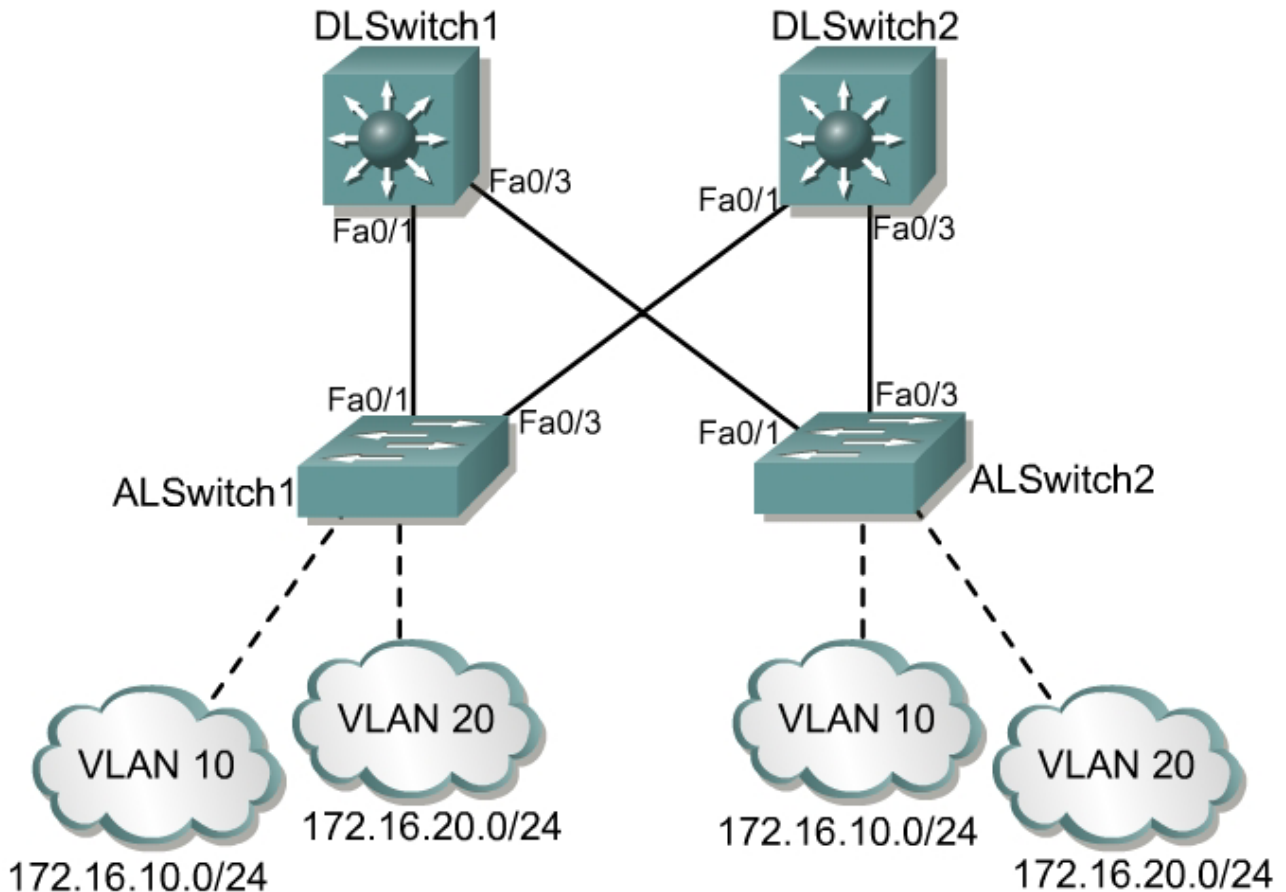


Lab 3.2.5.4 Per-VLAN Spanning-Tree Load Balancing



Objective

The purpose of this lab is to modify the default behavior of spanning tree for VLAN load balancing using Cisco IOS commands.

Scenario

Two distribution layers and two access layer switches have been installed. The network administrator wants to ensure that the access layer switches do not become the root bridge for spanning-tree. The distribution layer switch will serve this function. The network administrator also wants to provide per VLAN load balancing. DLSwitch1 will need to become the root bridge for VLAN 10 and DLSwitch2 will need to become the root bridge for VLAN 20.

The network design is as follows.

