



Application Performance Monitor



Note To achieve simplification and consistency, the Cisco SD-WAN solution has been rebranded as Cisco Catalyst SD-WAN. In addition, from Cisco IOS XE SD-WAN Release 17.12.1a and Cisco Catalyst SD-WAN Release 20.12.1, the following component changes are applicable: **Cisco vManage** to **Cisco Catalyst SD-WAN Manager**, **Cisco vAnalytics** to **Cisco Catalyst SD-WAN Analytics**, **Cisco vBond** to **Cisco Catalyst SD-WAN Validator**, **Cisco vSmart** to **Cisco Catalyst SD-WAN Controller**, and **Cisco Controllers** to **Cisco Catalyst SD-WAN Control Components**. See the latest Release Notes for a comprehensive list of all the component brand name changes. While we transition to the new names, some inconsistencies might be present in the documentation set because of a phased approach to the user interface updates of the software product.

Table 1: Feature History

Feature Name	Release Information	Description
Application Performance Monitor	Cisco IOS XE Catalyst SD-WAN Release 17.5.1a Cisco vManage Release 20.5.1	This feature provides an express method for configuring an intent-based performance monitor with the help of predefined monitoring profiles. Configure this feature using the CLI Add-on feature template in Cisco SD-WAN Manager.

- [Overview of Application Performance Monitor, on page 1](#)
- [Limitations and Restrictions, on page 3](#)
- [Configure Application Performance Monitor, on page 4](#)
- [Verify Performance Monitoring Configuration, on page 5](#)

Overview of Application Performance Monitor

The Application Performance Monitor feature is a simplified framework that enables you to configure intent-based performance monitors. With this feature, you can view real-time, end-to-end application performance filtered by client segments, network segments, and server segments. This information helps you optimize application performance.

An application performance monitor is a predefined configuration that is used to collect performance metrics for specific traffic.

Key Concepts in Application Performance Monitoring

Monitoring Profile: A profile is a predefined set of traffic monitors that can be enabled or disabled for a context. As part of this feature, the sdwan-performance profile has been enhanced to include Application Response Time (ART) and media monitors to monitor traffic passing through Cisco Catalyst SD-WAN tunnel interfaces. The sdwan-performance profile has a dedicated policy to filter traffic based on your intent.

When you choose the sdwan-performance profile, the related configuration is generated and applied automatically.

Context: A context represents a performance monitor policy map that is attached to an interface for ingress and egress traffic. A context contains information about a traffic monitor that has to be enabled. When a context is attached to an interface, two policy-maps are created, one each for ingress and egress traffic. Depending on the direction specified in the traffic monitor, the policy maps are attached in that direction and the traffic is monitored.



Note A context can be attached to multiple interfaces. Only one context can be attached to an interface. You can modify the context only when it is not attached to an interface.

Traffic Monitoring Specifications: You can choose to filter performance metrics using classification and sampler.

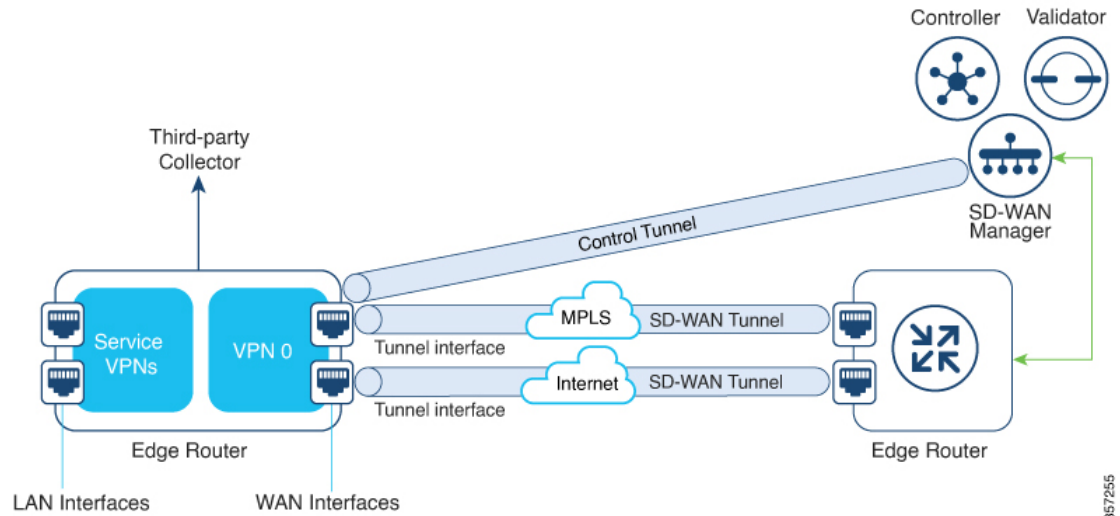
- **Classification:** Classification is a filter that defines the traffic that should be monitored for specified applications. This filter reduces the load on the device and performance collectors because they only need to monitor performance for specific applications.
- **Sampler:** A sampler monitors random traffic flows, based on the sampling rate specified, rather than all the flows. Enabling the sampler reduces scaling and performance impact when the scale of traffic is large.

