Configure and Verify QoS in SD-WAN Routers

Contents

Introduction

This document describes a step-by-step guide on how to configure and verify QoS Forwarding on SD-WAN routers using VManage GUI.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- Cisco SD-WAN.
- Basic understanding of how Quality of Services works.

Components Used

This document is based on these software and hardware versions:

- Cisco Edge Router version 17.9.3
- vManage version 20.9.3

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Note: This guide assumes that the Cisco Edge Routers are onboard on the vManage and that they are under vManage mode.

Background

When no centralized data policy is configured on the Cisco SD-WAN Controller, all data traffic is transmitted from the local service-side network to the local router, and then to the remote router and the remote service-side network, with no alterations in its path.

When you want to modify the default packet forwarding flow, you design and provision QoS policy. To activate the policy, you apply it to specific interfaces in the overlay network in either the inbound or the outbound direction. The direction is with respect to the routers in the network. You can have policies for packets coming in on an interface or for packets going out of an interface.

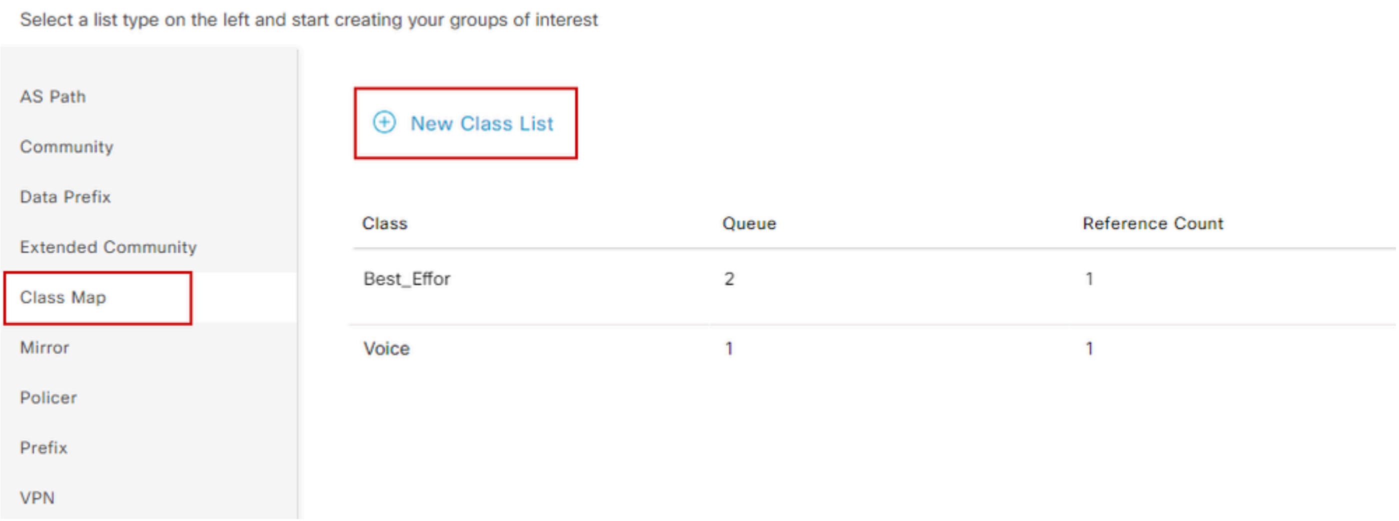
Configure

Familiarize yourself with the QoS Deployment Workflow.

- Create localized policy:
    - Creating Groups of Interest.
        - class-map
        - policier (optional)
    - Configuring Forwarding Classes/QoS
        - Create QoS Map Policy
        - Create Qos schedulers
- Apply localized policy to device template.
- Apply QoS map and re-write policy (optional) to WAN interface feature template.
- Create Centralized Traffic Data QoS policy to classify traffic into proper queue.

To configure QoS, begin by creating Class Lists. Navigate to **Configuration** > **Policies**,select **Localized Policy** > **Add Policy**.