Catalyst Type	Switch	VTP Domain	VTP Mode
3550	DLSwitch1	CORP	Server
3550	DLSwitch2	CORP	Client
2950	ALSwitch1	CORP	Client
2950	ALSwitch2	CORP	Client

The VLAN configuration information is as follows.

VLAN ID	VLAN Name	VLAN Subnet	DLSwitch1	DLSwitch2	ALSwitch1	ALSwitch2
1	Native	172.16.1.0	Fa0/1-10	Fa0/1-10	Fa0/1-4 Fa0/13 – 24	Fa0/1-4 Fa0/13 - 24
10	Accounting	172.16.10.0	Fa0/11-20	Fa0/11-20	Fa0/5-8	Fa0/5-8
20	Marketing	172.16.20.0	Fa0/21-24	Fa0/21-24	Fa0/9-12	Fa0/9-12
Trunk		802.1Q	802.1Q	802.1Q	802.1Q	802.1Q

Step 1

Do not cable the lab until all switch configurations and **vlan.dat** files have been erased.

If the VLAN database exists, delete it on all switches and clear the configuration.

```
switch#show flash
Directory of flash:/

   2  -rwx           0   Jan 01 1970 00:01:22  env_vars
   3  -rwx          342   Jan 01 1970 00:01:22  system_env_vars
   4  -rwx          720   Mar 01 1993 00:00:47  vlan.dat
   9  drwx          192   Mar 01 1993 00:03:39  c3550-i5q3l2-mz.121-8.EA1c

Switch#delete flash:vlan.dat
Delete filename [vlan.dat]?
Delete flash:vlan.dat? [confirm]
Switch#
Switch#erase startup-config
Erasing the nvram filesystem will remove all files! Continue? [confirm]
Switch#reload

System configuration has been modified. Save? [yes/no]:n
Proceed with reload? [confirm]
```

Cable the lab according to the diagram.

Configure the hostname, passwords, and Telnet access on all the switches. Configure the interface VLAN 1 IP address on each switch.

Observe the default behavior of Spanning-Tree (STP) using the **show spanning-tree** command on all switches.

```
Switch(config)#hostname DLSwitch1
DLSwitch1(config)#enable secret cisco
DLSwitch1(config)#line console 0
DLSwitch1(config-line)#password cisco
DLSwitch1(config-line)#login
DLSwitch1(config-line)#line vty 0 15
DLSwitch1(config-line)#password cisco
DLSwitch1(config-line)#interface vlan 1
DLSwitch1(config-if)#ip address 172.16.1.1 255.255.255.0
DLSwitch1(config-if)#no shutdown
DLSwitch1(config-if)#^Z
```

```
Switch(config)#hostname DLSwitch2
DLSwitch2(config)#enable secret cisco
DLSwitch2(config)#line console 0
DLSwitch2(config-line)#password cisco
DLSwitch2(config-line)#login
DLSwitch2(config-line)#line vty 0 15
DLSwitch2(config-line)#password cisco
DLSwitch2(config-line)#interface vlan 1
DLSwitch2(config-if)#ip address 172.16.1.2 255.255.255.0
DLSwitch2(config-if)#no shutdown
DLSwitch2(config-if)#^Z
```

```
Switch(config)#hostname ALSwitch1
ALSwitch1(config)#enable secret cisco
ALSwitch1(config)#line console 0
ALSwitch1(config-line)#password cisco
ALSwitch1(config-line)#login
ALSwitch1(config-line)#line vty 0 15
ALSwitch1(config-line)#password cisco
ALSwitch1(config-line)#login
ALSwitch1(config-line)#interface vlan 1
ALSwitch1(config-if)#ip address 172.16.1.3 255.255.255.0
ALSwitch1(config-if)#no shutdown
ALSwitch1(config-if)#^Z
```

```
Switch(config)#hostname ALSwitch2
ALSwitch2(config)#enable secret cisco
ALSwitch2(config)#line console 0
ALSwitch2(config-line)#password cisco
ALSwitch2(config-line)#login
ALSwitch2(config-line)#line vty 0 15
ALSwitch2(config-line)#password cisco
ALSwitch2(config-line)#login
ALSwitch2(config-line)#interface vlan 1
ALSwitch2(config-if)#ip address 172.16.1.4 255.255.255.0
ALSwitch2(config-if)#no shutdown
ALSwitch2(config-if)#^Z
```

```
DLSwitch1#show spanning-tree
```

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
             Address     000b.be34.1680
             Cost        38
```

