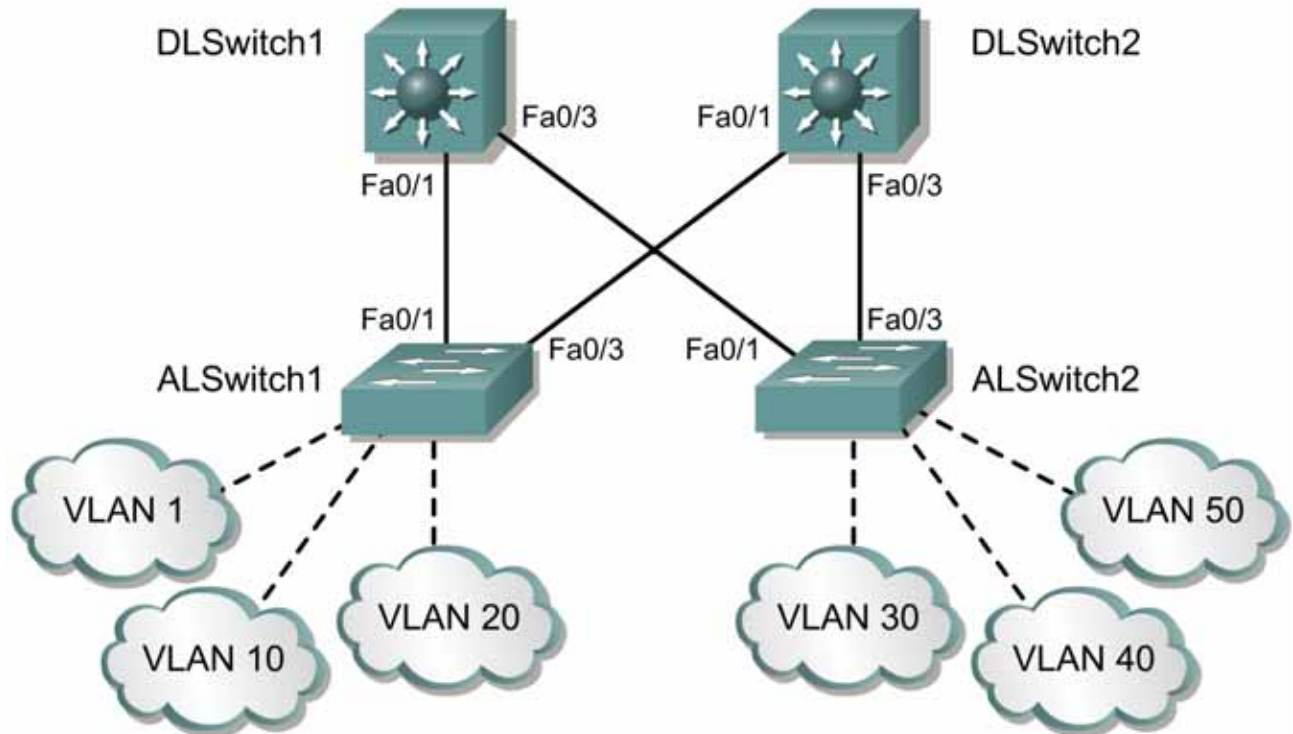


Lab 4.4.6 Implementing MST



Objective

The purpose of this lab is to implement MST in a switched network.

Scenario

PVST is the default STP behavior. However, it has two disadvantages. First, PVST is a Cisco proprietary protocol so it cannot work with other vendor products. Second, PVST creates spanning-tree instances for every VLAN. This can be very processor intensive. MST will be implemented to reduce the processor utilization and load balancing will be provided over the distribution layer switches.

The 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

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. Power cycle each of the switches after the **vlan.dat** file has been deleted.

```
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. Crossover Cat 5 cables must be used since the devices are similar.

Configure the hostname and passwords 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)#^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)#^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)#^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)#^Z
```

Step 2

Create a trunk link between the switches. Set the port to trunking with 802.1q encapsulation on DLSwitch1 and DLSwitch2 then verify the configurations with the **show interfaces trunk** command on both switches.

Note: An error may appear because the port is set to auto encapsulation. If this occurs, enter the **switchport mode trunk** command after the **switchport trunk encapsulation dot1q** command.

```
DLSwitch1(config)#interface fastethernet 0/1
DLSwitch1(config-if)#switchport trunk encapsulation dot1q
DLSwitch1(config-if)#switchport mode trunk
DLSwitch1(config-if)#exit
DLSwitch1(config)#interface fastethernet 0/3
DLSwitch1(config-if)#switchport trunk encapsulation dot1q
DLSwitch1(config-if)#switchport mode trunk
DLSwitch1(config-if)#exit

DLSwitch2(config)#interface fastethernet 0/1
DLSwitch2(config-if)#switchport trunk encapsulation dot1q
DLSwitch2(config-if)#switchport mode trunk
DLSwitch2(config-if)#exit
DLSwitch2(config)#interface fastethernet 0/3
DLSwitch2(config-if)#switchport trunk encapsulation dot1q
DLSwitch2(config-if)#switchport mode trunk
DLSwitch2(config-if)#exit
```

