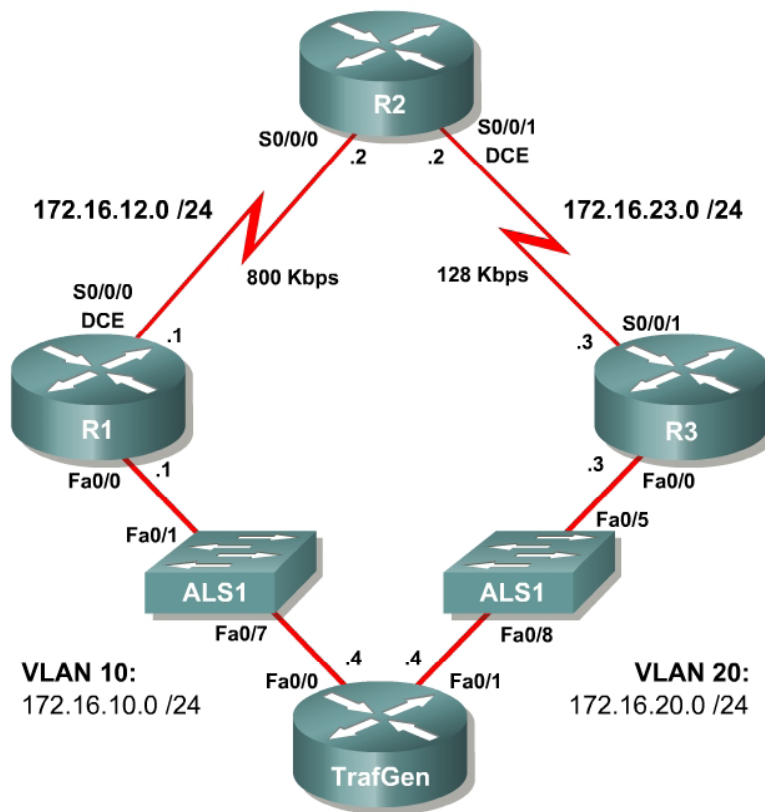


Lab 5.1 AutoQoS

Learning Objectives

- Configure AutoQoS Discovery
- Configure AutoQoS
- Verify AutoQoS behavior

Topology Diagram



Scenario

In this lab, you will configure AutoQoS, a Cisco QoS solution for simple, scalable QoS deployments. For this lab you are required to use a Packet IOS image on TrafGen to generate lab traffic.

Preparation

This lab uses the Basic Packet Configuration for TrafGen and the Switch to generate and facilitate lab traffic in a stream from TrafGen to R1 to R2. Prior to beginning this lab, configure TrafGen (R4) and the switch according to the

Basic Pagent Configuration in Lab 3.1: Preparing for QoS. You may simply accomplish this on R4 by loading the *basic-ios.cfg* file from Flash memory into the NVRAM, and reloading.

```
TrafGen# copy flash:basic-ios.cfg startup-config
Destination filename [startup-config]?
[OK]
2875 bytes copied in 1.456 secs (1975 bytes/sec)
TrafGen# reload
Proceed with reload? [confirm]
```

Next, instruct TGN to load the *basic-tgn.cfg* file and to start generating traffic.

```
TrafGen> enable
TrafGen# tgn load-config
TrafGen# tgn start
```

On the switch, load the *basic.cfg* file into NVRAM and reload the device.

```
ALS1# copy flash:basic.cfg startup-config
Destination filename [startup-config]?
[OK]
2875 bytes copied in 1.456 secs (1975 bytes/sec)
ALS1# reload
Proceed with reload? [confirm]
```

In addition, add the Fast Ethernet 0/5 interface on the switch to VLAN 20 since R3 will be the exit point from the network topology in this lab.

```
ALS1# configure terminal
ALS1(config)# interface fastethernet 0/5
ALS1(config-if)# switchport access vlan 20
ALS1(config-if)# switchport mode access
```

