Understand AVC on the Catalyst 9800 Wireless LAN Controller

Contents

Introduction

This document describes Application Visibility and Control (AVC) on a Cisco Catalyst 9800 WLC which enables precise management of application traffic.

Prerequisite

Cisco recommends that you have knowledge of these topics:

- Basic knowledge of Cisco WLC 9800.
- Basic knowledge of local and flex connect mode AP.
- The access points must be AVC capable. (Not applicable with Local Mode AP)
- For the control part of AVC (QoS) to work, the application visibility feature with FNF has to be configured.

Information about Application Visibility and Control (AVC)

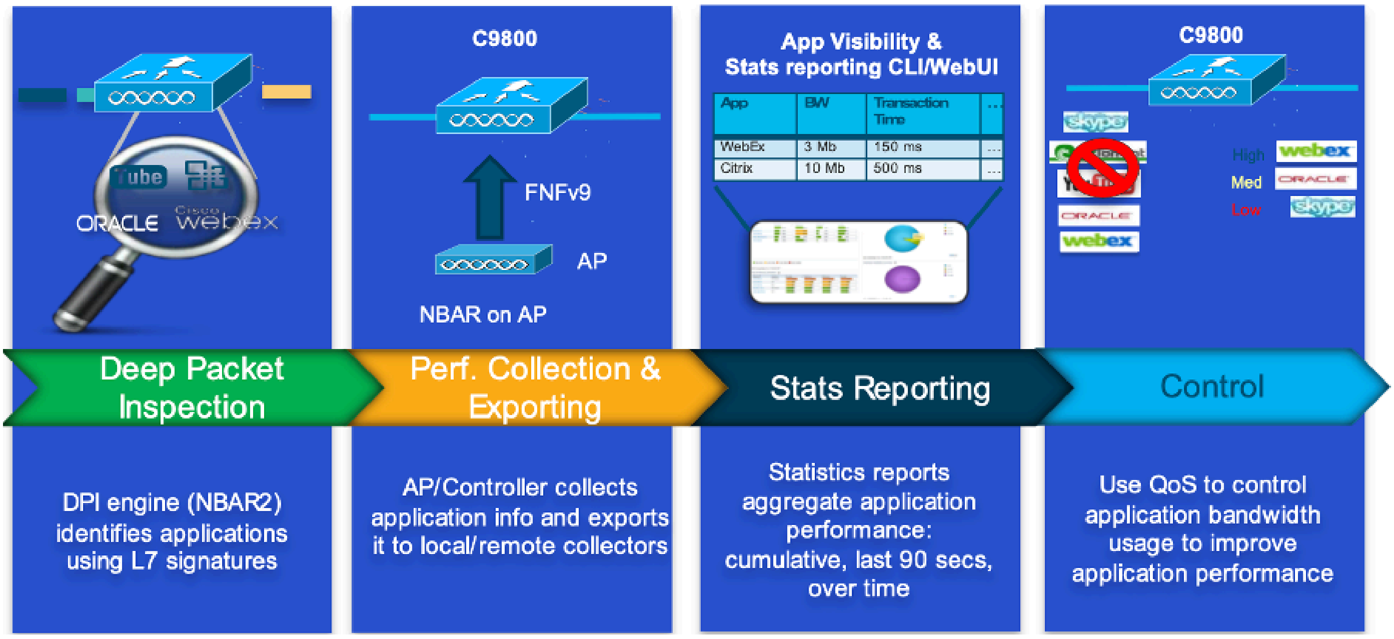
Application Visibility and Control (AVC) is Cisco's leading approach for deep-packet inspection (DPI) technology in both wireless and wired networks. With AVC, you can perform real-time analysis and create policies to effectively reduce network congestion, minimize costly network link usage, and avoid unnecessary infrastructure upgrades. In short, AVC empowers users to achieve a whole new level of traffic recognition and shaping through Network Based Application Recognition (NBAR). NBAR packages running on the 9800 WLC are used for DPI and the results are reported using Flexible NetFlow (FNF).

In addition to visibility, AVC provides the capability to prioritize, block, or throttle different types of traffic. For instance, administrators can create policies that prioritize voice and video applications to ensure quality of service (QoS) or limit the bandwidth available to non-essential applications during peak business hours. It can also be integrated with other Cisco technologies, such as Cisco Identity Services Engine (ISE) for identity-based application policies and Cisco Catalyst Center for centralized management.

How AVC Works

AVC utilizes advanced technologies such as FNF and NBAR2 engine for DPI. By analyzing and identifying traffic flows using the NBAR2 engine, specific flows are marked with the recognized protocol or application. The controller collects all reports and presents them through show commands, Web UI, or additional NetFlow export messages to external NetFlow collectors like Prime.

Once Application Visibility is established, users can create control rules with policing mechanisms for clients by configuring Qualty of service (QOS).



App	BW	Transaction Time	…
WebEx	3 Mb	150 ms	…
Citrix	10 Mb	500 ms	…

Deep Packet Inspection

Perf. Collection & Exporting

Stats Reporting

Control

DPI engine (NBAR2) identifies applications using L7 signatures

AP/Controller collects application info and exports it to local/remote collectors

Statistics reports aggregate application performance: cumulative, last 90 secs, over time

Use QoS to control application bandwidth usage to improve application performance

Working Mechanism of AVC

Network-Based Application Recognition (NBAR)

NBAR is a mechanism integrated on the 9800 WLC, which is used to perform DPI for identifying and classifying a wide variety of applications running over a network. It can recognize and classify a vast number of applications, including encrypted and dynamically port-mapped applications, which are often invisible to traditional packet inspection technologies.

Note: To leverage NBAR on the Catalyst 9800 WLC, it is necessary to enable and configure it correctly, often in conjunction with specific AVC profiles that define the appropriate actions to be taken based on the classification of the traffic.

NBAR continues to be periodically updated, and it is important to keep the WLC software up to date to ensure that the NBAR feature set remains current and effective.

A complete list of the protocols supported in the latest releases can be found at https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/qos_nbar/prot_lib/config_library/nbar-prot-pack-library.html

Enable NBAR Protocol on Policy Profile

```
9800WLC#configure terminal
9800WLC(config)#wireless profile policy AVC_testing
9800WLC(config-wireless-policy)#ip nbar protocol-discovery
9800WLC(config-wireless-policy)#end
```

Note: % Policy profile needs to be disabled before performing this operation.

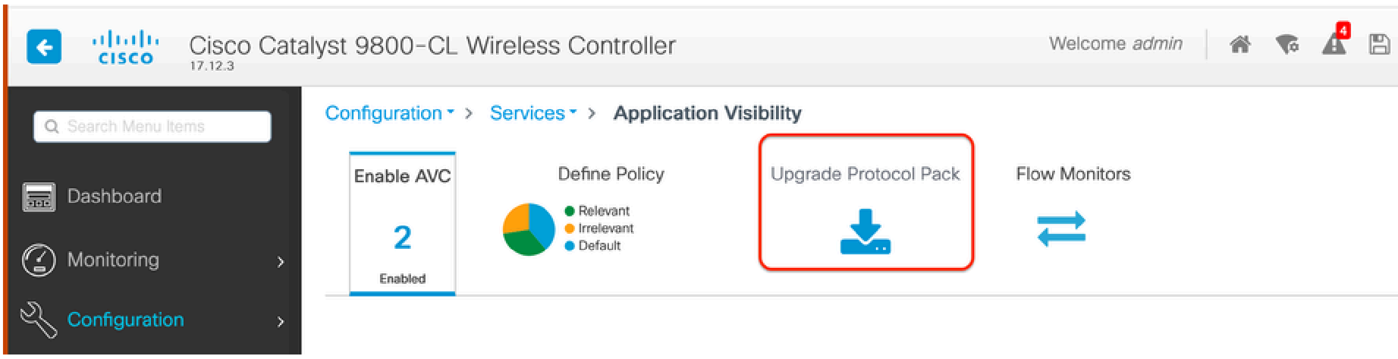
```
9800WLC#show wireless profile policy detailed AVC_testing | in NBAR
NBAR Protocol Discovery : Enabled
```

Upgrading NBAR on 9800 WLC

9800 WLC already has ~1500 recognizable applications. In the case where a new application is released, the protocol for the same will be updated in the latest NBAR which would be needed to be downloaded from the Software Download page for the specific 9800 model.

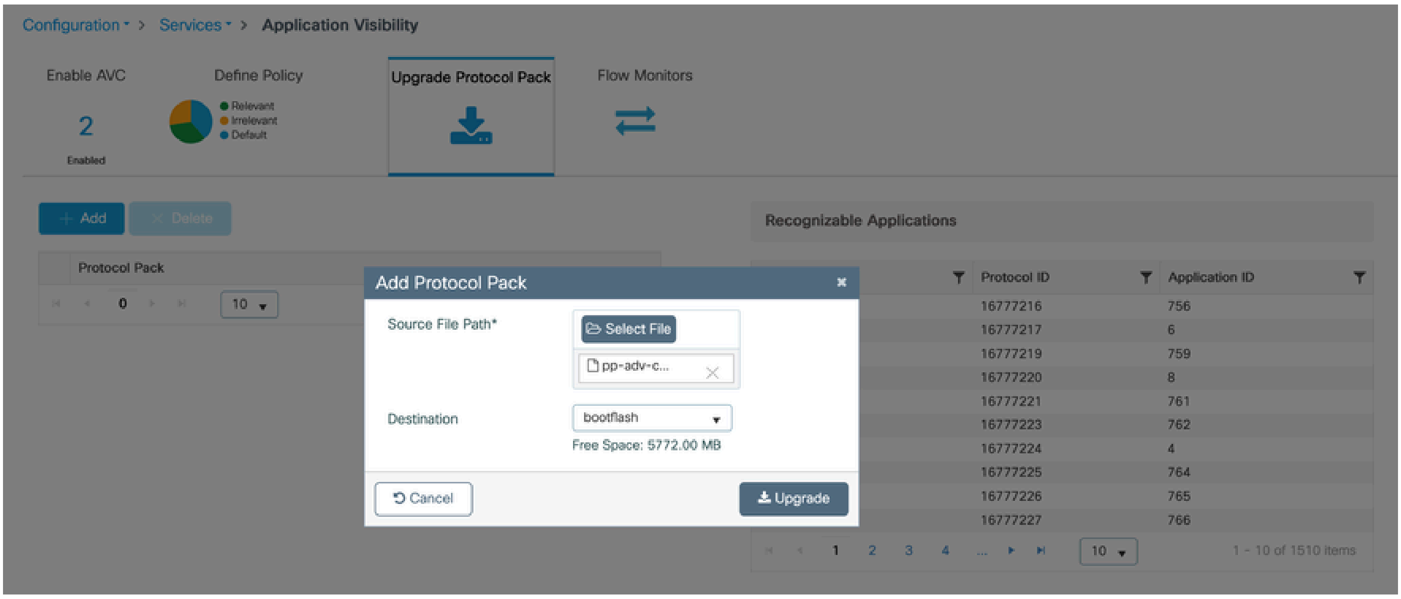
Via GUI

Navigate to **Configuration > Services > Application** Visibility. Click **Upgrade Protocol Pack** .



Upload Protocol Section in 9800 WLC

Click **Add**, then choose the protocol pack to be downloaded and click **Upgrade** .



Source File Path*: pp-adv-c...

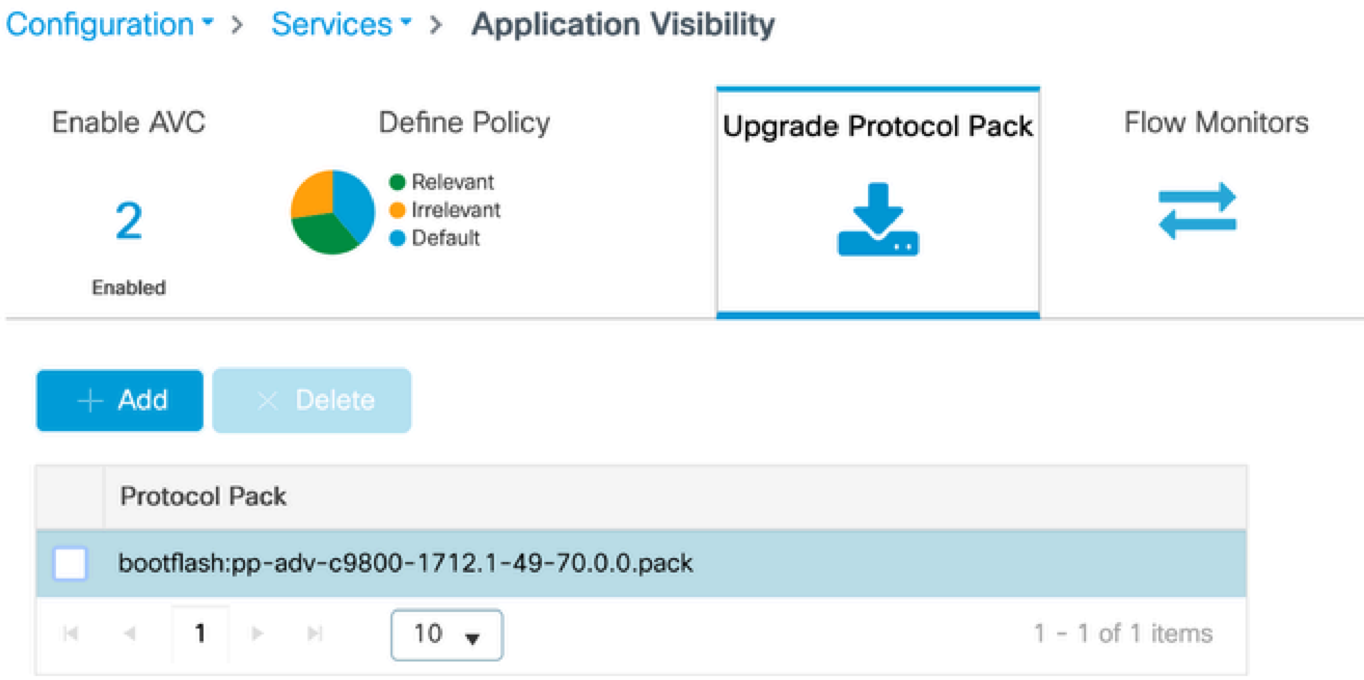
Destination: bootflash

Free Space: 5772.00 MB

Protocol ID	Application ID
16777216	756
16777217	6
16777219	759
16777220	8
16777221	761
16777223	762
16777224	4
16777225	764
16777226	765
16777227	766

Adding NBAR Protocol

Once Upgrade is done, you will see the protocol pack added.



	Protocol Pack
□	bootflash:pp-adv-c9800-1712.1-49-70.0.0.pack

Verification of Protocol Pack

Via CLI

```
9800WLC#copy tftp://10.10.10.1/pp-adv-c9800-1712.1-49-70.0.0.pack bootflash:
9800WLC#configure terminal
9800WLC(config)#ip nbar protocol-pack bootflash:pp-adv-c9800-1712.1-49-70.0.0.pack

To verify NBAR protocol pack version

9800WLC#show ip nbar protocol-pack active
Active Protocol Pack:
Name: Advanced Protocol Pack
Version: 70.0
Publisher: Cisco Systems Inc.
NBAR Engine Version: 49
Creation time: Tue Jun 4 10:18:09 UTC 2024
File: bootflash:pp-adv-c9800-1712.1-49-70.0.0.pack
State: Active
```

Note: There will be no service disruption during the upgrade of NBAR protocol pack.

NetFlow

NetFlow is a network protocol used for collecting IP traffic information and monitoring network flow data. It is used primarily for network traffic analysis and bandwidth monitoring. Here is an overview of how NetFlow works on the Cisco Catalyst 9800 series controllers:

- Data Collection: 9800 WLC collect data about IP traffic flowing through them. This data includes information such as source and destination IP addresses, source and destination ports, protocols used, class of service, and the cause of flow termination.
- Flow Records: The collected data is organized into flow records. A flow is defined as a unidirectional sequence of packets sharing a set of common attributes, such as the same source/destination IP, source/destination ports, and protocol type.
- Exporting Data: The flow records are periodically exported from the NetFlow-enabled device to a NetFlow collector. The collector can be local WLC or a dedicated server or software application that receives, stores, and processes the flow data.
- Analysis: You can use NetFlow collectors and analysis tools to visualize traffic patterns, identify

bandwidth, detect unusual traffic flows indicative of security breaches, optimize network performance, and plan for network expansion.

- Wireless-Specific Information: In the context of wireless controllers, NetFlow can include additional information specific to wireless networking, such as the SSID, AP names, client MAC addresses, and other details relevant to Wi-Fi traffic.

Flexible Netflow

Flexible NetFlow (FNF) is an advanced version of traditional NetFlow, and it is supported by the Cisco Catalyst 9800 Series Wireless LAN Controllers (WLCs). It provides more customization options for tracking, monitoring, and analyzing network traffic patterns. Key features of Flexible NetFlow on the Catalyst 9800 WLC include:

- Customization: FNF allows users to define what information they want to collect from the network traffic. This includes a wide range of traffic attributes like IP addresses, port numbers, timestamps, packet and byte counts, application types, and more.
- Enhanced Visibility: By leveraging FNF, administrators gain detailed visibility into the types of traffic flowing through the network, which is essential for capacity planning, usage-based network billing, network analysis, and security monitoring.
- Protocol Independence: FNF is flexible enough to support various protocols beyond IP, making it adaptable to different types of network environments.

On the Catalyst 9800 WLC, FNF can be configured to export flow records to an external NetFlow collector or analysis application. This data can then be used for troubleshooting, network planning, and security analysis. The FNF configuration involves defining a flow record (what to collect), a flow exporter (where to send the data), and attaching the flow monitor (which binds the record and exporter) to the appropriate interfaces.

Note: FNF can send 17 different data records (as defined in RFC 3954) to the External 3rd Party Netflow collector such as Stealthwatch, Solarwinds and others which are: Application Tag, Client Mac Address, AP Mac address, WlanID, Source IP, Destination IP, Source Port, Destination Port, Protocol, Flow Start Time, Flow End Time, Direction, Packet out, Byte count, VLAN ID (Local mode) – Mgmt/Client and TOS - DSCP Value

Flow Monitor

A flow monitor is a component used in conjunction with Flexible NetFlow (FNF) to capture and analyses network traffic data. It plays a crucial role in monitoring and understanding traffic patterns for network management, security, and troubleshooting. The flow monitor is essentially an applied instance of FNF that collects and tracks flow data based on defined criteria. It is associated with three main elements:

- Flow Record: This defines the data that the flow monitor must collect from the network traffic. It specifies the keys (such as source and destination IP addresses, ports, protocol types) and non-key fields (like packet and byte counters, timestamps) that will be included in the flow data.
- Flow Exporter: This specifies the destination where the collected flow data must be sent. It includes details like the IP address of the NetFlow collector, the transport protocol (usually UDP), and the destination port number where the collector is listening.

