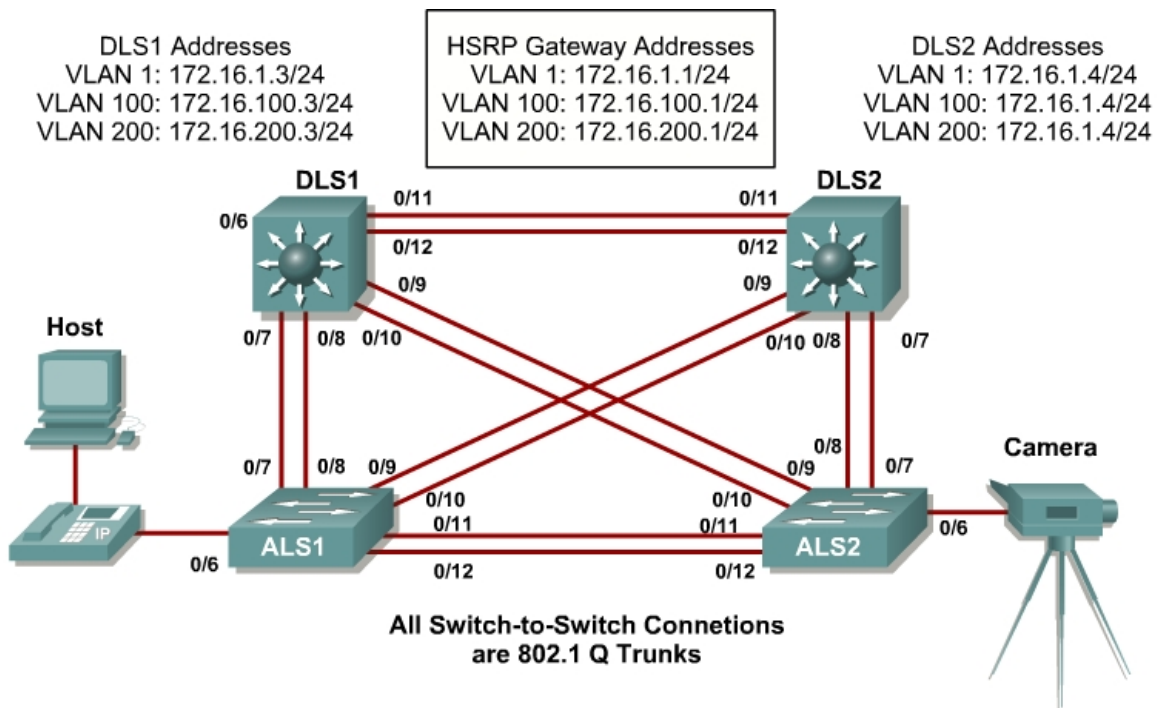## Lab 7-1 Configuring Switches for IP Telephony Support

Learning Objectives

- Configure auto QoS to support IP phones
- Configure CoS override for data frames
- Configure the distribution layer to trust access layer QoS measures
- Manually configure CoS for devices that cannot specify CoS (camera)
- Configure HSRP for voice and data VLANS to ensure redundancy
- Configure 802.1Q trunks and EtherChannels for Layer 2 redundancy and load balancing

Topology

Scenario

IP phones have been deployed throughout the network. The phones are connected to access ports on a 2960 Cisco switch. Each user's PC is connected to the network via the phone's internal switch so that the phones can be deployed without additional wiring.

You must configure the access and distribution layer switches to trust the CoS mapping provided by the IP phone through Cisco Discovery Protocol (CDP). To

ensure redundancy for the phones and user end stations, you must use HSRP on the distribution layer switches.

A camera for video is also deployed on the network, which requires that its access port on the 2960 be manually configured. It is not necessary to have a camera to successfully complete the lab.

Step 1

Power up the switches and use the standard process for establishing a HyperTerminal console connection from a workstation to each switch in your pod.

Prepare for the lab by removing all previous VLAN information and configurations. Refer to Lab 2.0, "Clearing a Single Switch," or Lab 2.0b, "Clearing a Switch Connected to a Larger Network."

Step 2

Cable the lab according to the diagram.

Configure the management IP addresses in VLAN 1, and the hostname, password, and telnet access on all four switches.

You also need to configure a default gateway on the access layer switches. The distribution layer switches act as Layer 3 devices and do not need default gateways.

```
Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# hostname ALS1
ALS1(config)# enable secret cisco
ALS1(config)# line vty 0 15
ALS1(config-line)# password cisco
ALS1(config-line)# login
ALS1(config-line)# exit
ALS1(config)# interface vlan 1
ALS1(config-if)# ip address 172.16.1.101 255.255.255.0
ALS1(config-if)# no shutdown
ALS1(config-if)# exit
ALS1(config)# ip default-gateway 172.16.1.1
ALS1(config)# end


Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# hostname ALS2
ALS2(config)# enable secret cisco
ALS2(config)# line vty 0 15
ALS2(config-line)# password cisco
ALS2(config-line)# login
ALS2(config-line)# exit
ALS2(config)# interface vlan 1
ALS2(config-if)# ip address 172.16.1.102 255.255.255.0
```

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```
ALS2(config-if)# no shutdown
ALS2(config-if)# exit
ALS2(config)# ip default-gateway 172.16.1.1
ALS2(config)# end


Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# hostname DLS1
DLS1(config)# enable secret cisco
DLS1(config)# line vty 0 15
DLS1(config-line)# password cisco
DLS1(config-line)# login
DLS1(config-line)# exit
DLS1(config)# interface vlan 1
DLS1(config-if)# ip address 172.16.1.3 255.255.255.0
DLS1(config-if)# no shutdown
DLS1(config-if)# end


Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# hostname DLS2
DLS2(config)# enable secret cisco
DLS2(config)# line vty 0 15
DLS2(config-line)# password cisco
DLS2(config-line)# login
DLS2(config-line)# exit
DLS2(config)# interface vlan 1
DLS2(config-if)# ip address 172.16.1.4 255.255.255.0
DLS2(config-if)# no shutdown
DLS2(config-if)# end
```

Step 3

Configure the trunks according to the diagram, and configure EtherChannels
between the switches. Using EtherChannel for the trunks provides Layer 2 load
balancing over redundant trunks.

The following is a sample configuration for the trunks and EtherChannel from
DLS1 to the other three switches. Notice that the 3560 needs the **switchport
trunk encapsulation** {**dot1q** | **isl}** command, because this switch also supports
ISL encapsulation.

```
DLS1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
DLS1(config)# interface range fastethernet 0/7 - 8
DLS1(config-if-range)# switchport trunk encapsulation dot1q
DLS1(config-if-range)# switchport mode trunk
DLS1(config-if-range)# channel-group 1 mode desirable

Creating a port-channel interface Port-channel 1

DLS1(config-if-range)# interface range fastethernet 0/9 - 10
DLS1(config-if-range)# switchport trunk encapsulation dot1q
DLS1(config-if-range)# switchport mode trunk
DLS1(config-if-range)# channel-group 2 mode desirable

Creating a port-channel interface Port-channel 2
```

```
DLS1(config-if-range)# interface range fastethernet 0/11 - 12
DLS1(config-if-range)# switchport trunk encapsulation dot1q
DLS1(config-if-range)# switchport mode trunk
DLS1(config-if-range)# channel-group 3 mode desirable
```

Creating a port-channel interface Port-channel 3

```
DLS1(config-if-range)# end
```

The following is a sample configuration for the trunks and EtherChannels from DLS2 to the other three switches:

```
DLS2# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
DLS2(config)# interface range fastethernet 0/7 - 8
DLS2(config-if-range)# switchport trunk encapsulation dot1q
DLS2(config-if-range)# switchport mode trunk
DLS2(config-if-range)# channel-group 1 mode desirable
```

Creating a port-channel interface Port-channel 1

```
DLS2(config-if-range)# interface range fastethernet 0/9 - 10
DLS2(config-if-range)# switchport trunk encapsulation dot1q
DLS2(config-if-range)# switchport mode trunk
DLS2(config-if-range)# channel-group 2 mode desirable
```

Creating a port-channel interface Port-channel 2

```
DLS2(config-if-range)# interface range fastethernet 0/11 - 12
DLS2(config-if-range)# switchport trunk encapsulation dot1q
DLS2(config-if-range)# switchport mode trunk
DLS2(config-if-range)# channel-group 3 mode desirable
```

Creating a port-channel interface Port-channel 3

```
DLS2(config-if-range)# end
```

The following is a sample configuration for the trunks and EtherChannel from ALS1 and ALS2 to the other switches:

```
ALS1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ALS1(config)# interface range fastethernet 0/7 - 8
ALS1(config-if-range)# switchport mode trunk
ALS1(config-if-range)# channel-group 1 mode desirable
```

Creating a port-channel interface Port-channel 1

```
ALS1(config-if-range)# interface range fastethernet 0/9 - 10
ALS1(config-if-range)# switchport mode trunk
ALS1(config-if-range)# channel-group 2 mode desirable
```

Creating a port-channel interface Port-channel 2

```
ALS1(config-if-range)# interface range fastethernet 0/11 - 12
ALS1(config-if-range)# switchport mode trunk
ALS1(config-if-range)# channel-group 3 mode desirable
```

Creating a port-channel interface Port-channel 3

```
ALS1(config-if-range)# end
```

Sample configuration from ALS2:

```
ALS2# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ALS2(config)# interface range fastethernet 0/7 - 8
ALS2(config-if-range)# switchport mode trunk
ALS2(config-if-range)# channel-group 1 mode desirable

Creating a port-channel interface Port-channel 1

ALS2(config-if-range)# interface range fastethernet 0/9 - 10
ALS2(config-if-range)# switchport mode trunk
ALS2(config-if-range)# channel-group 2 mode desirable

Creating a port-channel interface Port-channel 2

ALS2(config-if-range)# interface range fastethernet 0/11 - 12
ALS2(config-if-range)# switchport mode trunk
ALS2(config-if-range)# channel-group 3 mode desirable

Creating a port-channel interface Port-channel 3

ALS2(config-if-range)# end
```

Use the **show interfaces trunk** command on all switches to verify trunks.

1. Which VLANs are currently allowed on the newly created trunks?

Issue the **show etherchannel summary** command on each switch to verify
your EtherChannels.

2. Which EtherChannel negotiation protocol is in use here?

Step 4

Change the VTP mode of ALS1 and ALS2 to client.