```

Port 3 (FastEthernet0/3)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 000b.be4f.bc00
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 300

Interface Port ID Designated Port ID
Name Prio.Nbr Cost Sts Cost Bridge ID Prio.Nbr
-----
Fa0/1 128.1 19 BLK 19 32769 000b.bec6.b780 128.1
Fa0/3 128.3 19 FWD 19 32769 000b.bec6.5cc0 128.1

```

DLSwitch2#show spanning-tree

```

VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 32769
Address 000b.be34.1680
This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 000b.be34.1680
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 300

Interface Port ID Designated Port ID
Name Prio.Nbr Cost Sts Cost Bridge ID Prio.Nbr
-----
Fa0/1 128.1 19 FWD 0 32769 000b.be34.1680 128.1
Fa0/3 128.3 19 FWD 0 32769 000b.be34.1680 128.3

```

ALSwitch1#show spanning-tree

```

VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 32769
Address 000b.be34.1680
Cost 19
Port 3 (FastEthernet0/3)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 000b.bec6.b780
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 300

Interface Port ID Designated Port ID
Name Prio.Nbr Cost Sts Cost Bridge ID Prio.Nbr
-----
Fa0/1 128.1 19 FWD 19 32769 000b.bec6.b780 128.1
Fa0/3 128.3 19 FWD 0 32769 000b.be34.1680 128.1

```

ALSwitch2#show spanning-tree

```

VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 32769
Address 000b.be34.1680
Cost 19
Port 3 (FastEthernet0/3)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 000b.bec6.5cc0
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

```

Aging Time 300

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19	FWD	19 32769 000b.bec6.5cc0	128.1
Fa0/3	128.3	19	FWD	0 32769 000b.be34.1680	128.3

1. Which switch became the root bridge and why?
2. What command was used to view the root bridge?

Step 2

Configure the trunking interfaces to create a trunk link between the switches. Set the port to trunking with 802.1q encapsulation on DLSwitch1 and DLSwitch2.

Note	If an error is received because the port is set to auto encapsulation, enter the switchport mode trunk command after the switchport trunk encapsulation dot1q command.
-------------	--

```
DLSwitch1(config)#interface range fastethernet 0/1 , fastethernet 0/3
DLSwitch1(config-if-range)#switchport trunk encapsulation dot1q
DLSwitch1(config-if-range)#switchport mode trunk
DLSwitch1(config-if-range)#^Z

DLSwitch2(config)#interface range fastethernet 0/1 , fastethernet 0/3
DLSwitch2(config-if-range)#switchport trunk encapsulation dot1q
DLSwitch2(config-if-range)#switchport mode trunk
DLSwitch2(config-if-range)#^Z
```

The 2950 switches do not need the encapsulation configured. These switches default to 802.1q. Some IOS versions do not offer any other options. Console into each access level switch and configure trunking.

```
ALSwitch1(config)#interface range fastethernet 0/1 , fastethernet 0/3
ALSwitch1(config-if-range)#switchport mode trunk
ALSwitch1(config-if-range)#^Z

ALSwitch2(config)#interface range fastethernet 0/1 , fastethernet 0/3
ALSwitch2(config-if-range)#switchport mode trunk
ALSwitch2(config-if-range)#^Z
```

Step 3

Console into DLSwitch1 and configure the vtp domain **CORP**, server mode, and the appropriate VLANs and names as shown below.

```
DLSwitch1#vlan database
DLSwitch1(vlan)#vtp domain CORP
DLSwitch1(vlan)#vtp server
DLSwitch1(vlan)#vlan 10 name Accounting
DLSwitch1(vlan)#vlan 20 name Marketing
DLSwitch1(vlan)#exit
```

Verify the trunk configuration with the **show vtp status** and **show vtp counters** command.

```
DLSwitch1#show vtp status
VTP Version                : 2
Configuration Revision      : 1
Maximum VLANs supported locally : 1005
Number of existing VLANs    : 7
VTP Operating Mode          : Server
VTP Domain Name             : CORP
VTP Pruning Mode            : Disabled
VTP V2 Mode                 : Disabled
VTP Traps Generation        : Disabled
MD5 digest                  : 0xB4 0x57 0x1A 0x95 0x99 0x85 0x6D 0x49
Configuration last modified by 0.0.0.0 at 3-1-93 00:13:27
Local updater ID is 0.0.0.0 (no valid interface found)
```

```
DLSwitch1#show vtp counters
VTP statistics:
Summary advertisements received : 32
Subset advertisements received  : 2
Request advertisements received  : 3
Summary advertisements transmitted : 44
Subset advertisements transmitted : 3
Request advertisements transmitted : 0
Number of config revision errors  : 0
Number of config digest errors    : 0
Number of V1 summary errors       : 0
```

VTP pruning statistics:

Trunk	Join Transmitted	Join Received	Summary advts received from non-pruning-capable device
Fa0/1	0	0	0
Fa0/3	0	1	0

Assign ports to the respective VLANs in DLSwitch1 as shown below. The **interface range** command can be used to configure several interfaces at the same time.

