the reevaluation interval. During this period, the MOS value of the path increments slowly so that at the end of the reevaluation interval, the MOS value of the path may be greater than or equal to the configured threshold. At this point, a path MOS (PMOS), if available for the codec, is calculated and compared against the timer-updated MOS. (The PMOS is the MOS value calculated using the SLA metrics of the path.) If the PMOS value is less than the timer-updated MOS value, the MOS value of the path is updated to the value of the PMOS. If the PMOS value is greater than the threshold, the path is once again considered for traffic forwarding. This scheme prevents switching the flow to a path that is not optimal. Note, however, that the MOS value for a codec on a path is not kept forever and is eventually deleted.

For voice data, VOS devices use the MOS score to select the best available path for each voice stream. To calculate the MOS score, a VOS device uses the actual traffic, intercepting the Real-Time Transport Protocol (RTP) and RTP Control Protocol (RTCP) packets in a voice stream. From the RTP packets, it extracts jitter, loss, and delay (latency) information. The RTCP packets contain sender and receiver reports that include statistics about the quality of the voice stream. The VOS device calculates the MOS score continuously for every voice flow. You configure how often to check the MOS score and the threshold of acceptable MOS scores that are used to make the path-selection decision. The frequency of checking the MOS score affects how fast a voice steam can switch to a different path when the SLA for its path is violated. The SLA for a path is considered violated if the calculated MOS score for a voice flow is less than the threshold. You also configure the time interval after which a VOS device re-evaluates paths whose SLAs are violated.

The following figure illustrates the MOS path-selection process. Here, MOS path selection is enabled on the Site 1 branch device for traffic that Site 1 forwards to Site 2. Site 1 intercepts RTP and RTCP packets and uses the information in them to calculate the MOS score for the voice stream. Based on the score, Site 1 selects the best available path.

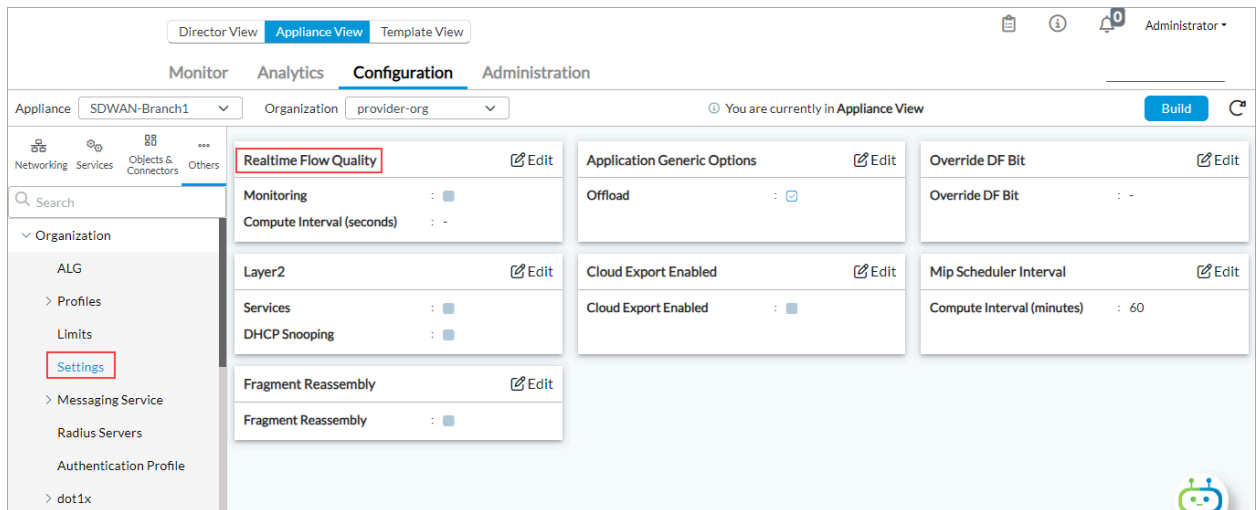



Configure MOS Score Monitoring

Note that if you configure a MOS score in a profile, you do not have to configure other SLA parameters in the profile, because MOS considers delay, loss, and jitter.