Within this window, select **Class Map** and click **New Class List.**

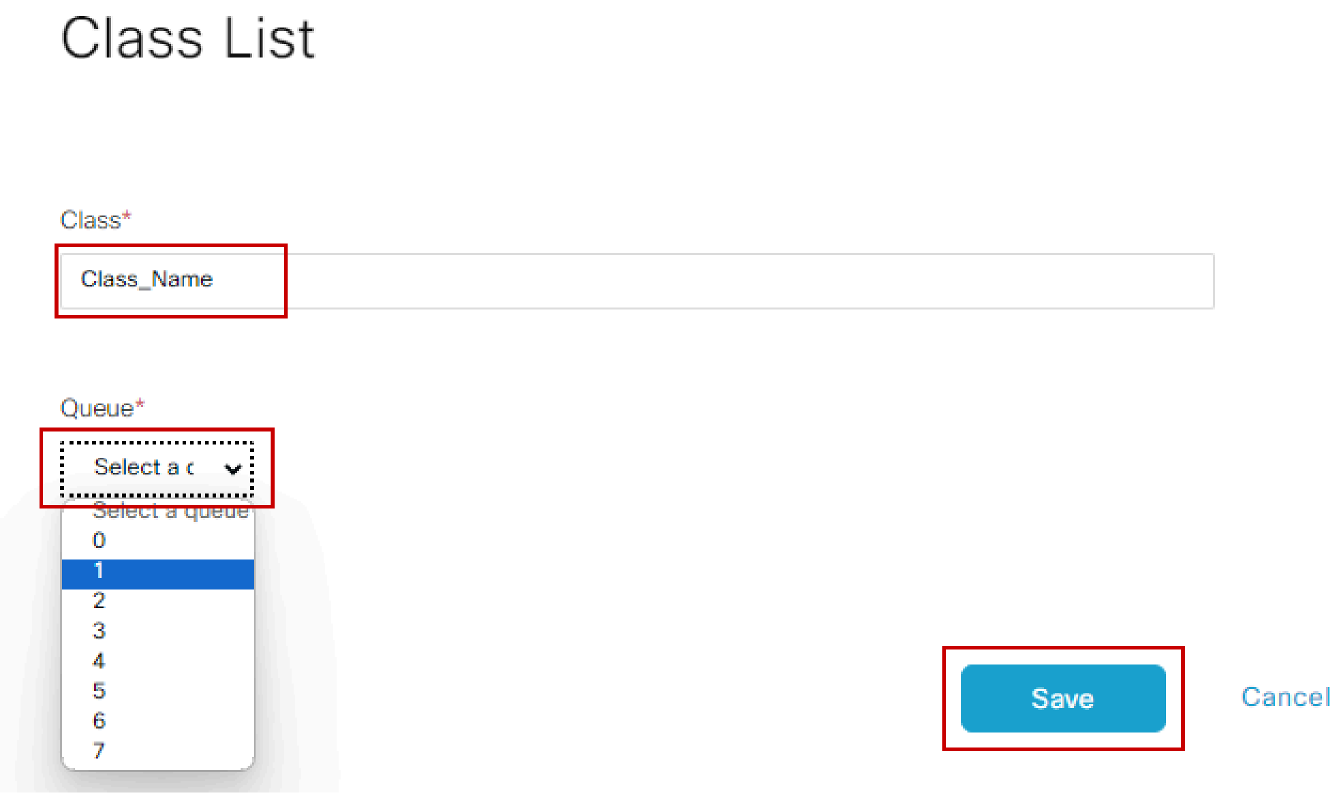


Select a list type on the left and start creating your groups of interest

Class	Queue	Reference Count
Best_Effor	2	1
Voice	1	1

Creating Class Lists

Provide a name for your class, assign it to a queue number, and then click **Save.** Repeat the same steps to add more classes**.**