Features and Benefits

- ART can be monitored for TCP flows. Some of the parameters that can be monitored are—server network delay, client network delay, and application delay.
- Jitter can be monitored for Real-time Transport Protocol (RTP) audio and video traffic.
- Information about input and output interfaces and local and remote TLOCs can be collected for every flow that matches the performance monitor.
- Performance monitor can be configured on all WAN tunnel interfaces or specific WAN tunnel interfaces using CLI commands.
- Global performance sampler is supported. The sampler allows you to monitor random flows based on the sampling rate configured, rather than the entire traffic, therefore, reducing performance and scaling overhead.

How Application Performance Monitor Works

Figure 1: Performance Monitoring Workflow



In this image, performance monitor has been applied globally (on all tunnel interfaces). You also have the option to enable it on specific interfaces. Performance is monitored for traffic going out of, and coming into the WAN tunnel interfaces. Based on the exporter parameters defined in the context that is initiated from the monitoring profile, the metrics that are collected are sent to the third-party collector that is defined. You can then view details of the application or media that you are monitoring using various show commands.

Limitations and Restrictions

- Performance monitoring is only supported on IPv4 traffic. IPv6 traffic is not supported.
- Once a performance monitor is applied to a device, the configuration cannot be modified and reapplied to the device. Follow these steps to make any modifications to performance monitor configuration:
 1. Edit the CLI Add-on feature template or device CLI template to remove the **performance monitor apply** command from the template. Update the device CLI template or the device template to which the CLI Add-on feature template is attached.
 2. Edit the **performance monitor context** in the CLI Add-on feature template, and apply the performance monitor again using the **performance monitor apply** command. Update the device template to which the CLI Add-on feature template is attached.

Alternatively, configure a new context based on the same monitoring profile, and remove the previous context configuration.

- App visibility must be enabled in a policy to be able to set the connector initiator value appropriately.

Configure Application Performance Monitor

You can enable application performance monitor globally (on all WAN tunnel interfaces) or on specific WAN tunnel interfaces. You can also enable performance monitoring for ART, or media monitors, or both.

To configure application performance monitoring using Cisco SD-WAN Manager, [create a CLI add-on feature template and attach it to the device template](#).

Enable Performance Monitor Globally

The following example shows how to configure a performance monitor context using the `sdwan-performance` profile. This configuration enables monitoring of traffic metrics for ART and media, and applies the configuration to all SD-WAN tunnel interfaces. Here, 10.0.1.128 is the IP address of the third-party collector, GigabitEthernet9 is the source interface, and 2055 is the listening port of the third-party collector.

```
performance monitor context CISCO-APP-MONITOR profile sdwan-performance
  exporter destination 10.0.1.128 source GigabitEthernet9 port 2055
  traffic-monitor application-response-time
  traffic-monitor media
!
performance monitor apply CISCO-APP-MONITOR sdwan-tunnel
```