To configure MOS score monitoring:

1. Enable MOS score monitoring:
 - a. In Director view, select the Configuration tab in the top menu bar.
 - b. Select Templates > Device Templates in the horizontal menu bar.
 - c. Select an organization in the left menu bar.
 - d. Select a template in the main pane. The view changes to Appliance view.
 - e. Select the Configuration tab in the top menu bar.
 - f. Select Others > Organization > Settings in the left menu bar. The main pane displays panes related to organization settings.



- g. Click the  Edit icon in the Real-Time Flow Quality pane. In the Edit Configuration popup window, enter information for the following fields.

Edit Configuration

Realtime Flow Quality

☒ Monitoring

Compute Interval (seconds)

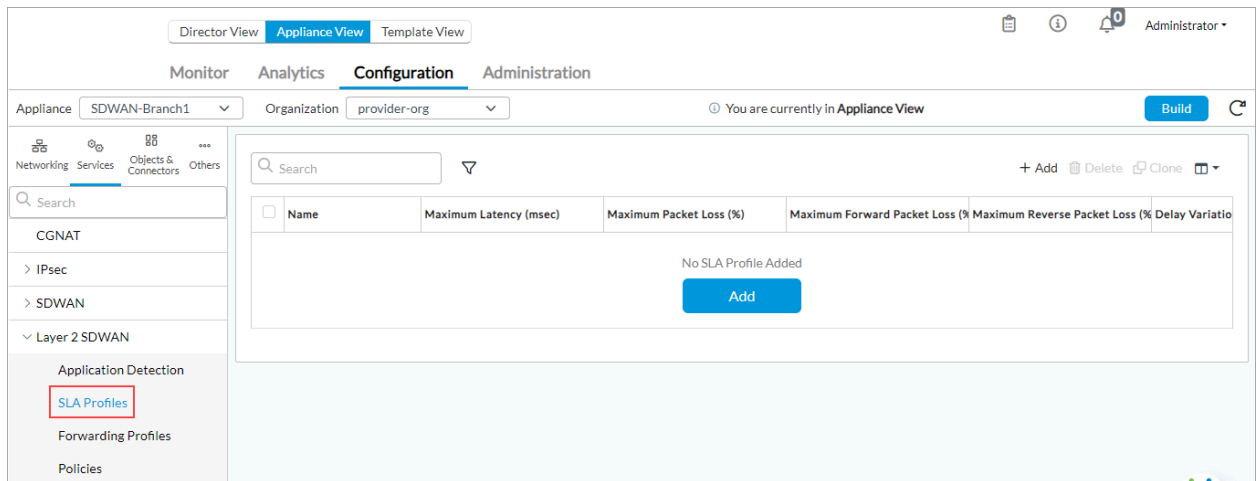
2

OK

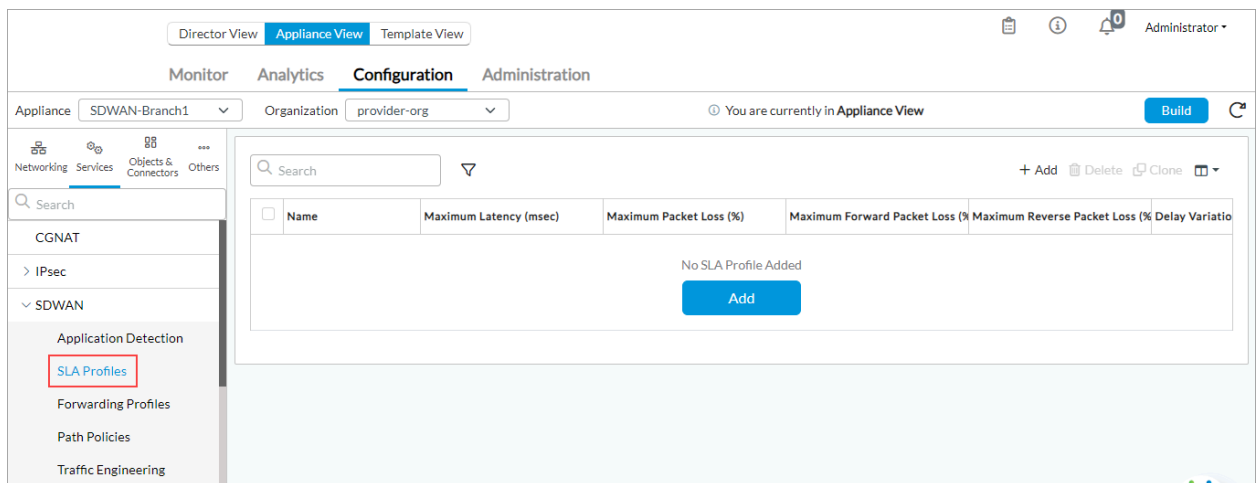
Cancel


Field	Description
Monitoring	Click to enable MOS monitoring. Monitoring information is sent to the active collector of the default LEF profile. For information about configure a default LEF profile, see Configure Log Export Functionality . For information about associating a LEF profile with the configuration for a feature or service, see Apply Log Export Functionality .
Compute interval	Enter how often to log the MOS score. The minimum value is 2 seconds.

- h. Click OK.
2. Configure an SLA profile that includes a MOS threshold:
 - a. In Appliance view, select the Configuration tab in the top menu bar.
 - b. For an SLA profile for Layer 2 traffic steering, select Services > Layer 2 SD-WAN > SLA Profiles in the left menu bar. The main pane displays the SLA profiles that are already configured.



- c. For an SLA profile for Layer 3 traffic steering, select Services > SD-WAN > SLA Profiles in the left menu bar. The main pane displays the SLA profiles that are already configured.