```
ALS1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ALS1(config)# vtp mode client
Setting device to VTP CLIENT mode.
ALS1(config)# end
ALS1#

ALS2# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ALS2(config)# vtp mode client
Setting device to VTP CLIENT mode.
```

```
ALS2(config)# end
```

Verify the VTP changes with the **show VTP status** command.

3. How many VLANs can be supported locally on the 2960 switch?

Step 5

Create the VTP domain on DLS1, and create VLANs 100 and 200 for the computer data and voice VLANs in the domain.

```
DLS1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
DLS1(config)# vtp domain SWPOD
DLS1(config)# vlan 100
DLS1(config-vlan)# name CP-Data
DLS1(config-vlan)# exit
DLS1(config)# vlan 200
DLS1(config-vlan)# name Voice
DLS1(config-vlan)# end
```

Verify the VTP information throughout the domain using the **show vlan** and **show vtp status** commands.

4. How many existing VLANs are in the VTP domain?

Step 6

Configure Hot Standby Router Protocol (HSRP) between the VLANs to provide redundancy in the network. To achieve some load balancing, issue the **standby** [*group*] **priority** command. Use the **ip routing** command on DLS1 and DLS2 to activate routing capabilities on the switch.

Each route processor will have its own IP address on each switched virtual interface (SVI), and also be assigned an HSRP virtual IP address for each VLAN. Devices connected to the VLAN 100 and VLAN 200 use the gateway IP address for the VLANs.

The **standby** command is also used to configure the IP address of the virtual gateway and configure the router for preempt. The **preempt** option allows for

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the active router with the higher priority to take over again after a network failure has been resolved.

Notice in the following configurations that the priority for VLANs 1 and 100 has been configured for 150 on DLS1, making DLS1 the active router for those VLANs. VLAN 200 has been configured for a priority of 100 on DLS1, making DLS1 the standby router for this VLAN. Reverse priorities have been configured on the VLANs on DLS2. DLS2 is the active router for VLAN 200, and the standby router for VLANs 1 and 100.

HSRP configuration for DLS1:

```
DLS1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
DLS1(config)# ip routing
DLS1(config)# interface vlan 1
DLS1(config-if)# standby 1 ip 172.16.1.1
DLS1(config-if)# standby 1 preempt
DLS1(config-if)# standby 1 priority 150
DLS1(config-if)# exit
DLS1(config)# interface vlan 100
DLS1(config-if)# ip address 172.16.100.3 255.255.255.0
DLS1(config-if)# standby 1 ip 172.16.100.1
DLS1(config-if)# standby 1 preempt
DLS1(config-if)# standby 1 priority 150
DLS1(config-if)# no shutdown
DLS1(config-if)# exit
DLS1(config)# interface vlan 200
DLS1(config-if)# ip address 172.16.200.3 255.255.255.0
DLS1(config-if)# standby 1 ip 172.16.200.1
DLS1(config-if)# standby 1 preempt
DLS1(config-if)# standby 1 priority 100
DLS1(config-if)# end
```

HSRP configuration for DLS2:

```
DLS2# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
DLS2(config)# ip routing
DLS2(config)# interface vlan 1
DLS2(config-if)# standby 1 ip 172.16.1.1
DLS2(config-if)# standby 1 preempt
DLS2(config-if)# standby 1 priority 100
DLS2(config-if)# exit
DLS2(config)# interface vlan 100
DLS2(config-if)# ip address 172.16.100.4 255.255.255.0
DLS2(config-if)# standby 1 ip 172.16.100.1
DLS2(config-if)# standby 1 preempt
DLS2(config-if)# standby 1 priority 100
DLS2(config-if)# no shutdown
DLS2(config-if)# exit
DLS2(config)# interface vlan 200
DLS2(config-if)# ip address 172.16.200.4 255.255.255.0
DLS2(config-if)# standby 1 ip 172.16.200.1
DLS2(config-if)# standby 1 preempt
DLS2(config-if)# standby 1 priority 150
DLS2(config-if)# end
```

Enter the **show standby** command on both DLS1 and DLS2.

5. Which router is the active router for VLANs 1 and 100? Which is the active router for VLAN 200?

6. What is the default hello time for each VLAN? What is the default hold time?

7. How is the active HSRP router selected?

Verify routing using the **show ip route** command.

The following is a sample output from DLS1:

```
DLS1# show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     172.16.0.0/24 is subnetted, 3 subnets
C        172.16.200.0 is directly connected, Vlan200
C        172.16.1.0 is directly connected, Vlan1
C        172.16.100.0 is directly connected, Vlan100
```

Step 7

The access layer switches will be the QoS trust boundaries for the network. Data coming in on the switchports will either have the CoS trusted or altered based on the information received on the ports.

Configure Fast Ethernet access ports 15 to 24 to trust the CoS for recognized IP phones on the network. The CoS of a Cisco IP phone is 5 by default. Any port that has a device other than a Cisco phone will not trust the CoS that is advertised. This configuration is accomplished by using the Cisco auto QoS features offered on these switches. Using a single command at the interface

level, you can implement both trust boundaries and QoS features. Information obtained through CDP is used to determine when an IP phone is attached to the access port.

The following configuration also sets the voice VLAN on the interface with the **switchport voice vlan** *vlan-number* command.

Configure Fast Ethernet ports 15 through 24 on ALS1 and ALS2 using the **interface range** command:

```
ALS1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ALS1(config)# interface range fastethernet 0/15 – 24
ALS1(config-if-range)# switchport access vlan 100
ALS1(config-if-range)# switchport voice vlan 200
ALS1(config-if-range)# auto qos voip cisco-phone
ALS1(config-if-range)# end


ALS2# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ALS2(config)# interface range fastethernet 0/15 – 24
ALS2(config-if-range)# switchport access vlan 100
ALS2(config-if-range)# switchport voice vlan 200
ALS2(config-if-range)# auto qos voip cisco-phone
ALS2(config-if-range)# end
```

Step 8

Verify the auto QoS configuration at the access layer using the **show mls qos interface** *interface-type interface-number* and the **show run** commands.

```
ALS1# show mls qos int fa 0/15
FastEthernet0/15
trust state: not trusted
trust mode: trust cos
trust enabled flag: dis
COS override: dis
default COS: 0
DSCP Mutation Map: Default DSCP Mutation Map
Trust device: cisco-phone
qos mode: port-based


ALS1# show run interface fastethernet 0/15
interface FastEthernet0/15
 switchport access vlan 100
 switchport voice vlan 200
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
 spanning-tree portfast
```

8. What is the default CoS for a PC connected to these interfaces?

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Step 9

Configure the distribution layer switches to trust the CoS information in the Layer 2 frames being sent from the access layer. Because the trust boundary is at the access layer, frames being sent from this layer should be trusted into the distribution layer for optimal QoS.

The following are sample configurations for both DLS1 and DLS2:

```
DLS1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
DLS1(config)# mls qos
DLS1(config)# interface range fa0/7 - 12
DLS1(config-if-range)# auto qos voip trust
DLS1(config-if-range)# end
DLS1#

DLS2# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
DLS2(config)# mls qos
DLS2(config)# interface range fa0/7 - 12
DLS2(config-if-range)#  auto qos voip trust
DLS2(config-if-range)# end
DLS1#
```

Step 10

Verify auto QoS at the distribution layer on DLS1 and DLS2 using the **show auto qos interface** command.

```
DLS1# show auto qos interface
FastEthernet0/7
auto qos voip trust

FastEthernet0/8
auto qos voip trust

FastEthernet0/9
auto qos voip trust

FastEthernet0/10
auto qos voip trust

FastEthernet0/11
auto qos voip trust

FastEthernet0/12
auto qos voip trust
```

Use the **show mls qos interface fastethernet** *interface ID* command on DLS1 to verify QoS on the trunk interfaces:

```
DLS1# show mls qos interface fastethernet 0/7
FastEthernet0/7
trust state: trust cos
trust mode: trust cos
```

```
trust enabled flag: ena
COS override: dis
default COS: 0
DSCP Mutation Map: Default DSCP Mutation Map
Trust device: none
qos mode: port-based
```

Step 11

A camera needs to be moved from its current location in the network and connected to FastEthernet0/5 of ALS2.

Video traffic must have priority treatment within the network, because it has different requirements than voice traffic. Because the camera is not capable of setting its own CoS, assign a CoS of 3 to ensure that the video traffic is identified by other switches and routers within the network.

```
ALS1(config)# interface fastethernet 0/5
ALS1(config-if)# mls qos cos 3
```

Verify the configuration using the **show mls qos interface** command on ALS2.

```
ALS2# show mls qos interface fa0/5
FastEthernet0/5
trust state: not trusted
trust mode: not trusted
trust enabled flag: ena
COS override: dis
default COS: 3
DSCP Mutation Map: Default DSCP Mutation Map
Trust device: none
qos mode: port-based
```

9. Will other devices that are attached to this port get a CoS of 3? Explain.

Final Configurations

```
DLS1# show run
!
hostname DLS1
!
enable secret cisco
!
!
ip routing
!
mls qos map cos-dscp 0 8 16 26 32 46 48 56
mls qos srr-queue input bandwidth 90 10
mls qos srr-queue input threshold 1 8 16
mls qos srr-queue input threshold 2 34 66
mls qos srr-queue input buffers 67 33
mls qos srr-queue input cos-map queue 1 threshold 2  1
mls qos srr-queue input cos-map queue 1 threshold 3  0
mls qos srr-queue input cos-map queue 2 threshold 1  2
```