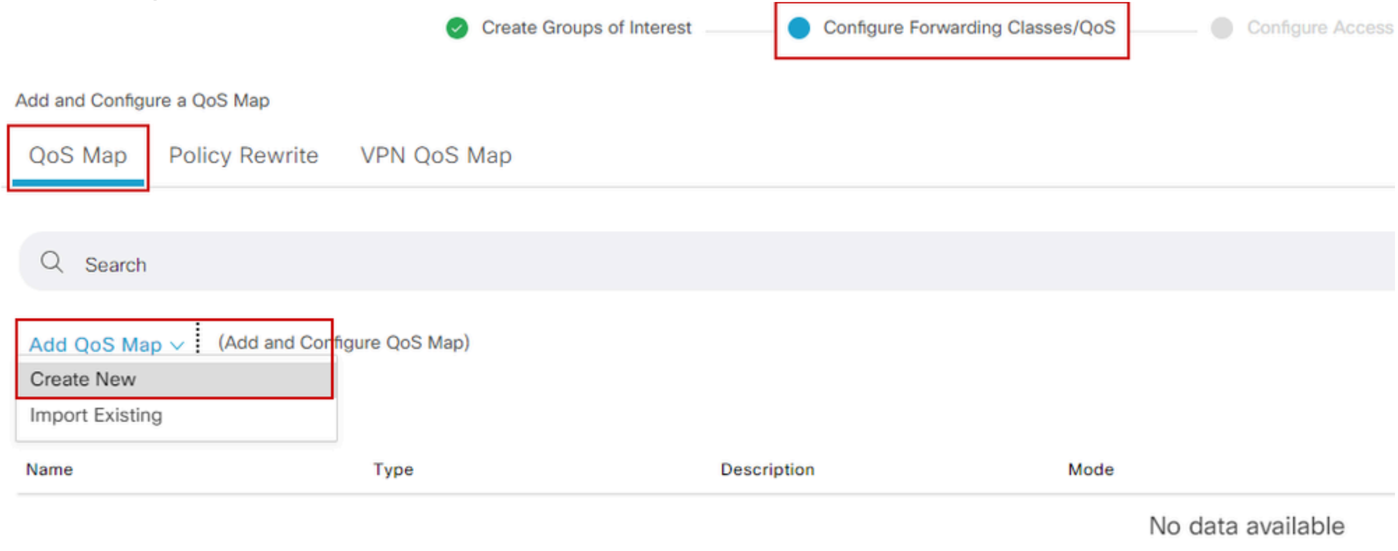
Class List

Class*: Class_Name

Queue*: Select a queue

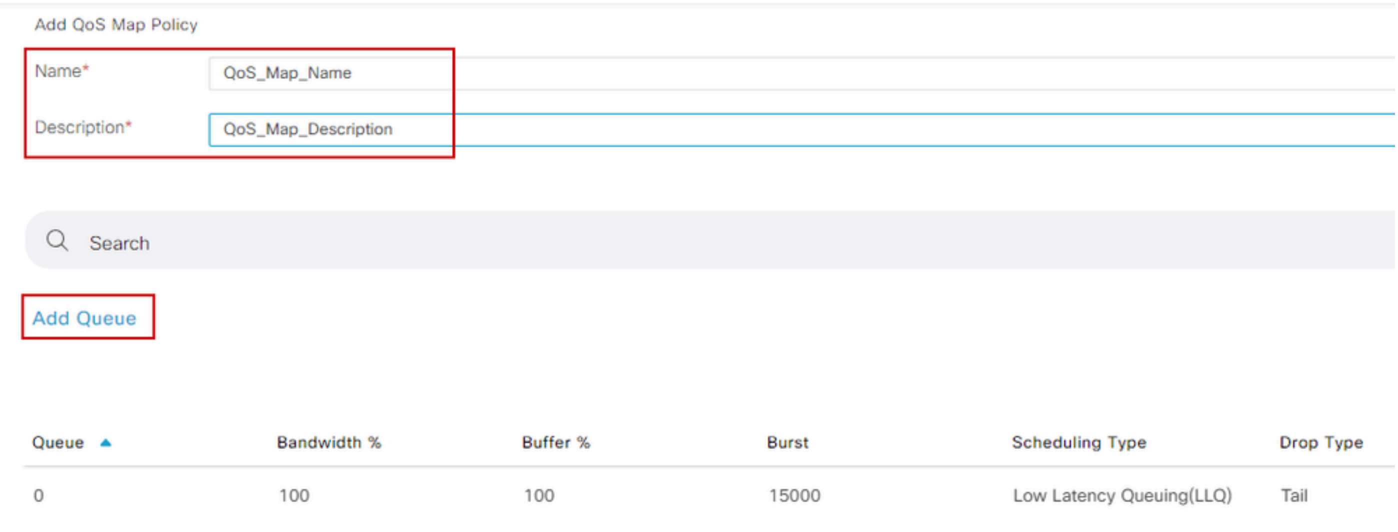
Saving Class List

After creating your class lists, click **Next** to proceed with the creation of **QoS Map**. In the **Configure Forwarding Classes/QoS** window, navigate to **QoS Map > Add QoS Map > Create New**.



Creatin the QoS Map

Give a name and describe for the QoS Map, and create a Queue by clicking **Add Queue**.



Add QoS Map Policy

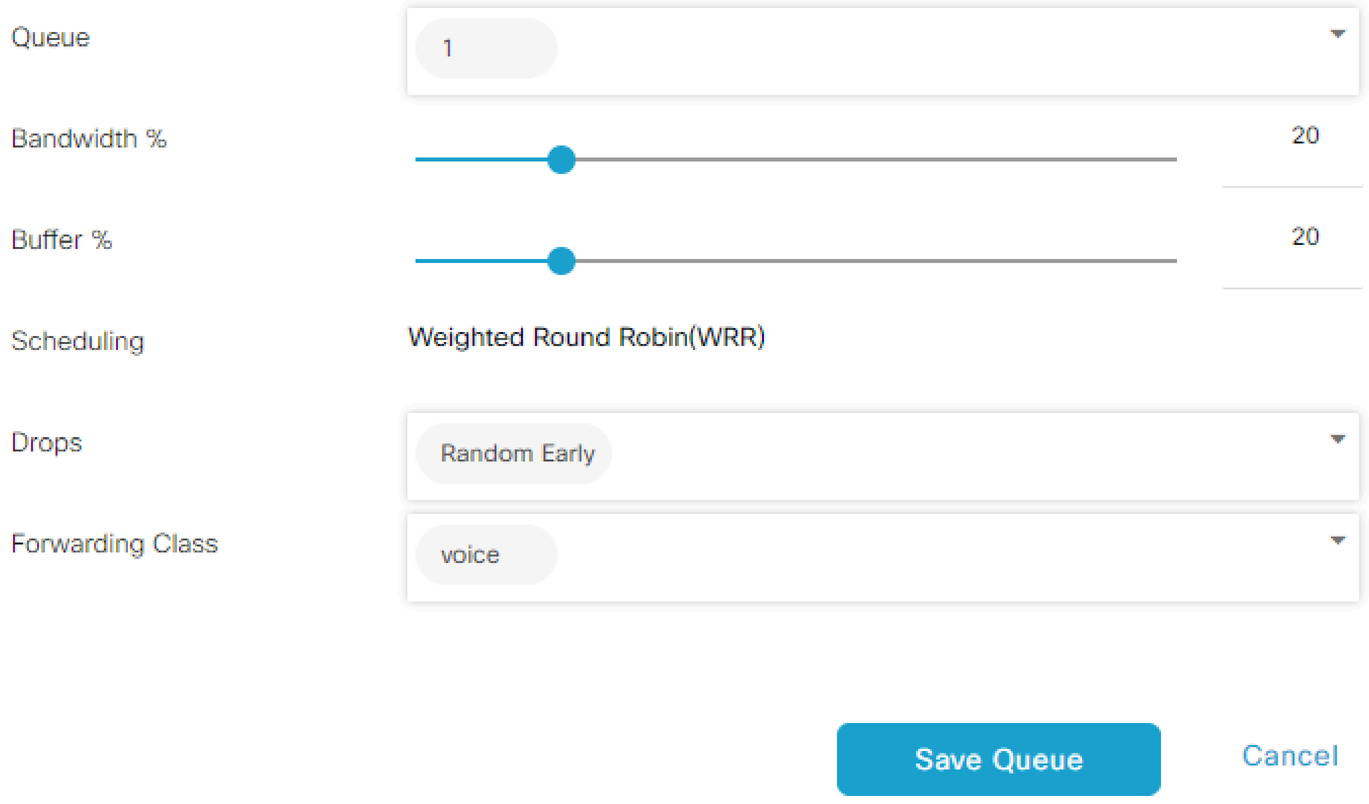
Name* QoS_Map_Name

Description* QoS_Map_Description

Queue	Bandwidth %	Buffer %	Burst	Scheduling Type	Drop Type
0	100	100	15000	Low Latency Queuing(LLQ)	Tail

Creating Queues inside QoS Map

Within this window, select the queue number assigned during the class list creation, specify bandwidth and buffer percentage, and choose the drop type for this queue. Click **Save Queue**. Repeat the same steps for each class list that you need to create.