- d. Click the  Add icon, or select an existing SLA profile. The Add (or Edit) SLA Profile popup window displays.

- e. For a Layer 3 SLA profile, select the General tab.
 - f. In the Name field, enter a name for the SLA profile.
 - g. In the MOS score field, enter a value for the MOS score. This is a value from 0 through 5, where 5 represents the best traffic quality.
 - h. Configure the other fields, as described in [Configure SLA Profiles for SD-WAN Traffic Steering](#) (for Layer 3 traffic-steering policy).
 - i. Click OK.
3. Associate the SLA profile that includes the MOS threshold with a forwarding profile:
 - a. In Appliance view, select the Configuration tab in the top menu bar.
 - b. For an SLA profile for Layer 2 traffic steering, select Services > Layer 3 SD-WAN > Forwarding Profiles in the left menu bar.
 - c. For an SLA profile for Layer 3 traffic steering, select Services > SD-WAN > Forwarding Profiles in the left menu bar.
 - d. Click the Add icon, or select an existing forwarding profile as shown below. The Add (or Edit) Forwarding Profile popup window displays.

Add Forwarding Profile

General
Circuit Priorities
FEC
Advanced Settings
NextHop

Name
Tags

Description

SLA Profile
--Select--
+ SLA Profile

Encryption
Optional

Connection Selection Method
Weighted Round Robin

Recompute Timer (seconds)
300

Path Reconsider Interval (seconds)

SLA Violation Action
Forward

Load Balancing Option
--Select--

Header Compression
Level
Low
Skip HMAC
Unidirectional

Replication
Enable
Stop When

Replication Factor

Start When
Always

Circuit Utilization

Evaluate Continuously
Reverse Route Verification
Enable Symmetric Forwarding
Reorder

OK
Cancel


- e. Select the General tab, and enter information for the following fields.