- Flow Monitor: The flow monitor itself binds the flow record and flow exporter together and applies them to an interface or WLAN to actually start the monitoring process. It determines how the flow data must be collected and exported based on the criteria set in the flow record and the destination set in the flow exporter.

AVC Supported Access Points

AVC is supported only on these access points:

- Cisco Catalyst 9100 Series Access Points
- Cisco Aironet 2800 Series Access Point
- Cisco Aironet 3800 Series Access Points
- Cisco Aironet 4800 Series Access Points

Support for different 9800 deplyment modes

Deployment Mode	9800 WLC	Wave 1 Access Point	Wave 2 Access Point	Wifi 6 Access Point
Local Mode (Central Switching)	IPV4 Traffic: AVC Supported FNF Supported IPV6 Traffic: AVC Supported FNF Supported	Processing at WLC Level	Processing at WLC Level	Processing at WLC Level
Flex Mode (Central Switching)	IPV4 Traffic: AVC Supported FNF Supported IPV6 Traffic: AVC Supported FNF Supported	Processing at WLC Level	Processing at WLC Level	Processing at WLC Level
Flex Mode (Local Switching)	Processing at AP Level	IPV4 Traffic: AVC Supported FNF Supported IPV6 Traffic: AVC Supported FNF Not Supported	IPV4 Traffic: AVC Supported FNF Supported IPV6 Traffic: AVC Supported FNF Supported	IPV4 Traffic: AVC Supported FNF Supported IPV6 Traffic: AVC Supported FNF Supported
Local Mode (Fabric)	Processing at AP Level	IPV4 Traffic: AVC Not Supported FNF Not Supported	IPV4 Traffic: AVC Supported FNF Supported	IPV4 Traffic: AVC Supported FNF Supported

		IPV6 Traffic: AVC Not Supported FNF Not Supported	IPV6 Traffic: AVC Supported FNF Supported	IPV6 Traffic: AVC Supported FNF Supported

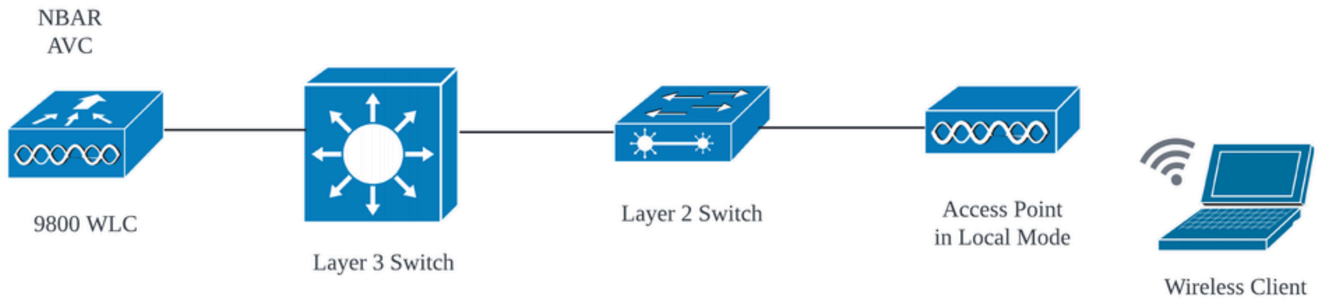
Restrictions while implementing AVC on 9800

Both Application Visibility and Control (AVC) and Flexible NetFlow (FNF) are powerful features on Cisco Catalyst 9800 Series Wireless LAN Controllers that enhance network visibility and control. However, there are some limitations and considerations to keep in mind when using these features:

- Layer 2 roaming is not supported across controllers.
- Multicast traffic is not supported.
- Only the applications that are recognized with App visibility can be used for applying QoS control.
- Data link is not supported for NetFlow fields in AVC.
- You cannot map the same WLAN profile to both the AVC-not-enabled policy profile and the AVC-enabled policy profile.
- You cannot use the policy profile with different switching mechanism to same WLAN to implement AVC.
- AVC is not supported on the management port (Gig 0/0).
- NBAR-based QoS policy configuration is allowed only on wired physical ports. Policy configuration is not supported on virtual interfaces, for example, VLAN, port channel and other logical interfaces.
- When AVC is enabled, the AVC profile supports only up to 23 rules, which includes the default DSCP rule. The AVC policy will not be pushed down to the AP, if rules are more than 23.

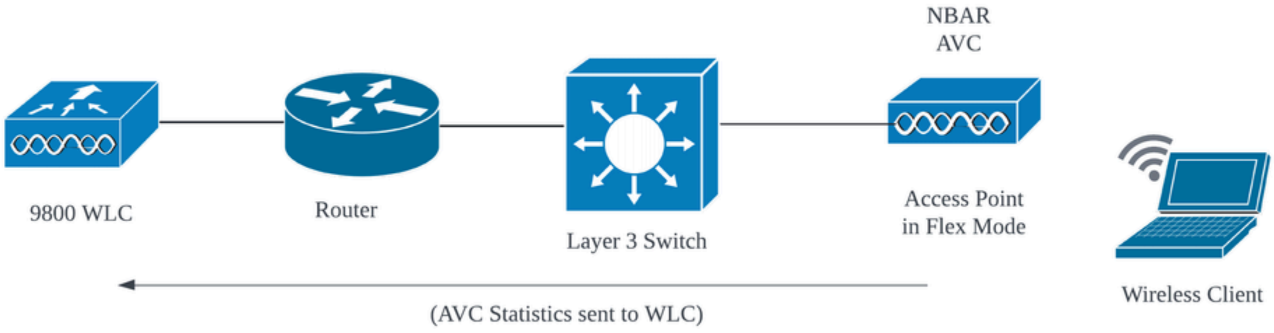
Network Topology

AP In Local Mode



AVC in Local Mode AP (Central Switching)

AP In flex Mode



AVC in Flex Mode AP

Configuration of AVC on 9800 WLC

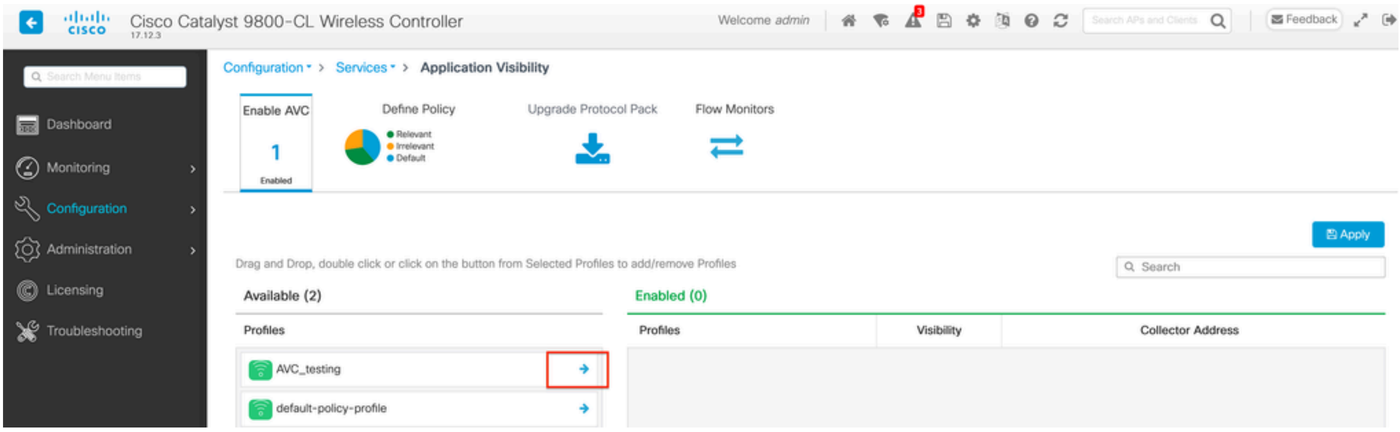
While Configuring AVC on 9800 WLC, you can use either it as NetFlow Collector or can export the NefFlow data to External NetFlow Collector.

Local Exporter

On a Cisco Catalyst 9800 Wireless LAN Controller (WLC), a local NetFlow collector refers to the embedded feature within the WLC that allows it to collect and locally store NetFlow data. This capability enables the WLC to perform basic NetFlow data analysis without the need to export the flow records to an external NetFlow collector.

Via GUI

Step 1: To enable AVC on Specific SSID Navigate to **Configuration** > **Services** > **Application Visibility**. Choose the particular Policy Profile for which you wish to activate AVC.



Drag and Drop, double click or click on the button from Selected Profiles to add/remove Profiles

Available (2)

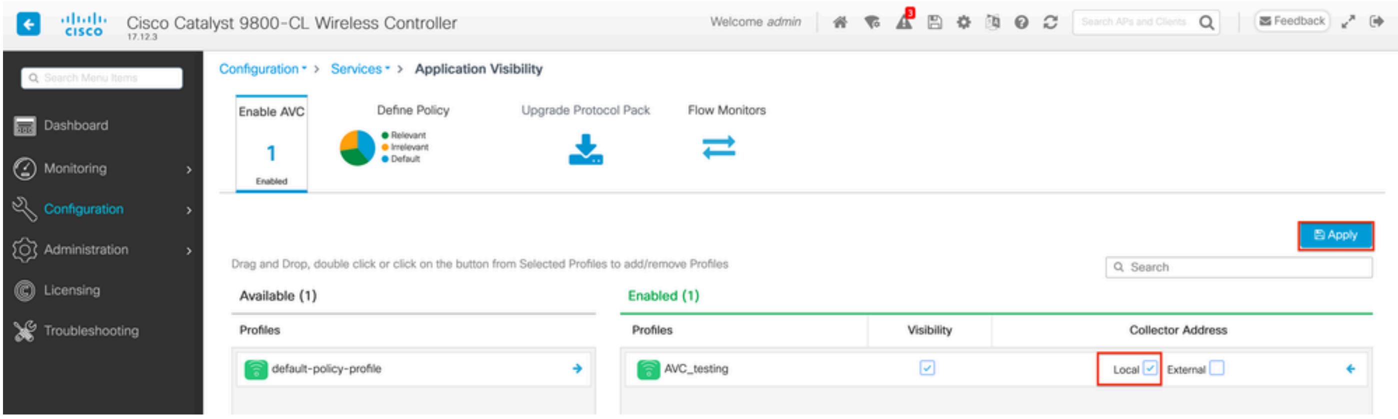
Profiles
AVC_testing
default-policy-profile

Enabled (0)

Profiles	Visibility	Collector Address

Enabling AVC on Policy Profile

Step 2: Select **Local** as Netflow Collector and Click **Apply**.



Drag and Drop, double click or click on the button from Selected Profiles to add/remove Profiles

Available (1)

Profiles
default-policy-profile

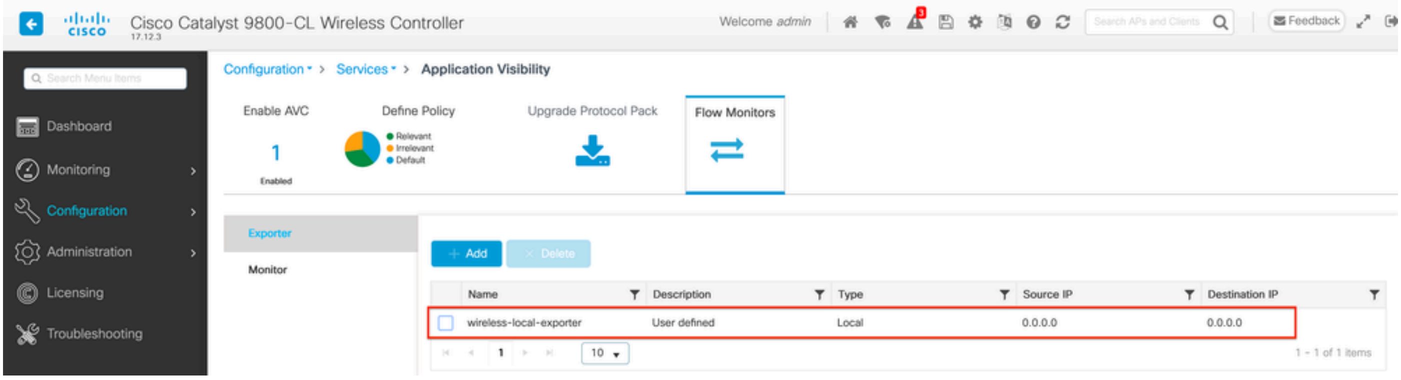
Enabled (1)

Profiles	Visibility	Collector Address
AVC_testing	☑	Local ☑ External □

Selecting Local NetFlow Collector

Observe that the NetFlow Exporter and NetFlow settings have been automatically configured according to the specified preferences once you apply the AVC configuration.

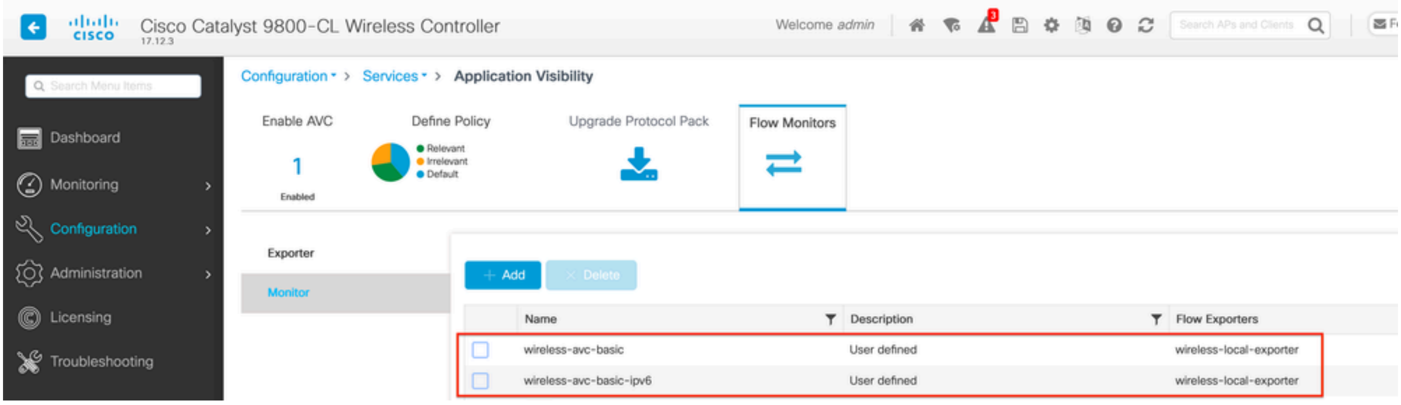
You can Validate the same by navigating to **Configuration** > **Services** > **Application Visibility** > **Flow Monitor** > **Exporter/Monitor** .



	Name	Description	Type	Source IP	Destination IP
□	wireless-local-exporter	User defined	Local	0.0.0.0	0.0.0.0

1 10 1 - 1 of 1 items

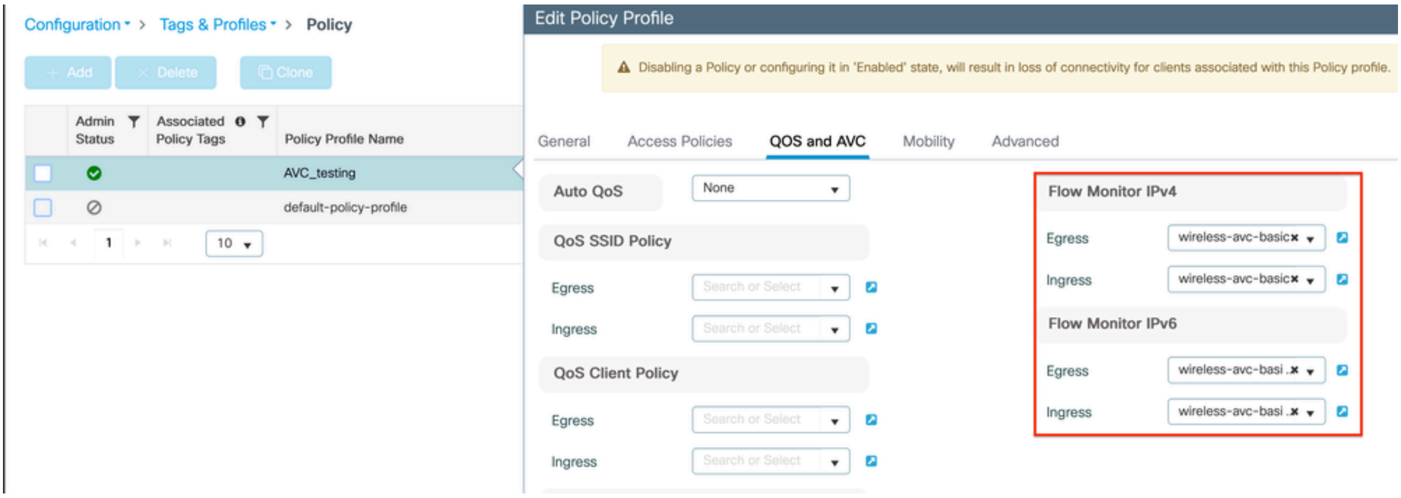
Local Flow Collector Configuration on 9800 WLC



	Name	Description	Flow Exporters
□	wireless-avc-basic	User defined	wireless-local-exporter
□	wireless-avc-basic-ipv6	User defined	wireless-local-exporter

Flow Monitor Configuration with Local NetFlow Collector

The IPv4 and IPv6 AVC Flow Monitors will get automatically associated with the Policy Profile. Navigate to **Configuration** > **Tags & Profile** > **Policy** . Click **Policy Profile** > **AVC** and **QOS** .



	Admin Status	Associated Policy Tags	Policy Profile Name
□	✓		AVC_testing
□	⊘		default-policy-profile

⚠ Disabling a Policy or configuring it in 'Enabled' state, will result in loss of connectivity for clients associated with this Policy profile.