Queue 1

Bandwidth % 20

Buffer % 20

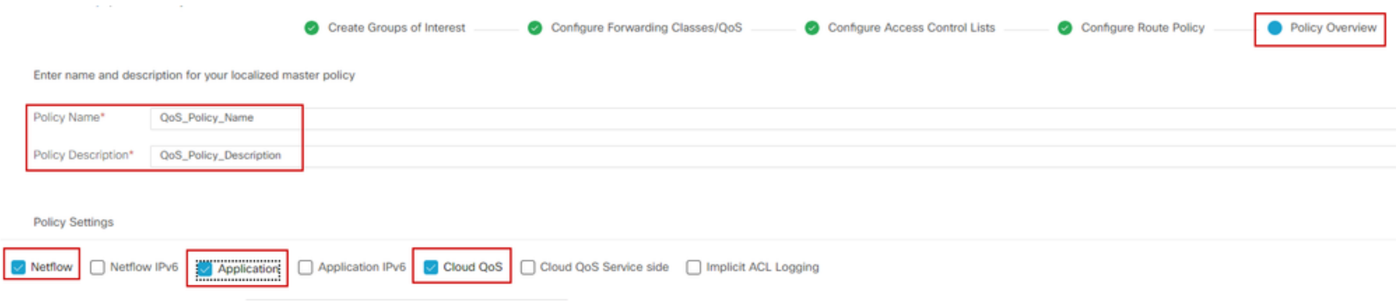
Scheduling Weighted Round Robin(WRR)

Drops Random Early

Forwarding Class voice

QoS schedular configuration

Once satisfied with the queue setup, click **Save Policy** and proceed by clicking **Next** until reaching the **Policy Overview** page**.** On this page, provide a name and description for our Local Policy, select options such as **Netflow, Application, Cloud QoS, and then click Save Policy**.



Create Groups of Interest — Configure Forwarding Classes/QoS — Configure Access Control Lists — Configure Route Policy — Policy Overview

Enter name and description for your localized master policy

Policy Name* QoS_Policy_Name

Policy Description* QoS_Policy_Description

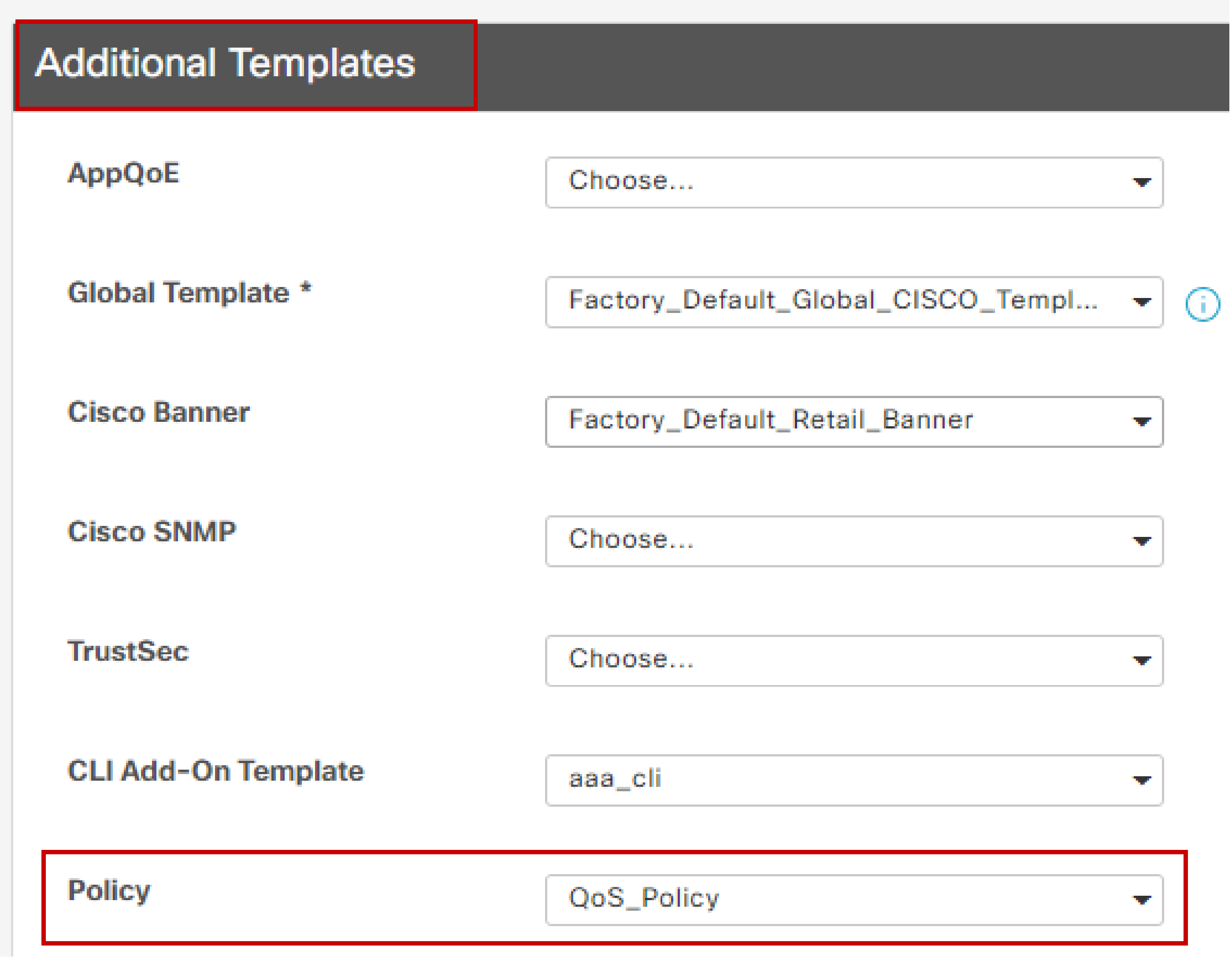
Policy Settings

☑ Netflow ☐ Netflow IPv6 ☑ Application ☐ Application IPv6 ☑ Cloud QoS ☐ Cloud QoS Service side ☐ Implicit ACL Logging

Save the QoS Policy

Note: For low-latency queuing (LLQ) any class that is mapped to queue 0 must also be configured to use LLQ. Queues 1 to 7 are available for data traffic, and the default scheduling for these seven queues is weighted round-robin (WRR). When QoS is not configured for data traffic, queue 2 is the default queue.

So far, you have established QoS criteria but have not applied them. To do so, attach the local policy to our device template by navigating to **Configuration** > **Template** > **Device Template**, locate our template, on three dots select "Edit." Inside the device template, access **Additional Templates**.