```
DLSwitch1(config)#interface range fastethernet 0/11 - 20
DLSwitch1(config-if-range)#switchport mode access
DLSwitch1(config-if-range)#switchport access vlan 10
DLSwitch1(config-if-range)#interface range fastethernet 0/21 - 24
DLSwitch1(config-if-range)#switchport mode access
DLSwitch1(config-if-range)#switchport access vlan 20
```

Configure DLSwitch2 as a VTP client and assign ports to the respective VLANs as shown below. The **interface range** command can be used to configure several interfaces at the same time.

```
DLSwitch2#vlan database
```

```

DLSwitch2(vlan)#vtp client
DLSwitch2(vlan)#exit

DLSwitch2#config terminal
DLSwitch2(config)#interface range fastethernet 0/11 - 20
DLSwitch2(config-if-range)#switchport mode access
DLSwitch2(config-if-range)#switchport access vlan 10
DLSwitch2(config-if-range)#interface range fastethernet 0/21 - 24
DLSwitch2(config-if-range)#switchport mode access
DLSwitch2(config-if-range)#switchport access vlan 20
DLSwitch2(config-if-range)^Z

```

Step 4

Configure ALSwitch1 and ALSwitch2 as VTP clients and assign ports to the respective VLANs in each switch as shown below. The **interface range** command can be used to configure several interfaces at the same time.

```

ALSwitch1#vlan database
ALSwitch1(vlan)#vtp client
ALSwitch1(vlan)#exit

ALSwitch1#config terminal
ALSwitch1(config)#interface range fastethernet 0/5 - 8
ALSwitch1(config-if-range)#switchport mode access
ALSwitch1(config-if-range)#switchport access vlan 10
ALSwitch1(config-if-range)#interface range fastethernet 0/9 - 12
ALSwitch1(config-if-range)#switchport mode access
ALSwitch1(config-if-range)#switchport access vlan 20
ALSwitch1(config-if-range)^Z

ALSwitch2#vlan database
ALSwitch2(vlan)#vtp client
ALSwitch2(vlan)#exit

ALSwitch2#config terminal
ALSwitch2(config)#interface range fastethernet 0/5 - 8
ALSwitch2(config-if-range)#switchport mode access
ALSwitch2(config-if-range)#switchport access vlan 10
ALSwitch2(config-if-range)#interface range fastethernet 0/9 - 12
ALSwitch2(config-if-range)#switchport mode access
ALSwitch2(config-if-range)#switchport access vlan 20
ALSwitch2(config-if-range)^Z

```

Console into each switch and verify the VTP and VLAN configurations with the **show vtp status** and **show vlan** commands.

```

DLSwitch1#show vtp status

VTP Version                : 2
Configuration Revision      : 1
Maximum VLANs supported locally : 1005
Number of existing VLANs    : 7
VTP Operating Mode          : Server
VTP Domain Name             : CORP
VTP Pruning Mode            : Disabled
VTP V2 Mode                 : Disabled
VTP Traps Generation        : Disabled
MD5 digest                  : 0x78 0x22 0xAC 0x9E 0xD0 0x20 0x93 0x02
Configuration last modified by 172.16.1.1 at 3-1-93 02:00:00
Local updater ID is 172.16.1.1 on interface V11 (lowest numbered VLAN interface found)

```

DLSwitch1#show vlan

VLAN	Name	Status	Ports
1	default	active	Fa0/2, Fa0/4, Fa0/5, Fa0/6 Fa0/7, Fa0/8, Fa0/9, Fa0/10 Gi0/1, Gi0/2
10	Accounting	active	Fa0/11, Fa0/12, Fa0/13, Fa0/14 Fa0/15, Fa0/16, Fa0/17, Fa0/18 Fa0/19, Fa0/20
20	Marketing	active	Fa0/21, Fa0/22, Fa0/23, Fa0/24
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0
20	enet	100020	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	-	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

Remote SPAN VLANs

Primary	Secondary	Type	Ports
---------	-----------	------	-------

DLSwitch2#show vtp status