The 2950 switches do not need the encapsulation configured. These switches default to 802.1q. Some IOS versions do not include any other options. Console into each access layer switch and configure trunking then verify the configurations with the **show interfaces trunk** command on both switches.

```
ALSwitch1(config)#interface fastethernet 0/1
ALSwitch1(config-if)#switchport mode trunk
ALSwitch1(config-if)#exit
ALSwitch1(config)#interface fastethernet 0/3
ALSwitch1(config-if)#switchport mode trunk
ALSwitch1(config-if)#exit

ALSwitch2(config)#interface fastethernet 0/1
ALSwitch2(config-if)#switchport mode trunk
ALSwitch2(config-if)#exit
ALSwitch2(config)#interface fastethernet 0/3
ALSwitch2(config-if)#switchport mode trunk
ALSwitch2(config-if)#exit
```

DLSwitch1#**show interfaces trunk**

Port	Mode	Encapsulation	Status	Native vlan
Fa0/1	on	802.1q	trunking	1
Fa0/3	on	802.1q	trunking	1

Port	Vlans allowed on trunk
Fa0/1	1-4094
Fa0/3	1-4094

Port	Vlans allowed and active in management domain
Fa0/1	1
Fa0/3	1

Port	Vlans in spanning tree forwarding state and not pruned
Fa0/1	none
Fa0/3	1

DLSwitch2#**show interfaces trunk**

Port	Mode	Encapsulation	Status	Native vlan
Fa0/1	on	802.1q	trunking	1
Fa0/3	on	802.1q	trunking	1

Port	Vlans allowed on trunk
Fa0/1	1-4094
Fa0/3	1-4094

Port	Vlans allowed and active in management domain
Fa0/1	1
Fa0/3	1

Port	Vlans in spanning tree forwarding state and not pruned
Fa0/1	1
Fa0/3	1

ALSwitch1#**show interfaces trunk**

Port	Mode	Encapsulation	Status	Native vlan
Fa0/1	on	802.1q	trunking	1
Fa0/3	on	802.1q	trunking	1

Port	Vlans allowed on trunk
Fa0/1	1-4094
Fa0/3	1-4094

Port	Vlans allowed and active in management domain
Fa0/1	1
Fa0/3	1

Port	Vlans in spanning tree forwarding state and not pruned
Fa0/1	1
Fa0/3	1

ALSwitch2#**show interfaces trunk**

Port	Mode	Encapsulation	Status	Native vlan
Fa0/1	on	802.1q	trunking	1
Fa0/3	on	802.1q	trunking	1

Port	Vlans allowed on trunk
Fa0/1	1-4094
Fa0/3	1-4094

Port	Vlans allowed and active in management domain
Fa0/1	1
Fa0/3	1

Port	Vlans in spanning tree forwarding state and not pruned
Fa0/1	1
Fa0/3	1

Step 3

Configure the VLAN database on DLSwitch1.

Create the VLANs on the DLSwitch1 and place the switch in vtp server mode. Name the VLANs as show in the following example.

```
DLSwitch1#vlan database
DLSwitch1(vlan)#vtp domain CORP
DLSwitch1(vlan)#vtp server
DLSwitch1(vlan)#vlan 10 name Accounting
VLAN 10 modified:
      Name: Accounting
```

```

DLSwitch1(vlan)#vlan 20 name Marketing
VLAN 20 modified:
  Name: Marketing
DLSwitch1(vlan)#vlan 30 name Engineering
VLAN 30 added:
  Name: Engineering
DLSwitch1(vlan)#vlan 40 name HumanResource
VLAN 40 added:
  Name: HumanResource
DLSwitch1(vlan)#vlan 50 name GraphicDesign
VLAN 50 added:
  Name: GraphicDesign
DLSwitch1(vlan)#exit

```

Use the **show vlan** command to verify the configuration.

```

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
                                           Fa0/11, Fa0/12, 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
20   Marketing                               active
30   Engineering                             active
40   HumanResource                           active
50   GraphicDesign                           active
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
30   enet    100030    1500   -       -       -       -      -         0      0
40   enet    100040    1500   -       -       -       -      -         0      0
50   enet    100050    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
-----

```

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

```

DLSwitch1#show vtp status
VTP Version                : 2
Configuration Revision      : 5
Maximum VLANs supported locally : 1005
Number of existing VLANs    : 10
VTP Operating Mode          : Server
VTP Domain Name             : CORP

```

```

VTP Pruning Mode           : Disabled
VTP V2 Mode               : Disabled
VTP Traps Generation      : Disabled
MD5 digest                 : 0xF2 0xB3 0x19 0x9B 0x2E 0xD3 0xE0 0xD5
Configuration last modified by 0.0.0.0 at 3-1-93 09:14:16
Local updater ID is 0.0.0.0 (no valid interface found)