Step 1: Configure the Physical Interfaces

Configure all of the physical interfaces shown in the topology diagram. Set the clock rate on the serial link between R1 and R2 to 800 Kbps and the clock rate of the serial link between R2 and R3 to 128 Kbps; use the **no shutdown** command on all interfaces. Set the informational bandwidth parameter appropriately on the serial interfaces.

```
R1(config)# interface fastethernet 0/0
R1(config-if)# ip address 172.16.10.1 255.255.255.0
R1(config-if)# no shutdown
R1(config-if)# interface serial 0/0/0
R1(config-if)# bandwidth 800
R1(config-if)# ip address 172.16.12.1 255.255.255.0
R1(config-if)# clock rate 800000
R1(config-if)# no shutdown

R2(config)# interface serial 0/0/0
R2(config-if)# bandwidth 800
R2(config-if)# ip address 172.16.12.2 255.255.255.0
R2(config-if)# no shutdown
R2(config-if)# interface serial 0/0/1
R2(config-if)# bandwidth 128
```

```
R2(config-if)# ip address 172.16.23.2 255.255.255.0
R2(config-if)# clock rate 128000
R2(config-if)# no shutdown
```

```
R3(config)# interface fastethernet 0/0
R3(config-if)# ip address 172.16.20.3 255.255.255.0
R3(config-if)# no shutdown
R3(config-if)# interface serial 0/0/1
R3(config-if)# bandwidth 128
R3(config-if)# ip address 172.16.23.3 255.255.255.0
R3(config-if)# no shutdown
```

Note: If you do not use the basic-ios.cfg and basic-tgn.cfg files, enter these commands on R4 to configure it for traffic generation.

```
TrafGen(config)#interface fastethernet 0/0
TrafGen(config-if)# ip address 172.16.10.4 255.255.255.0
TrafGen(config-if)# no shutdown
TrafGen(config-if)# interface fastethernet 0/1
TrafGen(config-if)# ip address 172.16.20.4
TrafGen(config-if)# no shutdown
```

From global configuration mode on TrafGen, enter TGN configuration mode:

```
TrafGen# tgn
TrafGen(TGN:OFF<Fa0/0:none)#
```

Enter (or copy and paste) the following commands at the prompt. Note that you will need to enter the MAC address of R1's FastEthernet 0/0 interface in the highlighted field.

```
fastethernet 0/0
add tcp
rate 1000
L2-dest [enter MAC address of R1 Fa0/0]
L3-src 172.16.10.4
L3-dest 172.16.20.4
L4-dest 23
length random 16 to 1500
burst on
burst duration off 1000 to 2000
burst duration on 1000 to 3000
add fastethernet0/0 1
l4-dest 80
data ascii 0 GET /index.html HTTP/1.1
add fastethernet0/0 1
l4-dest 21
add fastethernet0/0 1
l4-dest 123
add fastethernet0/0 1
l4-dest 110
add fastethernet0/0 1
l4-dest 25
add fastethernet0/0 1
l4-dest 22
add fastethernet0/0 1
l4-dest 6000
```

```
!  
end
```

Start generating traffic by entering the “start” command at the TGN prompt:

```
TrafGen(TGN:ON,Fa0/0:8/8)# start
```

Step 2: Configure EIGRP AS 1

Configure routing between R1, R2 and R3 using Enhanced Interior Gateway Router Protocol (EIGRP). Include the entire 172.16.0.0/16 major network in AS 1 and disable automatic summarization.

```
R1(config)# router eigrp 1  
R1(config-router)# no auto-summary  
R1(config-router)# network 172.16.0.0  
  
R2(config)# router eigrp 1  
R2(config-router)# no auto-summary  
R2(config-router)# network 172.16.0.0  
  
R3(config)# router eigrp 1  
R3(config-router)# no auto-summary  
R3(config-router)# network 172.16.0.0
```

Verify that the number of packets counted is increasing on the outbound interface of R3 using the **show interfaces fastethernet 0/1** command. Issue the command twice to make sure the number of packets output has changed. If the number is not increasing, troubleshoot Layer 1, 2, and 3 connectivity and the EIGRP configurations.

Step 3: Configure AutoQoS

AutoQoS is an IOS feature that observes traffic patterns on an interface via Network-based Application Recognition (NBAR) and generates appropriate class-based QoS policies based on observed traffic patterns.