Auto QoS: None

QoS SSID Policy
Egress: Search or Select
Ingress: Search or Select

QoS Client Policy
Egress: Search or Select
Ingress: Search or Select

Flow Monitor IPv4
Egress: wireless-avc-basic
Ingress: wireless-avc-basic

Flow Monitor IPv6
Egress: wireless-avc-basi
Ingress: wireless-avc-basi

Flow Monitor Configuration In Policy Profile

Via CLI

Step1: Configure 9800 WLC as Local Exporter.

```
9800-Cl-VM#config t
9800-Cl-VM(config)#flow exporter wireless-local-exporter
9800-Cl-VM(config-flow-exporter)#destination local wlc
9800-Cl-VM(config-flow-exporter)#exit
```

Step2: Configure IPv4 and IPv6 Network Flow Monitor to use Local(WLC) as Netflow Exporter.

```
9800-Cl-VM(config)#flow monitor wireless-avc-basic
9800-Cl-VM(config-flow-monitor)#exporter wireless-local-exporter
9800-Cl-VM(config-flow-monitor)#cache timeout active 60
9800-Cl-VM(config-flow-monitor)#record wireless avc ipv4 basic
9800-Cl-VM(config-flow-monitor)#exit

9800-Cl-VM(config)#flow monitor wireless-avc-basic-ipv6
9800-Cl-VM(config-flow-monitor)#exporter avc_local_exporter
9800-Cl-VM(config-flow-monitor)#cache timeout active 60
9800-Cl-VM(config-flow-monitor)#record wireless avc ipv6 basic
9800-Cl-VM(config-flow-monitor)#exit
```

Step 3: Map the IPv4 and IPv6 Flow Minitor in Policy Profile for both ingress and egress traffic.

```
9800-Cl-VM(config)#wireless profile policy AVC_Testing
9800-Cl-VM(config-wireless-policy)#shutdown

Disabling policy profile will result in associated AP/Client rejoin

9800-Cl-VM(config-wireless-policy)#ipv4 flow monitor wireless-avc-basic input
9800-Cl-VM(config-wireless-policy)#ipv4 flow monitor wireless-avc-basic output
9800-Cl-VM(config-wireless-policy)#ipv6 flow monitor wireless-avc-basic-ipv6 input
9800-Cl-VM(config-wireless-policy)#ipv6 flow monitor wireless-avc-basic-ipv6 output
```

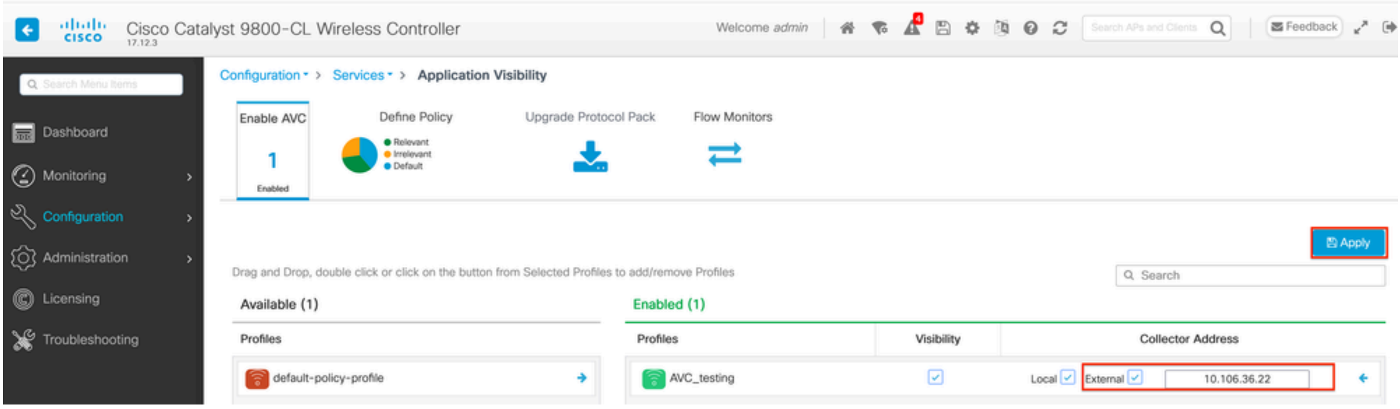
```
9800-Cl-VM(config-wireless-policy)#no shutdown
9800-Cl-VM(config-wireless-policy)#exit
```

External NetFlow Collector

An external NetFlow collector, when used in the context of Application Visibility and Control (AVC) on a Cisco Catalyst 9800 Wireless LAN Controller (WLC), is a dedicated system or service that receives, aggregates, and analyzes NetFlow data exported from the WLC. You can Either Configure only external NeFlow Collector to Monitor the Application Visibility or can use it along with Local Collector as well.

Via GUI

Step 1: To enable AVC on Specific SSID Navigate to **Configuration** > **Services** > **Application Visibility**. Choose the particular Policy Profile for which you wish to activate AVC. Select Collector as External and configure the IP address of NetFlow Collector like Cisco Prime, SolarWind, StealthWatch and click **Apply**.



Available (1)

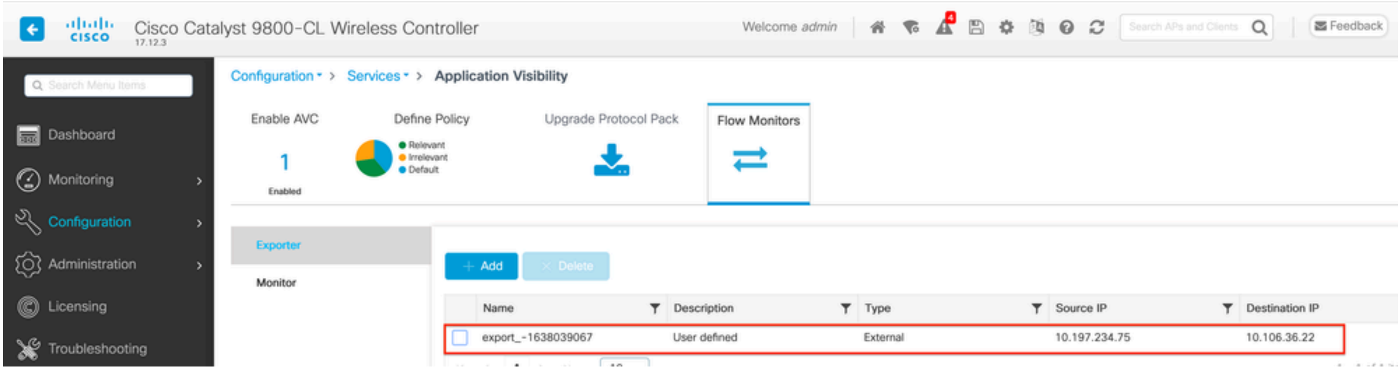
Profiles
default-policy-profile

Enabled (1)

Profiles	Visibility	Collector Address
AVC_testing	☑	Local ☑ External ☑ 10.106.36.22

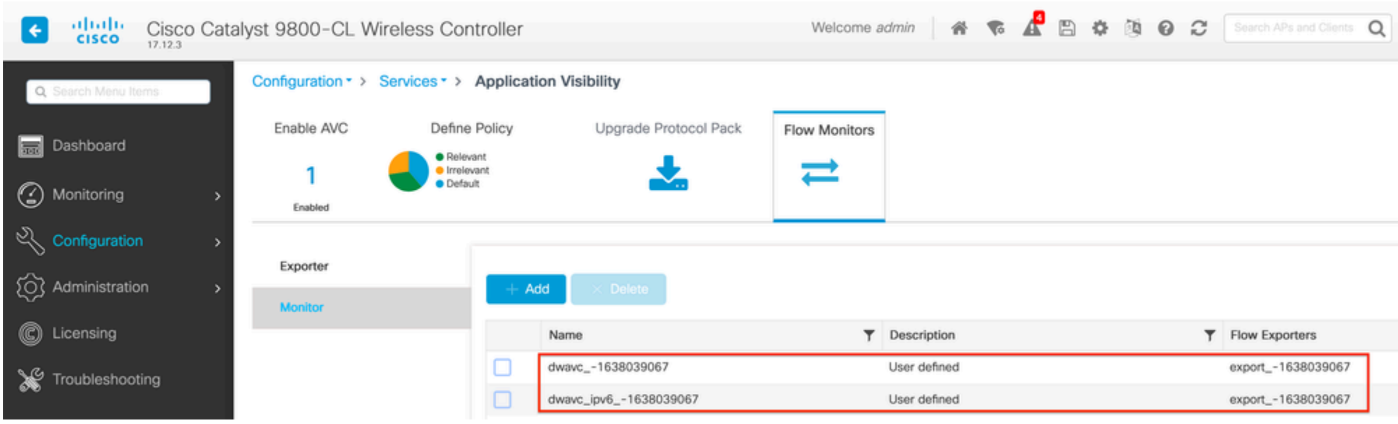
AVC Configuration for External NetFlow Collector

Observe that, once you apply the AVC configuration, the NetFlow Exporter and NetFlow settings have been automatically configured with the NetFlow Collector IP address as exporter and Exporter address as 9800 WLC with default timeout settings and UDP port 9995. You can Validate the same by navigating to **Configuration** > **Services** > **Application Visibility** > **Flow Monitor** > **Exporter/Monitor** .



	Name	Description	Type	Source IP	Destination IP
□	export_-1638039067	User defined	External	10.197.234.75	10.106.36.22

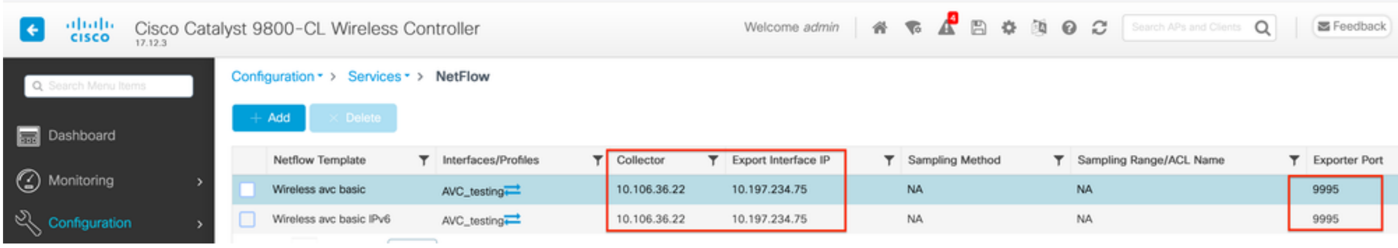
External NetFlow Collector Configuration on 9800 WLC



	Name	Description	Flow Exporters
□	dwavc_-1638039067	User defined	export_-1638039067
□	dwavc_ipv6_-1638039067	User defined	export_-1638039067

Flow Monitor Configuration with External NetFlow Collector

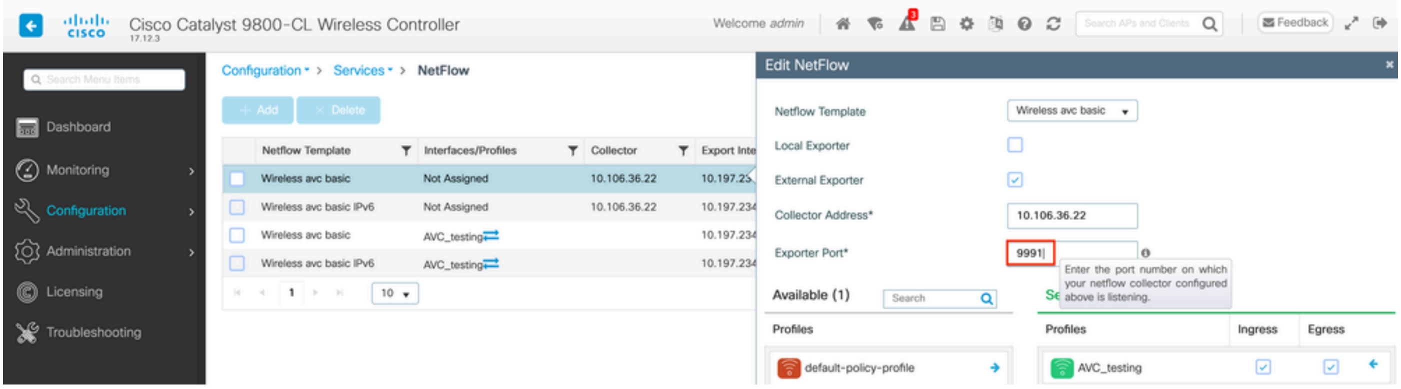
You can check the Port Configuration of automatically generated NetFlow Monitor by navigating to **Configuration** > **Services** > **NetFlow** .



	Netflow Template	Interfaces/Profiles	Collector	Export Interface IP	Sampling Method	Sampling Range/ACL Name	Exporter Port
□	Wireless avc basic	AVC_testing	10.106.36.22	10.197.234.75	NA	NA	9995
□	Wireless avc basic IPv6	AVC_testing	10.106.36.22	10.197.234.75	NA	NA	9995

Note: If you Configure AVC via GUI, The automatically generated NetFlow Exporter will be configured to use UDP 9995 port. Please make sure to validate the port number which is being used by your NetFlow collector.

For Example: If you are using Cisco Prime as your NetFlow Collector, it is essential to set the Exporter port to 9991, as this is the port on which Cisco Prime listens for NetFlow traffic. You can manually change the Exporter Port in NetFlow Configuration.



	Netflow Template	Interfaces/Profiles	Collector	Export Inte
□	Wireless avc basic	Not Assigned	10.106.36.22	10.197.23
□	Wireless avc basic IPv6	Not Assigned	10.106.36.22	10.197.234
□	Wireless avc basic	AVC_testing		10.197.234
□	Wireless avc basic IPv6	AVC_testing		10.197.234

Edit NetFlow

Netflow Template: Wireless avc basic

Local Exporter: □

External Exporter: ☑

Collector Address*: 10.106.36.22

Exporter Port*: 9991

Enter the port number on which your netflow collector configured above is listening.

Changing Exporter Port Number in NetFlow Configuration

Via CLI

Step1: Configure the IP address of External NetFlow Collector with the source interface.

```
9800-Cl-VM#config t
9800-Cl-VM(config)#flow exporter External_Exporter
9800-Cl-VM(config-flow-exporter)#destination 10.106.36.22
9800-Cl-VM(config-flow-exporter)#source $Source_Interface
9800-Cl-VM(config-flow-exporter)#transport udp $Port_Numbet
9800-Cl-VM(config-flow-exporter)#exit
```

Step2: Configure IPv4 and IPv6 Network Flow Monitor to use Local(WLC) as Netflow Exporter.

```
9800-Cl-VM(config)#flow monitor wireless-avc-basic
9800-Cl-VM(config-flow-monitor)#exporter External_Exporter
9800-Cl-VM(config-flow-monitor)#cache timeout active 60
9800-Cl-VM(config-flow-monitor)#record wireless avc ipv4 basic
9800-Cl-VM(config-flow-monitor)#exit

9800-Cl-VM(config)#flow monitor wireless avc ipv6 basic
9800-Cl-VM(config-flow-monitor)#exporter External_Exporter
9800-Cl-VM(config-flow-monitor)#cache timeout active 60
9800-Cl-VM(config-flow-monitor)#record wireless avc ipv6 basic
9800-Cl-VM(config-flow-monitor)#exit
```

Step 3: Map the IPv4 and IPv6 Flow Minitor in Policy Profile for both ingress and egress traffic.

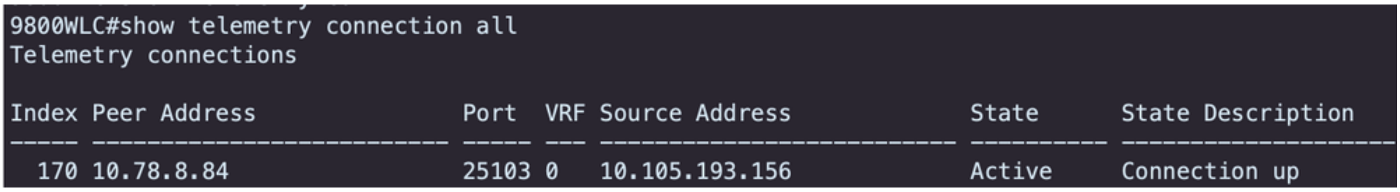
```
9800-Cl-VM(config)#wireless profile policy AVC_Testing
9800-Cl-VM(config-wireless-policy)#shutdown

Disabling policy profile will result in associated AP/Client rejoin

9800-Cl-VM(config-wireless-policy)#ipv4 flow monitor wireless-avc-basic input
9800-Cl-VM(config-wireless-policy)#ipv4 flow monitor wireless-avc-basic output
9800-Cl-VM(config-wireless-policy)#ipv6 flow monitor wireless avc ipv6 basic input
9800-Cl-VM(config-wireless-policy)#ipv6 flow monitor wireless avc ipv6 basic output
9800-Cl-VM(config-wireless-policy)#no shutdown
9800-Cl-VM(config-wireless-policy)#exit
```

Configuration of AVC on 9800 WLC using Cisco Catalyst Center

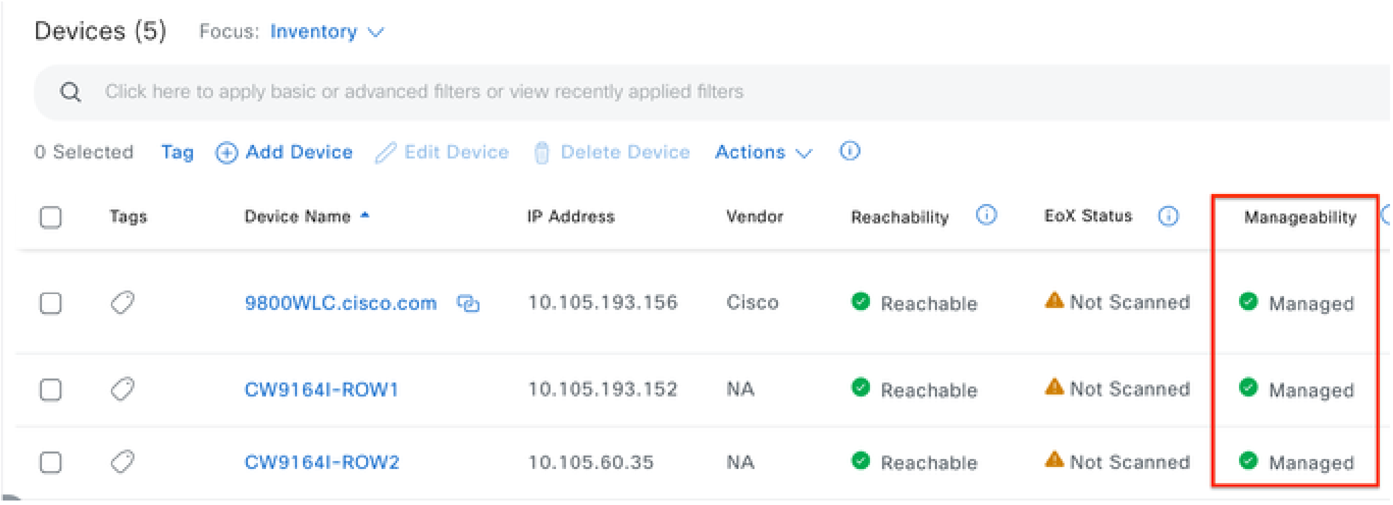
Before proceeding with the configuration of Application Visibility and Control (AVC) on a Cisco Catalyst 9800 Wireless LAN Controller (WLC) through Cisco Catalyst Center, it is important to verify that telemetry communication between the WLC and Cisco Catalyst Center has been successfully established. Ensure that the WLC appears in a managed state within the Cisco Catalyst Center interface and that its health status is being actively updated. Additionally, for effective monitoring of the health status, it is important to properly assign both the WLC and the Access Points (APs) to their respective sites within Cisco Catalyst Center.



```
9800WLC#show telemetry connection all
Telemetry connections

Index Peer Address                Port  VRF Source Address             State      State Description
----- -------------------------- ----- --- -------------------------- ---------- --------------------
  170 10.78.8.84                 25103 0   10.105.193.156             Active     Connection up
```