```

DLSwitch1#**show vtp counter**

```

VTP statistics:
Summary advertisements received : 225
Subset advertisements received  : 8
Request advertisements received  : 0
Summary advertisements transmitted : 234
Subset advertisements transmitted : 27
Request advertisements transmitted : 2
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	0	0

Verify the configuration on all remaining switches.

DLSwitch1#**show vtp status**

```

VTP Version           : 2
Configuration Revision : 1
Maximum VLANs supported locally : 1005
Number of existing VLANs : 10
VTP Operating Mode    : Server
VTP Domain Name       : CORP
VTP Pruning Mode      : Disabled
VTP V2 Mode           : Disabled
VTP Traps Generation  : Disabled
MD5 digest            : 0x48 0x97 0x44 0xC7 0x68 0x83 0xD6 0xE9
Configuration last modified by 0.0.0.0 at 3-1-93 00:28:25
Local updater ID is 0.0.0.0 (no valid interface found)

```

DLSwitch1#**show vtp counters**

```

VTP statistics:
Summary advertisements received : 4
Subset advertisements received  : 4
Request advertisements received  : 0
Summary advertisements transmitted : 4
Subset advertisements transmitted : 4
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          1          0
Fa0/3

```

DLSwitch2#show vtp status

```

VTP Version           : 2
Configuration Revision : 1
Maximum VLANs supported locally : 1005
Number of existing VLANs : 10
VTP Operating Mode     : Server
VTP Domain Name        : CORP
VTP Pruning Mode       : Disabled
VTP V2 Mode            : Disabled
VTP Traps Generation   : Disabled
MD5 digest             : 0x48 0x97 0x44 0xC7 0x68 0x83 0xD6 0xE9
Configuration last modified by 0.0.0.0 at 3-1-93 00:28:25
Local updater ID is 0.0.0.0 (no valid interface found)

```

DLSwitch2#show vtp counters

```

VTP statistics:
Summary advertisements received : 4
Subset advertisements received : 4
Request advertisements received : 0
Summary advertisements transmitted : 4
Subset advertisements transmitted : 4
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	1	1	0
Fa0/3	1	1	0

ALSwitch1#show vtp status

```

VTP Version           : 2
Configuration Revision : 1
Maximum VLANs supported locally : 250
Number of existing VLANs : 10
VTP Operating Mode     : Server
VTP Domain Name        : CORP
VTP Pruning Mode       : Disabled
VTP V2 Mode            : Disabled
VTP Traps Generation   : Disabled
MD5 digest             : 0x48 0x97 0x44 0xC7 0x68 0x83 0xD6 0xE9
Configuration last modified by 0.0.0.0 at 3-1-93 00:28:25
Local updater ID is 0.0.0.0 (no valid interface found)

```

ALSwitch1#show vtp counters

```

VTP statistics:
Summary advertisements received      : 4
Subset advertisements received      : 4
Request advertisements received      : 0
Summary advertisements transmitted  : 4
Subset advertisements transmitted    : 4
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 from device	Join Transmitted	Join Received	Summary advts received non-pruning-capable
-----	-----	-----	-----

Fa0/1	1	0	0
Fa0/3	1	1	0

ALSwitch2#show vtp status

```

VTP Version                : 2
Configuration Revision      : 1
Maximum VLANs supported locally : 250
Number of existing VLANs    : 10
VTP Operating Mode          : Server
VTP Domain Name             : CORP
VTP Pruning Mode            : Disabled
VTP V2 Mode                 : Disabled
VTP Traps Generation        : Disabled
MD5 digest                  : 0x48 0x97 0x44 0xC7 0x68 0x83 0xD6 0xE9
Configuration last modified by 0.0.0.0 at 3-1-93 00:28:25
Local updater ID is 0.0.0.0 (no valid interface found)

```

ALSwitch2#show vtp counters

```

VTP statistics:
Summary advertisements received      : 4
Subset advertisements received      : 4
Request advertisements received      : 0
Summary advertisements transmitted  : 4
Subset advertisements transmitted    : 4
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 from device	Join Transmitted	Join Received	Summary advts received non-pruning-capable
-----	-----	-----	-----

Fa0/1	1	0	0
Fa0/3	1	1	0

Step 4

Console into DLSwitch2 and each access layer switch and configure the VTP mode to client from the vlan database configuration mode as shown in the generic example below.

