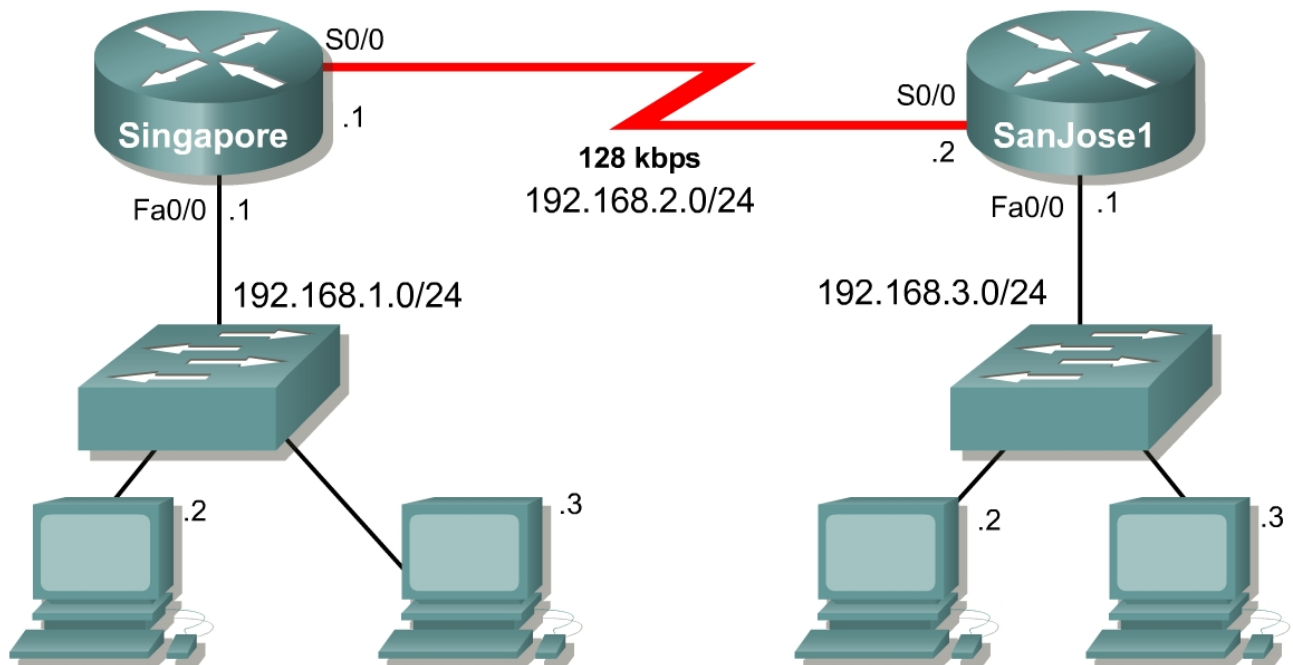


Lab 8.1.10.3 QoS Classification and Policing Using CAR



Objective

This lab uses Committed Access Rate (CAR) to classify and police traffic. Although the classification and policing actions in this lab are configured on one router, this is not a requirement for CAR. CAR is commonly used to classify traffic at a distribution router and then police the traffic on congested core routers.

Scenario

Managing the bandwidth of the WAN link is difficult because the marketing departments in Singapore and San Jose frequently use peer-to-peer networking to exchange large graphics.

When CAR is used to classify traffic, the DSCP value of the traffic can be lowered when excessive data rates occur. An analysis of current traffic patterns indicates that it is reasonable to allow up to 32 kbps of traffic between any two peers across the WAN link. All traffic up to the 32-kbps limit will be permitted with a best-effort DSCP value of 8. If the peers attempt to exchange data across the WAN link at rates exceeding 32 kbps, traffic will still be permitted to enter the network. However, the excessive traffic will be given a DSCP value of 0, which will rank it lower than best-effort status.

On the WAN link, allow a maximum of 16 kbps of less than best-effort traffic with a DSCP value of 0. Any best-effort traffic that exceeds this bandwidth should be dropped.