Telemetry Connection Verfication on 9800 WLC



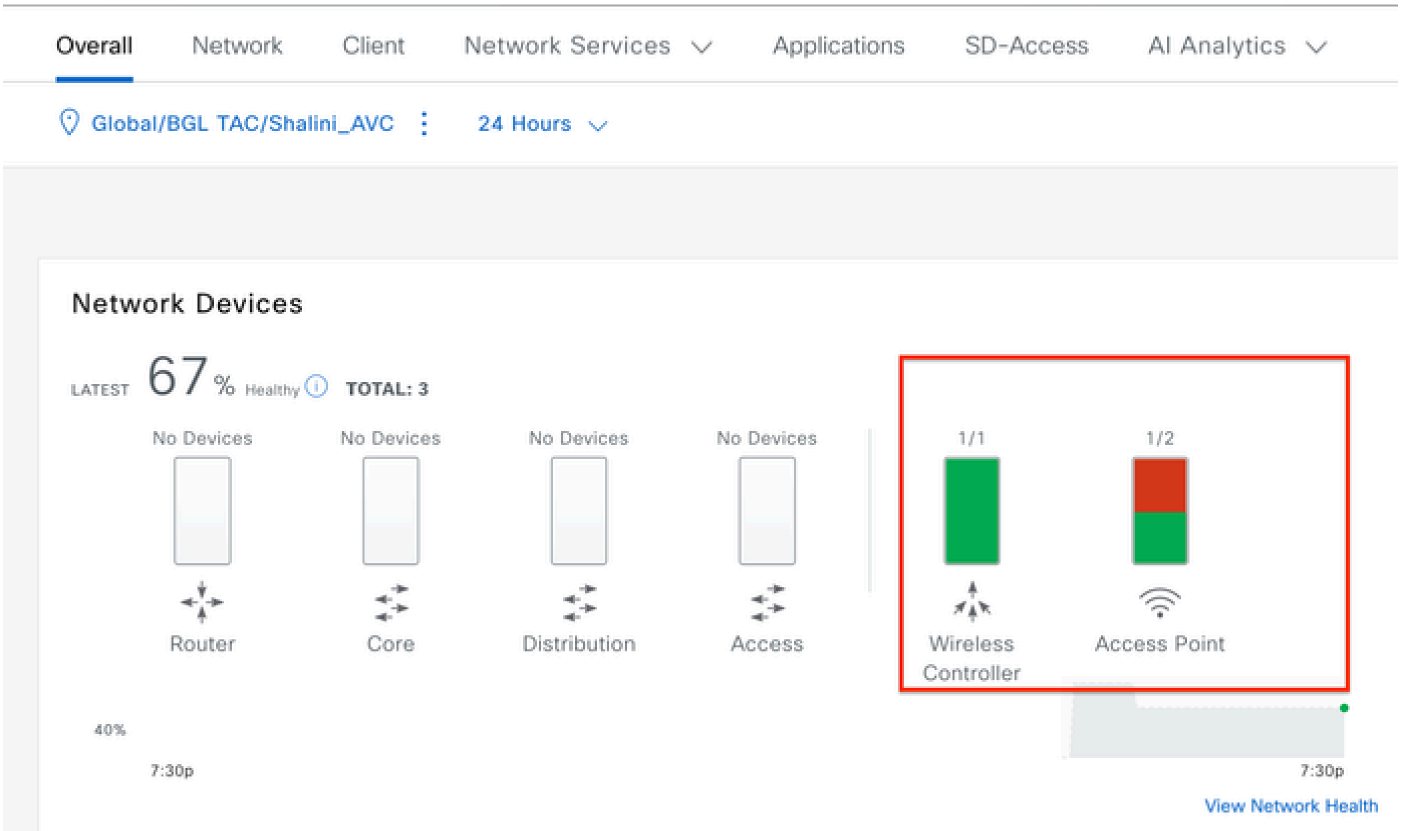
Devices (5) Focus: Inventory

Click here to apply basic or advanced filters or view recently applied filters

0 Selected Tag Add Device Edit Device Delete Device Actions

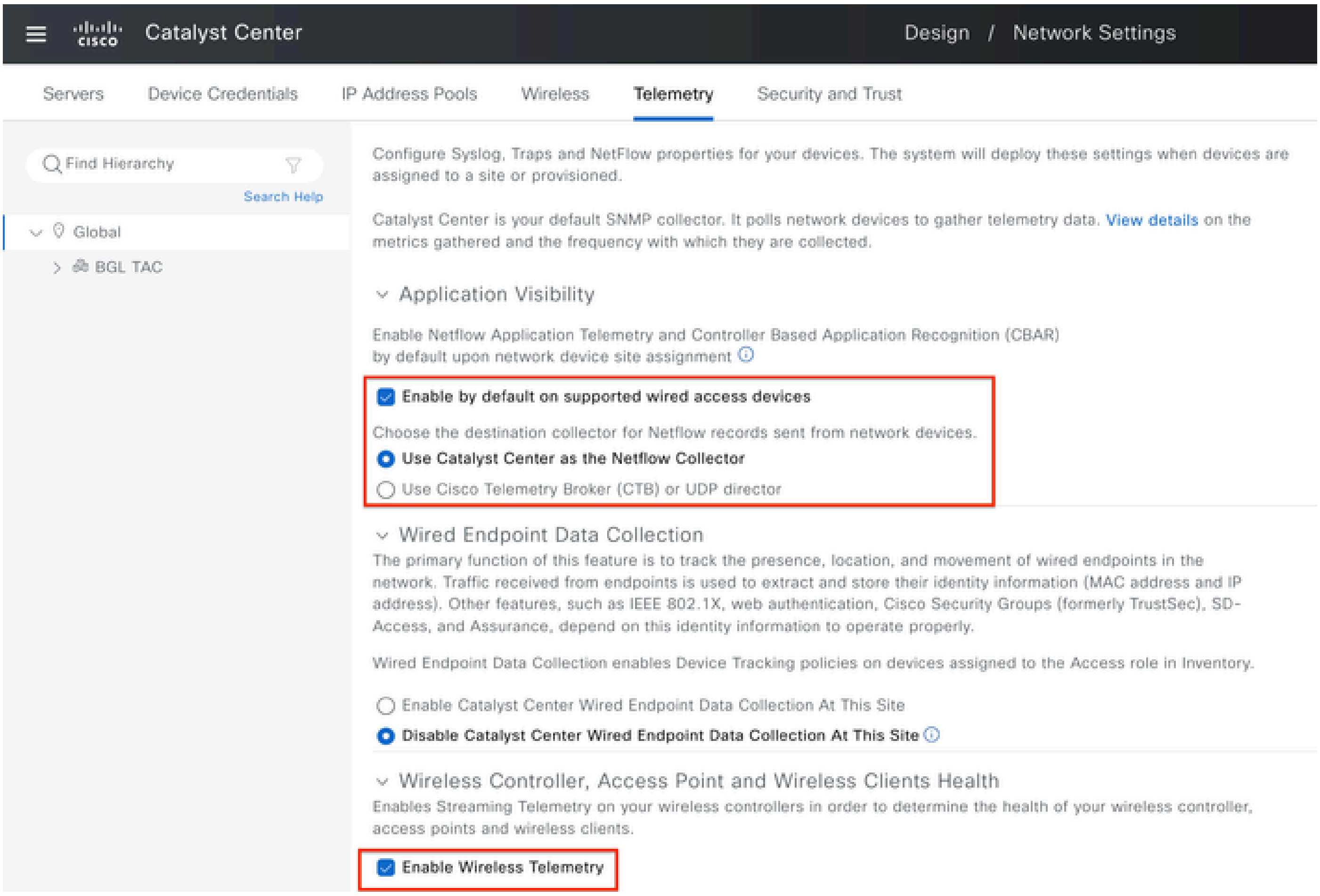
☐	Tags	Device Name	IP Address	Vendor	Reachability	EoX Status	Manageability
☐		9800WLC.cisco.com	10.105.193.156	Cisco	✓ Reachable	⚠ Not Scanned	✓ Managed
☐		CW9164I-ROW1	10.105.193.152	NA	✓ Reachable	⚠ Not Scanned	✓ Managed
☐		CW9164I-ROW2	10.105.60.35	NA	✓ Reachable	⚠ Not Scanned	✓ Managed

WLC and AP are in Managed State



Health Status of WLC and AP on Cisco Catalyst Center

Step 1: Configure Cisco Catalyst Center as NetFlow collector and enable Wireless Telemetry in Global setting. Navigate to **Design** > **Network Setting** > **Telemetry** and enable the desired configuration as demonstrated.



Configure Syslog, Traps and NetFlow properties for your devices. The system will deploy these settings when devices are assigned to a site or provisioned.

Catalyst Center is your default SNMP collector. It polls network devices to gather telemetry data. View details on the metrics gathered and the frequency with which they are collected.

Application Visibility

Enable Netflow Application Telemetry and Controller Based Application Recognition (CBAR) by default upon network device site assignment

☑ Enable by default on supported wired access devices

Choose the destination collector for Netflow records sent from network devices.

● Use Catalyst Center as the Netflow Collector

○ Use Cisco Telemetry Broker (CTB) or UDP director

Wired Endpoint Data Collection

The primary function of this feature is to track the presence, location, and movement of wired endpoints in the network. Traffic received from endpoints is used to extract and store their identity information (MAC address and IP address). Other features, such as IEEE 802.1X, web authentication, Cisco Security Groups (formerly TrustSec), SD-Access, and Assurance, depend on this identity information to operate properly.

Wired Endpoint Data Collection enables Device Tracking policies on devices assigned to the Access role in Inventory.

○ Enable Catalyst Center Wired Endpoint Data Collection At This Site

● Disable Catalyst Center Wired Endpoint Data Collection At This Site

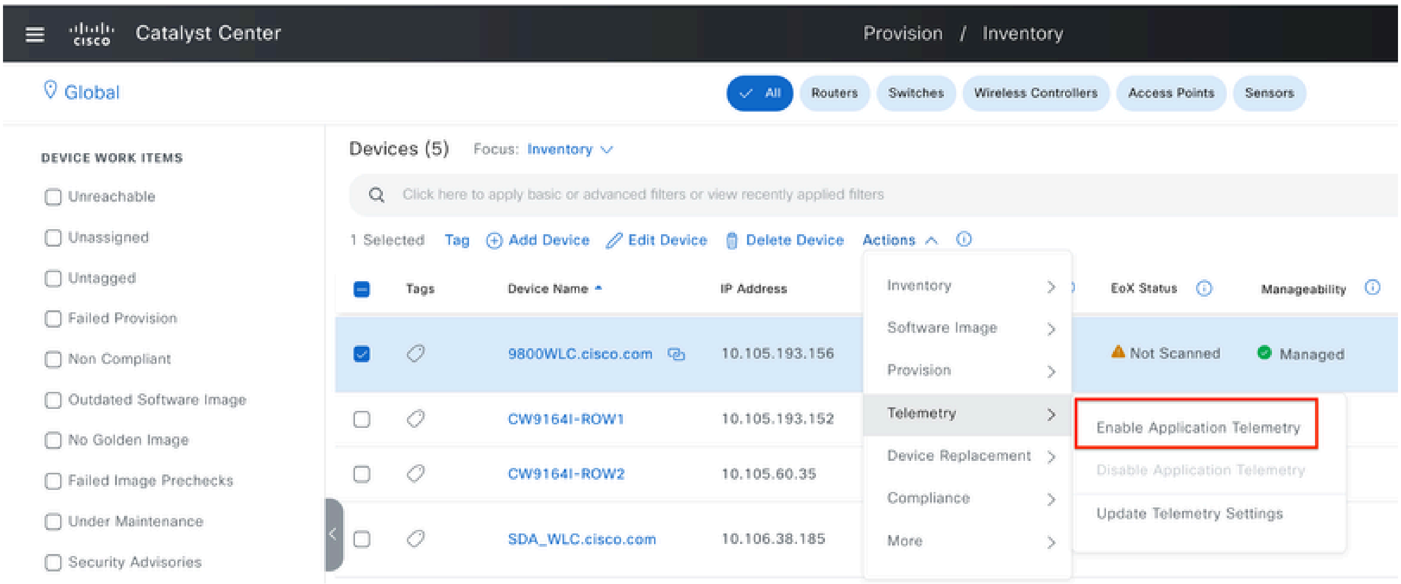
Wireless Controller, Access Point and Wireless Clients Health

Enables Streaming Telemetry on your wireless controllers in order to determine the health of your wireless controller, access points and wireless clients.

☑ Enable Wireless Telemetry

Wireless Telemetry and AVC Configuration

Step 2: Enable Application Telemetry on the desired 9800 WLC to push the AVC configuration on 9800 WLC. For this navigate to **Provision > Network Device > Inventory**. Choose the 9800 WLC on which you wish to activate Application Telemetry, and then navigate to **Action > Telemetry > Enable Application Telemetry** .



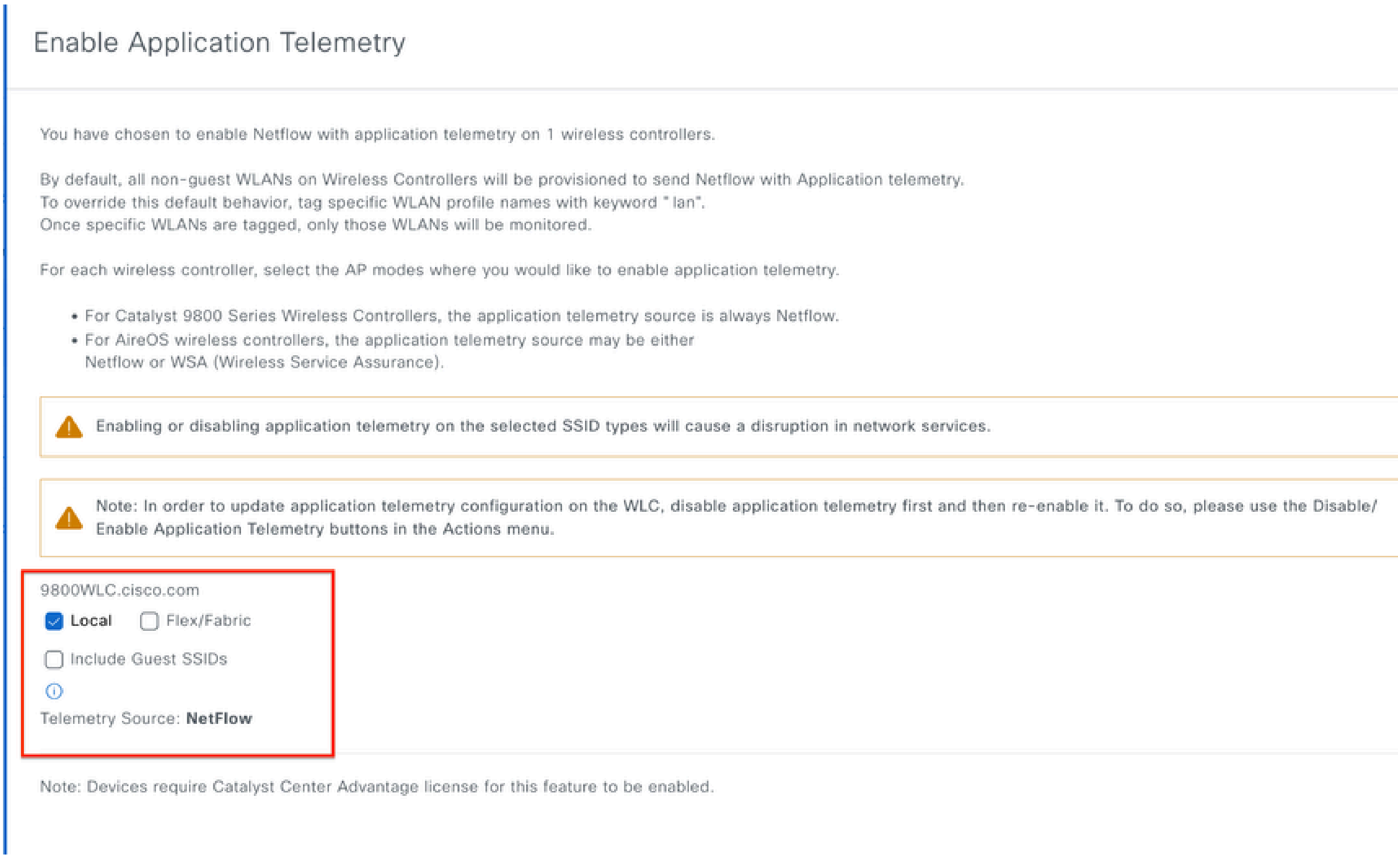
	Tags	Device Name	IP Address	EoX Status	Manageability
☑		9800WLC.cisco.com	10.105.193.156	Not Scanned	Managed
□		CW9164I-ROW1	10.105.193.152		
□		CW9164I-ROW2	10.105.60.35		
□		SDA_WLC.cisco.com	10.106.38.185		

Enabling Application Telemetry on 9800 WLC

Step 3: Choose the Deployment Mode as per the requirement.

Local: To enable AVC in local Policy profile (Central Switching)

Flex/Fabric: To enable AVC in Flex Policy Profile (Local Switching) or Fabric based SSID.



Enable Application Telemetry

You have chosen to enable Netflow with application telemetry on 1 wireless controllers.

By default, all non-guest WLANs on Wireless Controllers will be provisioned to send Netflow with Application telemetry.
To override this default behavior, tag specific WLAN profile names with keyword " lan".
Once specific WLANs are tagged, only those WLANs will be monitored.

For each wireless controller, select the AP modes where you would like to enable application telemetry.

- For Catalyst 9800 Series Wireless Controllers, the application telemetry source is always Netflow.
- For AireOS wireless controllers, the application telemetry source may be either Netflow or WSA (Wireless Service Assurance).

⚠ Enabling or disabling application telemetry on the selected SSID types will cause a disruption in network services.

⚠ Note: In order to update application telemetry configuration on the WLC, disable application telemetry first and then re-enable it. To do so, please use the Disable/Enable Application Telemetry buttons in the Actions menu.