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

Verify the VLAN configuration on all the switches with the **show vlan** command.

```
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 Fa0/11, Fa0/12, 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
20	Marketing	active
30	Engineering	active
40	HumanResource	active
50	GraphicDesign	active
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

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
20	enet	100020	1500	-	-	-	-	-	0	0
30	enet	100030	1500	-	-	-	-	-	0	0
40	enet	100040	1500	-	-	-	-	-	0	0
50	enet	100050	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	-	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

Remote SPAN VLANs

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

```
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 Fa0/11, Fa0/12, 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	
20	Marketing	active	
30	Engineering	active	
40	HumanResource	active	

```

50    GraphicDesign          active
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

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
20	enet	100020	1500	-	-	-	-	-	0	0
30	enet	100030	1500	-	-	-	-	-	0	0
40	enet	100040	1500	-	-	-	-	-	0	0
50	enet	100050	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	-	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

Remote SPAN VLANs

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

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 Fa0/11, Fa0/12, 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	
20	Marketing	active	
30	Engineering	active	
40	HumanResource	active	
50	GraphicDesign	active	
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

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
20	enet	100020	1500	-	-	-	-	-	0	0
30	enet	100030	1500	-	-	-	-	-	0	0
40	enet	100040	1500	-	-	-	-	-	0	0
50	enet	100050	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	srp	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

Remote SPAN VLANs

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

ALSwitch1#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 Fa0/11, Fa0/12, 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	
20	Marketing	active	
30	Engineering	active	
40	HumanResource	active	
50	GraphicDesign	active	
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

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
20	enet	100020	1500	-	-	-	-	-	0	0
30	enet	100030	1500	-	-	-	-	-	0	0
40	enet	100040	1500	-	-	-	-	-	0	0
50	enet	100050	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 vlan

VLAN	Name	Status	Ports
1	default	active	Fa0/2, Fa0/4, Fa0/5, Fa0/6 Fa0/7, Fa0/8, Fa0/9, Fa0/10 Fa0/11, Fa0/12, 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	
20	Marketing	active	
30	Engineering	active	
40	HumanResource	active	
50	GraphicDesign	active	
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

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
20	enet	100020	1500	-	-	-	-	-	0	0
30	enet	100030	1500	-	-	-	-	-	0	0
40	enet	100040	1500	-	-	-	-	-	0	0

50	enet	100050	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 Spanning-Tree Protocol (STP). Use the **show spanning-tree** command on all the switches.

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 Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port 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	

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

VLAN0030

Spanning tree enabled protocol ieee

```

Root ID      Priority      32798
             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      32798 (priority 32768 sys-id-ext 30)
             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 32798	000b.bec6.b780	128.1
Fa0/3	128.3	19	FWD	19 32798	000b.bec6.5cc0	128.1

VLAN0040

Spanning tree enabled protocol ieee

```

Root ID      Priority      32808
             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      32808 (priority 32768 sys-id-ext 40)
             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 32808	000b.bec6.b780	128.1
Fa0/3	128.3	19	FWD	19 32808	000b.bec6.5cc0	128.1

VLAN0050

Spanning tree enabled protocol ieee

```

Root ID      Priority      32818
             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    32818 (priority 32768 sys-id-ext 50)
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 32818 000b.bec6.b780	128.1
Fa0/3	128.3	19	FWD	19 32818 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

```

VLAN0030
Spanning tree enabled protocol ieee
Root ID    Priority    32798
           Address    000b.be34.1680
           This bridge is the root
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID  Priority    32798 (priority 32768 sys-id-ext 30)
           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 32798 000b.be34.1680	128.1
Fa0/3	128.3	19 FWD	0 32798 000b.be34.1680	128.3

```

VLAN0040
Spanning tree enabled protocol ieee
Root ID    Priority    32808
           Address    000b.be34.1680
           This bridge is the root
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID  Priority    32808 (priority 32768 sys-id-ext 40)
           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 32808 000b.be34.1680	128.1
Fa0/3	128.3	19 FWD	0 32808 000b.be34.1680	128.3

```

VLAN0050
Spanning tree enabled protocol ieee
Root ID    Priority    32818
           Address    000b.be34.1680
           This bridge is the root
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID  Priority    32818 (priority 32768 sys-id-ext 50)
           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 32818 000b.be34.1680	128.1
Fa0/3	128.3	19 FWD	0 32818 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

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

VLAN0030

```

Spanning tree enabled protocol ieee
Root ID    Priority    32798
           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    32798 (priority 32768 sys-id-ext 30)
           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	32798 000b.bec6.b780	128.1
Fa0/3	128.3	19	FWD	0	32798 000b.be34.1680	128.1

VLAN0040

```

Spanning tree enabled protocol ieee
Root ID    Priority    32808
           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    32808 (priority 32768 sys-id-ext 40)

```



```

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 32808 000b.bec6.b780	128.1
Fa0/3	128.3	19 FWD	0 32808 000b.be34.1680	128.1

VLAN0050

```

Spanning tree enabled protocol ieee
Root ID    Priority    32818
           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    32818 (priority 32768 sys-id-ext 50)
           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 32818 000b.bec6.b780	128.1
Fa0/3	128.3	19 FWD	0 32818 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

VLAN0030

```

Spanning tree enabled protocol ieee
Root ID    Priority    32798
           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    32798 (priority 32768 sys-id-ext 30)
           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 32798 000b.bec6.5cc0	128.1
Fa0/3	128.3	19 FWD	0 32798 000b.be34.1680	128.3

VLAN0040