Step 1

Build and configure the network according to the diagram. Before beginning a lab, the configurations on all the routers should be cleared and then reloaded or power cycled to reset their default

configurations. Delete the **vlan.dat** and startup configuration files on the switches before reloading them.

Configure EIGRP with an AS of 100 as the routing protocol. The configuration of CAR will occur on the routers so the access-layer switches can be left in their factory-default configuration.

```
Router(config)#hostname Singapore
Singapore(config)#interface fastethernet 0/0
Singapore(config-if)#ip address 192.168.1.1 255.255.255.0
Singapore(config-if)#no shutdown
Singapore(config-if)#interface serial 0/0
Singapore(config-if)#ip address 192.168.2.1 255.255.255.0
Singapore(config-if)#clock rate 128000
Singapore(config-if)#no shutdown
Singapore(config-if)#router eigrp 100
Singapore(config-router)#network 192.168.1.0
Singapore(config-router)#network 192.168.2.0
```

```
Router(config)#hostname SanJose1
SanJose1(config)#interface fastethernet 0/0
SanJose1(config-if)#ip address 192.168.3.1 255.255.255.0
SanJose1(config-if)#no shutdown
SanJose1(config-if)#interface serial 0/0
SanJose1(config-if)#ip address 192.168.2.2 255.255.255.0
SanJose1(config-if)#clock rate 128000
SanJose1(config-if)#no shutdown
SanJose1(config-if)#router eigrp 100
SanJose1(config-router)#network 192.168.3.0
SanJose1(config-router)#network 192.168.2.0
```

Step 2

On each router, use an access list to define the peers that will be subject to CAR. In this lab, each LAN network must be permitted access to the other.

```
Singapore(config)#access-list 100 permit ip 192.168.1.0 0.0.0.255
192.168.3.0 0.0.0.255

SanJose1(config)#access-list 100 permit ip 192.168.3.0 0.0.0.255
192.168.1.0 0.0.0.255
```

Step 3

Use the **rate-limit** command to classify the traffic on each router at the Fa0/0 interface. A partial syntax for the **rate-limit** command is as follows:

```
Router(config-if)#rate-limit {input | output} [dscp dscp value][access-
group [rate-limit] acl-index] bps burst-normal burst-max conform-action
action exceed-action action
```

Mark conforming traffic of up to 32 kbps with a DSCP value of 8 and non-conforming traffic in excess of 32 kbps with a DSCP value of 0. The traffic will then be forwarded.

Use question-marks (?) extensively in the following commands to become familiar with the different QoS options available.

```
Singapore(config)#interface fastethernet 0/0
Singapore(config-if)#rate-limit input access-group 100 32000 3200 3200
conform-action set-dscp-transmit 8 exceed-action set-dscp-transmit 0

SanJose1(config)#interface fastethernet 0/0
```

```
SanJose1(config-if)#rate-limit input access-group 100 32000 3200 3200
conform-action set-dscp-transmit 8 exceed-action set-dscp-transmit 0
```

These commands will only mark the traffic using the DSCP. Both conforming and non-conforming traffic will be transmitted.

```
Singapore#show interfaces rate-limit
FastEthernet0/0
  Input
    matches: access-group 100
    params: 32000 bps, 3200 limit, 3200 extended limit
    conformed 0 packets, 0 bytes; action: set-dscp-transmit 8
    exceeded 0 packets, 0 bytes; action: set-dscp-transmit 0
    last packet: 11998472ms ago, current burst: 0 bytes
    last cleared 00:02:27 ago, conformed 0 bps, exceeded 0 bps
```

```
SanJose1#show interfaces rate-limit
FastEthernet0/0
  Input
    matches: access-group 100
    params: 32000 bps, 3200 limit, 3200 extended limit
    conformed 0 packets, 0 bytes; action: set-dscp-transmit 8
    exceeded 0 packets, 0 bytes; action: set-dscp-transmit 0
    last packet: 12253992ms ago, current burst: 0 bytes      last cleared
00:00:40 ago, conformed 0 bps, exceeded 0 bps
```

Step 4

On the outbound WAN interfaces, police the traffic according to the requirements of keeping less than best-effort traffic with a DSCP value of 0 to a maximum of 16 kbps.