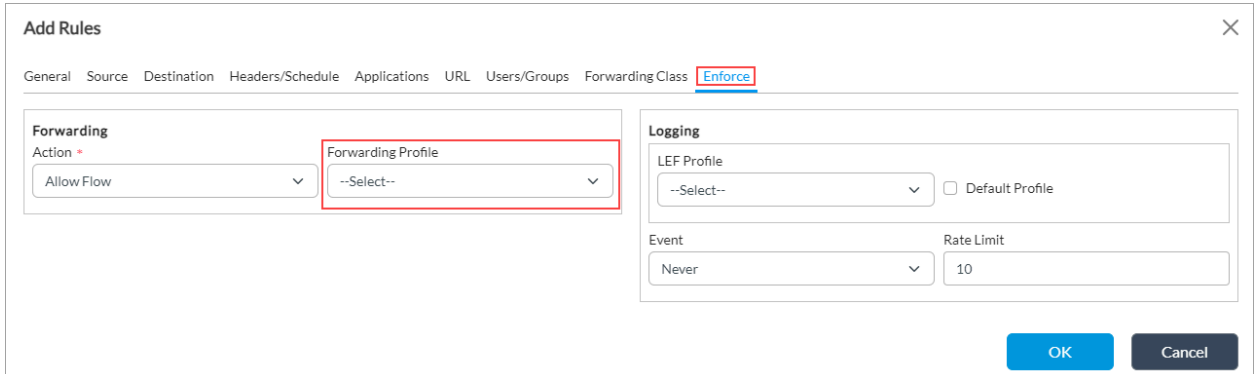
Field	Description
SLA Profile	Select the SLA profile.
SLA Violation Action	Select Forward.
Evaluate Continuously	Click to enable continuous evaluation.
Enable Symmetric Forwarding	Click to enable symmetric forwarding.

- f. Configure the other fields, as described in [Configure SD-WAN Traffic Steering](#) (for Layer 3 traffic-steering policy).

- g. Click OK.

4. Associate the forwarding profile with a Layer 2 or Layer 3 SD-WAN policy rule that matches RTP and RTCP traffic:
- In Appliance view, select the Configuration tab in the top menu bar.
 - For a Layer 2 SD-WAN policy, select Services > Layer 2 SD-WAN > Policies > Rules in the left menu bar.
 - For a Layer 3 SD-WAN policy, select Services > SD-WAN > Policies > Rules in the left menu bar.

- d. Click the  Add icon to add a rule. The Add Rules window displays.
- e. Select the Enforce tab.



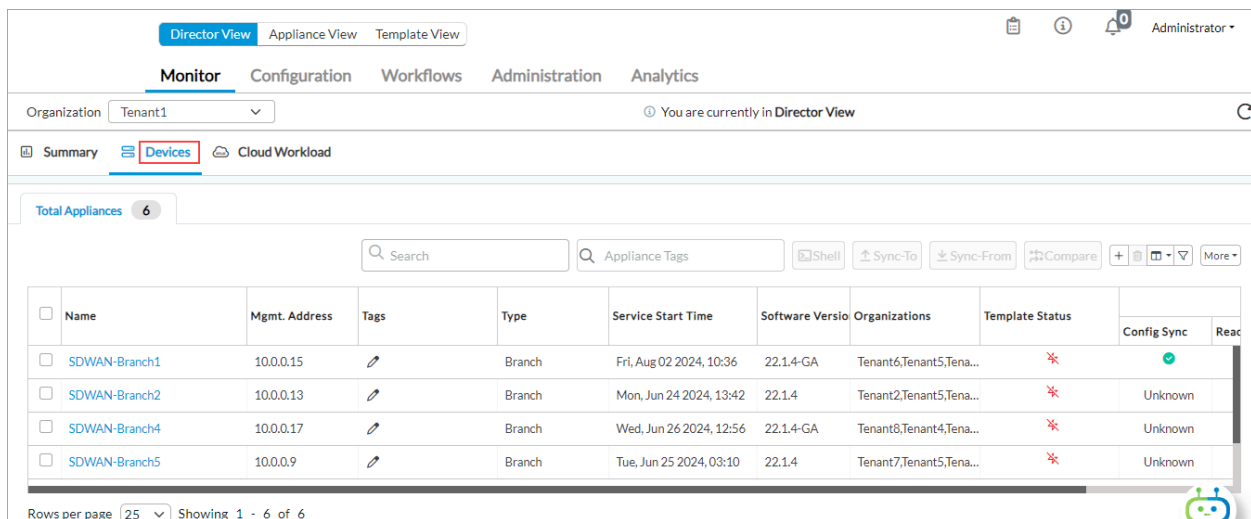
The 'Add Rules' window is shown with the 'Enforce' tab selected. The 'Forwarding' section has 'Action' set to 'Allow Flow' and 'Forwarding Profile' set to '--Select--'. The 'Logging' section has 'LEF Profile' set to '--Select--' and 'Default Profile' unchecked. 'Event' is set to 'Never' and 'Rate Limit' is set to '10'. 'OK' and 'Cancel' buttons are at the bottom right.