You must initiate AutoQoS in a discovery phase in which the application observes traffic on an interface. You may decide to observe traffic over a significant period of time to ensure that all types of traffic have been accounted for.

Then, you must instruct AutoQoS to create QoS policies. The policies that AutoQoS creates can both mark traffic and implement various traffic shaping mechanisms. For more information on NBAR and the MQC, consult Lab 4.5: Class-based Queuing and NBAR.

Configure AutoQoS on R1’s Serial 0/0/0 interface so that the application can observe traffic passing through R1 toward R2. Begin the discovery phase of

AutoQoS by applying the **auto discovery qos** command in interface configuration mode.

```
R1(config)# interface serial 0/0/0
R1(config-if)# auto discovery qos
```

The router may not respond to input for a few moments while AutoQoS starts.

Let auto discovery run for a few minutes, and then peruse the traffic profile and suggested policy using the **show auto discovery qos** command. Your output may vary, as the results from this command are dynamically generated based on the traffic patterns observed.

```
R1# show auto discovery qos
Serial0/0/0
AutoQoS Discovery enabled for applications
Discovery up time: 2 minutes, 26 seconds
AutoQoS Class information:
Class Voice:
  No data found.
Class Interactive Video:
  No data found.
Class Signaling:
  No data found.
Class Streaming Video:
  No data found.
Class Transactional:
  Recommended Minimum Bandwidth: 10635 Kbps/688% (AverageRate)
  Detected applications and data:
  Application/          AverageRate          PeakRate            Total
  Protocol              (kbps/%)            (kbps/%)            (bytes)
  -----
  telnet                3640/235             4235/274            66441515
  ssh                   3536/229             4359/282            64545226
  xwindows              3459/224             3863/250            63133333
Class Bulk:
  Recommended Minimum Bandwidth: 10568 Kbps/684% (AverageRate)
  Detected applications and data:
  Application/          AverageRate          PeakRate            Total
  Protocol              (kbps/%)            (kbps/%)            (bytes)
  -----
  ftp                   3564/230             4110/266            65052327
  smtp                  3522/228             4086/264            64278471
  pop3                  3482/225             4314/279            63556253
Class Scavenger:
  No data found.
Class Management:
  No data found.
Class Routing:
  Recommended Minimum Bandwidth: 0 Kbps/0% (AverageRate)
  Detected applications and data:
  Application/          AverageRate          PeakRate            Total
  Protocol              (kbps/%)            (kbps/%)            (bytes)
  -----
  eigrp                 0/0                  0/0                  1984
Class Best Effort:
  Current Bandwidth Estimation: 6953 Kbps/450% (AverageRate)
  Detected applications and data:
  Application/          AverageRate          PeakRate            Total
  Protocol              (kbps/%)            (kbps/%)            (bytes)
```

| ----- | ----- | ----- | ----- |
|-------|----------|----------|----------|
| ntp | 3510/227 | 4127/267 | 64072875 |
| http | 3443/222 | 4159/269 | 62848166 |

Suggested AutoQoS Policy for the current uptime:

```

!
class-map match-any AutoQoS-Transactional-Se0/0/0
  match protocol telnet
  match protocol ssh
  match protocol xwindows
!
class-map match-any AutoQoS-Bulk-Se0/0/0
  match protocol ftp
  match protocol smtp
  match protocol pop3
!
policy-map AutoQoS-Policy-Se0/0/0
  class AutoQoS-Transactional-Se0/0/0
    bandwidth remaining percent 49
    random-detect dscp-based
    set dscp af21
  class AutoQoS-Bulk-Se0/0/0
    bandwidth remaining percent 49
    random-detect dscp-based
    set dscp af11
  class class-default
    fair-queue

```

There are a few observations you can make about this output. Besides the details of the statistics gathered, you can see that it separates traffic into classes based on function and latency requirements. At the end of the output, a suggested traffic policy is created. If the traffic generated by the traffic generator was different or more extensive, you might see other classes being utilized, with their own entries in the policy.