9800WLC.cisco.com

☑ Local ☐ Flex/Fabric

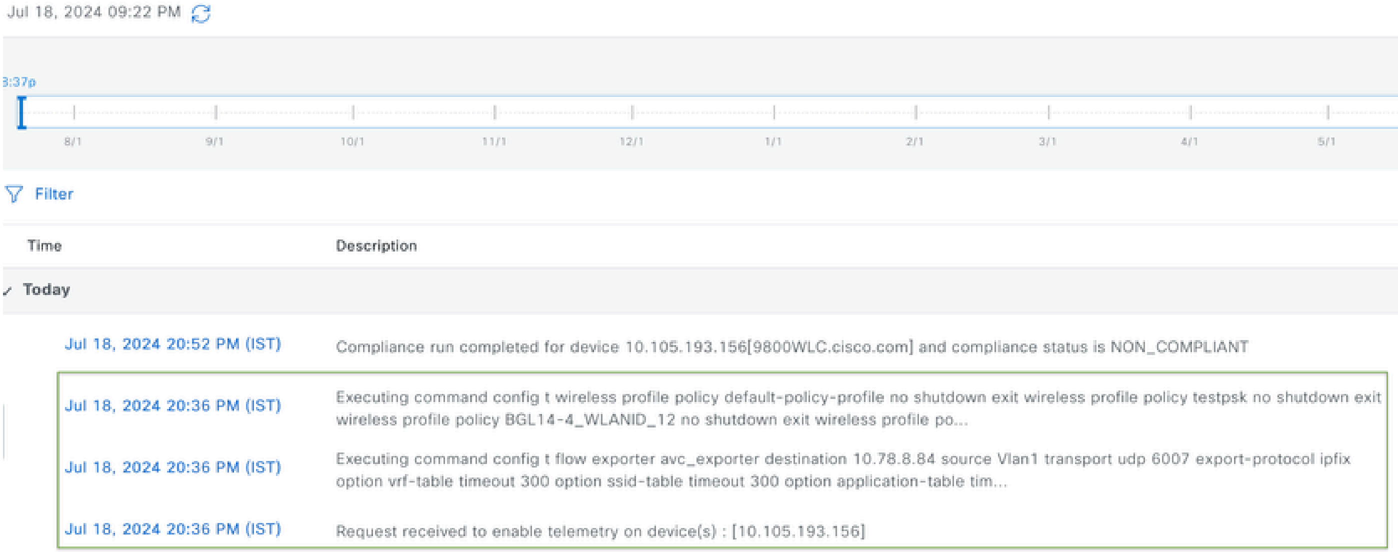
☐ Include Guest SSIDs

Telemetry Source: **NetFlow**

Note: Devices require Catalyst Center Advantage license for this feature to be enabled.

Deployment Mode Selection on Cisco Catalyst Center

Step 4: It initiates a task to activate the AVC settings, and the corresponding configuration will be applied to the 9800 WLC. You can view the status by navigating to **Activities** > **Audit Log** .



Time	Description
Today	
Jul 18, 2024 20:52 PM (IST)	Compliance run completed for device 10.105.193.156[9800WLC.cisco.com] and compliance status is NON_COMPLIANT
Jul 18, 2024 20:36 PM (IST)	Executing command config t wireless profile policy default-policy-profile no shutdown exit wireless profile policy testpsk no shutdown exit wireless profile policy BGL14-4_WLANID_12 no shutdown exit wireless profile po...
Jul 18, 2024 20:36 PM (IST)	Executing command config t flow exporter avc_exporter destination 10.78.8.84 source Vlan1 transport udp 6007 export-protocol ipfix option vrf-table timeout 300 option ssid-table timeout 300 option application-table tim...
Jul 18, 2024 20:36 PM (IST)	Request received to enable telemetry on device(s) : [10.105.193.156]

Audit Logs after Enabling Telemetry on 9800 WLC

Cisco Catalyst Center will deploy the Flow Exporter and Flow Monitor configurations, including the specified port and other settings, and activate them within the chosen mode policy profile as shown below:

Configure Cisco Catalyst Center as Flow Exporter:

```
9800-Cl-VM#config t
9800-Cl-VM(config)#flow exporter avc_exporter
9800-Cl-VM(config-flow-exporter)#destination 10.104.222.201
9800-Cl-VM(config-flow-exporter)#source Vlan10
9800-Cl-VM(config-flow-exporter)#transport udp 6007
9800-Cl-VM(config-flow-exporter)#export-protocol ipfix
9800-Cl-VM(config-flow-exporter)#option vrf-table timeout 300
9800-Cl-VM(config-flow-exporter)#option ssid-table timeout 300
9800-Cl-VM(config-flow-exporter)#option application-table timeout 300
9800-Cl-VM(config-flow-exporter)#option application-attributes timeout 300
9800-Cl-VM(config-flow-exporter)#exit
```

Configure 9800 WLC as Local Exporter

```
9800-Cl-VM#config t
9800-Cl-VM(config)#flow exporter avc_local_exporter
9800-Cl-VM(config-flow-exporter)#destination local wlc
9800-Cl-VM(config-flow-exporter)#exit
```

Configure Network Flow Monitor to use both Local(WLC) and Cisco Catalyst Center as Netflow Exporter:

```
9800-Cl-VM(config)#flow monitor avc_ipv4_assurance
9800-Cl-VM(config-flow-monitor)#exporter avc_exporter
9800-Cl-VM(config-flow-monitor)#exporter avc_local_exporter
9800-Cl-VM(config-flow-monitor)#cache timeout active 60
9800-Cl-VM(config-flow-monitor)#default cache entries
9800-Cl-VM(config-flow-monitor)#record wireless avc ipv4 assurance
9800-Cl-VM(config-flow-monitor)#exit

9800-Cl-VM(config)#flow monitor avc_ipv6_assurance
9800-Cl-VM(config-flow-monitor)#exporter avc_exporter
9800-Cl-VM(config-flow-monitor)#exporter avc_local_exporter
9800-Cl-VM(config-flow-monitor)#cache timeout active 60
9800-Cl-VM(config-flow-monitor)#default cache entries
9800-Cl-VM(config-flow-monitor)#record wireless avc ipv6 assurance
9800-Cl-VM(config-flow-monitor)#exit

9800-Cl-VM(config)#flow monitor avc_ipv4_assurance_rtp
9800-Cl-VM(config-flow-monitor)#exporter avc_exporter
9800-Cl-VM(config-flow-monitor)#cache timeout active 60
9800-Cl-VM(config-flow-monitor)#default cache entries
9800-Cl-VM(config-flow-monitor)#record wireless avc ipv4 assurance-rtp
9800-Cl-VM(config-flow-monitor)#exit

9800-Cl-VM(config)#flow monitor avc_ipv6_assurance_rtp
9800-Cl-VM(config-flow-monitor)#exporter avc_exporter
9800-Cl-VM(config-flow-monitor)#cache timeout active 60
9800-Cl-VM(config-flow-monitor)#default cache entries
9800-Cl-VM(config-flow-monitor)#record wireless avc ipv6 assurance-rtp
9800-Cl-VM(config-flow-monitor)#exit
```

```
Mapping the IPv4 and IPv6 Flow Minitor in Policy Profile

9800-Cl-VM(config)#wireless profile policy AVC_Testing
9800-Cl-VM(config-wireless-policy)#shutdown

Disabling policy profile will result in associated AP/Client rejoin

9800-Cl-VM(config-wireless-policy)#ipv4 flow monitor avc_ipv4_assurance input
9800-Cl-VM(config-wireless-policy)#ipv4 flow monitor avc_ipv4_assurance output
9800-Cl-VM(config-wireless-policy)#ipv4 flow monitor avc_ipv4_assurance_rtp input
9800-Cl-VM(config-wireless-policy)#ipv4 flow monitor avc_ipv4_assurance_rtp output
9800-Cl-VM(config-wireless-policy)#ipv6 flow monitor avc_ipv6_assurance input
9800-Cl-VM(config-wireless-policy)#ipv6 flow monitor avc_ipv6_assurance output
9800-Cl-VM(config-wireless-policy)#ipv6 flow monitor avc_ipv6_assurance_rtp input
9800-Cl-VM(config-wireless-policy)#ipv6 flow monitor avc_ipv6_assurance_rtp output
9800-Cl-VM(config-wireless-policy)#no shutdown
9800-Cl-VM(config-wireless-policy)#exit
```

Verification of AVC

On 9800

When the 9800 WLC is utilized as a Flow exporter, these AVC statistics can be observed:

- Application Visibility for clients connected across all SSIDs.

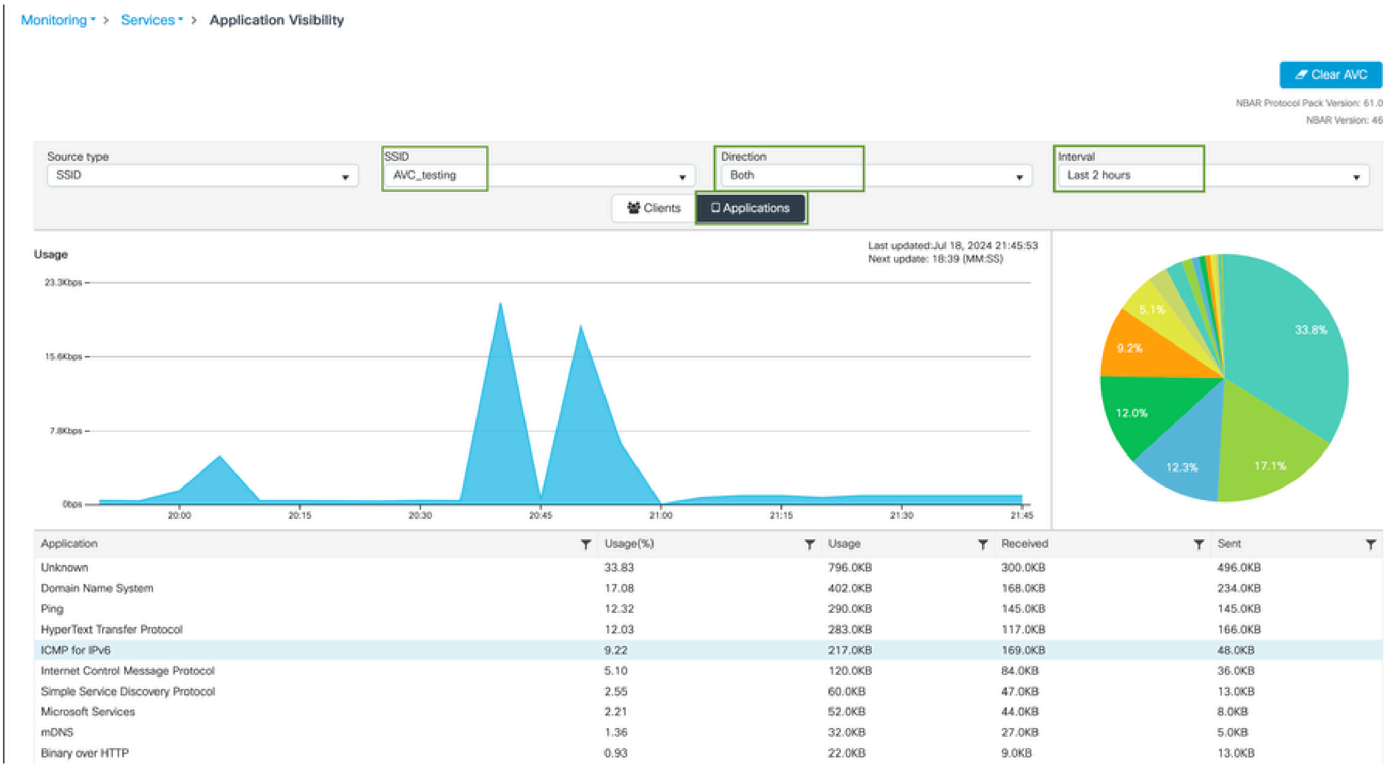
- Individual Application usage for each client.

- Specific Application usage on each SSID separately.

Note: You have the option to filter the data by direction, covering both incoming (ingress) and outgoing (egress) traffic, as well as by time interval, with the ability to select a range of up to 48 hours.

Via GUI

Navigate to **Monitoring > Services > Application Visibility** .



NBAR Protocol Pack Version: 61.0
NBAR Version: 46

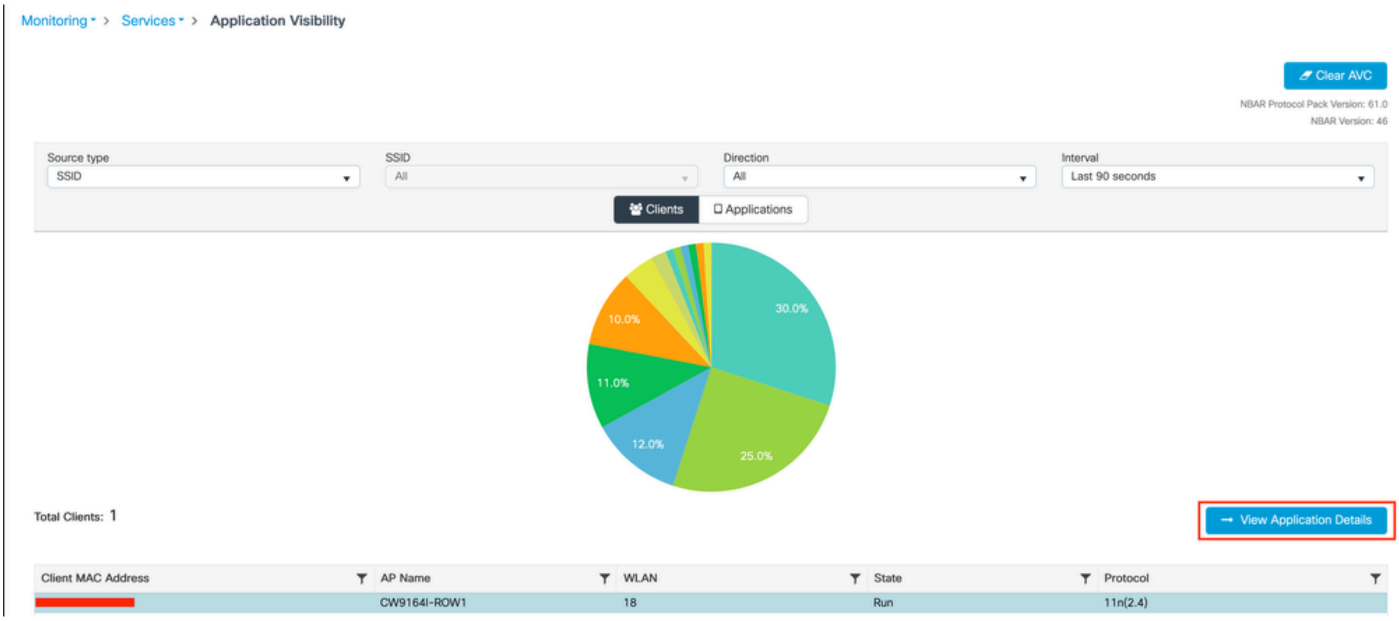
Source type: SSID
SSID: AVC_testing
Direction: Both
Interval: Last 2 hours

Last updated:Jul 18, 2024 21:45:53
Next update: 18:39 (MM:SS)

Application	Usage(%)	Usage	Received	Sent
Unknown	33.83	796.0KB	300.0KB	496.0KB
Domain Name System	17.08	402.0KB	168.0KB	234.0KB
Ping	12.32	290.0KB	145.0KB	145.0KB
HyperText Transfer Protocol	12.03	283.0KB	117.0KB	166.0KB
ICMP for IPv6	9.22	217.0KB	169.0KB	48.0KB
Internet Control Message Protocol	5.10	120.0KB	84.0KB	36.0KB
Simple Service Discovery Protocol	2.55	60.0KB	47.0KB	13.0KB
Microsoft Services	2.21	52.0KB	44.0KB	8.0KB
mDNS	1.36	32.0KB	27.0KB	5.0KB
Binary over HTTP	0.93	22.0KB	9.0KB	13.0KB

Application Visibility of users connected to AVC_testing SSID for both Ingress and Egress Traffic

To view Application Visibility statistics for each client, you can click on the Clients tab, choose a specific client, and then click **View Application Details**.