```

VTP Version                : 2
Configuration Revision      : 1
Maximum VLANs supported locally : 1005
Number of existing VLANs    : 7
VTP Operating Mode          : Client
VTP Domain Name             : CORP
VTP Pruning Mode            : Disabled
VTP V2 Mode                 : Disabled
VTP Traps Generation        : Disabled
MD5 digest                  : 0x78 0x22 0xAC 0x9E 0xD0 0x20 0x93 0x02
Configuration last modified by 172.16.1.1 at 3-1-93 02:00:00
DLSwitch2#show vlan

```

VLAN	Name	Status	Ports
1	default	active	Fa0/2, Fa0/4, Fa0/5, Fa0/6 Fa0/7, Fa0/8, Fa0/9, Fa0/10 Gi0/1, Gi0/2
10	Accounting	active	Fa0/11, Fa0/12, Fa0/13, Fa0/14 Fa0/15, Fa0/16, Fa0/17, Fa0/18 Fa0/19, Fa0/20
20	Marketing	active	Fa0/21, Fa0/22, Fa0/23, Fa0/24
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0
20	enet	100020	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	srp	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

Remote SPAN VLANs

Primary	Secondary	Type	Ports
---------	-----------	------	-------

ALSwitch1#show vtp status

```

VTP Version                : 2
Configuration Revision      : 1
Maximum VLANs supported locally : 250
Number of existing VLANs    : 7
VTP Operating Mode          : Client
VTP Domain Name             : CORP
VTP Pruning Mode            : Disabled
VTP V2 Mode                  : Disabled
VTP Traps Generation        : Disabled
MD5 digest                   : 0x78 0x22 0xAC 0x9E 0xD0 0x20 0x93 0x02
Configuration last modified by 172.16.1.1 at 3-1-93 02:00:00

```

ALSwitch1#show vlan

VLAN	Name	Status	Ports
1	default	active	Fa0/2, Fa0/4, Fa0/13, Fa0/14 Fa0/15, Fa0/16, Fa0/17, Fa0/18 Fa0/19, Fa0/20, Fa0/21, Fa0/22 Fa0/23, Fa0/24, Gi0/1, Gi0/2
10	Accounting	active	Fa0/5, Fa0/6, Fa0/7, Fa0/8
20	Marketing	active	Fa0/9, Fa0/10, Fa0/11, Fa0/12
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0
20	enet	100020	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	srb	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

Remote SPAN VLANs

Primary	Secondary	Type	Ports
---------	-----------	------	-------

ALSwitch2#show vtp status

```

VTP Version                : 2
Configuration Revision      : 1
Maximum VLANs supported locally : 250
Number of existing VLANs    : 7
VTP Operating Mode          : Client
VTP Domain Name             : CORP
VTP Pruning Mode            : Disabled
VTP V2 Mode                  : Disabled
VTP Traps Generation        : Disabled
MD5 digest                   : 0x78 0x22 0xAC 0x9E 0xD0 0x20 0x93 0x02

```

ALSwitch2#show vlan

VLAN	Name	Status	Ports
1	default	active	Fa0/2, Fa0/4, Fa0/13, Fa0/14 Fa0/15, Fa0/16, Fa0/17, Fa0/18 Fa0/19, Fa0/20, Fa0/21, Fa0/22 Fa0/23, Fa0/24, Gi0/1, Gi0/2
10	Accounting	active	Fa0/5, Fa0/6, Fa0/7, Fa0/8
20	Marketing	active	Fa0/9, Fa0/10, Fa0/11, Fa0/12
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0
20	enet	100020	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	srb	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

Remote SPAN VLANs

Primary	Secondary	Type	Ports
---------	-----------	------	-------

Step 5

Verify the default behavior of STP. Use the **show spanning-tree** command on all the switches.

DLSwitch1#show spanning-tree

VLAN0001

Spanning tree enabled protocol ieee
 Root ID Priority 32769
 Address 000b.be34.1680
 Cost 38
 Port 3 (FastEthernet0/3)
 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
 Address 000b.be4f.bc00
 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
 Aging Time 300

Interface Name	Port ID Prio.Nbr	Cost Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19 BLK	19 32769 000b.bec6.b780	128.1
Fa0/3	128.3	19 FWD	19 32769 000b.bec6.5cc0	128.1

VLAN0010

Spanning tree enabled protocol ieee
 Root ID Priority 32778
 Address 000b.be34.1680
 Cost 38
 Port 3 (FastEthernet0/3)
 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority 32778 (priority 32768 sys-id-ext 10)
 Address 000b.be4f.bc00
 Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
 Aging Time 300

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19	BLK	19 32778 000b.bec6.b780	128.1
Fa0/3	128.3	19	FWD	19 32778 000b.bec6.5cc0	128.1

VLAN0020