How many traffic classes has AutoQoS derived from the observed patterns?

AutoQoS has classified all traffic into two distinct queues.

Is this how you would also classify traffic generated by the Pagent router if you were to implement the suggested QoS policy on the command line? Explain.

If Pagent was being used, you would expect a minimum of three distinct queues. Minimally, a queue would be added for voice traffic.

What does the DSCP marking AF11 indicate?

Queue class 1—most preferred queue, low drop priority.

What does the differentiated services code point (DSCP) marking AF21 indicate?

Queue class 2—low drop priority.

Are these markings locally significant to the router or globally significant over the entire routed path?

If markings are applied at ingress and re-marked at egress, then they may be only locally significant. However, if packets are marked at egress then they will be seen by other routers. The DSCP markings will be carried in the Layer 3 IP header until remarked so they are essentially globally significant. These markings will also be significant if considered by other routers in their routed path. Normally in the Differentiated Service model, you prefer to mark once and classify based on marking at a later node.

How much bandwidth do you expect to be allocated to the transactional and bulk traffic classes respectively?

Transactional: $75\% \times 49\% \approx 37\%$

Bulk: $38.25\% \times 49\% \approx 19\%$

Although auto discovery uses NBAR for protocol recognition, it does not actually configure NBAR protocol discovery on the interface. You can verify this by looking at the running configuration for the serial interface.

```
R1# show run interface serial 0/0/0
Building configuration...

Current configuration : 107 bytes
!
interface Serial0/0/0
 ip address 172.16.12.1 255.255.255.0
 auto discovery qos
 clock rate 800000
end
```

Issue the **auto qos** command in interface configuration mode to implement the current AutoQoS-recommended configuration. This command requires AutoQoS' auto discovery to already be active.

```
R1(config)# interface serial0/0/0
R1(config-if)# auto qos
```

Verify the configuration that AutoQoS has applied by issuing the **show auto qos** command.

```
R1# show auto qos
!
policy-map AutoQoS-Policy-Se0/0/0
class AutoQoS-Transactional-Se0/0/0
  bandwidth remaining percent 49
  random-detect dscp-based
  set dscp af21
class AutoQoS-Bulk-Se0/0/0
  bandwidth remaining percent 49
  random-detect dscp-based
  set dscp af11
class class-default
  fair-queue
!
class-map match-any AutoQoS-Transactional-Se0/0/0
  match protocol ssh
  match protocol telnet
  match protocol xwindows
!
class-map match-any AutoQoS-Bulk-Se0/0/0
  match protocol ftp
  match protocol smtp
  match protocol pop3

Serial0/0/0 -
!
interface Serial0/0/0
  service-policy output AutoQoS-Policy-Se0/0/0
```

Which queuing tool does the policy generated on router R1 represent?

Class-based weighted fair queuing (CBWFQ).

Thus, when you issue the **auto qos** command, AutoQoS immediately generates the MQC configuration and applies it to the interface. Verify the statistics on the policy map using the **show policy-map interface serial 0/0/0** command.

```
R1# show policy-map interface serial 0/0/0
Serial0/0/0

Service-policy output: AutoQoS-Policy-Se0/0/0

Class-map: AutoQoS-Transactional-Se0/0/0 (match-any)
  24415 packets, 19366297 bytes
  5 minute offered rate 194000 bps, drop rate 187000 bps
  Match: protocol ssh
    8564 packets, 6637316 bytes
    5 minute rate 69000 bps
  Match: protocol xwindows
    8758 packets, 7046646 bytes
    5 minute rate 77000 bps
  Match: protocol telnet
    7093 packets, 5682335 bytes
```