- f. In the Forwarding Profile field, select the forwarding profile you configured in Step 3 (here, Default-FP).
- g. Configure other fields in the popup window, as required. For more information, see [Configure SD-WAN Policy](#).
- h. Click OK.










Verify the MOS Score Monitoring Information

To verify MOS score monitoring information:

1. In Director view:
2. Select the Monitor tab in the top menu bar.
3. Select the organization from the left navigation panel.
4. Select the Devices tab.



The screenshot shows the 'Director View' interface with the 'Monitor' tab selected. The 'Organization' dropdown is set to 'Tenant1'. The 'Devices' tab is selected in the left navigation panel. The table below lists the devices.

	Name	Mgmt. Address	Tags	Type	Service Start Time	Software Versio	Organizations	Template Status	Config Sync	Reac
<input type="checkbox"/>	SDWAN-Branch1	10.0.0.15		Branch	Fri, Aug 02 2024, 10:36	22.1.4-GA	Tenant6,Tenant5,Tena...			
<input type="checkbox"/>	SDWAN-Branch2	10.0.0.13		Branch	Mon, Jun 24 2024, 13:42	22.1.4	Tenant2,Tenant5,Tena...		Unknown	
<input type="checkbox"/>	SDWAN-Branch4	10.0.0.17		Branch	Wed, Jun 26 2024, 12:56	22.1.4-GA	Tenant8,Tenant4,Tena...		Unknown	
<input type="checkbox"/>	SDWAN-Branch5	10.0.0.9		Branch	Tue, Jun 25 2024, 03:10	22.1.4	Tenant7,Tenant5,Tena...		Unknown	

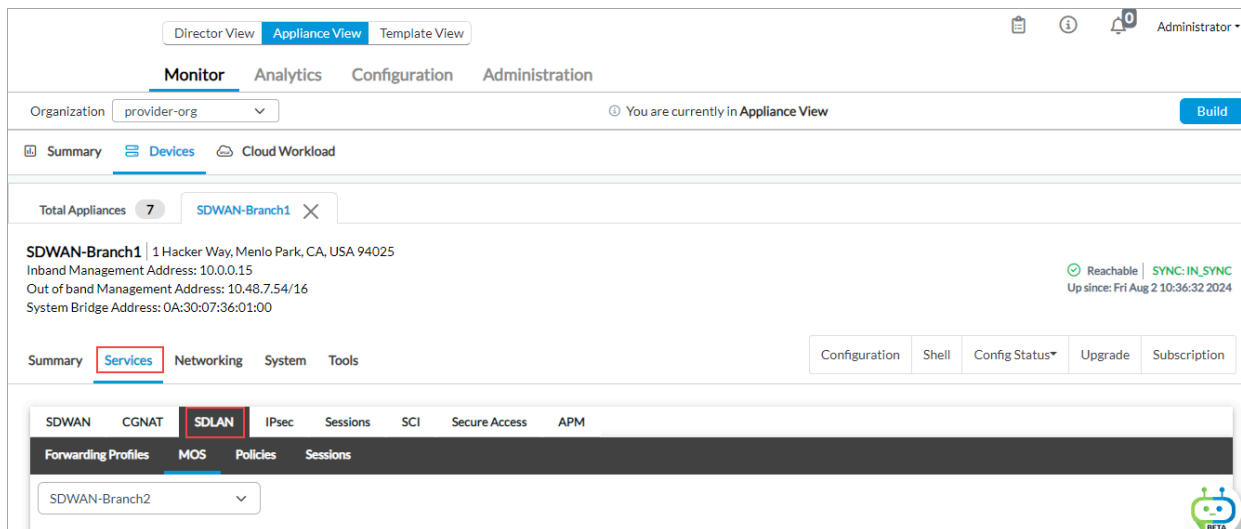
Rows per page: 25 Showing 1 - 6 of 6

https://docs.versa-networks.com/Secure_SD-WAN/01_Configuration_from_Director/SD-WAN_Configuration/Advanced_SD-W...