```

Spanning tree enabled protocol ieee
Root ID    Priority    32808
           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    32808 (priority 32768 sys-id-ext 40)
           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 32808 000b.bec6.5cc0	128.1
Fa0/3	128.3	19 FWD	0 32808 000b.be34.1680	128.3

VLAN0050

```

Spanning tree enabled protocol ieee
Root ID    Priority    32818
           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    32818 (priority 32768 sys-id-ext 50)
           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 32818 000b.bec6.5cc0 128.1
Fa0/3	128.3	19 FWD	0 32818 000b.be34.1680 128.3

<Output omitted>

1. Which switch became the root bridge and why?
2. Do all the VLANs have the same root bridge?

This is not the most efficient behavior of spanning tree. There is an instance of spanning tree for every VLAN.

Step 6

Multiple Spanning-Tree Protocol (MST) uses RSTP for rapid convergence. MST enables VLANs to be grouped into a spanning-tree instance. Each instance has a spanning-tree topology that is independent of the other spanning-tree instances. This architecture provides multiple forwarding paths for data traffic and enables load balancing. This also reduces the number of spanning-tree instances that are required to support a large number of VLANs.

MST regions are used to partition the network. All switches in the same region must have the same VLAN-to-instance mapping, the same configuration revision number, and the same name.

MST groups a few VLANs into one spanning-tree instance unlike PVST, which has a spanning-tree instance for every VLAN. This reduces the number spanning-tree processes required and enhances the switch performance. MST support 16 instances, numbered 1 through 15.

MST is configured in the MST configuration mode. It is enabled in the global configuration mode.

Enter the MST configuration mode to configure MST on DLSwitch1. Map VLAN 1 through VLAN 50 to spanning-tree instance 1.

```
DLSwitch1(config)#spanning-tree mst configuration
DLSwitch1(config-mst)#instance 1 vlan 1-50
```

Name the MST region **REGION1**.

```
DLSwitch1(config-mst)#name REGION1
```

Configure the MST revision number.

```
DLSwitch1(config-mst)#revision 1
```

Verify the configuration with the **show pending** command.

```
DLSwitch1(config-mst)#show pending
Pending MST configuration
Name      [REGION1]
Revision  1
Instance  Vlans mapped
```

```

-----
0          51-4094
1          1-50
-----

```

The **exit** command will apply the changes and return the prompt to global configuration mode.

```

DLSwitch1(config-mst)#exit
DLSwitch1(config)#

```

MST must be enabled after configuration.

Note: Traffic can be disrupted when spanning-tree modes are changed because all spanning-tree instances are stopped for the previous mode and restarted in the new mode.

```

DLSwtch1(config)#spanning-tree mode mst

```

Use the **show spanning-tree** command to view spanning-tree configuration.

```

DLSwitch1#show spanning-tree

```

MST00

```

Spanning tree enabled protocol MST
Root ID    Priority    32768
           Address    000a.b701.f700
           This bridge is the root
           Hello Time  2 sec    Max Age 20 sec    Forward Delay 15 sec

```

```

Bridge ID  Priority    32768 (priority 32768 sys-id-ext 0)
           Address    000a.b701.f700
           Hello Time  2 sec    Max Age 20 sec    Forward Delay 15 sec
           Aging Time  0

```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost	Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	100	FWD	0 32768	000a.b701.f700	128.1
Fa0/3	128.3	200000	FWD	0 32768	000a.b701.f700	128.3

MST01

```

Spanning tree enabled protocol MST
Root ID    Priority    32769
           Address    000a.b701.f700
           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    000a.b701.f700
           Hello Time  2 sec    Max Age 20 sec    Forward Delay 15 sec
           Aging Time  0

```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost	Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	100	FWD	0 32769	000a.b701.f700	128.1
Fa0/3	128.3	200000	FWD	0 32769	000a.b701.f700	128.3

Notice that there are only two instances of spanning tree. The 0 instance was created by default and the 1 instance was configured. The DLSwitch1 also became the root bridge. It is the root bridge because it is the only switch running MST.

Use the following commands to configure and enable the remaining switches for MST.

```

DLSwitch2(config)#spanning-tree mst configuration
DLSwitch2(config-mst)#instance 1 vlan 1-50
DLSwitch2(config-mst)#name REGION1
DLSwitch2(config-mst)#revision 1
DLSwitch2(config-mst)#exit
DLSwitch2(config)#spanning-tree mode mst
DLSwitch2(config)#^Z

```

```

ALSwitch2(config)#spanning-tree mst configuration
ALSwitch2(config-mst)#instance 1 vlan 1-50
ALSwitch2(config-mst)#name REGION1
ALSwitch2(config-mst)#revision 1
ALSwitch2(config-mst)#exit
ALSwitch2(config)#spanning-tree mode mst
ALSwitch2(config)#^Z

```

```

ALSwitch1(config)#spanning-tree mst configuration
ALSwitch1(config-mst)#instance 1 vlan 1-50
ALSwitch1(config-mst)#name REGION1
ALSwitch1(config-mst)#revision 1
ALSwitch1(config-mst)#exit
ALSwitch1(config)#spanning-tree mode mst
ALSwitch1(config)#^Z

```

Use the **show spanning-tree** command to verify spanning tree.