5 minute rate 53000 bps
 Queueing
 Output Queue: Conversation 265
 Bandwidth remaining 49 (%)
 (pkts matched/bytes matched) 24564/19497687
 (depth/total drops/no-buffer drops) 41/23580/0
 exponential weight: 9
 mean queue depth: 41

| dscp | Transmitted pkts/bytes | Random drop pkts/bytes | Tail drop pkts/bytes | Minimum thresh | Maximum thresh | Mark prob |
|---------|---------------------------|---------------------------|-------------------------|-------------------|-------------------|--------------|
| af11 | 0/0 | 0/0 | 0/0 | 32 | 40 | 1/10 |
| af12 | 0/0 | 0/0 | 0/0 | 28 | 40 | 1/10 |
| af13 | 0/0 | 0/0 | 0/0 | 24 | 40 | 1/10 |
| af21 | 985/788284 | 145/117412 | 23486/18634727 | 32 | 40 | 1/10 |
| af22 | 0/0 | 0/0 | 0/0 | 28 | 40 | 1/10 |
| af23 | 0/0 | 0/0 | 0/0 | 24 | 40 | 1/10 |
| af31 | 0/0 | 0/0 | 0/0 | 32 | 40 | 1/10 |
| af32 | 0/0 | 0/0 | 0/0 | 28 | 40 | 1/10 |
| af33 | 0/0 | 0/0 | 0/0 | 24 | 40 | 1/10 |
| af41 | 0/0 | 0/0 | 0/0 | 32 | 40 | 1/10 |
| af42 | 0/0 | 0/0 | 0/0 | 28 | 40 | 1/10 |
| af43 | 0/0 | 0/0 | 0/0 | 24 | 40 | 1/10 |
| cs1 | 0/0 | 0/0 | 0/0 | 22 | 40 | 1/10 |
| cs2 | 0/0 | 0/0 | 0/0 | 24 | 40 | 1/10 |
| cs3 | 0/0 | 0/0 | 0/0 | 26 | 40 | 1/10 |
| cs4 | 0/0 | 0/0 | 0/0 | 28 | 40 | 1/10 |
| cs5 | 0/0 | 0/0 | 0/0 | 30 | 40 | 1/10 |
| cs6 | 0/0 | 0/0 | 0/0 | 32 | 40 | 1/10 |
| cs7 | 0/0 | 0/0 | 0/0 | 34 | 40 | 1/10 |
| ef | 0/0 | 0/0 | 0/0 | 36 | 40 | 1/10 |
| rsvp | 0/0 | 0/0 | 0/0 | 36 | 40 | 1/10 |
| default | 0/0 | 0/0 | 0/0 | 20 | 40 | 1/10 |

QoS Set
 dscp af21
 Packets marked 24769

Class-map: AutoQoS-Bulk-Se0/0/0 (match-any)
 25530 packets, 19973981 bytes
 5 minute offered rate 200000 bps, drop rate 192000 bps
 Match: protocol pop3
 7795 packets, 6150162 bytes
 5 minute rate 66000 bps
 Match: protocol smtp
 9381 packets, 7226367 bytes
 5 minute rate 67000 bps
 Match: protocol ftp
 8354 packets, 6597452 bytes
 5 minute rate 72000 bps

Queueing
 Output Queue: Conversation 266
 Bandwidth remaining 49 (%)
 (pkts matched/bytes matched) 25847/20236550
 (depth/total drops/no-buffer drops) 41/24769/0
 exponential weight: 9
 mean queue depth: 41

| dscp | Transmitted pkts/bytes | Random drop pkts/bytes | Tail drop pkts/bytes | Minimum thresh | Maximum thresh | Mark prob |
|------|---------------------------|---------------------------|-------------------------|-------------------|-------------------|--------------|
| af11 | 1090/869842 | 246/196528 | 24536/19186281 | 32 | 40 | 1/10 |
| af12 | 0/0 | 0/0 | 0/0 | 28 | 40 | 1/10 |
| af13 | 0/0 | 0/0 | 0/0 | 24 | 40 | 1/10 |