Updated: Wed, 23 Oct 2024 08:10:14 GMT

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5. Select a device in the main pane. The view changes to Appliance view.
6. To view the Layer 2 MOS score information:
 - a. In the Services tab, select SD-LAN.



- b. Select the MOS tab, and then select a branch or Controller from the drop-down list.

Forwarding Profiles MOS Policies Sessions			
SDWAN-Branch2			
<div>Search</div>			
Local Circuit	Remote Circuit	Codec	MOS
WAN1	WAN1	-	0.00
WAN1	WAN2	-	0.00
WAN2	WAN1	-	0.00
WAN2	WAN2	-	0.00
WAN3	WAN3	-	0.00

7. To view the Layer 3 MOS score information:
 - a. In the Services tab, select SD-WAN.
 - b. Select the MOS tab, and then select a branch or Controller from the drop-down list.

Troubleshoot MOS-Based Path Selection

This section describes the commands available to debug issues related to MOS-based path selection.

Troubleshoot the AppID Module

To troubleshoot the VOS application identifier software, use the following VTY commands:

- To display the AppID module information, issue the **show appid engine info** command. The highlighted text in the output below shows that the MOS monitoring is enabled for Tenant 1 and disabled for Tenant 2

```
vsm-vcsn0> show appid engine info
```

```
Tenant ID = 1
  IxEngine Bypassed      = FALSE
  Firewall mode          = nextgen_firewall
  ALG Bypassed           = FALSE
  ALG Enable Bitmap      = 000000fe
  FTP ALG bounce check enable = TRUE
  Num of app-sp-options tbl entry = 0
  VQmon monitoring enabled = TRUE
  VQmon reporting interval = 2

Tenant ID = 2
  IxEngine Bypassed      = FALSE
  Firewall mode          = nextgen_firewall
  ALG Bypassed           = FALSE
  ALG Enable Bitmap      = 000000fe
  FTP ALG bounce check enable = TRUE
  Num of app-sp-options tbl entry = 0
  VQmon monitoring enabled = FALSE
  VQmon reporting interval = 5
```

- To display statistics related to MOS-based events, issue the **show appid stats debug** command. The output displays statistics such as memory statistics and the number of events per traffic direction that were sent to PBF.

```
vsm-vcsn0> show appid stats debug
```

VQmon debug Information...

```
VQmon Memory usage :
  vqmon_mallocs (M)      : 306 (64976 bytes)
  vqmon_reallocs (R)     : 0 (0 bytes)
  vqmon_frees (F)        : 304
  vqmon_create_stream_events : 10
  vqmon_destroy_stream_events : 10
  vqmon_indicate-pkt-events-fwd : 15754
  vqmon_indicate-pkt-events-rev : 14343
  vqmon_indicate-rtcp-pkt-events-fwd : 75
  vqmon_indicate-rtcp_pkt-events-rev : 72
  vqmon_report-events-fwd : 144
  vqmon_report-events-rev : 142
```

- To view the MOS information for each session, issue the **show vsf session handle extensive session-name** command. The following output displays information about an RTP session. The highlighted text shows the latest MOS score reported to the PBF software as compared to the current time, to give an indication of when the next update will be sent to the PBF software. The RTCP Peered field displays Y, indicating that the corresponding RTCP session is successfully peered with the RTP session. This information must not be present in the VSF session command output when the session closes. If it is present, check the Created At and Destroyed At fields to determine the times between which to check the logs for issues.

```
vsm-vcsn0> show vsf session handle extensive 0x2000004
```

```
Service Module Specific Information:
  SDWAN Session Ext: 7fa6cb8068f0
  SDWAN Flow info:
```

```

Rule: r1
Onward Flow:
FP 235, RT gen 75 (current 75), tx ifindex 1053
Prio 2, Win ID: 0, current 754269
Codec G.711 u-law/PLC, mos score 420 path mos 0
PBF Flow (Reverse) info
Rule: None
APPID Information:
Appid = base.ip.udp.rtp
ParentSessPresent = Y Offload status = No
ALGInfoPresent = N FileNodePresent = N

VQMon Information:
Reporting Interval: 2000 ms
RTCP Flow: N
Forward direction:
Stream Handle: 7fa6b58bfe00
Created at: 2018-01-09 13:41:09
Destroyed at: 1969-12-31 16:00:00
MOS: 1074
Last reported: 752872 Curr clock: 754270
RTCP Peered: Y
Reverse direction:
Stream Handle: 7fa6b58c0c00
Created at: 2018-01-09 13:41:10
Destroyed at: 1969-12-31 16:00:00
MOS: 1074
Last reported: 753243 Curr clock: 754270
RTCP Peered: Y