```

ALSwitch2#show spanning-tree

```

MST00

Spanning tree enabled protocol MST

```

Root ID      Priority      32768
             Address      0009.430f.a400
             This bridge is the root
Hello Time    2 sec      Max Age 20 sec  Forward Delay 15 sec

```

```

Bridge ID    Priority      32768 (priority 32768 sys-id-ext 0)
             Address      0009.430f.a400
Hello Time    2 sec      Max Age 20 sec  Forward Delay 15 sec
Aging Time    0

```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	200000	FWD	0 32768 0009.430f.a400	128.1
Fa0/3	128.3	200000	FWD	0 32768 0009.430f.a400	128.3

MST01

Spanning tree enabled protocol MST

```

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    0

```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	200000	FWD	0 32769 0009.430f.a400	128.1
Fa0/3	128.3	200000	FWD	0 32769 0009.430f.a400	128.3

Notice in the sample output above, the ALSwitch2 has become the root bridge.

Note	Whichever switch was the Root Bridge in Step 5 should resume being the Root Bridge.
-------------	---

The MST has now been configured on the network.

DLSwitch1#**show spanning-tree**

MST00

```
Spanning tree enabled protocol mstp
Root ID    Priority    32768
           Address    000b.be34.1680
           Cost        0
           Port        1 (FastEthernet0/1)
           Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
```

```
Bridge ID  Priority    32768 (priority 32768 sys-id-ext 0)
           Address    000b.be4f.bc00
           Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
           Aging Time   0
```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost	Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	200000	FWD	0 32768	000b.bec6.b780	128.1
Fa0/3	128.3	200000	FWD	0 32768	000b.be4f.bc00	128.3

MST01

```
Spanning tree enabled protocol mstp
Root ID    Priority    32769
           Address    000b.be34.1680
           Cost        400000
           Port        1 (FastEthernet0/1)
           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   0
```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost	Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	200000	FWD	200000 32769	000b.bec6.b780	128.1
Fa0/3	128.3	200000	FWD	400000 32769	000b.be4f.bc00	128.3

DLSwitch2#**show spanning-tree**

MST00

```
Spanning tree enabled protocol mstp
Root ID    Priority    32768
           Address    000b.be34.1680
           This bridge is the root
           Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
```

```
Bridge ID  Priority    32768 (priority 32768 sys-id-ext 0)
           Address    000b.be34.1680
           Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
           Aging Time   0
```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost	Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	200000	FWD	0 32768	000b.be34.1680	128.1
Fa0/3	128.3	200000	FWD	0 32768	000b.be34.1680	128.3

```

MST01
Spanning tree enabled protocol mstp
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  0

Interface      Port ID      Designated
Name           Prio.Nbr     Cost Sts     Cost Bridge ID
-----
Fa0/1          128.1        200000 FWD         0 32769 000b.be34.1680 128.1
Fa0/3          128.3        200000 FWD         0 32769 000b.be34.1680 128.3

```

ALSwitch1#show spanning-tree

```

MST00
Spanning tree enabled protocol mstp
Root ID    Priority    32768
           Address    000b.be34.1680
           Cost        0
           Port        3 (FastEthernet0/3)
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID  Priority    32768 (priority 32768 sys-id-ext 0)
           Address    000b.bec6.b780
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
           Aging Time  0

Interface      Port ID      Designated
Name           Prio.Nbr     Cost Sts     Cost Bridge ID
-----
Fa0/1          128.1        200000 FWD         0 32768 000b.bec6.b780 128.1
Fa0/3          128.3        200000 FWD         0 32768 000b.be34.1680 128.1

```

```

MST01
Spanning tree enabled protocol mstp
Root ID    Priority    32769
           Address    000b.be34.1680
           Cost        200000
           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  0

Interface      Port ID      Designated
Name           Prio.Nbr     Cost Sts     Cost Bridge ID
-----
Fa0/1          128.1        200000 FWD        200000 32769 000b.bec6.b780 128.1
Fa0/3          128.3        200000 FWD         0 32769 000b.be34.1680 128.1

```

ALSwitch2#show spanning-tree