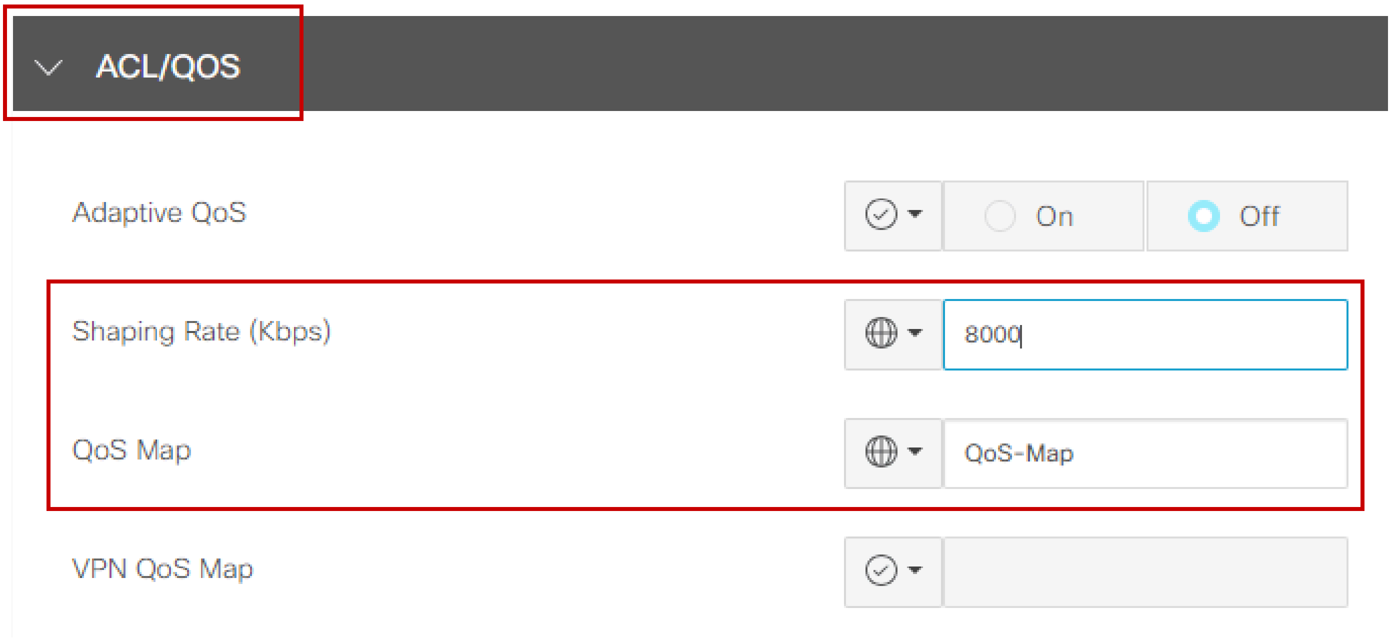


Additional Templates

AppQoE	Choose...
Global Template *	Factory_Default_Global_CISCO_Templ...
Cisco Banner	Factory_Default_Retail_Banner
Cisco SNMP	Choose...
TrustSec	Choose...
CLI Add-On Template	aaa_cli
Policy	QoS_Policy

Assign QoS Policy on Device Template

Please note, if this is a live template, complete the standard process to push the changes to the device. The next step involves applying the QoS-Map and Shaping Rate on the WAN interface by navigating to **Configuration > Template > Feature Template.** Locate your interface template,on three dots select **Edit,** and then proceed to configure **Shaping Rate and QoS Map** under **ACL/QoS.** Click **Update** when finished.



Adaptive QoS: ○ On ● Off

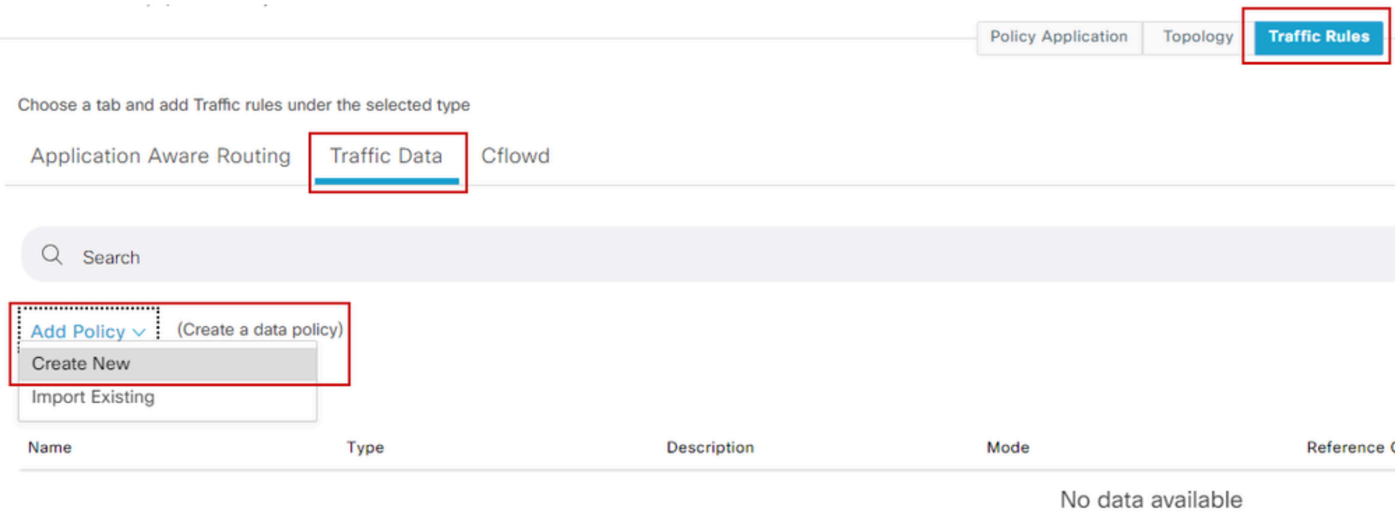
Shaping Rate (Kbps): 8000

QoS Map: QoS-Map

VPN QoS Map:

QoS Policy and Shapping on Interface

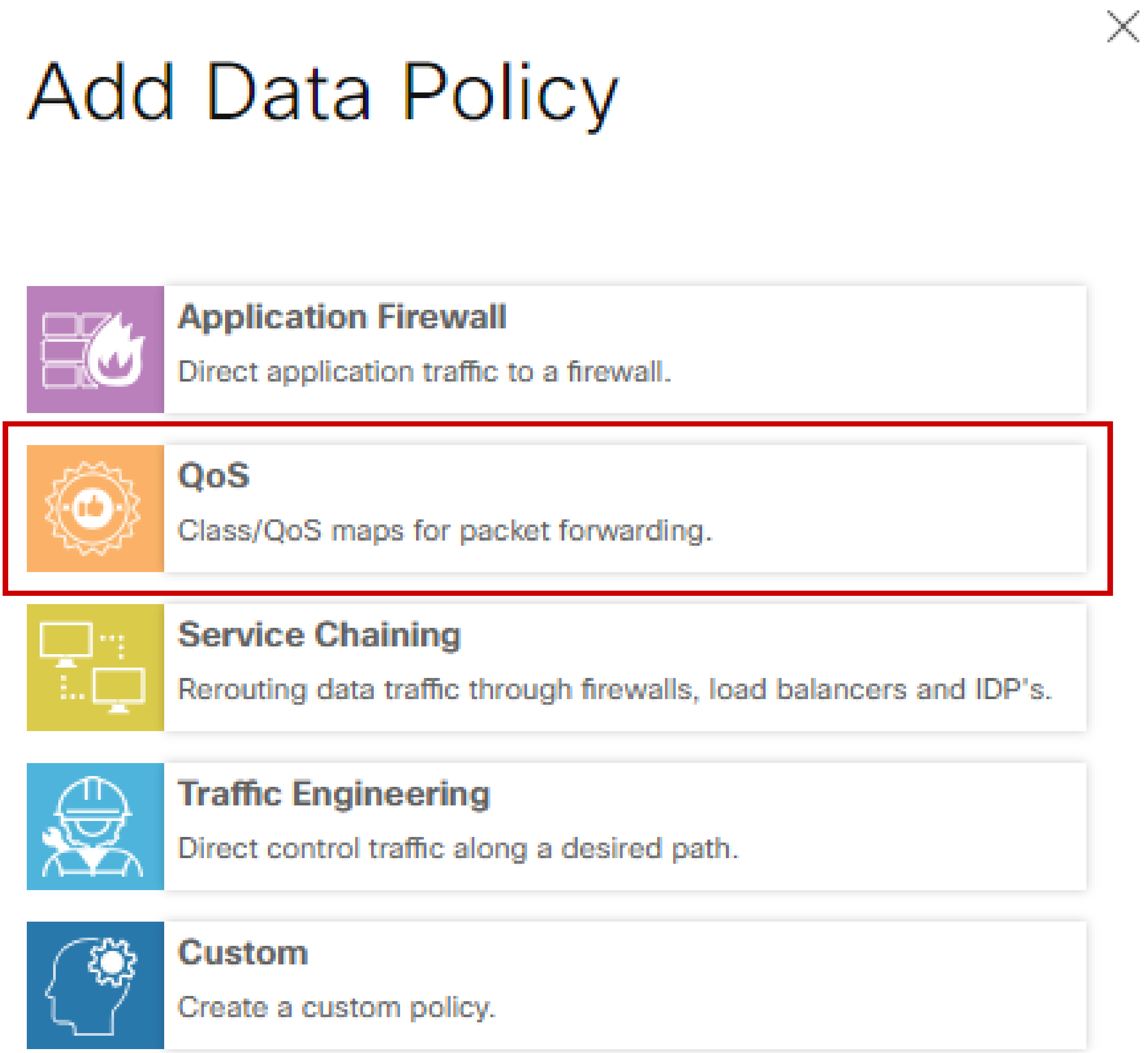
Now that you have successfully created the QoS settings, the next step involves creating a Data Policy to appropriately classify our traffic into Forwarding Classes. To achieve this, click on **Configuration > Policies > Centralized Policy > Find our Main Policy**, on three dots select **Edit**, then access **Traffic Rules > Traffic Data > Add Policy > Create New**.



Choose a tab and add Traffic rules under the selected type

Creating QoS Data Policy

In the Sequence type, ensure **QoS** is selected.



Add Data Policy

Application Firewall
Direct application traffic to a firewall.

QoS
Class/QoS maps for packet forwarding.

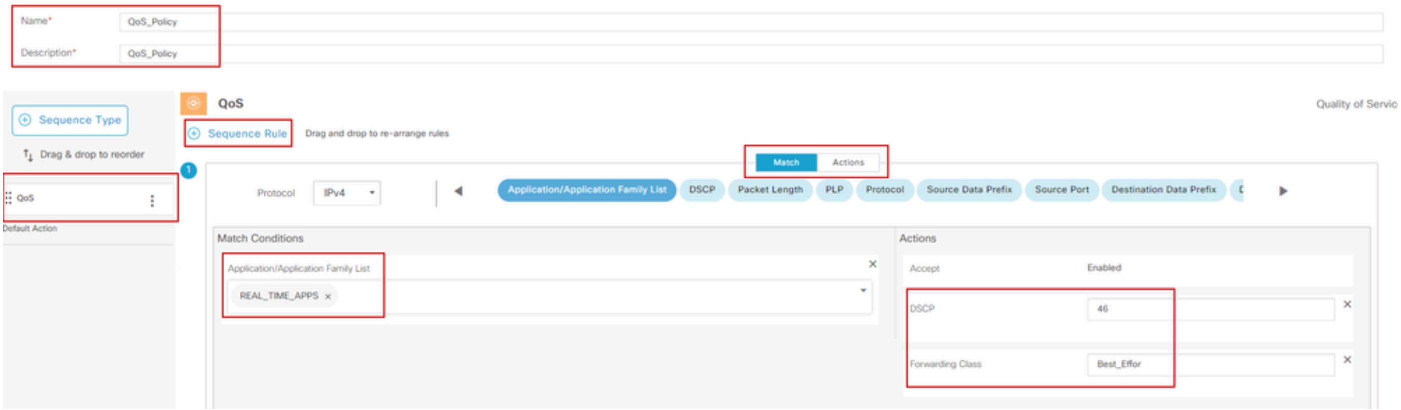
Service Chaining
Rerouting data traffic through firewalls, load balancers and IDP's.