```
mls qos srr-queue input cos-map queue 2 threshold 2  4 6 7
mls qos srr-queue input cos-map queue 2 threshold 3  3 5
mls qos srr-queue input dscp-map queue 1 threshold 2  9 10 11 12 13 14 15
mls qos srr-queue input dscp-map queue 1 threshold 3  0 1 2 3 4 5 6 7
mls qos srr-queue input dscp-map queue 1 threshold 3  32
mls qos srr-queue input dscp-map queue 2 threshold 1  16 17 18 19 20 21 22 23
mls qos srr-queue input dscp-map queue 2 threshold 2  33 34 35 36 37 38 39 48
mls qos srr-queue input dscp-map queue 2 threshold 2  49 50 51 52 53 54 55 56
mls qos srr-queue input dscp-map queue 2 threshold 2  57 58 59 60 61 62 63
mls qos srr-queue input dscp-map queue 2 threshold 3  24 25 26 27 28 29 30 31
mls qos srr-queue input dscp-map queue 2 threshold 3  40 41 42 43 44 45 46 47
mls qos srr-queue output cos-map queue 1 threshold 3  5
mls qos srr-queue output cos-map queue 2 threshold 3  3 6 7
mls qos srr-queue output cos-map queue 3 threshold 3  2 4
mls qos srr-queue output cos-map queue 4 threshold 2  1
mls qos srr-queue output cos-map queue 4 threshold 3  0
mls qos srr-queue output dscp-map queue 1 threshold 3  40 41 42 43 44 45 46 47
mls qos srr-queue output dscp-map queue 2 threshold 3  24 25 26 27 28 29 30 31
mls qos srr-queue output dscp-map queue 2 threshold 3  48 49 50 51 52 53 54 55
mls qos srr-queue output dscp-map queue 2 threshold 3  56 57 58 59 60 61 62 63
mls qos srr-queue output dscp-map queue 3 threshold 3  16 17 18 19 20 21 22 23
mls qos srr-queue output dscp-map queue 3 threshold 3  32 33 34 35 36 37 38 39
mls qos srr-queue output dscp-map queue 4 threshold 1  8
mls qos srr-queue output dscp-map queue 4 threshold 2  9 10 11 12 13 14 15
mls qos srr-queue output dscp-map queue 4 threshold 3  0 1 2 3 4 5 6 7
mls qos queue-set output 1 threshold 1 138 138 92 138
mls qos queue-set output 1 threshold 2 138 138 92 400
mls qos queue-set output 1 threshold 3 36 77 100 318
mls qos queue-set output 1 threshold 4 20 50 67 400
mls qos queue-set output 2 threshold 1 149 149 100 149
mls qos queue-set output 2 threshold 2 118 118 100 235
mls qos queue-set output 2 threshold 3 41 68 100 272
mls qos queue-set output 2 threshold 4 42 72 100 242
mls qos queue-set output 1 buffers 10 10 26 54
mls qos queue-set output 2 buffers 16 6 17 61
mls qos



!
interface Port-channel1
 switchport trunk encapsulation dot1q
 switchport mode trunk
!
interface Port-channel2
 switchport trunk encapsulation dot1q
 switchport mode trunk
!
interface Port-channel3
 switchport trunk encapsulation dot1q
 switchport mode trunk
!
!
interface FastEthernet0/7
 switchport trunk encapsulation dot1q
 switchport mode trunk
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust cos
 auto qos voip trust
 channel-group 1 mode desirable
!
interface FastEthernet0/8
```

```
 switchport trunk encapsulation dot1q
 switchport mode trunk
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust cos
 auto qos voip trust
 channel-group 1 mode desirable
!
interface FastEthernet0/9
 switchport trunk encapsulation dot1q
 switchport mode trunk
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust cos
 auto qos voip trust
 channel-group 2 mode desirable
!
interface FastEthernet0/10
 switchport trunk encapsulation dot1q
 switchport mode trunk
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust cos
 auto qos voip trust
 channel-group 2 mode desirable
!
interface FastEthernet0/11
 switchport trunk encapsulation dot1q
 switchport mode trunk
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust cos
 auto qos voip trust
 channel-group 3 mode desirable
!
interface FastEthernet0/12
 switchport trunk encapsulation dot1q
 switchport mode trunk
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust cos
 auto qos voip trust
 channel-group 3 mode desirable
!
!
interface Vlan1
 ip address 172.16.1.3 255.255.255.0
 standby 1 ip 172.16.1.1
 standby 1 priority 150
 standby 1 preempt
 no shutdown
!
interface Vlan100
 ip address 172.16.100.3 255.255.255.0
 standby 1 ip 172.16.100.1
 standby 1 priority 150
 standby 1 preempt
 no shutdown
!
interface Vlan200
 ip address 172.16.200.3 255.255.255.0
 standby 1 ip 172.16.200.1
 standby 1 preempt
```

```
 no shutdown
!
!
line con 0
 password cisco
 login
line vty 0 4
 password cisco
 login
line vty 5 15
 password cisco
 login
!
end