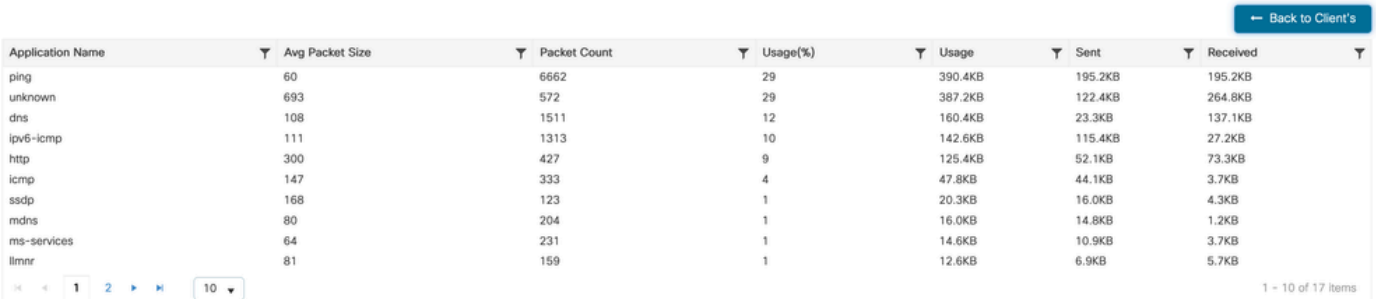
NBAR Protocol Pack Version: 61.0
NBAR Version: 46

Source type: SSID
SSID: All
Direction: All
Interval: Last 90 seconds

Total Clients: 1

Client MAC Address	AP Name	WLAN	State	Protocol
[redacted]	CW9164I-ROW1	18	Run	11n(2.4)

Application Visibility for Specific Client - 1



Application Name	Avg Packet Size	Packet Count	Usage(%)	Usage	Sent	Received
ping	60	6662	29	390.4KB	195.2KB	195.2KB
unknown	693	572	29	387.2KB	122.4KB	264.8KB
dns	108	1511	12	160.4KB	23.3KB	137.1KB
ipv6-icmp	111	1313	10	142.6KB	115.4KB	27.2KB
http	300	427	9	125.4KB	52.1KB	73.3KB
icmp	147	333	4	47.8KB	44.1KB	3.7KB
ssdp	168	123	1	20.3KB	16.0KB	4.3KB
mdns	80	204	1	16.0KB	14.8KB	1.2KB
ms-services	64	231	1	14.6KB	10.9KB	3.7KB
llmnr	81	159	1	12.6KB	6.9KB	5.7KB

1 - 10 of 17 items

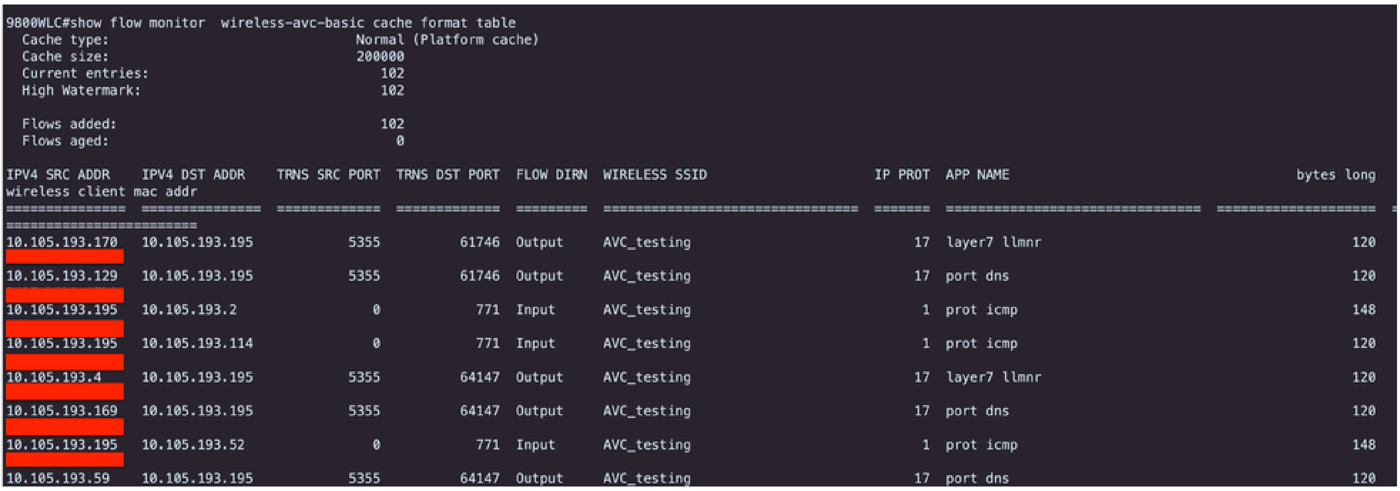
Via CLI

Verify AVC status

```
9800WLC#show avc status wlan AVC_testing
WLAN profile name: AVC_testing
----------------------------------------------------------
AVC configuration complete: YES
```

Statistics from NetFlow (FNF Cache)

```
9800WLC#show flow monitor $Flow_Monitor_Name cache format table
```



```
9800WLC#show flow monitor  wireless-avc-basic cache format table
  Cache type:                               Normal (Platform cache)
  Cache size:                               200000
  Current entries:                             102
  High Watermark:                              102

  Flows added:                                 102
  Flows aged:                                    0

IPV4 SRC ADDR    IPV4 DST ADDR    TRNS SRC PORT  TRNS DST PORT  FLOW DIRN  WIRELESS SSID                     IP PROT  APP NAME                                    bytes long
wireless client mac addr
===============  ===============  =============  =============  =========  ================================  =======  ================================  ====================  =
========================
10.105.193.170   10.105.193.195            5355          61746  Output     AVC_testing                            17  layer7 llmnr                                     120
[redacted]
10.105.193.129   10.105.193.195            5355          61746  Output     AVC_testing                            17  port dns                                         120
[redacted]
10.105.193.195   10.105.193.2                 0            771  Input      AVC_testing                             1  prot icmp                                        148
[redacted]
10.105.193.195   10.105.193.114               0            771  Input      AVC_testing                             1  prot icmp                                        120
[redacted]
10.105.193.4     10.105.193.195            5355          64147  Output     AVC_testing                            17  layer7 llmnr                                     120
[redacted]
10.105.193.169   10.105.193.195            5355          64147  Output     AVC_testing                            17  port dns                                         120
[redacted]
10.105.193.195   10.105.193.52                0            771  Input      AVC_testing                             1  prot icmp                                        148
[redacted]
10.105.193.59    10.105.193.195            5355          64147  Output     AVC_testing                            17  port dns                                         120
```

Verification of AVC on 9800 CLI

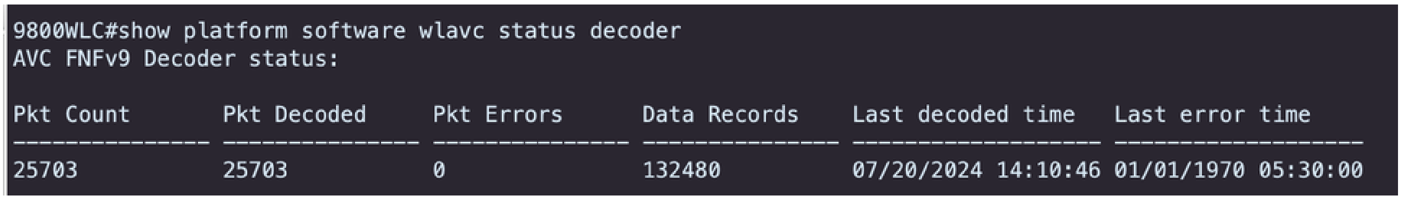
To individually examine the top application usage for each WLAN and its connected clients:

```
9800WLC#show avc wlan <SSID> top <n> applications <aggregate|downstream|upstream>
9800WLC#show avc client <mac> top <n> applications <aggregate|downstream|upstream>
where n = <1-30> Enter the number of applications

9800WLC#show avc wlan <SSID> application <app> top <n> <aggregate|downstream|upstream>
where n =  <1-10> Enter the number of clients
```

Verify FNFv9 packets counts and decode status punted to Control Plane (CP)

```
9800WLC#show platform software wlavc status decoder
```



```
9800WLC#show platform software wlavc status decoder
AVC FNFv9 Decoder status:

Pkt Count       Pkt Decoded     Pkt Errors      Data Records    Last decoded time   Last error time
--------------- --------------- --------------- --------------- ------------------- -------------------
25703           25703           0               132480          07/20/2024 14:10:46 01/01/1970 05:30:00
```

FNFv9 Packet Record

You can also check the nbar statistics directly.

```
9800WLC#show ip nbar protocol-discovery
```

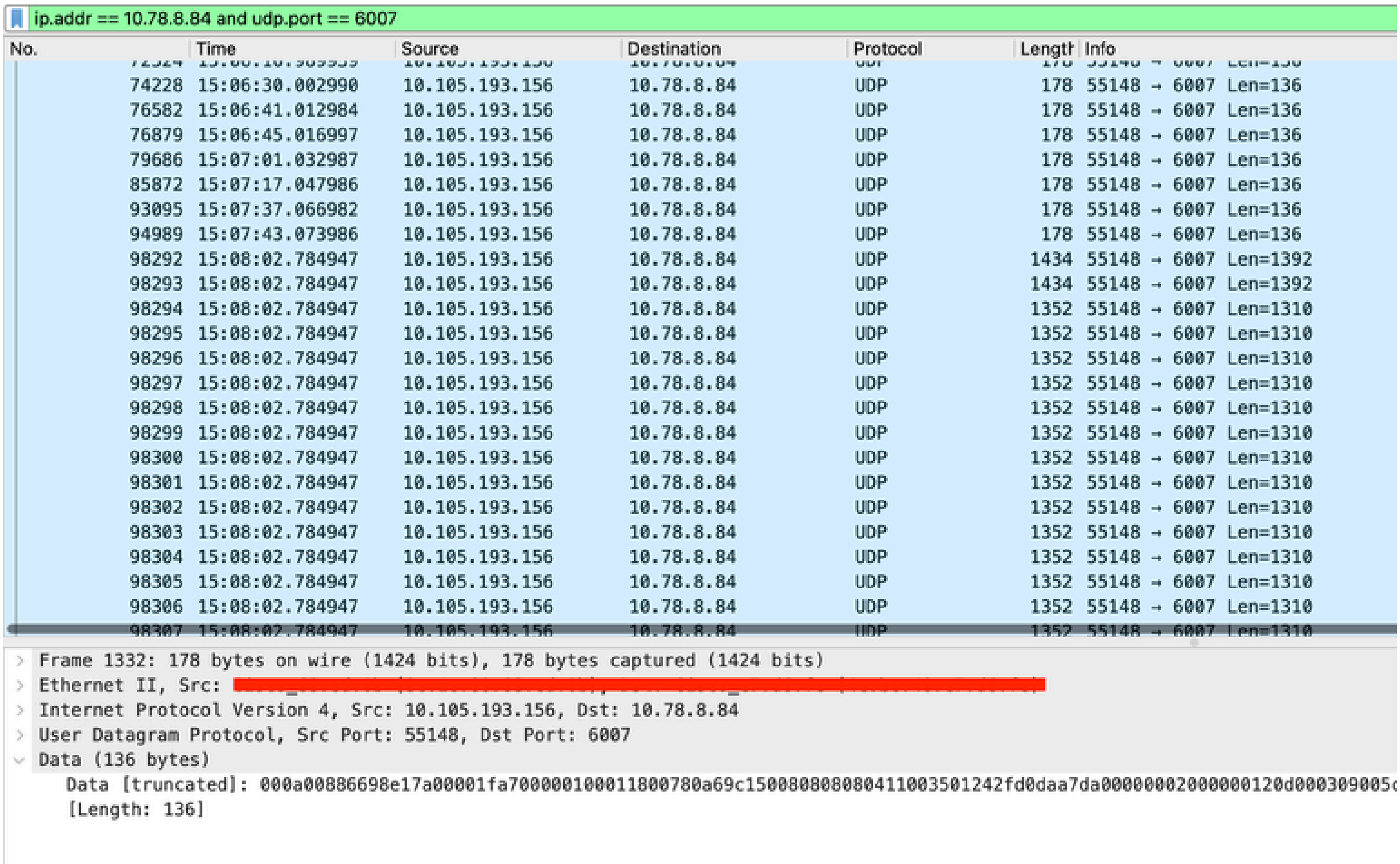
On Fabric and Flex modes, you can get the NBAR stats from AP via:

```
AP#show avc nbar statistics
Works on both IOS and ClickOS APs
```

Note: In a foreign-anchor setup, the anchor WLC serves as the Layer 3 presence for the client, while the foreign WLC operates at Layer 2. Because Application Visibility and Control (AVC) operates at Layer 3, the relevant data is only observable on the anchor WLC.

On DNAC

From the packet capture taken on 9800 WLC we can validate it is sending data regarding the applications and network traffic to Cisco Catalyst Center continuously.



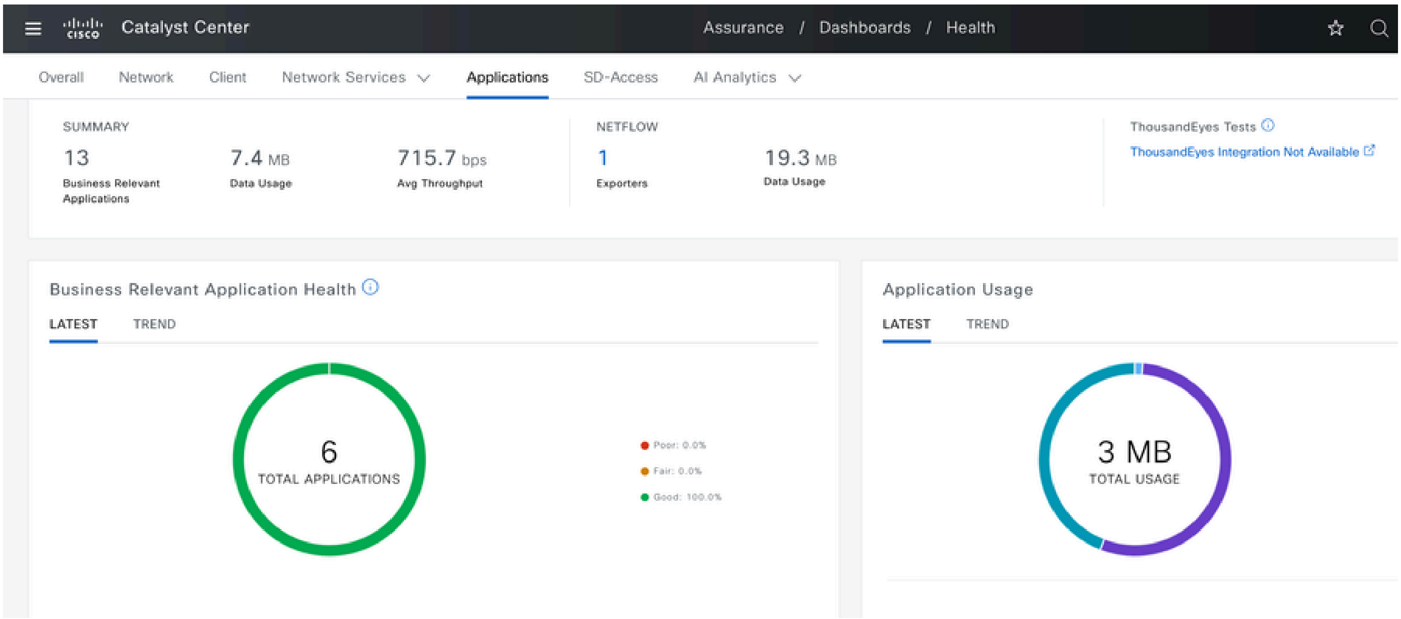
ip.addr == 10.78.8.84 and udp.port == 6007

```
No.    Time             Source           Destination   Protocol  Length Info
74228  15:06:30.002990  10.105.193.156   10.78.8.84    UDP        178  55148 → 6007 Len=136
76582  15:06:41.012984  10.105.193.156   10.78.8.84    UDP        178  55148 → 6007 Len=136
76879  15:06:45.016997  10.105.193.156   10.78.8.84    UDP        178  55148 → 6007 Len=136
79686  15:07:01.032987  10.105.193.156   10.78.8.84    UDP        178  55148 → 6007 Len=136
85872  15:07:17.047986  10.105.193.156   10.78.8.84    UDP        178  55148 → 6007 Len=136
93095  15:07:37.066982  10.105.193.156   10.78.8.84    UDP        178  55148 → 6007 Len=136
94989  15:07:43.073986  10.105.193.156   10.78.8.84    UDP        178  55148 → 6007 Len=136
98292  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1434  55148 → 6007 Len=1392
98293  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1434  55148 → 6007 Len=1392
98294  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
98295  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
98296  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
98297  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
98298  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
98299  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
98300  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
98301  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
98302  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
98303  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
98304  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
98305  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
98306  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
98307  15:08:02.784947  10.105.193.156   10.78.8.84    UDP       1352  55148 → 6007 Len=1310
```

```
> Frame 1332: 178 bytes on wire (1424 bits), 178 bytes captured (1424 bits)
> Ethernet II, Src: [redacted]
> Internet Protocol Version 4, Src: 10.105.193.156, Dst: 10.78.8.84
> User Datagram Protocol, Src Port: 55148, Dst Port: 6007
v Data (136 bytes)
    Data [truncated]: 000a00886698e17a00001fa700000100011800780a69c15008080808080411003501242fd0daa7da0000000200000120d000309005c
    [Length: 136]
```

Packet Capture on 9800 WLC

To view the application data for clients connected to a specific WLC on Cisco Catalyst Center, navigate to **Assurance > Dashboards > Health > Application** .



SUMMARY

13 Business Relevant Applications

7.4 MB Data Usage

715.7 bps Avg Throughput

NETFLOW

1 Exporters

19.3 MB Data Usage

ThousandEyes Tests

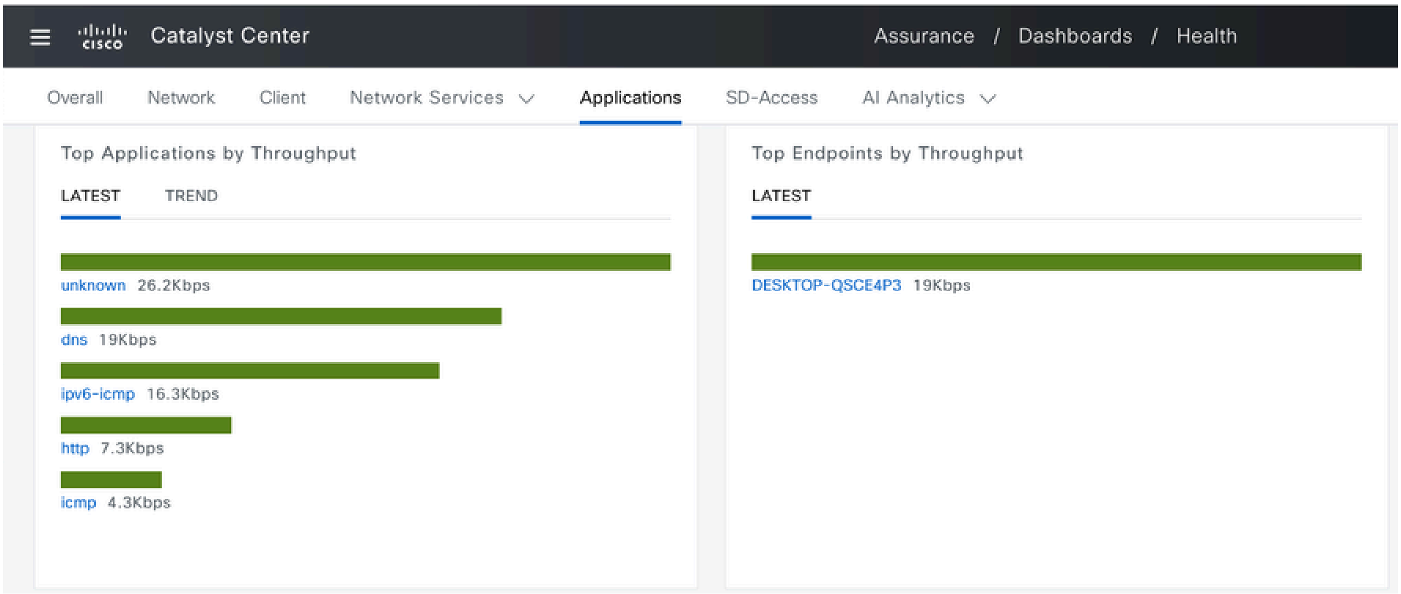
ThousandEyes Integration Not Available

Business Relevant Application Health

Application Usage

AVC Monitoring on Cisco Catalyst Center

We can track the most frequently used applications by clients and identify the highest data consumers, as demonstrated here.