Traffic Engineering
Direct control traffic along a desired path.

Custom
Create a custom policy.

Sequence Type Selection

Provide a name and description for the QoS Policy. Click on **Sequence Rule**, select your application under the **Match** field, and under the **Action** tab, select **DSCP**, **Forwarding Class**. Repeat this process for other applications or traffic patterns that require matching.



Name* QoS_Policy
Description* QoS_Policy

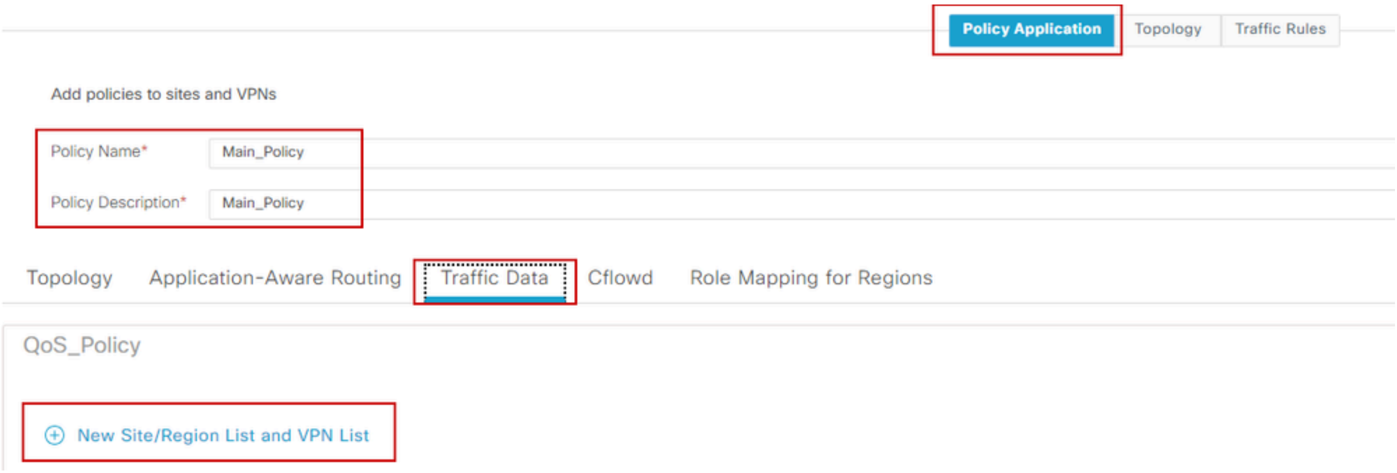
Protocol: IPv4

Match Conditions
Application/Application Family List: REAL_TIME_APPS

Actions
Accept: Enabled
DSCP: 46
Forwarding Class: Best_Effor

Create a Sequence Rule

Once all sequences are created, click **Save Data Policy**. To apply the QoS Policy to correct VPN and site list, navigate to **Policy Application > Traffic Data**, find your QoS Policy, click on **New Site/Region List and VPN List**.



Add policies to sites and VPNs

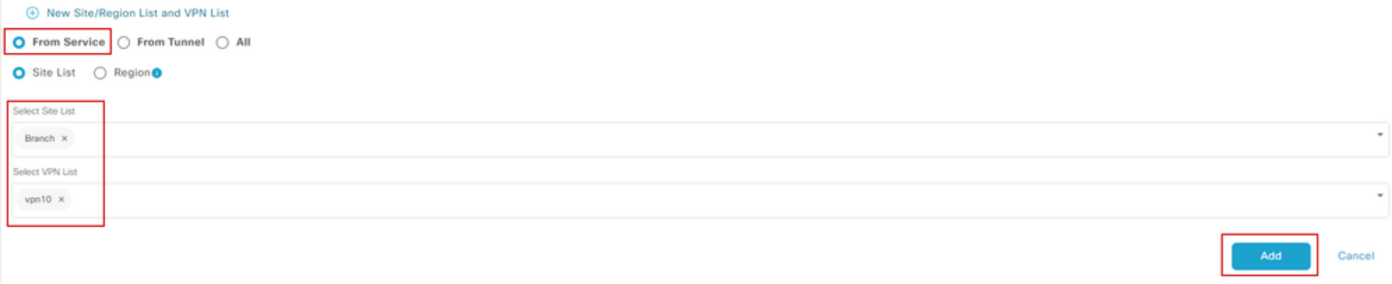
Policy Name* Main_Policy

Policy Description* Main_Policy

QoS_Policy

Ataching QoS policy on the main policy

This policy need to be applied **From Service** direction, select **Site List** and **VPN list** where this policy applies. Click **Add** when finished.



● From Service ○ From Tunnel ○ All

● Site List ○ Region

Select Site List: Branch ×

Select VPN List: vpn10 ×

assigning the site and vpn list

Finally, save the **Policy Changes** and **Approve** the activation. Since this is a live Policy, the changes are going to be sent directly to the vSmarts.