DLS1# show run
!
hostname DLS2
!
enable secret cisco
!
!
mls qos map cos-dscp 0 8 16 26 32 46 48 56
mls qos srr-queue input bandwidth 90 10
mls qos srr-queue input threshold 1 8 16
mls qos srr-queue input threshold 2 34 66
mls qos srr-queue input buffers 67 33
mls qos srr-queue input cos-map queue 1 threshold 2  1
mls qos srr-queue input cos-map queue 1 threshold 3  0
mls qos srr-queue input cos-map queue 2 threshold 1  2
mls qos srr-queue input cos-map queue 2 threshold 2  4 6 7
mls qos srr-queue input cos-map queue 2 threshold 3  3 5
mls qos srr-queue input dscp-map queue 1 threshold 2  9 10 11 12 13 14 15
mls qos srr-queue input dscp-map queue 1 threshold 3  0 1 2 3 4 5 6 7
mls qos srr-queue input dscp-map queue 1 threshold 3  32
mls qos srr-queue input dscp-map queue 2 threshold 1  16 17 18 19 20 21 22 23
mls qos srr-queue input dscp-map queue 2 threshold 2  33 34 35 36 37 38 39 48
mls qos srr-queue input dscp-map queue 2 threshold 2  49 50 51 52 53 54 55 56
mls qos srr-queue input dscp-map queue 2 threshold 2  57 58 59 60 61 62 63
mls qos srr-queue input dscp-map queue 2 threshold 3  24 25 26 27 28 29 30 31
mls qos srr-queue input dscp-map queue 2 threshold 3  40 41 42 43 44 45 46 47
mls qos srr-queue output cos-map queue 1 threshold 3  5
mls qos srr-queue output cos-map queue 2 threshold 3  3 6 7
mls qos srr-queue output cos-map queue 3 threshold 3  2 4
mls qos srr-queue output cos-map queue 4 threshold 2  1
mls qos srr-queue output cos-map queue 4 threshold 3  0
mls qos srr-queue output dscp-map queue 1 threshold 3  40 41 42 43 44 45 46 47
mls qos srr-queue output dscp-map queue 2 threshold 3  24 25 26 27 28 29 30 31
mls qos srr-queue output dscp-map queue 2 threshold 3  48 49 50 51 52 53 54 55
mls qos srr-queue output dscp-map queue 2 threshold 3  56 57 58 59 60 61 62 63
mls qos srr-queue output dscp-map queue 3 threshold 3  16 17 18 19 20 21 22 23
mls qos srr-queue output dscp-map queue 3 threshold 3  32 33 34 35 36 37 38 39
mls qos srr-queue output dscp-map queue 4 threshold 1  8
mls qos srr-queue output dscp-map queue 4 threshold 2  9 10 11 12 13 14 15
mls qos srr-queue output dscp-map queue 4 threshold 3  0 1 2 3 4 5 6 7
mls qos queue-set output 1 threshold 1 138 138 92 138
mls qos queue-set output 1 threshold 2 138 138 92 400
mls qos queue-set output 1 threshold 3 36 77 100 318
mls qos queue-set output 1 threshold 4 20 50 67 400
mls qos queue-set output 2 threshold 1 149 149 100 149
mls qos queue-set output 2 threshold 2 118 118 100 235
mls qos queue-set output 2 threshold 3 41 68 100 272
```

```
mls qos queue-set output 2 threshold 4 42 72 100 242
mls qos queue-set output 1 buffers 10 10 26 54
mls qos queue-set output 2 buffers 16 6 17 61
mls qos
!
!
!
interface Port-channel1
 switchport trunk encapsulation dot1q
 switchport mode trunk
!
interface Port-channel2
 switchport trunk encapsulation dot1q
 switchport mode trunk
!
interface Port-channel3
 switchport trunk encapsulation dot1q
 switchport mode trunk
!
!
interface FastEthernet0/7
 switchport trunk encapsulation dot1q
 switchport mode trunk
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust cos
 auto qos voip trust
 channel-group 1 mode desirable
!
interface FastEthernet0/8
 switchport trunk encapsulation dot1q
 switchport mode trunk
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust cos
 auto qos voip trust
 channel-group 1 mode desirable
!
interface FastEthernet0/9
 switchport trunk encapsulation dot1q
 switchport mode trunk
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust cos
 auto qos voip trust
 channel-group 2 mode desirable
!
interface FastEthernet0/10
 switchport trunk encapsulation dot1q
 switchport mode trunk
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust cos
 auto qos voip trust
 channel-group 2 mode desirable
!
interface FastEthernet0/11
 switchport trunk encapsulation dot1q
 switchport mode trunk
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust cos
 auto qos voip trust
```

```
 channel-group 3 mode desirable
!
interface FastEthernet0/12
 switchport trunk encapsulation dot1q
 switchport mode trunk
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust cos
 auto qos voip trust
 channel-group 3 mode desirable
!
!
interface Vlan1
 ip address 172.16.1.4 255.255.255.0
 standby 1 ip 172.16.1.1
 standby 1 preempt
 no shutdown
!
interface Vlan100
 ip address 172.16.100.4 255.255.255.0
 standby 1 ip 172.16.100.1
 standby 1 preempt
 no shutdown
!
interface Vlan200
 ip address 172.16.200.4 255.255.255.0
 standby 1 ip 172.16.200.1
 standby 1 priority 150
 standby 1 preempt
 no shutdown
!
!
line con 0
 password cisco
 login
line vty 0 4
 password cisco
 login
line vty 5 15
 password cisco
 login
!
end

ALS1# show run
!
hostname ALS1
!
enable secret cisco
!
mls qos map cos-dscp 0 8 16 26 32 46 48 56
mls qos srr-queue input bandwidth 90 10
mls qos srr-queue input threshold 1 8 16
mls qos srr-queue input threshold 2 34 66
mls qos srr-queue input buffers 67 33
mls qos srr-queue input cos-map queue 1 threshold 2  1
mls qos srr-queue input cos-map queue 1 threshold 3  0
mls qos srr-queue input cos-map queue 2 threshold 1  2
mls qos srr-queue input cos-map queue 2 threshold 2  4 6 7
mls qos srr-queue input cos-map queue 2 threshold 3  3 5
mls qos srr-queue input dscp-map queue 1 threshold 2  9 10 11 12 13 14 15
mls qos srr-queue input dscp-map queue 1 threshold 3  0 1 2 3 4 5 6 7
mls qos srr-queue input dscp-map queue 1 threshold 3  32
```