Enable Performance Monitor on a Specific Interface

The following example shows how to configure a performance monitor context using the `sdwan-performance` profile. This configuration enables monitoring of traffic metrics for ART and media, and applies it to a specific tunnel interface, in this case, Tunnel1. Here, 10.0.1.128 is the IP address of the third-party collector, GigabitEthernet9 is the source interface, and 2055 is the listening port of the third-party collector.

```
performance monitor context CISCO-APP-MONITOR profile sdwan-performance
  exporter destination 10.0.1.128 source GigabitEthernet9 port 2055
  traffic-monitor application-response-time
  traffic-monitor media
!
interface Tunnel1
  performance monitor context CISCO-APP-MONITOR
```

Specify Additional Monitoring Filters and Sampling Rate

The following example shows how to enable specific type of traffic to be monitored. In this case, the match protocol of `rtp-audio` is defined in the class map named `match-audio`. This class is then referenced in **traffic-monitor media class-and** `match-audio` so that `rtp-audio` traffic is specifically monitored. Alternatively, you can use the keyword **class-and**. In such a case, the customized class map replaces the default class map, which is automatically created when you enable the `sdwan-performance` profile.

In this example, performance monitor is applied globally, which means that it is applied on all Cisco Catalyst SD-WAN tunnel interfaces. The sampling rate of 10 indicates that one in 10 flows is monitored. Sampling rate 100 indicates that one in 100 flows is monitored.

```
class-map match-any match-audio
  match protocol rtp-audio
!
performance monitor context CISCO-APP-MONITOR profile sdwan-performancekeyword
  exporter destination 10.75.212.84 source GigabitEthernet0/0/0 port 2055
```

```

traffic-monitor application-response-time
traffic-monitor media class-and (or class-replace) match-audio
!
performance monitor apply CISCO-APP-MONITOR sdwan-tunnel
performance monitor sampling-rate 10

```

Verify Performance Monitoring Configuration

View Performance Monitor Configuration Summary

The following sample out displays the information about traffic monitors that are enabled and the interfaces to which they are applied.

```
Device# show performance monitor context CISCO-MONITOR summary
```

```

=====
|                               CISCO-MONITOR                               |
=====
Description: User defined

Based on profile: sdwan-performance

Coarse-grain NBAR based profile

Configured traffic monitors
=====
application-response-time:
media: class-and match_audio

Attached to Interfaces
=====

Tunnell

```

The following sample out displays operational information about the third-party exporters that are attached to the specified context.

```
Device# show performance monitor context CISCO-MONITOR exporter
```

```

=====
|                               Exporters information of context CISCO-MONITOR                               |
=====

```

Flow Exporter 175_SDWAN-1:

Description: performance monitor context CISCO-MONITOR exporter

Export protocol: IPFIX (Version 10)

Transport Configuration:

Destination type: IP

Destination IP address: 10.75.212.84

Source IP address: 10.74.28.19

Source Interface: GigabitEthernet0/0/0

Transport Protocol: UDP

Destination Port: 2055

Source Port: 63494

DSCP: 0x0

TTL: 255

Output Features: Used

Options Configuration:

interface-table (timeout 600 seconds) (active)

sampler-table (timeout 600 seconds) (active)

application-table (timeout 600 seconds) (active)

sub-application-table (timeout 600 seconds) (active)

application-attributes (timeout 600 seconds) (active)

tunnel-tloc-table (timeout 600 seconds) (active)

Flow Exporter 175_SDWAN-1:

Packet send statistics (last cleared 04:13:19 ago):

Successfully sent: 10270 (13709142 bytes)

Client send statistics:

Client: Option options interface-table

Records added: 312

- sent: 312

Bytes added: 31824

- sent: 31824

Client: Option options sampler-table

Records added:	28
- sent:	28
Bytes added:	1344
- sent:	1344

Client: Option options application-name

Records added:	38766
- sent:	38766
Bytes added:	3217578
- sent:	3217578

Client: Option sub-application-table

Records added:	858
- sent:	858
Bytes added:	144144
- sent:	144144

Client: Option options application-attributes

Records added:	38038
- sent:	38038
Bytes added:	9813804
- sent:	9813804

Client: Option options tunnel-tloc-table

Records added:	26
- sent:	26
Bytes added:	1352
- sent:	1352

Client: MMA EXPORTER GROUP MMA-EXP-1

Records added:	0
----------------	---

```
Bytes added:          0
```

```
Client: Flow Monitor 175_SDWAN-art_ipv4
```

```
Records added:       0
```

```
Bytes added:         0
```

For more information, see the [show performance monitor context](#) command page.