Verify

We can verify the changes during the template push on **Config Preview**

Under class-map section you notice the classes that you created.
In this example Best_Effor matches on Queue 2 and Voice matches on Queue 1. Please notice that Queue 0 is added by default since it is low-latency queuing (LLQ).

```
class-map match-any Best_Effor
match qos-group 2
!

class-map match-any Queue0
match qos-group 0
!
class-map match-any Queue1
```

```
match qos-group 1
!
class-map match-any Queue2
match qos-group 2
!
class-map match-any Voice
match qos-group 1
!
```

Under **policy-map** section you can see the policy name, police rate in percentage, scheduler type.
In this example class Queue0 has a 40% bandwidth and **priority level 1** since this queue it is LLQ, other queues 1 and w are used for data traffic and schedular type is set to **random-detect precedence-based**

```
policy-map QoS-Map
class Queue0
police rate percent 40
!
priority level 1
!
class Queue1
bandwidth remaining ratio 35
random-detect precedence-based
!
class class-default
bandwidth remaining ratio 25
random-detect precedence-based
!
```

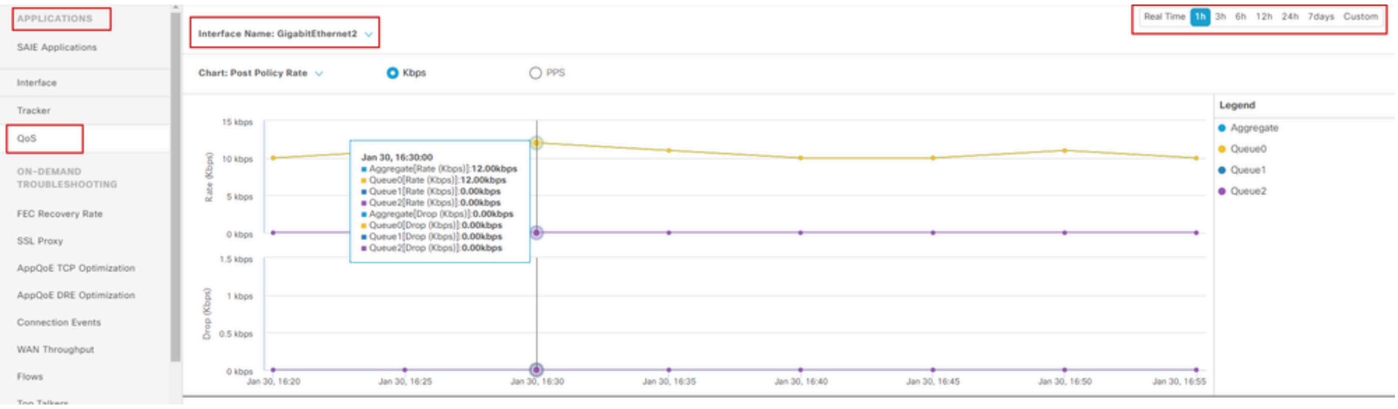
Under each WAN interfaces you can see the QoS policy that it is applied outband.

```
interface GigabitEthernet1

service-policy output QoS-Map


interface GigabitEthernet2
service-policy output QoS-Map
```

You can monitor QoS by navigation to **Monitor > Devices** or **Monitor > Network** for codes 20.6.x and early. Select the desired router and navigate **Applications > QoS > Select WAN interface** and you can check Real Time or per hour traffic for each queue.



Interface Name: GigabitEthernet2

Chart: Post Policy Rate

● Kbps ○ PPS

Jan 30, 16:30:00
- Aggregate[Rate (Kbps)]: 12.00kbps
- Queue0[Rate (Kbps)]: 12.00kbps
- Queue1[Rate (Kbps)]: 0.00kbps
- Queue2[Rate (Kbps)]: 0.00kbps
- Aggregate[Drop (Kbps)]: 0.00kbps
- Queue0[Drop (Kbps)]: 0.00kbps
- Queue1[Drop (Kbps)]: 0.00kbps
- Queue2[Drop (Kbps)]: 0.00kbps

Monitoring QoS graphic

Monitoring Commands

If you are using any local access list use commands:

```
show sdwan policy access-list-associations
show sdwan policy access-list-counters
show sdwan policy access-list-names
show sdwan policy access-list-policers
```

To check the QoS Data policy through centralize policy run command and from the output you are going to notice the QoS Policy name, what traffic you are matching, what dscp values and forward class are you are assigning per each sequence under **action.**
show sdwan policy data-policy-filter
For example:
policy
data-policy **_vpn10_QoS_Policy**
vpn-list vpn10
sequence 1
match
source-ip 0.0.0.0/0
app-list REAL_TIME_APPS
!
action accept
set
dscp 46
forwarding-class Best_Effor
!
sequence 11
match
source-ip 0.0.0.0/0
app-list VIDEO_CONF
!
action accept
set
dscp 46
forwarding-class Voice
!
default-action accept
!

Using command **show policy-map interface GigabitEthernet 1**, you are going to find useful information regarding traffic for each queue and if and drops associated.
For example:

<#root>

```
GigabitEthernet1
 Class-map: class-default (match-any)


 1100 packets,
 113813 bytes
 30 second offered rate 0000 bps,
drop rate 0000 bps


 Match: any
 Queueing


 queue limit 1041 packets


 (queue depth/total drops/no-buffer drops) 0/0/0
 (pkts output/bytes output) 934/56377
 bandwidth remaining ratio 25
 Exp-weight-constant: 9 (1/512)
 Mean queue depth: 0 packets
 class          Transmitted     Random drop     Tail drop     Minimum    Maximum    Mark
                 pkts/bytes      pkts/bytes     pkts/bytes    thresh     thresh    prob


 0                 929/55910       0/0             0/0          260        520      1/10


 1                   0/0           0/0             0/0          292        520      1/10
 2                   0/0           0/0             0/0          325        520      1/10
 3                   0/0           0/0             0/0          357        520      1/10
 4                   0/0           0/0             0/0          390        520      1/10
 5                   0/0           0/0             0/0           422       520      1/10
 6                   5/467         0/0             0/0           455       520      1/10
 7                   0/0           0/0             0/0           487       520      1/10
```

Related Information

- Cisco Technical Support & Downloads