```
mls qos srr-queue input dscp-map queue 2 threshold 1  16 17 18 19 20 21 22 23
mls qos srr-queue input dscp-map queue 2 threshold 2  33 34 35 36 37 38 39 48
mls qos srr-queue input dscp-map queue 2 threshold 2  49 50 51 52 53 54 55 56
mls qos srr-queue input dscp-map queue 2 threshold 2  57 58 59 60 61 62 63
mls qos srr-queue input dscp-map queue 2 threshold 3  24 25 26 27 28 29 30 31
mls qos srr-queue input dscp-map queue 2 threshold 3  40 41 42 43 44 45 46 47
mls qos srr-queue output cos-map queue 1 threshold 3  5
mls qos srr-queue output cos-map queue 2 threshold 3  3 6 7
mls qos srr-queue output cos-map queue 3 threshold 3  2 4
mls qos srr-queue output cos-map queue 4 threshold 2  1
mls qos srr-queue output cos-map queue 4 threshold 3  0
mls qos srr-queue output dscp-map queue 1 threshold 3  40 41 42 43 44 45 46 47
mls qos srr-queue output dscp-map queue 2 threshold 3  24 25 26 27 28 29 30 31
mls qos srr-queue output dscp-map queue 2 threshold 3  48 49 50 51 52 53 54 55
mls qos srr-queue output dscp-map queue 2 threshold 3  56 57 58 59 60 61 62 63
mls qos srr-queue output dscp-map queue 3 threshold 3  16 17 18 19 20 21 22 23
mls qos srr-queue output dscp-map queue 3 threshold 3  32 33 34 35 36 37 38 39
mls qos srr-queue output dscp-map queue 4 threshold 1  8
mls qos srr-queue output dscp-map queue 4 threshold 2  9 10 11 12 13 14 15
mls qos srr-queue output dscp-map queue 4 threshold 3  0 1 2 3 4 5 6 7
mls qos queue-set output 1 threshold 1 138 138 92 138
mls qos queue-set output 1 threshold 2 138 138 92 400
mls qos queue-set output 1 threshold 3 36 77 100 318
mls qos queue-set output 1 threshold 4 20 50 67 400
mls qos queue-set output 2 threshold 1 149 149 100 149
mls qos queue-set output 2 threshold 2 118 118 100 235
mls qos queue-set output 2 threshold 3 41 68 100 272
mls qos queue-set output 2 threshold 4 42 72 100 242
mls qos queue-set output 1 buffers 10 10 26 54
mls qos queue-set output 2 buffers 16 6 17 61
mls qos
!
!
interface Port-channel1
 switchport mode trunk
!
interface Port-channel2
 switchport mode trunk
!
interface Port-channel3
 switchport mode trunk
!
!
interface FastEthernet0/7
 switchport mode trunk
 channel-group 1 mode desirable
!
interface FastEthernet0/8
 switchport mode trunk
 channel-group 1 mode desirable
!
interface FastEthernet0/9
 switchport mode trunk
 channel-group 2 mode desirable
!
interface FastEthernet0/10
 switchport mode trunk
 channel-group 2 mode desirable
!
interface FastEthernet0/11
 switchport mode trunk
 channel-group 3 mode desirable
!
```

```
interface FastEthernet0/12
 switchport mode trunk
 channel-group 3 mode desirable
!
!
interface FastEthernet0/15
 switchport access vlan 100
 switchport voice vlan 200
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
 spanning-tree portfast
!
interface FastEthernet0/16
 switchport access vlan 100
 switchport voice vlan 200
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
 spanning-tree portfast
!
interface FastEthernet0/17
 switchport access vlan 100
 switchport voice vlan 200
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
 spanning-tree portfast
!
interface FastEthernet0/18
 switchport access vlan 100
 switchport voice vlan 200
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
 spanning-tree portfast
!
interface FastEthernet0/19
 switchport access vlan 100
 switchport voice vlan 200
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
 spanning-tree portfast
!
interface FastEthernet0/20
 switchport access vlan 100
 switchport voice vlan 200
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
```

```
 spanning-tree portfast
!
interface FastEthernet0/21
 switchport access vlan 100
 switchport voice vlan 200
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
 spanning-tree portfast
!
interface FastEthernet0/22
 switchport access vlan 100
 switchport voice vlan 200
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
 spanning-tree portfast
!
interface FastEthernet0/23
 switchport access vlan 100
 switchport voice vlan 200
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
 spanning-tree portfast
!
interface FastEthernet0/24
 switchport access vlan 100
 switchport voice vlan 200
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
 spanning-tree portfast
!
!
interface Vlan1
 ip address 172.16.1.101 255.255.255.0
 no shutdown
!
ip default-gateway 172.16.1.1
!
!
line con 0
 password cisco
 login
line vty 0 4
 password cisco
 login
line vty 5 15
 password cisco
 login
!
end