```

Spanning tree enabled protocol ieee
Root ID    Priority    32788
           Address    000b.be34.1680
           Cost        38
           Port        3 (FastEthernet0/3)
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID  Priority    32788 (priority 32768 sys-id-ext 20)
           Address    000b.be4f.bc00
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
           Aging Time  300

```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19	BLK	19 32788 000b.bec6.b780	128.1
Fa0/3	128.3	19	FWD	19 32788 000b.bec6.5cc0	128.1

DLSwitch2#show spanning-tree

VLAN0001

```

Spanning tree enabled protocol ieee
Root ID    Priority    32769
           Address    000b.be34.1680
           This bridge is the root
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
           Address    000b.be34.1680
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
           Aging Time  300

```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19	FWD	0 32769 000b.be34.1680	128.1
Fa0/3	128.3	19	FWD	0 32769 000b.be34.1680	128.3

VLAN0010

```

Spanning tree enabled protocol ieee
Root ID    Priority    32778
           Address    000b.be34.1680
           This bridge is the root
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID  Priority    32778 (priority 32768 sys-id-ext 10)
           Address    000b.be34.1680
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
           Aging Time  300

```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19	FWD	0 32778 000b.be34.1680	128.1
Fa0/3	128.3	19	FWD	0 32778 000b.be34.1680	128.3

VLAN0020

```

Spanning tree enabled protocol ieee
Root ID    Priority    32788
           Address    000b.be34.1680
           This bridge is the root
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

```

```

Bridge ID Priority      32788 (priority 32768 sys-id-ext 20)
Address      000b.be34.1680
Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
Aging Time   300

```

Interface Name	Port ID Prio.Nbr	Cost Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19 FWD	0 32788 000b.be34.1680	128.1
Fa0/3	128.3	19 FWD	0 32788 000b.be34.1680	128.3

ALSwitch1#show spanning-tree

VLAN0001

```

Spanning tree enabled protocol ieee
Root ID Priority      32769
Address      000b.be34.1680
Cost         19
Port         3 (FastEthernet0/3)
Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

```

```

Bridge ID Priority      32769 (priority 32768 sys-id-ext 1)
Address      000b.bec6.b780
Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
Aging Time   300

```

Interface Name	Port ID Prio.Nbr	Cost Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19 FWD	19 32769 000b.bec6.b780	128.1
Fa0/3	128.3	19 FWD	0 32769 000b.be34.1680	128.1

VLAN0010

```

Spanning tree enabled protocol ieee
Root ID Priority      32778
Address      000b.be34.1680
Cost         19
Port         3 (FastEthernet0/3)
Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

```

```

Bridge ID Priority      32778 (priority 32768 sys-id-ext 10)
Address      000b.bec6.b780
Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
Aging Time   300

```

Interface Name	Port ID Prio.Nbr	Cost Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19 FWD	19 32778 000b.bec6.b780	128.1
Fa0/3	128.3	19 FWD	0 32778 000b.be34.1680	128.1

VLAN0020

```

Spanning tree enabled protocol ieee
Root ID Priority      32788
Address      000b.be34.1680
Cost         19
Port         3 (FastEthernet0/3)
Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

```

```

Bridge ID Priority      32788 (priority 32768 sys-id-ext 20)
Address      000b.bec6.b780
Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
Aging Time   300

```

Interface Name	Port ID Prio.Nbr	Cost Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19 FWD	19 32788 000b.bec6.b780	128.1
Fa0/3	128.3	19 FWD	0 32788 000b.be34.1680	128.1

ALSwitch2#show spanning-tree

VLAN0001

```

Spanning tree enabled protocol ieee
Root ID    Priority    32769
           Address    000b.be34.1680
           Cost       19
           Port       3 (FastEthernet0/3)
           Hello Time 2 sec   Max Age 20 sec   Forward Delay 15 sec