```

The following output displays typical values for the fields in an RTCP session, for when the RTCP Flow field (highlighted) displays Y.

```
vsm-vcsn0> show vsf session handle extensive 0x2000004
```

```

Service Module Specific Information:
SDWAN Session Ext: 7fa6cb8069d0
SDWAN Flow info:
Rule: r1
Onward Flow:
FP 265, RT gen 75 (current 75), tx ifindex 1053
Prio 2, Win ID: 0, current 900745
PBF Flow (Reverse) info
Rule: None
APPID Information:
Appid = base.ip.udp.rtcp
ParentSessPresent = Y Offload status = No
ALGInfoPresent = N FileNodePresent = N

VQMon Information:
Reporting Interval: 2000 ms
RTCP Flow: Y
Forward direction:

```

```
Created at: 1969-12-31 16:00:00
Destroyed at: 1969-12-31 16:00:00
MOS: 0
Last reported: 0 Curr clock: 900745
RTCP Peered: N
Reverse direction:
Created at: 1969-12-31 16:00:00
Destroyed at: 1969-12-31 16:00:00
MOS: 0
Last reported: 0 Curr clock: 900745
RTCP Peered: N
```

Troubleshoot the Policy-Based Forwarding Module

You can view the MOS database maintained globally across all forwarding profiles using CLI and VTY commands.

To view the MOS score that is in the database, Issue the **show orgs organization-name sd-wan path mos-score** CLI command. The following output shows that there are two flows in the path, b1-w1, h1-w1, that they have the same MOS value of 3.57, and that they use codecs G.711 A-law and G.711 u-law, respectively.

```
admin@tcp-sdwan-br1-cli> show orgs org-services Customer2 sd-wan path mos-score
REMOTE    LOCAL    REMOTE
BRANCH    CIRCUIT  CIRCUIT  CODEC      MOS
-----
Branch2   b1-w1   h1-w1   G.711 A-law/PLC 3.57
          b1-w1   h1-w1   G.711 u-law/PLC 3.57
          b1-w2   h1-w2   -           0.00
          b1-w3   h1-w3   -           0.00
controller1 b1-w1   c1-w1   -           0.00
          b1-w2   c1-w2   -           0.00
          b1-w3   c1-w3   -           0.00
```

To view the same MOS score details from the database, issue the **show sd-wan mos database-name detail** VTY command. For example:

```
vsm-vcsn0> show sd-wan mos branch-database detail
Tenant  Branch  Local AC  Remote AC  Codec      MOS  Source
-----
1       16      b1-w1    c1-w1
          b1-w2    c1-w2
          b1-w3    c1-w3
1       102     b1-w1    h1-w1      G.711 u-law/PLC 3.57 VQMon
          G.711 A-law/PLC 3.53 VQMon
          b1-w2    h1-w2
          b1-w3    h1-w3
2       16      b1-w1    c1-w1
          b1-w2    c1-w2
          b1-w3    c1-w3
2       102     b1-w1    h1-w1
          b1-w2    h1-w2
          b1-w3    h1-w3
```

The VTY output has an additional field, Source, that identifies the source of the MOS value for that flow. The value for this field can be:

- VQMon—MOS value was last updated as the result of a MOS event from the AppID module.
- Timer—MOS value was last updated by the timer logic in the PBF module.
- PMOS—MOS value was last updated because of a path MOS calculation.