ALS2# show run
```

```
!
hostname ALS2
!
enable secret cisco
!
!
mls qos map cos-dscp 0 8 16 26 32 46 48 56
mls qos srr-queue input bandwidth 90 10
mls qos srr-queue input threshold 1 8 16
mls qos srr-queue input threshold 2 34 66
mls qos srr-queue input buffers 67 33
mls qos srr-queue input cos-map queue 1 threshold 2  1
mls qos srr-queue input cos-map queue 1 threshold 3  0
mls qos srr-queue input cos-map queue 2 threshold 1  2
mls qos srr-queue input cos-map queue 2 threshold 2  4 6 7
mls qos srr-queue input cos-map queue 2 threshold 3  3 5
mls qos srr-queue input dscp-map queue 1 threshold 2  9 10 11 12 13 14 15
mls qos srr-queue input dscp-map queue 1 threshold 3  0 1 2 3 4 5 6 7
mls qos srr-queue input dscp-map queue 1 threshold 3  32
mls qos srr-queue input dscp-map queue 2 threshold 1  16 17 18 19 20 21 22 23
mls qos srr-queue input dscp-map queue 2 threshold 2  33 34 35 36 37 38 39 48
mls qos srr-queue input dscp-map queue 2 threshold 2  49 50 51 52 53 54 55 56
mls qos srr-queue input dscp-map queue 2 threshold 2  57 58 59 60 61 62 63
mls qos srr-queue input dscp-map queue 2 threshold 3  24 25 26 27 28 29 30 31
mls qos srr-queue input dscp-map queue 2 threshold 3  40 41 42 43 44 45 46 47
mls qos srr-queue output cos-map queue 1 threshold 3  5
mls qos srr-queue output cos-map queue 2 threshold 3  3 6 7
mls qos srr-queue output cos-map queue 3 threshold 3  2 4
mls qos srr-queue output cos-map queue 4 threshold 2  1
mls qos srr-queue output cos-map queue 4 threshold 3  0
mls qos srr-queue output dscp-map queue 1 threshold 3  40 41 42 43 44 45 46 47
mls qos srr-queue output dscp-map queue 2 threshold 3  24 25 26 27 28 29 30 31
mls qos srr-queue output dscp-map queue 2 threshold 3  48 49 50 51 52 53 54 55
mls qos srr-queue output dscp-map queue 2 threshold 3  56 57 58 59 60 61 62 63
mls qos srr-queue output dscp-map queue 3 threshold 3  16 17 18 19 20 21 22 23
mls qos srr-queue output dscp-map queue 3 threshold 3  32 33 34 35 36 37 38 39
mls qos srr-queue output dscp-map queue 4 threshold 1  8
mls qos srr-queue output dscp-map queue 4 threshold 2  9 10 11 12 13 14 15
mls qos srr-queue output dscp-map queue 4 threshold 3  0 1 2 3 4 5 6 7
mls qos queue-set output 1 threshold 1 138 138 92 138
mls qos queue-set output 1 threshold 2 138 138 92 400
mls qos queue-set output 1 threshold 3 36 77 100 318
mls qos queue-set output 1 threshold 4 20 50 67 400
mls qos queue-set output 2 threshold 1 149 149 100 149
mls qos queue-set output 2 threshold 2 118 118 100 235
mls qos queue-set output 2 threshold 3 41 68 100 272
mls qos queue-set output 2 threshold 4 42 72 100 242
mls qos queue-set output 1 buffers 10 10 26 54
mls qos queue-set output 2 buffers 16 6 17 61
mls qos
!
!
interface Port-channel1
 switchport mode trunk
!
interface Port-channel2
 switchport mode trunk
!
interface Port-channel3
 switchport mode trunk
!
!
interface FastEthernet0/5
```

```
 mls qos cos 3
!
!
interface FastEthernet0/7
 switchport mode trunk
 channel-group 1 mode desirable
!
interface FastEthernet0/8
 switchport mode trunk
 channel-group 1 mode desirable
!
interface FastEthernet0/9
 switchport mode trunk
 channel-group 2 mode desirable
!
interface FastEthernet0/10
 switchport mode trunk
 channel-group 2 mode desirable
!
interface FastEthernet0/11
 switchport mode trunk
 channel-group 3 mode desirable
!
interface FastEthernet0/12
 switchport mode trunk
 channel-group 3 mode desirable
!
!
interface FastEthernet0/15
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
!
interface FastEthernet0/16
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
!
interface FastEthernet0/17
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
!
interface FastEthernet0/18
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
!
interface FastEthernet0/19
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
!
```

```
interface FastEthernet0/20
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
!
interface FastEthernet0/21
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
!
interface FastEthernet0/22
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
!
interface FastEthernet0/23
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
!
interface FastEthernet0/24
 srr-queue bandwidth share 10 10 60 20
 srr-queue bandwidth shape  10  0  0  0
 mls qos trust device cisco-phone
 mls qos trust cos
 auto qos voip cisco-phone
!
!
interface Vlan1
 ip address 172.16.1.102 255.255.255.0
 no shutdown
!
ip default-gateway 172.16.1.1
!
!
line con 0
 password cisco
 login
line vty 0 4
 password cisco
 login
 line vty 5 15
 password cisco
 login
!
end
```