Bridge ID   Priority    32769 (priority 32768 sys-id-ext 1)
           Address    000b.bec6.5cc0
           Hello Time 2 sec   Max Age 20 sec   Forward Delay 15 sec
           Aging Time 300

```

Interface Name	Port ID Prio.Nbr	Cost Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19 FWD	19 32769 000b.bec6.5cc0	128.1
Fa0/3	128.3	19 FWD	0 32769 000b.be34.1680	128.3

VLAN0010

```

Spanning tree enabled protocol ieee
Root ID    Priority    32778
           Address    000b.be34.1680
           Cost       19
           Port       3 (FastEthernet0/3)
           Hello Time 2 sec   Max Age 20 sec   Forward Delay 15 sec

Bridge ID   Priority    32778 (priority 32768 sys-id-ext 10)
           Address    000b.bec6.5cc0
           Hello Time 2 sec   Max Age 20 sec   Forward Delay 15 sec
           Aging Time 300

```

Interface Name	Port ID Prio.Nbr	Cost Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19 FWD	19 32778 000b.bec6.5cc0	128.1
Fa0/3	128.3	19 FWD	0 32778 000b.be34.1680	128.3

VLAN0020

```

Spanning tree enabled protocol ieee
Root ID    Priority    32788
           Address    000b.be34.1680
           Cost       19
           Port       3 (FastEthernet0/3)
           Hello Time 2 sec   Max Age 20 sec   Forward Delay 15 sec

Bridge ID   Priority    32788 (priority 32768 sys-id-ext 20)
           Address    000b.bec6.5cc0
           Hello Time 2 sec   Max Age 20 sec   Forward Delay 15 sec
           Aging Time 300

```

Interface Name	Port ID Prio.Nbr	Cost Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19 FWD	19 32788 000b.bec6.5cc0	128.1
Fa0/3	128.3	19 FWD	0 32788 000b.be34.1680	128.3

ALSwitch2#show spanning-tree

VLAN0001

```

Spanning tree enabled protocol ieee
Root ID    Priority    32769
           Address    0009.430f.a400
           This bridge is the root
           Hello Time 2 sec   Max Age 20 sec   Forward Delay 15 sec

```

```

Bridge ID  Priority      32769  (priority 32768 sys-id-ext 1)
Address      0009.430f.a400
Hello Time   2 sec   Max Age 20 sec   Forward Delay 15 sec
Aging Time  300

Interface    Port ID          Designated          Port ID
Name         Prio.Nbr        Cost Sts          Cost Bridge ID      Prio.Nbr
-----
Fa0/1        128.1           19 FWD            0 32769 0009.430f.a400 128.1
Fa0/3        128.3           19 FWD            0 32769 0009.430f.a400 128.3

VLAN0010
Spanning tree enabled protocol ieee
Root ID      Priority      32778
Address      0009.430f.a400
This bridge is the root
Hello Time   2 sec   Max Age 20 sec   Forward Delay 15 sec

Bridge ID  Priority      32778  (priority 32768 sys-id-ext 10)
Address      0009.430f.a400
Hello Time   2 sec   Max Age 20 sec   Forward Delay 15 sec
Aging Time  300

Interface    Port ID          Designated          Port ID
Name         Prio.Nbr        Cost Sts          Cost Bridge ID      Prio.Nbr
-----
Fa0/1        128.1           19 FWD            0 32778 0009.430f.a400 128.1
Fa0/3        128.3           19 FWD            0 32778 0009.430f.a400 128.3

VLAN0020
Spanning tree enabled protocol ieee
Root ID      Priority      32788
Address      0009.430f.a400
This bridge is the root
Hello Time   2 sec   Max Age 20 sec   Forward Delay 15 sec

Bridge ID  Priority      32788  (priority 32768 sys-id-ext 20)
Address      0009.430f.a400
Hello Time   2 sec   Max Age 20 sec   Forward Delay 15 sec
Aging Time  300