```

MST00
Spanning tree enabled protocol mstp
Root ID    Priority    32768
           Address    000b.be34.1680
           Cost        200000
           Port        3 (FastEthernet0/3)
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID  Priority    32768 (priority 32768 sys-id-ext 0)
           Address    000b.bec6.5cc0
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

```

Aging Time 0

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost	Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	200000	BLK	0 32768	000b.be4f.bc00	128.3
Fa0/3	128.3	200000	FWD	0 32768	000b.be34.1680	128.3

MST01

Spanning tree enabled protocol mstp

Root ID Priority 32769
Address 000b.bec6.5cc0
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.bec6.5cc0
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 0

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost	Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	200000	BLK	0 32769	000b.bec6.5cc0	128.1
Fa0/3	128.3	200000	FWD	0 32769	000b.bec6.5cc0	128.3

Step 7

Configure the distribution layer switch as the root bridge to make the network more efficient.

To configure a switch to become the root, use the **spanning-tree mst instance-id root** global configuration command. This will change the switch priority from the default value of 32768 to a significantly lower value. With the lowest root priority, this switch will become the root switch for the specified spanning-tree instance.

When this command is entered, the switch will check the switch priorities of the root switches. The switch will set its own priority for the specified instance to 24576 because of the extended system ID support. If any root switch for the specified instance has a switch priority lower than 24576, the switch will set its own priority to 4096 less than the lowest switch priority.

Enter the following command on DLSwitch1.

```
DLSwitch1(config)#spanning-tree mst 1 root primary
DLSwitch1(config)^Z
```

Use the **show spanning-tree mst instance-number** command to view the changes.

```
DLSwitch1#show spanning-tree mst 1
```

```
##### MST01          vlans mapped:    1-50
Bridge      address 000a.b701.f700  priority  24577 (24576 sysid 1)
Root        this switch for MST01
```

Interface	role	state	cost	prio	type
Fa0/1	desg	FWD	100	128	P2P
Fa0/3	desg	FWD	200000	128	P2P

The DLSwitch1 is now the root bridge with a priority of 24576. Use the **spanning-tree mst 1 priority** command to manually set the MST root priority. The **spanning-tree mst 1 root primary** command will dynamically configure the lowest priority.

Step 8

Configure DLSwitch2 as the secondary root to create fault tolerance in the network. DLSwitch2 will act as a backup root bridge if the primary root bridge fails.

When a Catalyst 3550 switch that supports the extended system ID as the secondary root is configured, the spanning-tree switch priority is modified from the default value of 32768 to 28672.

```
DLSwitch2(config)#spanning-tree mst 1 root secondary
mst 1 bridge priority set to 28672
```

Use the **show spanning-tree mst 1** command to view the STP priority.

```
DLSwitch2#show spanning-tree mst 1

##### MST01          vlans mapped:    1-50
Bridge      address 000a.b702.a200  priority 28673 (28672 sysid 1)
Root        address 000a.b701.f700  priority 24577 (24576 sysid 1)
              port   Fa0/1          cost      200100          rem hops
              18

Interface    role state cost      prio type
-----
Fa0/1        root FWD   200000    128  P2P
Fa0/3        altn BLK   200000    128  P2P
```

Disconnect DLSwitch1 from the network and monitor. DLSwitch2 will become the root bridge. Enter the **show spanning-tree mst 1** command on DLSwitch2.

```
DLSwitch2#show spanning-tree mst 1

##### MST01          vlans mapped:    1-50
Bridge      address 000a.b702.a200  priority 28673 (28672 sysid 1)
Root        this switch for MST01

Interface    role state cost      prio type
-----
Fa0/1        desg FWD   200000    128  P2P
Fa0/3        desg FWD   200000    128  P2P
```

DLSwitch2 is now the root bridge. Reconnect DLSwitch1 into the network.

Step 9

Group VLANs 30 through 60 into a second MST instance to provide load balancing.

One of the advantages of MST is that it permits load balancing. When VLANs are grouped into separate MST instances, a different root bridge is chosen for each MST instance.

Enter the following commands on all switches.

```
DLSwitch1(config)#spanning-tree mst configuration
DLSwitch1(config-mst)#instance 2 vlan 30-60
DLSwitch1(config-mst)#exit
```

Configure DLSwitch2 to become the root for MST instance 2.

```
DLSwitch2(config)#spanning-tree mst 2 root primary
DLSwitch2(config)#^Z
```

Use the **show spanning-tree mst** command to monitor the change. DLSwitch1 is the root bridge for VLANs 1 to 29 and DLSwitch2 is the root bridge for VLANs 30 to 60.

Load balancing has now been achieved.

DLSwitch1#**show spanning-tree mst**

```
##### MST00          vlans mapped:    61-4094
Bridge      address 000b.be4f.bc00 priority 32768 (32768 sysid 0)
Root        address 000b.be34.1680 priority 32768 (32768 sysid 0)
            port Fa0/1 path cost 0
IST master  address 000b.be34.1680 priority 32768 (32768 sysid 0)
            path cost 400000 rem hops 18
Operational hello time 2, forward delay 15, max age 20, max hops 20
Configured  hello time 2, forward delay 15, max age 20, max hops 20

-----
Fa0/1        root FWD    200000    128   P2P
Fa0/3        desg FWD    200000    128   P2P bound(RSTP)