Police the traffic by dropping it if it is non conformant.

```
SanJose1(config)#interface serial 0/0
SanJose1(config-if)#rate-limit output dscp 0 16000 1600 2000 conform-action
transmit exceed-action drop
```

```
Singapore(config)#interface serial 0/0
Singapore(config-if)#rate-limit output dscp 0 16000 1600 2000 conform-
action transmit exceed-action drop
```

```
Singapore#show interfaces rate-limit
FastEthernet0/0
  Input
    matches: access-group 100
    params: 32000 bps, 3200 limit, 3200 extended limit
    conformed 0 packets, 0 bytes; action: set-dscp-transmit 8
    exceeded 0 packets, 0 bytes; action: set-dscp-transmit 0
    last packet: 4202168ms ago, current burst: 0 bytes
    last cleared 00:38:39 ago, conformed 0 bps, exceeded 0 bps
Serial0/0
  Output
    matches: dscp 0
    params: 16000 bps, 1600 limit, 2000 extended limit
    conformed 0 packets, 0 bytes; action: transmit
    exceeded 0 packets, 0 bytes; action: drop
    last packet: 4202960ms ago, current burst: 0 bytes
    last cleared 00:13:29 ago, conformed 0 bps, exceeded 0 bps
Singapore#
```

```
SanJose1#show interfaces rate-limit
```

```

FastEthernet0/0
  Input
    matches: access-group 100
    params: 32000 bps, 3200 limit, 3200 extended limit
    conformed 0 packets, 0 bytes; action: set-dscp-transmit 8
    exceeded 0 packets, 0 bytes; action: set-dscp-transmit 0
    last packet: 4304948ms ago, current burst: 0 bytes
    last cleared 00:34:27 ago, conformed 0 bps, exceeded 0 bps
Serial0/0
  Output
    matches: dscp 0
    params: 16000 bps, 1600 limit, 2000 extended limit
    conformed 0 packets, 0 bytes; action: transmit
    exceeded 0 packets, 0 bytes; action: drop
    last packet: 4305768ms ago, current burst: 0 bytes
    last cleared 00:15:34 ago, conformed 0 bps, exceeded 0 bps
SanJose1#

```

Step 5

Use an extended **ping** between LAN interfaces to test the traffic rate limiting policies. It may be helpful to experiment with ICMP packets that are different sizes.

```

SanJose1#ping
Protocol [ip]:
Target IP address: 192.168.1.1
Repeat count [5]: 20
Datagram size [100]: 1500
Timeout in seconds [2]:
Extended commands [n]: y
Source address or interface: 192.168.3.1
Type of service [0]:
Set DF bit in IP header? [no]:
Validate reply data? [no]:
Data pattern [0xABCD]:
Loose, Strict, Record, Timestamp, Verbose[none]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 20, 1500-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
Packet sent with a source address of 192.168.3.1
!!!!!!!!!!!!!!!!!!!!
Success rate is 70 percent (14/20), round-trip min/avg/max = 188/188/192 ms
SanJose1#

```

Step 6

The actions of CAR can be monitored by using the **show interfaces rate-limit** command to display the counters. Note that some of the 1500-byte packets exceeded the policed bandwidth on the WAN link and were dropped.

```

SanJose1#show interfaces rate-limit
FastEthernet0/0
  Input
    matches: access-group 100
    params: 32000 bps, 3200 limit, 3200 extended limit
    conformed 0 packets, 0 bytes; action: set-dscp-transmit 8
    exceeded 0 packets, 0 bytes; action: set-dscp-transmit 0
    last packet: 4850120ms ago, current burst: 0 bytes
    last cleared 00:00:44 ago, conformed 0 bps, exceeded 0 bps
Serial0/0
  Output
    matches: dscp 0

```

```
params: 16000 bps, 1600 limit, 2000 extended limit
conformed 14 packets, 21056 bytes; action: transmit
exceeded 6 packets, 9024 bytes; action: drop
last packet: 7304ms ago, current burst: 1120 bytes
last cleared 00:00:46 ago, conformed 3000 bps, exceeded 1000 bps
SanJose1#
```

Congratulations, CAR has been configured to classify and police traffic.