View Flow Record Cache

The following sample output displays flow record cache for the specified monitor, in this case, CISCO-MONITOR-art_ipv4 .

```
Device# show performance monitor cache
```

```
Monitor: CISCO-MONITOR
```

```
Data Collection Monitor:
```

```
Cache type:          Synchronized (Platform cache)
Cache size:          4000
Current entries:     0

Flows added:         0
Flows aged:         0
Synchronized timeout (secs): 60
```

```
Monitor: CISCO-MONITOR-art_ipv4
```

```
Data Collection Monitor:
```

```
Cache type:          Synchronized (Platform cache)
Cache size:          11250
```



```

Current entries:                0

Flows added:                    0

Flows aged:                    0

Synchronized timeout (secs):   60

```

For more information, see the [show performance monitor cache](#) command page.

View Performance Monitor Templates

The following sample output displays flow exporter template information for the specified monitor.

```
Device# show flow exporter CISCO-MONITOR templates
```

```
Flow Exporter CISCO-MONITOR:
```

```
Client: Option options sampler-table
```

```
Exporter Format: IPFIX (Version 10)
```

```
Template ID      : 257
```

```
Source ID       : 6
```

```
Record Size     : 48
```

```
Template layout
```

Field	ID	Ent.ID	Offset	Size
FLOW SAMPLER	48		0	4
flow sampler name	84		4	41
flow sampler algorithm export	49		45	1
flow sampler interval	50		46	2

```
Client: Option options application-name
```

```
Exporter Format: IPFIX (Version 10)
```

```
Template ID      : 258
```

```
Source ID       : 6
```

```
Record Size     : 83
```

```
Template layout
```

Field	ID	Ent.ID	Offset	Size
APPLICATION ID	95		0	4
application name	96		4	24
application description	94		28	55

Client: Option sub-application-table

Exporter Format: IPFIX (Version 10)

Template ID : 259

Source ID : 6

Record Size : 168

Template layout

Field	ID	Ent.ID	Offset	Size
APPLICATION ID	95		0	4
SUB APPLICATION TAG	97		4	4
sub application name	109		8	80
sub application description	110		88	80

Client: Option options application-attributes

Exporter Format: IPFIX (Version 10)

Template ID : 260

Source ID : 6

Record Size : 258

Template layout

Field	ID	Ent.ID	Offset	Size
-------	----	--------	--------	------

APPLICATION ID	95	0	4
application category name	12232	9	4 32
application sub category name	12233	9	36 32
application group name	12234	9	68 32
application traffic-class	12243	9	100 32
application business-relevance	12244	9	132 32
p2p technology	288	164	10
tunnel technology	289	174	10
encrypted technology	290	184	10
application set name	12231	9	194 32
application family name	12230	9	226 32

Client: Option options tunnel-tloc-table

Exporter Format: IPFIX (Version 10)

Template ID : 261

Source ID : 6

Record Size : 52

Template layout

Field	ID	Ent.ID	Offset	Size
TLOC TABLE OVERLAY SESSION ID	12435	9	0	4
tloc local color	12437	9	4	16
tloc remote color	12439	9	20	16
tloc tunnel protocol	12440	9	36	8
tloc local system ip address	12436	9	44	4
tloc remote system ip address	12438	9	48	4

Client: Flow Monitor CISCO-MONITOR-art_ipv4

Exporter Format: IPFIX (Version 10)