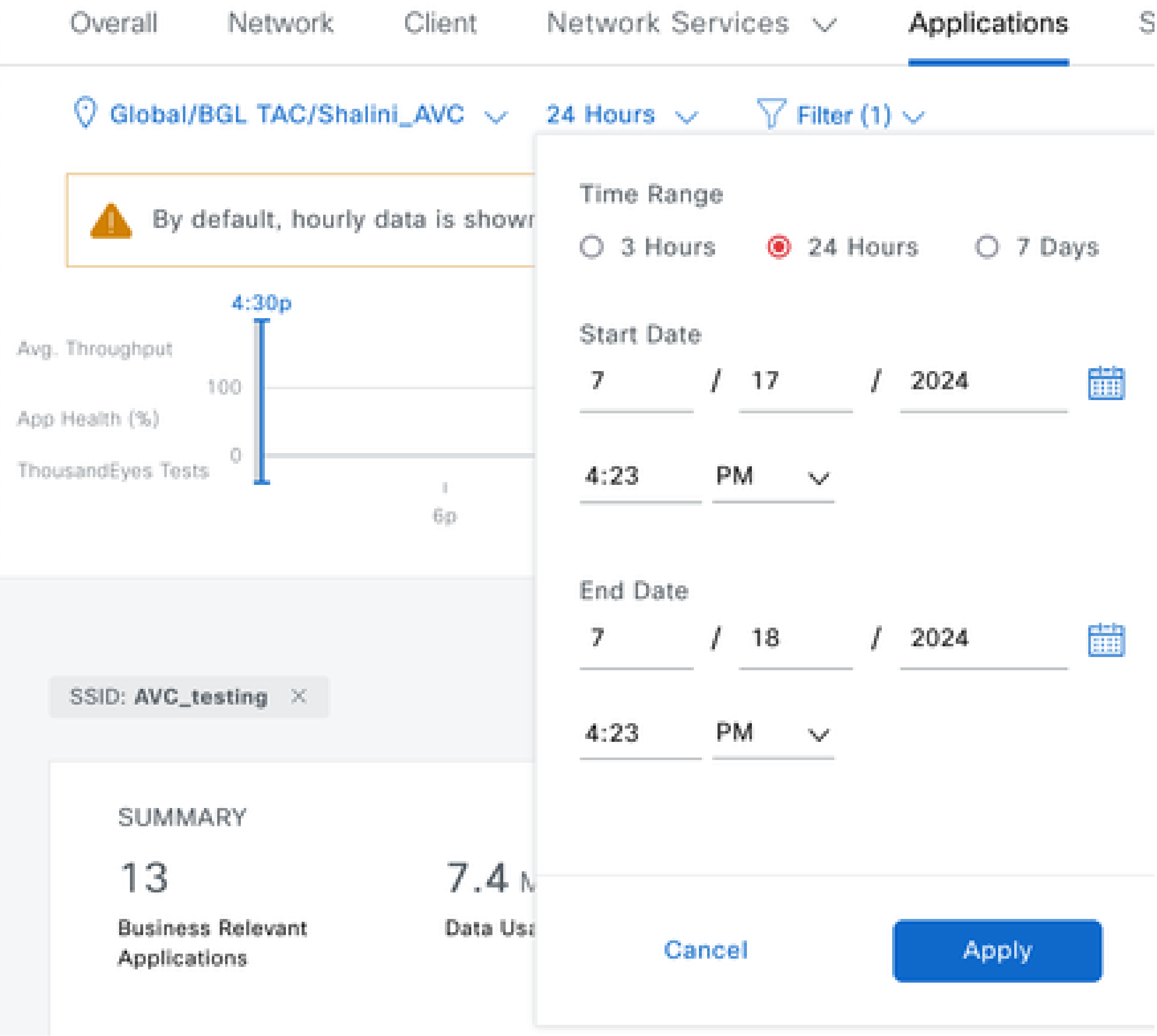


Top application and Top Bandwidth User Statistics

You have the ability to set a filter for a particular SSID, which allows you to monitor the overall throughput and application usage of clients associated with that SSID.

This functionality enables you to identify the Top applications and the highest bandwidth-consuming users within your network.

Additionally, you can utilize the Time Filter feature to examine this data for previous time periods, offering historical insights into network usage.



Time Range

○ 3 Hours ● 24 Hours ○ 7 Days

Start Date

7 / 17 / 2024

4:23 PM

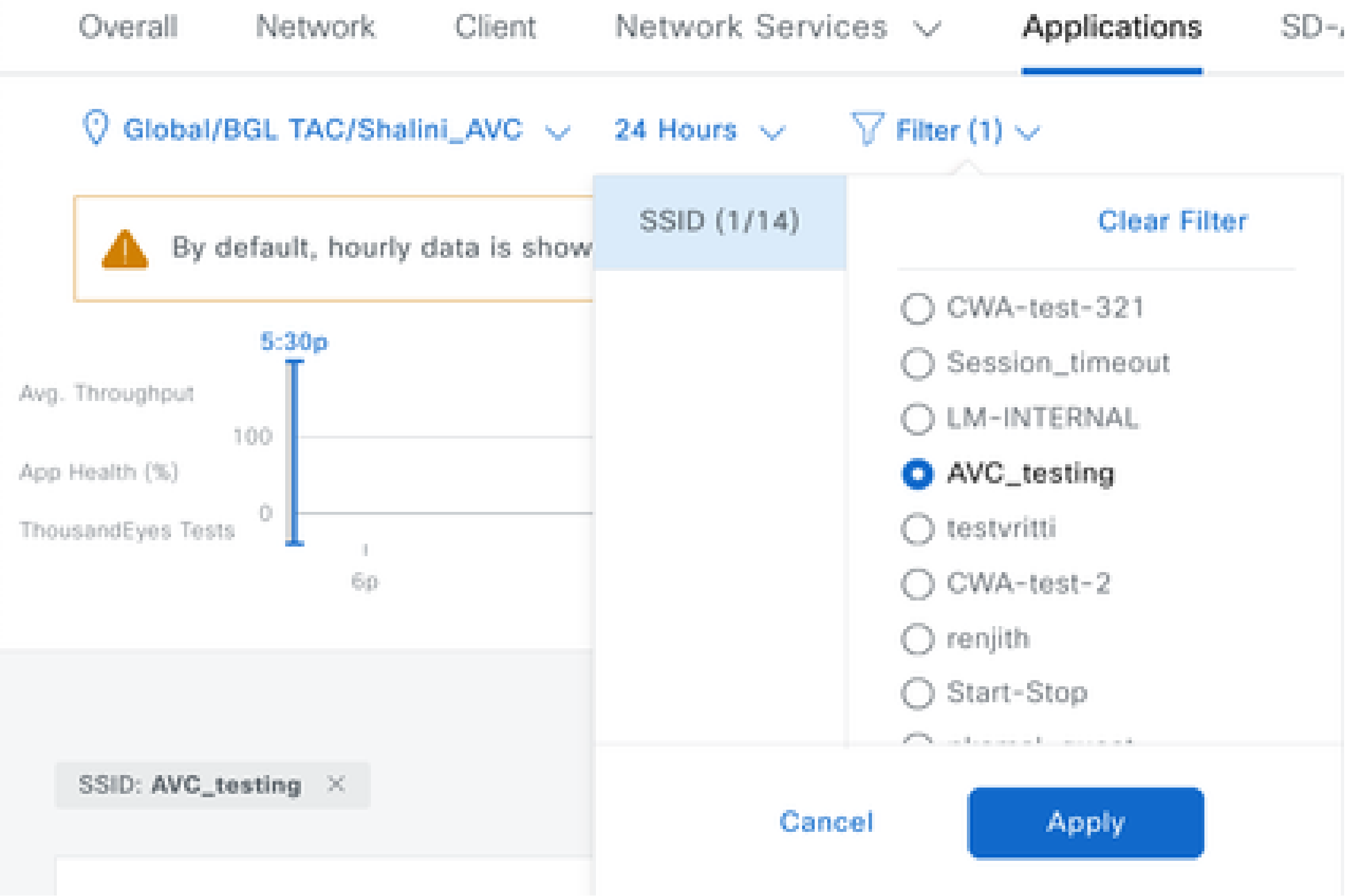
End Date

7 / 18 / 2024

4:23 PM

Time Filter to display AVC statistics

.



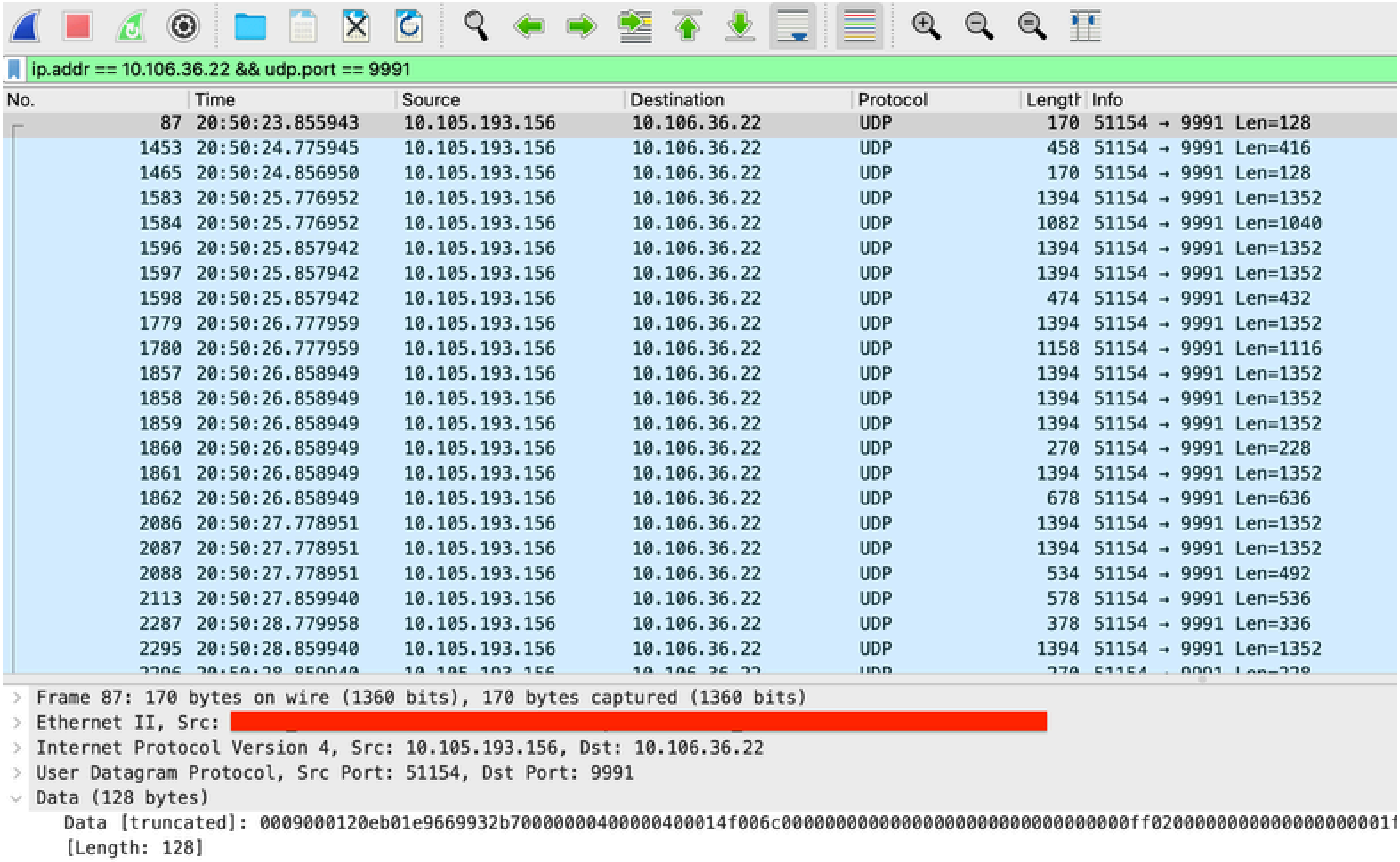
SSID Filter to display AVC Statistics

On External NetFlow Collector

Example1: Cisco Prime as Netflow Collector

When you use Cisco Prime as Netflow collector the collected You can see 9800 WLC as Data source sending Netflow data and the NetFlow template will be created automatically as per the data being sent by 9800 WLC.

From the packet capture taken on 9800 WLC we can validate it is sending data regarding the applications and network traffic to Cisco Prime continuously.

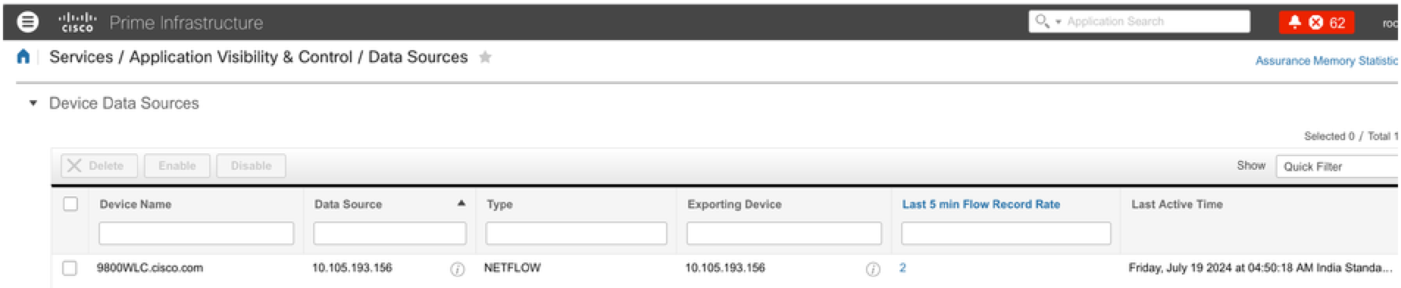


ip.addr == 10.106.36.22 && udp.port == 9991

```
No.     Time             Source           Destination     Protocol  Length Info
     87 20:50:23.855943  10.105.193.156   10.106.36.22    UDP         170 51154 → 9991 Len=128
   1453 20:50:24.775945  10.105.193.156   10.106.36.22    UDP         458 51154 → 9991 Len=416
   1465 20:50:24.856950  10.105.193.156   10.106.36.22    UDP         170 51154 → 9991 Len=128
   1583 20:50:25.776952  10.105.193.156   10.106.36.22    UDP        1394 51154 → 9991 Len=1352
   1584 20:50:25.776952  10.105.193.156   10.106.36.22    UDP        1082 51154 → 9991 Len=1040
   1596 20:50:25.857942  10.105.193.156   10.106.36.22    UDP        1394 51154 → 9991 Len=1352
   1597 20:50:25.857942  10.105.193.156   10.106.36.22    UDP        1394 51154 → 9991 Len=1352
   1598 20:50:25.857942  10.105.193.156   10.106.36.22    UDP         474 51154 → 9991 Len=432
   1779 20:50:26.777959  10.105.193.156   10.106.36.22    UDP        1394 51154 → 9991 Len=1352
   1780 20:50:26.777959  10.105.193.156   10.106.36.22    UDP        1158 51154 → 9991 Len=1116
   1857 20:50:26.858949  10.105.193.156   10.106.36.22    UDP        1394 51154 → 9991 Len=1352
   1858 20:50:26.858949  10.105.193.156   10.106.36.22    UDP        1394 51154 → 9991 Len=1352
   1859 20:50:26.858949  10.105.193.156   10.106.36.22    UDP        1394 51154 → 9991 Len=1352
   1860 20:50:26.858949  10.105.193.156   10.106.36.22    UDP         270 51154 → 9991 Len=228
   1861 20:50:26.858949  10.105.193.156   10.106.36.22    UDP        1394 51154 → 9991 Len=1352
   1862 20:50:26.858949  10.105.193.156   10.106.36.22    UDP         678 51154 → 9991 Len=636
   2086 20:50:27.778951  10.105.193.156   10.106.36.22    UDP        1394 51154 → 9991 Len=1352
   2087 20:50:27.778951  10.105.193.156   10.106.36.22    UDP        1394 51154 → 9991 Len=1352
   2088 20:50:27.778951  10.105.193.156   10.106.36.22    UDP         534 51154 → 9991 Len=492
   2113 20:50:27.859940  10.105.193.156   10.106.36.22    UDP         578 51154 → 9991 Len=536
   2287 20:50:28.779958  10.105.193.156   10.106.36.22    UDP         378 51154 → 9991 Len=336
   2295 20:50:28.859940  10.105.193.156   10.106.36.22    UDP        1394 51154 → 9991 Len=1352
   2296 20:50:28.859940  10.105.193.156   10.106.36.22    UDP         270 51154 → 9991 Len=228
```

```
> Frame 87: 170 bytes on wire (1360 bits), 170 bytes captured (1360 bits)
> Ethernet II, Src: [redacted]
> Internet Protocol Version 4, Src: 10.105.193.156, Dst: 10.106.36.22
> User Datagram Protocol, Src Port: 51154, Dst Port: 9991
v Data (128 bytes)
    Data [truncated]: 0009000120eb01e9669932b70000000400000400014f006c00000000000000000000000000000000ff02000000000000000000001f
    [Length: 128]
```