To display the MOS database maintained for each forwarding profile, issue the following command:

```
admin@tcp-sdwan-branch1-cli> show orgs org-services customer2 sd-wan policies p1 rules app-state
codec
  REMOTE   FORWARDING SLA   LOCAL   REMOTE
NAME BRANCH  PROFILE  PROFILE CIRCUIT CIRCUIT CODEC      PRIORITY  MOS
-----
r1  Branch2  fp1      slap1   b1-w1  h1-w1  G.711 u-law/PLC SLA Violated 3.19
      b1-w2  h1-w2          2      0.00
      b1-w3  h1-w3  G.711 u-law/PLC 2      3.57
controller1 fp1  slap1   b1-w1  c1-w1          2      0.00
      b1-w2  c1-w2          2      0.00
      b1-w3  c1-w3          2      0.00
```

The output above shows the state of a system in which an RTP session was initially flowing through path b1-w1, h1-w1 before it violated the MOS SLA and moved to path b1-w3, h1-w3.

You can view the same information from the VTY. The output below shows that there are two sessions on the path (b1-w1-, h1-w1) with codecs G.711 u-law and G.711 A-law, respectively. For both these streams, the path is at its configured priority of 2, because the MOS value meets the configured threshold of 3.25.

```
vsm-vcsn0> show sd-wan mos forwarding-profile Customer2/fp1 102 path-state
argc: 3 arg0: Customer2/fp1 arg1: 102 arg2: path-state
Branch  Local AC  Remote AC  Codec      MOS  Flows
-----
102     b1-w2     h1-w2
      b1-w1     h1-w1     G.711 u-law/PLC 3.57 2
              G.711 A-law/PLC 3.57
      b1-w3     h1-w3

vsm-vcsn0> show sd-wan mos forwarding-profile Customer2/fp1 102 codec-state
Branch: 102
Codec: G.711 u-law/PLC
Priority: 2
VLs: 17
Codec: G.711 A-law/PLC
Priority: 2
VLs: 17
```

The highlighted text in the following VTY output shows an SLA-violated path for that codec, and it shows that there are no current session flows:

```
vsm-vcsn0> show sd-wan mos forwarding-profile Customer2/fp1 102 path-state
argc: 3 arg0: Customer2/fp1 arg1: 102 arg2: path-state
```

Branch	Local AC	Remote AC	Codec	MOS	Flows
102	b1-w2	h1-w2			
	b1-w1	h1-w1	G.711 u-law/PLC	2.81	0
	b1-w3	h1-w3	G.711 u-law/PLC	3.57	1

```
vsm-vcsn0> show sd-wan mos forwarding-profile Customer2/fp1 102 codec-state
argc: 3 arg0: Customer2/fp1 arg1: 102 arg2: codec-state
Branch: 102
Codec: G.711 u-law/PLC
Priority: 2
VLs: 51
Priority: 11
VLs: 17
```

To view the codec table created while booting up, issue the **show sd-wan codec database** VTY command. For example:

```
vsm-vcsn0> show sd-wan codec database
Codec Name          Id    VQMON Id
-----
MPEG Audio Layer 1    1      1001
MPEG Audio Layer 2    2      1002
MPEG Audio Layer 3    3      1003
MPEG-2 AAC            4      1004
AC-3 Audio            5      1005
MPEG-4 AAC            6      1006
MPEG-4 LD-AAC         7      1007
MPEG-4 HE-AAC         8      1008
WMA Professional     9      1009
MPEG-4 HE-AACv2      10     100a
```

Supported Software Information

Releases 20.2 and later support all content described in this article, except:

- Release 21.2.1 adds support for configuring MOS score monitoring for Layer 2 SD-WAN traffic-steering policy.

Additional Information

[Apply Log Export Functionality](#)

[Configure Log Export Functionality](#)

[Configure Real-Time Monitoring](#)

[Configure SD-WAN Traffic Steering](#)

[Configure SLA Profiles for SD-WAN Traffic Steering](#)

[Overview of Policy-Based Forwarding in an SD-WAN Network](#)

https://docs.versa-networks.com/Secure_SD-WAN/01_Configuration_from_Director/SD-WAN_Configuration/Advanced_SD-W...

Updated: Wed, 23 Oct 2024 08:10:14 GMT

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