Template ID : 0

Verify Performance Monitoring Configuration

Source ID : 0
 Record Size : 208
 Template layout

Field	ID	Ent.ID	Offset	Size
interface input snmp	10		0	4
connection client ipv4 address	12236	9	4	4
connection server ipv4 address	12237	9	8	4
ip dscp	195		12	1
ip protocol	4		13	1
ip ttl	192		14	1
connection server transport port	12241	9	15	2
connection initiator	239		17	1
timestamp absolute monitoring-interval	359		18	8
flow observation point	138		26	8
overlay session id input	12432	9	34	4
routing vrf service	12434	9	38	4
application id	95		42	4
interface output snmp	14		46	4
flow direction	61		50	1
flow sampler	48		51	1
overlay session id output	12433	9	52	4
timestamp absolute first	152		56	8
timestamp absolute last	153		64	8
connection new-connections	278		72	4
connection sum-duration	279		76	8
connection server counter bytes long	232		84	8
connection server counter packets long	299		92	8
connection client counter bytes long	231		100	8
connection client counter packets long	298		108	8
connection server counter bytes network	8337	9	116	8

connection client counter bytes network	8338	9	124	8	
connection delay response to-server sum	9303	9	132	4	
connection server counter responses	9292	9	136	4	
connection delay response to-server his	9300	9	140	4	
connection client counter packets retra	9268	9	144	4	
connection delay application sum	9306	9	148	4	
connection delay response client-to-ser	9309	9	152	4	
connection transaction duration sum	9273	9	156	4	
connection transaction duration min	9275	9	160	4	
connection transaction duration max	9274	9	164	4	
connection transaction counter complete	9272	9	168	4	
connection client counter bytes retrans	9267	9	172	4	
connection server counter bytes retrans	9269	9	176	4	
connection server counter packets retra	9270	9	180	4	
connection delay network long-lived to-	9255	9	184	4	
connection delay network to-client num-	9259	9	188	4	
connection delay network long-lived to-	9254	9	192	4	
connection delay network to-server num-	9258	9	196	4	
connection delay network long-lived cli	9256	9	200	4	
connection delay network client-to-serv	9257	9	204	4	

Client: Flow Monitor CISCO-MONITOR-media_ipv4

Exporter Format: IPFIX (Version 10)

Template ID : 0

Source ID : 0

Record Size : 180

Template layout

Field	ID	Ent.ID	Offset	Size
ipv4 source address	8		0	4
ipv4 destination address	12		4	4

interface input snmp	10	8	4
ip dscp	195	12	1
ip protocol	4	13	1
ip ttl	192	14	1
ipv6 source address	27	15	16
ipv6 destination address	28	31	16
transport source-port	7	47	2
transport destination-port	11	49	2
connection initiator	239	51	1
timestamp absolute monitoring-interval	359	52	8
flow observation point	138	60	8
overlay session id input	12432	9	68
routing vrf service	12434	9	72
application id	95	76	4
routing forwarding-status	89	80	1
interface output snmp	14	81	4
flow direction	61	85	1
flow sampler	48	86	1
overlay session id output	12433	9	87
transport rtp ssrc	4254	9	91
transport rtp payload-type	4273	9	95
counter bytes long	1	96	8
counter packets	2	104	4
timestamp absolute first	152	108	8
timestamp absolute last	153	116	8
connection new-connections	278	124	4
transport packets expected counter	4246	9	128
transport packets lost counter	4251	9	132
transport packets lost rate	4253	9	136
transport rtp jitter mean	4255	9	140
transport rtp jitter minimum	4256	9	144
transport rtp jitter maximum	4257	9	148

```
| counter bytes rate          | 4235 | 9 | 152 | 4 |
| application media bytes counter | 4236 | 9 | 156 | 4 |
| application media bytes rate   | 4238 | 9 | 160 | 4 |
| application media packets counter | 4239 | 9 | 164 | 4 |
| application media packets rate  | 4241 | 9 | 168 | 4 |
| transport rtp jitter mean sum   | 4325 | 9 | 172 | 8 |
```

For more information, see the [show flow exporter](#) command page.