| | | | | | | |
|---------|-----|-----|-----|----|----|------|
| af21 | 0/0 | 0/0 | 0/0 | 32 | 40 | 1/10 |
| af22 | 0/0 | 0/0 | 0/0 | 28 | 40 | 1/10 |
| af23 | 0/0 | 0/0 | 0/0 | 24 | 40 | 1/10 |
| af31 | 0/0 | 0/0 | 0/0 | 32 | 40 | 1/10 |
| af32 | 0/0 | 0/0 | 0/0 | 28 | 40 | 1/10 |
| af33 | 0/0 | 0/0 | 0/0 | 24 | 40 | 1/10 |
| af41 | 0/0 | 0/0 | 0/0 | 32 | 40 | 1/10 |
| af42 | 0/0 | 0/0 | 0/0 | 28 | 40 | 1/10 |
| af43 | 0/0 | 0/0 | 0/0 | 24 | 40 | 1/10 |
| cs1 | 0/0 | 0/0 | 0/0 | 22 | 40 | 1/10 |
| cs2 | 0/0 | 0/0 | 0/0 | 24 | 40 | 1/10 |
| cs3 | 0/0 | 0/0 | 0/0 | 26 | 40 | 1/10 |
| cs4 | 0/0 | 0/0 | 0/0 | 28 | 40 | 1/10 |
| cs5 | 0/0 | 0/0 | 0/0 | 30 | 40 | 1/10 |
| cs6 | 0/0 | 0/0 | 0/0 | 32 | 40 | 1/10 |
| cs7 | 0/0 | 0/0 | 0/0 | 34 | 40 | 1/10 |
| ef | 0/0 | 0/0 | 0/0 | 36 | 40 | 1/10 |
| rsvp | 0/0 | 0/0 | 0/0 | 36 | 40 | 1/10 |
| default | 0/0 | 0/0 | 0/0 | 20 | 40 | 1/10 |

```

QoS Set
  dscp af11
    Packets marked 25975

```

```

Class-map: class-default (match-any)
  16903 packets, 13301976 bytes
  5 minute offered rate 130000 bps, drop rate 128000 bps
  Match: any
  Queueing
    Flow Based Fair Queueing
    Maximum Number of Hashed Queues 256
    (total queued/total drops/no-buffer drops) 115/17584/0

```

Why is the auto discovery step separate from the actual implementation of AutoQoS?

Having the auto discovery step separate from the actual implementation of AutoQoS allows the discovery phase as much time as needed to observe traffic patterns. Once traffic patterns are evaluated for an appropriate period of time, the person implementing AutoQoS can decide whether this is the policy that should be activated for the interface, or whether this policy needs to be tweaked.

Step 4: Configure AutoQoS with DSCP

In the previous step, you configured AutoQoS with a base configuration that classified traffic based on protocols. The configuration marked the packets with various DSCP values in addition to configuring CBWFQ. AutoQoS in an enterprise deployment can be configured to trust DSCP values from other routers and make QoS decisions based on those values.

Describe the efficiency of enabling AutoQoS on all routers in your network, but not configuring AutoQoS to trust markings from other routers.

Each router would need to use processor time to run NBAR classification on ingress and egress packets rather than simply classifying based on DSCP markings. This would be highly inefficient.

Modify the **auto discovery qos** command with the **trust** keyword on on R2's Serial 0/0/0 interface.

```
R2(config)# interface serial 0/0/1
R2(config-if)# auto discovery qos trust
```