##### MST01          vlans mapped:    1-29
Bridge      address 000b.be4f.bc00 priority 24577 (24576 sysid 1)
Root        this switch for MST01

Interface    role state cost        prio type
-----
Fa0/1        desg FWD    200000    128   P2P
Fa0/3        boun FWD    200000    128   P2P bound(RSTP)

##### MST02          vlans mapped:    30-60
Bridge      address 000b.be4f.bc00 priority 32770 (32768 sysid 2)
Root        address 000b.be34.1680 priority 24578 (24576 sysid 2)
            port Fa0/1 cost 400000 rem hops 18

Interface    role state cost        prio type
-----
Fa0/1        root FWD    200000    128   P2P
Fa0/3        boun FWD    200000    128   P2P bound(RSTP)
```

DLSwitch2#**show spanning-tree mst**

```
##### MST00          vlans mapped:    61-4094
Bridge      address 000b.be34.1680 priority 32768 (32768 sysid 0)
Root        this switch for CST and IST
Configured  hello time 2, forward delay 15, max age 20, max hops 20

Interface    role state cost        prio type
-----
Fa0/1        desg FWD    200000    128   P2P
Fa0/3        desg FWD    200000    128   P2P bound(RSTP)

##### MST01          vlans mapped:    1-29
Bridge      address 000b.be34.1680 priority 28673 (28672 sysid 1)
Root        address 000b.be4f.bc00 priority 24577 (24576 sysid 1)
            port Fa0/1 cost 400000 rem hops 18

Interface    role state cost        prio type
-----
Fa0/1        root FWD    200000    128   P2P
Fa0/3        boun FWD    200000    128   P2P bound(RSTP)

##### MST02          vlans mapped:    30-60
Bridge      address 000b.be34.1680 priority 24578 (24576 sysid 2)
Root        this switch for MST02

Interface    role state cost        prio type
-----
Fa0/1        desg FWD    200000    128   P2P
Fa0/3        boun FWD    200000    128   P2P bound(RSTP)
```

ALSwitch1#show spanning-tree mst

```
##### MST00          vlans mapped:    61-4094
Bridge      address 000b.bec6.b780 priority 32768 (32768 sysid 0)
Root        address 000b.be34.1680 priority 32768 (32768 sysid 0)
              port Fa0/3          path cost 0
IST master  address 000b.be34.1680 priority 32768 (32768 sysid 0)
              path cost 200000    rem hops 19
Operational hello time 2, forward delay 15, max age 20, max hops 20
Configured  hello time 2, forward delay 15, max age 20, max hops 20

Interface      role state cost      prio type
-----
Fa0/1          desg FWD  200000    128 P2P
Fa0/3          root FWD  200000    128 P2P

##### MST01          vlans mapped:    1-29
Bridge      address 000b.bec6.b780 priority 32769 (32768 sysid 1)
Root        address 000b.be4f.bc00 priority 24577 (24576 sysid 1)
              port Fa0/1          cost      200000          rem hops 19

Interface      role state cost      prio type
-----
Fa0/1          root FWD  200000    128 P2P
Fa0/3          desg FWD  200000    128 P2P

##### MST02          vlans mapped:    30-60
Bridge      address 000b.bec6.b780 priority 32770 (32768 sysid 2)
Root        address 000b.be34.1680 priority 24578 (24576 sysid 2)
              port Fa0/3          cost      200000          rem hops 19

Interface      role state cost      prio type
-----
Fa0/1          desg FWD  200000    128 P2P
Fa0/3          root FWD  200000    128 P2P
```

ALSwitch2#show spanning-tree mst

```
##### MST00          vlans mapped:    61-4094
Bridge      address 000b.bec6.5cc0 priority 32768 (32768 sysid 0)
Root        address 000b.be34.1680 priority 32768 (32768 sysid 0)
              port Fa0/3          path cost 200000
IST master  this switch
Operational hello time 2, forward delay 15, max age 20, max hops 20
Configured  hello time 2, forward delay 15, max age 20, max hops 20

Interface      role state cost      prio type
-----
Fa0/1          altn BLK  200000    128 P2P bound(RSTP)
Fa0/3          root FWD  200000    128 P2P bound(RSTP)

##### MST01          vlans mapped:    1-29
Bridge      address 000b.bec6.5cc0 priority 32769 (32768 sysid 1)
Root        this switch for MST01

Interface      role state cost      prio type
-----
Fa0/1          boun BLK  200000    128 P2P bound(RSTP)
Fa0/3          boun FWD  200000    128 P2P bound(RSTP)

##### MST02          vlans mapped:    30-60
Bridge      address 000b.bec6.5cc0 priority 32770 (32768 sysid 2)
Root        this switch for MST02

Interface      role state cost      prio type
-----
Fa0/1          boun BLK  200000    128 P2P bound(RSTP)
Fa0/3          boun FWD  200000    128 P2P bound(RSTP)
```