Interface    Port ID          Designated          Port ID
Name         Prio.Nbr        Cost Sts          Cost Bridge ID      Prio.Nbr
-----
Fa0/1        128.1           19 FWD            0 32788 0009.430f.a400 128.1
Fa0/3        128.3           19 FWD            0 32788 0009.430f.a400 128.3

```

1. Which switch became the root bridge and why?

2. Did all the VLANs have the same root bridge?

This is not the most efficient behavior of spanning tree. In the sample output above, ALSwitch2 became the root bridge. All traffic will go through ALSwitch2 even if it is not the best path to the destination. It would be more efficient to set a distribution layer switch as the root bridge.

Step 6

Set a distribution layer switch as the root bridge to increase network efficiency. To further increase efficiency, split the load between the two distribution layer switches. DLSwitch1 will become the root bridge for VLAN 10 and DLSwitch2 will become the root bridge for VLAN 20.

Cisco switches use per-VLAN spanning tree (PVST) by default. The range for the priority value is 0 to 61440 in increments of 4096. The default value is 32768. The lower the number, the more likely the switch will be chosen as the root bridge. Valid priority values are 0, 4096, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, and 61440. All other values are rejected.

Change to root bridge priority for DLSwitch1 on VLAN 10 to 4096 to force DLSwitch1 to be the root bridge.

```
DLSwitch1(config)#spanning-tree vlan 10 priority 4096
```

Use the **show spanning-tree** command to verify which switch is the root bridge.

```
DLSwitch1#show spanning-tree
```

```
VLAN0001
```

```
Spanning tree enabled protocol ieee
```

```
Root ID    Priority    32769  
Address    0009.430f.a400
```

```
Cost       19
```

```
Port       3 (FastEthernet0/3)
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
```

```
Address    000a.b701.f700
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Aging Time 300
```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost	Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19	FWD	19 32769	000a.b701.f700	128.1
Fa0/3	128.3	19	FWD	0 32769	0009.430f.a400	128.1

```
VLAN0010
```

```
Spanning tree enabled protocol ieee
```

```
Root ID    Priority    4106  
Address    000a.b701.f700  
This bridge is the root
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Bridge ID  Priority    4106 (priority 4096 sys-id-ext 10)
```

```
Address    000a.b701.f700
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Aging Time 300
```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost	Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19	FWD	0 4106	000a.b701.f700	128.1
Fa0/3	128.3	19	FWD	0 4106	000a.b701.f700	128.3

```
VLAN0020
```

```
Spanning tree enabled protocol ieee
```

```
Root ID    Priority    32788  
Address    0009.430f.a400
```

```
Cost       19
```

```
Port       3 (FastEthernet0/3)
```

```

Hello Time    2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID Priority    32788 (priority 32768 sys-id-ext 20)
Address      000a.b701.f700
Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
Aging Time   300

Interface      Port ID      Cost Sts      Designated      Port ID
Name           Prio.Nbr          Cost Bridge ID          Prio.Nbr
-----
Fa0/1          128.1           19 FWD        19 32788 000a.b701.f700 128.1
Fa0/3          128.3           19 FWD        0 32788 0009.430f.a400 128.1

```

Notice that the root bridge priority only changed for VLAN 10 and DLSwitch1 is the root bridge.

DLSwitch2 will be configured as the root bridge for VLAN 20. A switch to root should be set with the **spanning-tree vlan *vlan-id* root primary** command. This will set the default root priority to 24576. If a switch has a lower priority than 24576, the root command must set the priority to 4096 lower then the lowest priority to guarantee that the switch will become root.

```

DLSwitch2(config)#spanning-tree vlan 20 root primary
vlan 20 bridge priority set to 24576
vlan 20 bridge max aging time unchanged at 20
vlan 20 bridge hello time unchanged at 2
vlan 20 bridge forward delay unchanged at 15

```

Verify the change with the **show spanning-tree vlan 20** command.

```

DLSwitch2#show spanning-tree vlan 20

VLAN0020
Spanning tree enabled protocol ieee
Root ID    Priority    24596
Address    000a.b702.a200
This bridge is the root
Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID Priority    24596 (priority 24576 sys-id-ext 20)
Address    000a.b702.a200
Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
Aging Time 300

Interface      Port ID      Cost Sts      Designated      Port ID
Name           Prio.Nbr          Cost Bridge ID          Prio.Nbr
-----
Fa0/1          128.1           19 FWD        0 24596 000a.b702.a200 128.1
Fa0/3          128.3           19 FWD        0 24596 000a.b702.a200 128.3

```

The root bridge priority has changed to 24576 and DLSwitch2 has become the root bridge.

All traffic that originates from VLAN 10 and crosses the distribution layer will be forwarded to DLSwitch1. All traffic from VLAN 20 that crosses the Distribution Layer will be forwarded to DLSwitch2.