Wait a few minutes for auto discovery to capture statistics. Then, use the **show auto discovery qos** command to view the traffic patterns that AutoQoS has observed.

```
R2# show auto discovery qos
Serial0/0/1
AutoQoS Discovery enabled for trusted DSCP
Discovery up time: 9 minutes, 23 seconds
AutoQoS Class information:
Class Voice:
  No data found.
Class Interactive Video:
  No data found.
Class Signaling:
  No data found.
Class Streaming Video:
  No data found.
Class Transactional:
  Recommended Minimum Bandwidth: 397 Kbps/25% (AverageRate)
  Detected DSCPs and data:
  DSCP value      AverageRate      PeakRate      Total
                  (kbps/%)        (kbps/%)      (bytes)
  -----
  18/af21         397/25          475/30        27986160
Class Bulk:
  Recommended Minimum Bandwidth: 394 Kbps/25% (AverageRate)
  Detected DSCPs and data:
  DSCP value      AverageRate      PeakRate      Total
                  (kbps/%)        (kbps/%)      (bytes)
  -----
  10/af11         394/25          478/30        27770932
Class Scavenger:
  No data found.
Class Management:
  No data found.
Class Routing:
  No data found.
Class Best Effort:
  Current Bandwidth Estimation: 0 Kbps/0% (AverageRate)
  Detected DSCPs and data:
  DSCP value      AverageRate      PeakRate      Total
                  (kbps/%)        (kbps/%)      (bytes)
  -----
  0/default       0/0             3/<1          54449
Suggested AutoQoS Policy for the current uptime:
!
```

```

class-map match-any AutoQoS-Transactional-Trust
  match ip dscp af21
  match ip dscp af22
  match ip dscp af23
!
class-map match-any AutoQoS-Bulk-Trust
  match ip dscp af11
  match ip dscp af12
  match ip dscp af13
!
policy-map AutoQoS-Policy-Se0/0/1-Trust
  class AutoQoS-Transactional-Trust
    bandwidth remaining percent 25
    random-detect dscp-based
  class AutoQoS-Bulk-Trust
    bandwidth remaining percent 25
    random-detect dscp-based
  class class-default
    fair-queue

```

Notice that the output is very similar to the output in the previous step. However, this time, the statistics are based on DSCP values, not individual applications. Enable AutoQoS on the interface.

```

R2(config)# interface serial0/0/1
R2(config-if)# auto qos

```

Verify using the command **show auto qos**.

```

R2# show auto qos
!
policy-map AutoQoS-Policy-Se0/0/1-Trust
  class AutoQoS-Transactional-Trust
    bandwidth remaining percent 25
    random-detect dscp-based
  class AutoQoS-Bulk-Trust
    bandwidth remaining percent 25
    random-detect dscp-based
  class class-default
    fair-queue
!
class-map match-any AutoQoS-Bulk-Trust
  match ip dscp af11
  match ip dscp af12
  match ip dscp af13
!
class-map match-any AutoQoS-Transactional-Trust
  match ip dscp af21
  match ip dscp af22
  match ip dscp af23

Serial0/0/1 -
!
interface Serial0/0/1
  service-policy output AutoQoS-Policy-Se0/0/1-Trust

```

Final Configurations

```

R1# show run
!
hostname R1

```

```

!
policy-map AutoQoS-Policy-Se0/0/0
class AutoQoS-Transactional-Se0/0/0
  bandwidth remaining percent 49
  random-detect dscp-based
  set dscp af21
class AutoQoS-Bulk-Se0/0/0
  bandwidth remaining percent 49
  random-detect dscp-based
  set dscp af11
class class-default
  fair-queue
!
interface FastEthernet0/0
ip address 172.16.10.1 255.255.255.0
no shutdown
!
interface Serial0/0/0
ip address 172.16.12.1 255.255.255.0
auto qos
auto discovery qos
clock rate 800000
service-policy output AutoQoS-Policy-Se0/0/0
no shutdown
!
router eigrp 1
network 172.16.0.0
no auto-summary
!
end

R2# show run
!
hostname R2
!
policy-map AutoQoS-Policy-Se0/0/1-Trust
class AutoQoS-Transactional-Trust
  bandwidth remaining percent 25
  random-detect dscp-based
class AutoQoS-Bulk-Trust
  bandwidth remaining percent 25
  random-detect dscp-based
class class-default
  fair-queue
!
interface Serial0/0/0
ip address 172.16.12.2 255.255.255.0
no shutdown
!
interface Serial0/0/1
ip address 172.16.23.2 255.255.255.0
auto qos
auto discovery qos trust
clock rate 800000
service-policy output AutoQoS-Policy-Se0/0/1-Trust
no shutdown
!
router eigrp 1
network 172.16.0.0
no auto-summary
!
end

```

```
R3# show run
!  
hostname R3  
!  
interface FastEthernet0/1  
 ip address 172.16.20.3 255.255.255.0  
 no shutdown  
!  
interface Serial0/0/1  
 ip address 172.16.23.3 255.255.255.0  
 no shutdown  
!  
router eigrp 1  
 network 172.16.0.0  
 no auto-summary  
!  
end
```