Packet Capture Taken on 9800 WLC



Services / Application Visibility & Control / Data Sources

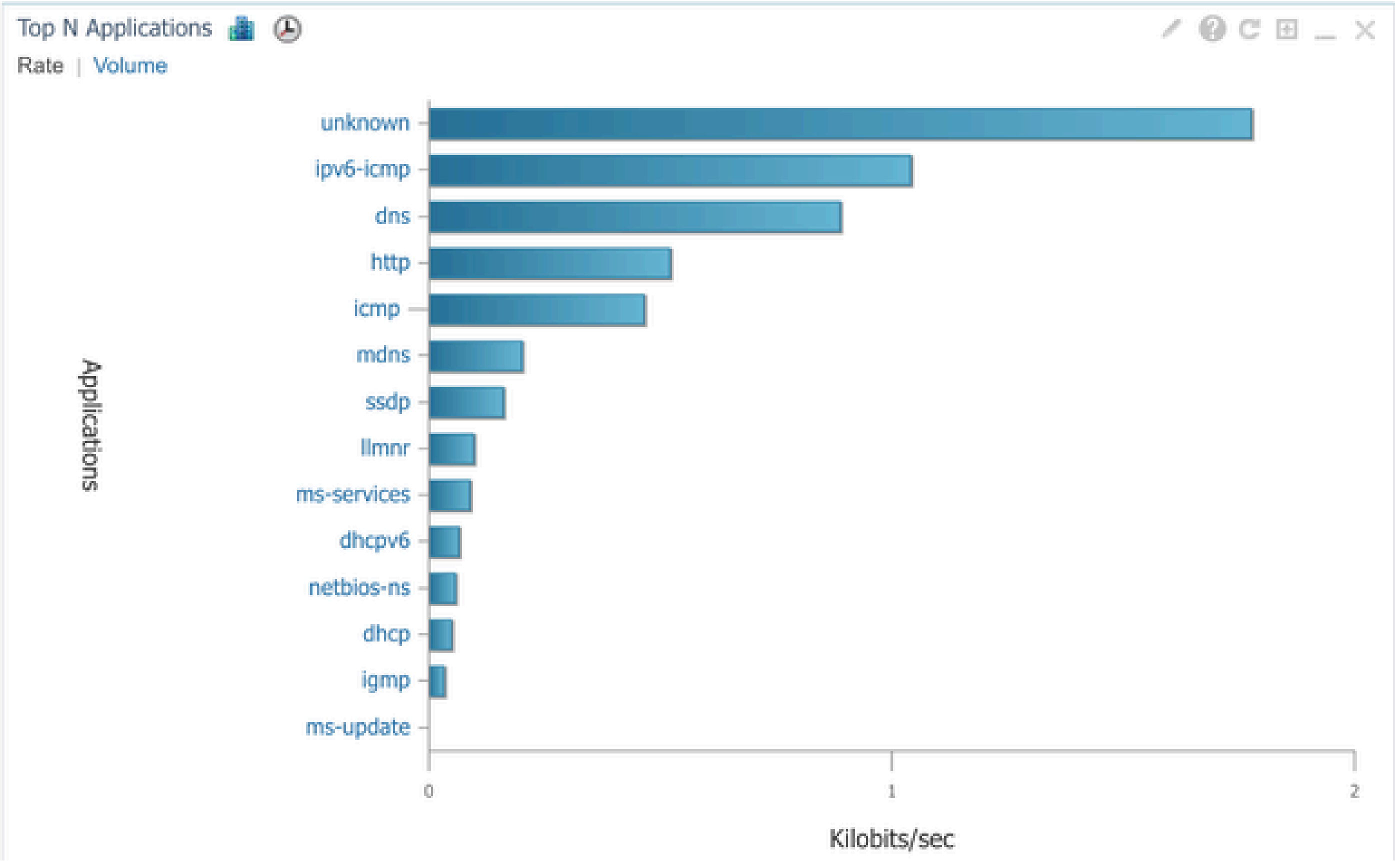
▾ Device Data Sources

Selected 0 / Total 1

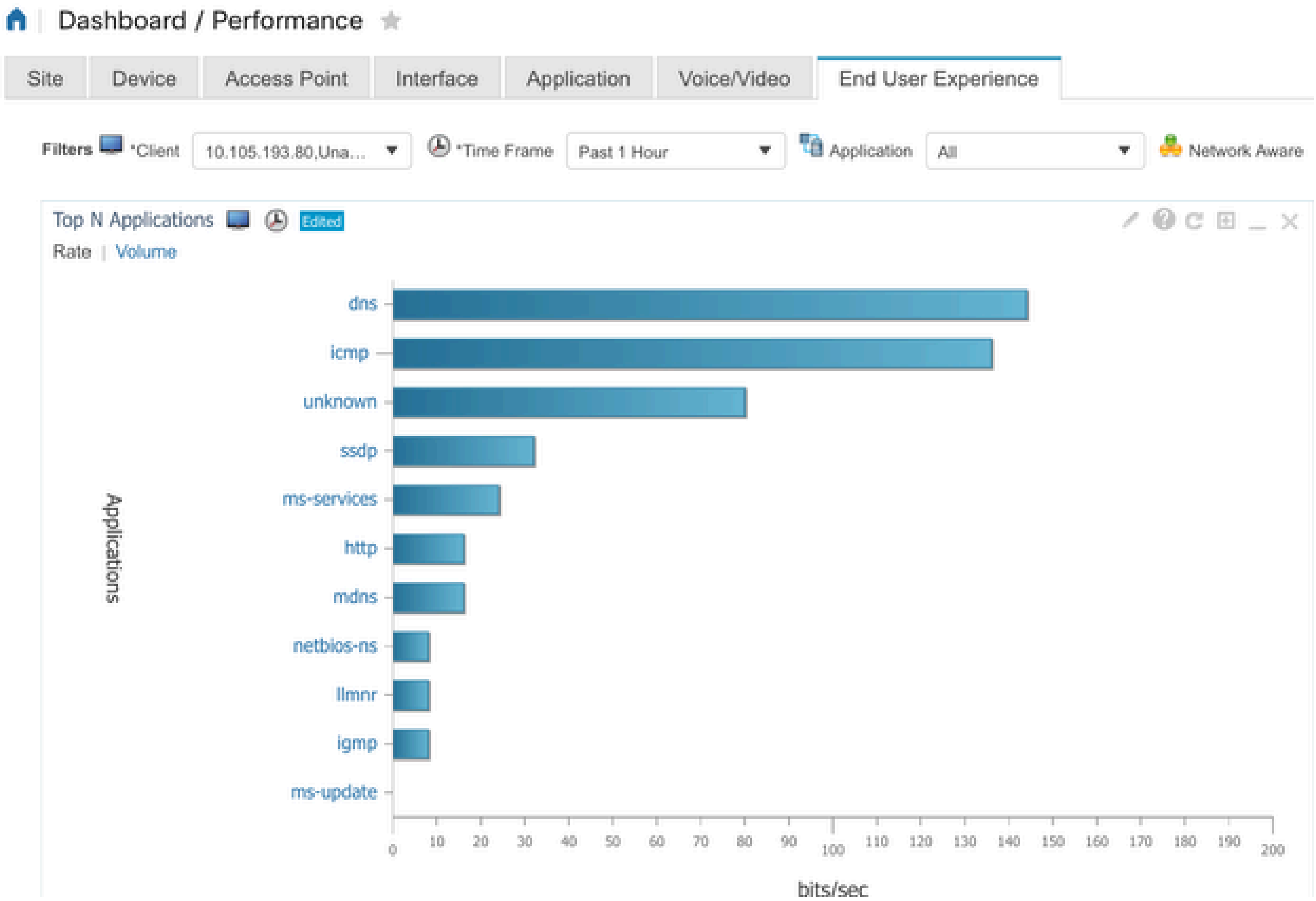
□	Device Name	Data Source	Type	Exporting Device	Last 5 min Flow Record Rate	Last Active Time
□	9800WLC.cisco.com	10.105.193.156	NETFLOW	10.105.193.156	2	Friday, July 19 2024 at 04:50:18 AM India Standa...

Cisco Prime Detecting 9800 WLC as Netflow Data Source

You can set filters based on Application, Services, and even by Client, using the IP address for more targeted data analysis.



Application Visibility for all Clients

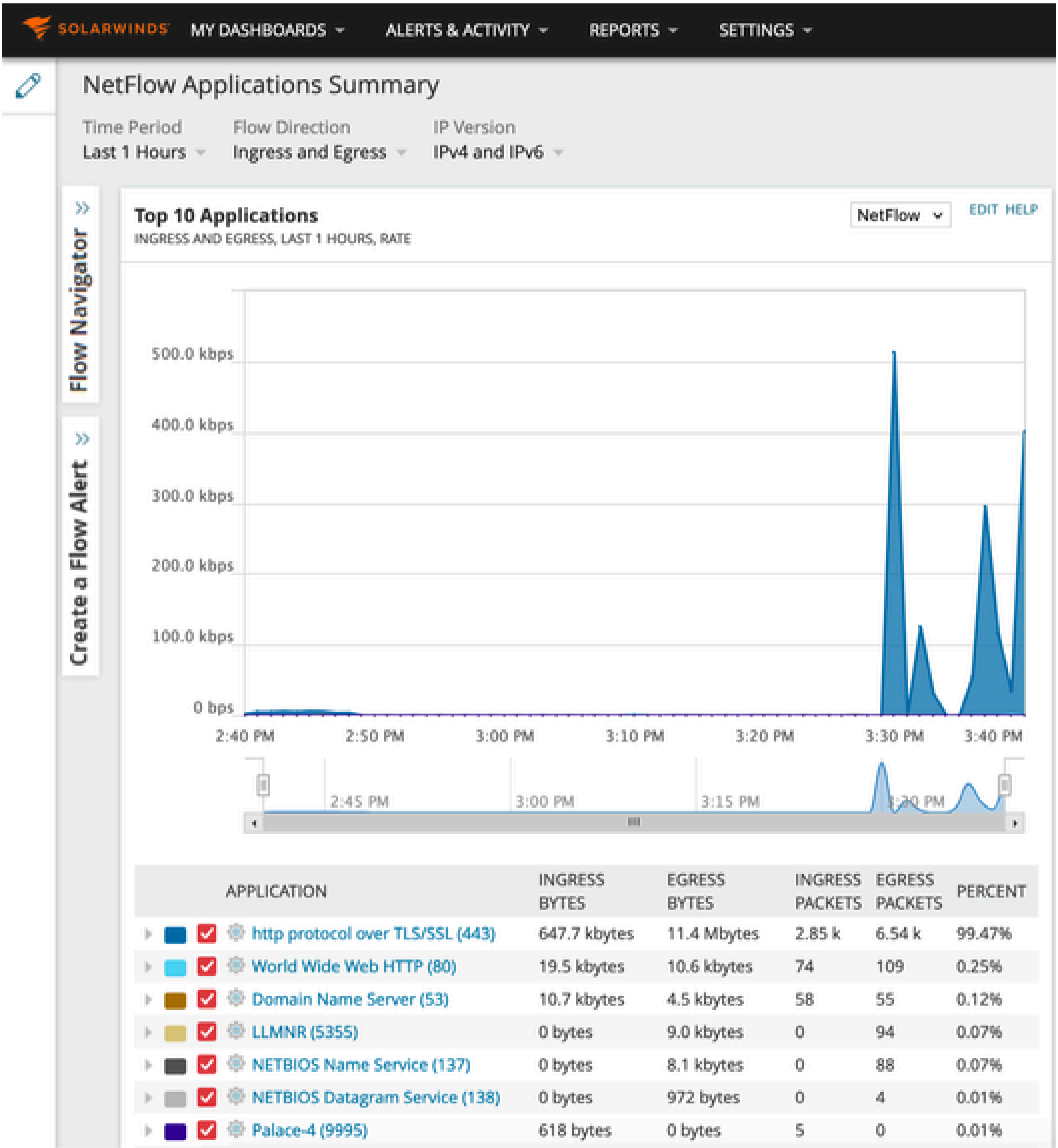


Filters *Client 10.105.193.80,Una... *Time Frame Past 1 Hour Application All

Application of specific Client Using IP address

Example 2: Third party NetFlow Collector

In this example, the third-party NetFlow collector [SolarWinds] is utilized to gather application statistics. The 9800 WLC employs Flexible NetFlow (FNF) to transmit comprehensive data regarding the applications and network traffic, which is then collected by SolarWinds.



NetFlow Applications Summary

Time Period: Last 1 Hours

Flow Direction: Ingress and Egress

IP Version: IPv4 and IPv6

Top 10 Applications

INGRESS AND EGRESS, LAST 1 HOURS, RATE

		APPLICATION	INGRESS BYTES	EGRESS BYTES	INGRESS PACKETS	EGRESS PACKETS	PERCENT
🟦	☑	http protocol over TLS/SSL (443)	647.7 kbytes	11.4 Mbytes	2.85 k	6.54 k	99.47%
🟦	☑	World Wide Web HTTP (80)	19.5 kbytes	10.6 kbytes	74	109	0.25%
🟫	☑	Domain Name Server (53)	10.7 kbytes	4.5 kbytes	58	55	0.12%
🟨	☑	LLMNR (5355)	0 bytes	9.0 kbytes	0	94	0.07%
⬛	☑	NETBIOS Name Service (137)	0 bytes	8.1 kbytes	0	88	0.07%
⬜	☑	NETBIOS Datagram Service (138)	0 bytes	972 bytes	0	4	0.01%
🟪	☑	Palace-4 (9995)	618 bytes	0 bytes	5	0	0.01%

Netflow Application Statistics on SolarWind

Traffic Control

Traffic control refers to a set of features and mechanisms used to manage and regulate the flow of network traffic. Traffic policing or rate limiting are mechanisms used in wireless controller to control the amount of traffic transmitted from client. It monitors the data rate for network traffic and takes immediate action when a predefined rate limit is exceeded. When the traffic exceeds the specified rate, rate limiting can drop the excess packets or mark them down by changing their Class of Service (CoS) or Differentiated Services Code Point (DSCP) values. This can be achieved by configuring QOS in 9800 WLC, You can refer to https://www.cisco.com/c/en/us/support/docs/wireless/catalyst-9800-series-wireless-controllers/215441-configure-qos-rate-limiting-on-catalyst.html to get the overview of how these components work and how can they be configured to achieve different results.

Troubleshooting

Troubleshooting AVC issues involves involves identifying and resolving problems that possibly affect the AVC's ability to accurately identify, classify, and manage application traffic on your wireless network. Common issues can include problems with traffic classification, policy enforcement, or reporting. Here are some steps and considerations when troubleshooting AVC issues on a Catalyst 9800 WLC:

- Verify AVC Configuration: Ensure that AVC is properly configured on the WLC and associated with the correct WLANs and profiles.

- When setting up AVC through the GUI, it will automatically assign port 9995 as the default. However, if you are using an External Collector, verify which port it is configured to listen on for NetFlow traffic. It is crucial to accurately configure this port number to match your collector's settings.

- Verify the AP Model and deployment mode support.
- Refer to limitations on 9800 WLC while implementing AVC in your wireless network.

Log Collection

WLC logs

1. Enable timestamp to have time reference for all the commands.

```
9800WLC#term exec prompt timestamp
```

2. To review the configuration

```
9800WLC#show tech-support wireless
```

3. You can verify the avc status and netflow statistics.

Check the AVC configuration status.

```
9800WLC#show avc status wlan <wlan_name>
```

Check FNFv9 packets counts and decode status punted to Control Plane (CP).

```
9800WLC#show platform software wlavc status decoder
```

Check Statistics from NetFlow (FNF Cache).

```
9800WLC#show flow monitor <Flow_Monitor_Name>
```

Check Top n application usage for each wlan, where n = <1-30> Enter the number of applications.

```
9800WLC#show avc wlan <SSID> top <n> applications <aggregate|downstream|upstream>
```

Check top n application usage for each client, where n = <1-30> Enter the number of applications.

```
9800WLC#show avc client <mac> top <n> applications <aggregate|downstream|upstream>
```

Check top n clients connected to specific wlan using the specific application, where n=<1-10> Enter the number of clients.

```
9800WLC#show avc wlan <SSID> application <app> top <n> <aggregate|downstream|upstream>
```

Check the nbar statistics.

```
9800WLC#show ip nbar protocol-discovery
```

4. Set logging level to debug/verbose.

```
9800WLC#set platform software trace all debug/verbose

!! To View the collected logs
9800WLC#show logging profile wireless internal start last clear to-file bootflash:<File_Name

!!Set logging level back to notice post troubleshooting
9800WLC#set platform software trace wireless all debug/verbose
```

5. Enable Radioactive (RA) Trace for client MAC address to validate the AVC stats.
Via CLI

```
9800WLLC#debug wireless {mac | ip} {aaaa.bbbb.cccc | x.x.x.x } {monitor-time} {N seconds} !! Setting ti
9800WLC#no debug wireless mac <Client_MAC>
!!WLC generates a debug trace file with Client_info, command to check for debug trace file generated.
9800WLC#dir bootflash: | i debug
```

Caution: The conditional debugging enables debug-level logging which in turn increases the volume of the logs generated. Leaving this running reduces how far back in time you can view logs from. So, it is recommended to always disable debugging at the end of the troubleshooting session.

```
# clear platform condition all
# undebug all
```

Via GUI
Step 1. Navigate to Troubleshooting > Radioactive Trace .
Step 2. Click **Add** and enter a client Mac address that you want to troubleshoot. You can add several Mac addresses to track.

Step 3. When you are ready to start the radioactive tracing, click start. Once started, debug logging is written to disk about any control plane processing related to the tracked MAC addresses.

Step 4. When you reproduce the issue you want to troubleshoot, click **Stop** .

Step 5. For each mac address debugged, you can generate a log file collating all the logs pertaining to that mac address by clicking **Generate** .

Step 6. Choose how long back you want your collated log file to go and click **Apply to Device**.

Step 7. You can now download the file by clicking the small icon next to the file name. This file is present in the boot flash drive of the controller and can also be copied out of the box through CLI.

Here's a glimpse of AVC debugs in RA traces

```
2024/07/20 20:15:24.514842337 {wstatsd_R0-0}{2}: [avc-stats] [15736]: (debug): Received stats record fo
2024/07/20 20:15:24.514865665 {wstatsd_R0-0}{2}: [avc-stats] [15736]: (debug): Received stats record fo
2024/07/20 20:15:24.514875837 {wstatsd_R0-0}{2}: [avc-stats] [15736]: (debug): Received stats record fo
2024/07/20 20:15:40.530177442 {wstatsd_R0-0}{2}: [avc-stats] [15736]: (debug): Received stats record fo
```

6. Embedded Captures filtered by client MAC address in both directions, Client inner MAC filter available after 17.1.

It is particularly useful when using an external collector, as it helps confirm whether the WLC is transmitting NetFlow data to the intended port as expected.

Via CLI

```
monitor capture MYCAP clear
monitor capture MYCAP interface <Interface> both
monitor capture MYCAP buffer size 100
monitor capture MYCAP match any
monitor capture MYCAP inner mac CLIENT_MAC@
monitor capture MYCAP start
!! Inititiate different application traffic from user
monitor capture MYCAP stop
monitor capture MYCAP export flash:|tftp:|http:.../filename.pcap
```

Via GUI
Step 1. Navigate to **Troubleshooting** > **Packet Capture** > **+Add** .

Step 2. Define the name of the packet capture. A maximum of 8 characters is allowed.

Step 3. Define filters, if any.

Step 4. Check the box to Monitor Control Traffic if you want to see traffic punted to the system CPU and injected back into the data plane.

Step 5. Define buffer size. A maximum of 100 MB is allowed.

Step 6. Define limit, either by duration which allows a range of 1 - 1000000 seconds or by number of packets which allows a range of 1 - 100000 packets, as desired.

Step 7. Choose the interface from the list of interfaces in the left column and select the arrow to move it to the right column.

Step 8. Click on **Apply to Device**.

Step 9. To start the capture, select **Start .**

Step 10. You can let the capture run to the defined limit. To manually stop the capture, select **Stop**.

Step 11. Once stopped, an **Export** button becomes available to click with the option to download the capture file (.pcap) on the local desktop via HTTP or TFTP server or FTP server or local system hard disk or flash.

AP Logs

On Fabric and Flex modes

1. show tech to have all config details and client stats for the AP.

2. show avc nbar statistics nbar stats from AP

3. AVC debugs

```
AP#term mon
AP#debug capwap client avc <all/detail/error/event>
AP#debug capwap client avc netflow <all/detail/error/event/packet>
```

Related Information

AVC Configuration Guide

Rate Limiting on 9800 WLC