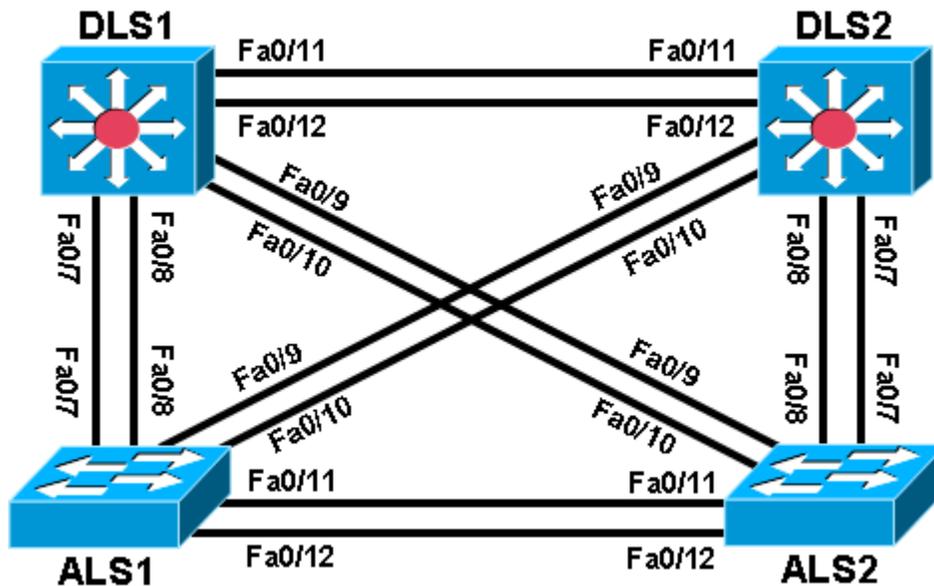


Chapter 3 Lab 3-1, Spanning Tree Protocol (STP) Default Behavior

Topology



Objective

- Observe the default behavior of STP.

Background

Four switches have just been installed. The distribution layer switches are Catalyst 3560s, and the access layer switches are Catalyst 2960s. There are redundant uplinks between the access layer and distribution layer. Because of the possibility of bridging loops, spanning tree logically removes any redundant links. In this lab, you will observe what spanning tree does and why.

Note: This lab uses Cisco WS-C2960-24TT-L switches with the Cisco IOS image c2960-lanbasek9-mz.122-46.SE.bin and Catalyst 3560-24PS switches with the Cisco IOS image c3560-advipservicesk9-mz.122-46.SE.bin. Other switches (such as a 2950 or 3550), and Cisco IOS Software versions can be used if they have comparable capabilities and features. Depending on the switch model and Cisco IOS Software version, the commands available and output produced might vary from what is shown in this lab.

Required Resources

- 2 switches (Cisco 2960 with the Cisco IOS Release 12.2(46)SE C2960-LANBASEK9-M image or comparable)
- 2 switches (Cisco 3560 with the Cisco IOS Release 12.2(46)SE C3560-ADVIPSERVICESK9-M image or comparable)
- Ethernet and console cables

Step 1: Prepare the switches for the lab.

Refer to Lab 1-1 Clearing a Switch and Lab 1-2 Clearing a Switch Connected to a Larger Network to prepare all four switches for this lab. Cable the equipment as shown. If you are accessing your equipment remotely, ask your instructor for instructions on how to do this.

Step 2: Configure basic switch parameters.

- a. Configure the four switches as shown in the diagram with a hostname.

ALS1 example:

```
Switch> enable
Switch# configure terminal
Switch(config)# hostname ALS1
```

- b. Optionally, configure an enable secret password and console security. Configure the console line with **logging synchronous** and no timeout.

ALS1 example:

```
ALS1(config)# enable secret class
ALS1(config)# line console 0
ALS1(config-line)# logging synchronous
ALS1(config-line)# exec-timeout 0 0
ALS1(config-line)# password cisco
ALS1(config-line)# login
```

Note: After the cables are connected spanning tree is initiated and the switch detects the redundant links.

By default, spanning tree runs on every port. When a new link becomes active, the port goes through the IEEE 802.1D spanning tree listening and learning states before transitioning to forwarding state. During this period, the switch discovers if it is connected to another switch or an end-user device.

One of the switches is elected as the root bridge for the tree. Then an agreement is established as to which links to keep active and which links to logically remove from the spanning tree (disable) if multiple links exist.

What type of frame does STP use to communicate with other switches?

The results in this lab will vary. Spanning tree operation is based on the MAC addresses of the switches.

- c. Observe the LEDs on the switch to check the status of the link. For access ports a bright green light indicates an active link. An amber light indicates an inactive link.

Step 3: Display default spanning tree information for all switches.

- a. Verify IEEE 802.1D STP with the **show spanning-tree** command on DLS1.

Note: Your output may differ, based on the root bridge selected in your topology. The sample output below may also differ from those in your lab, because they were generated with a different set of switches.

CCNPv6 SWITCH

```
DLS1# show spanning-tree
```

```
VLAN0001
```

```
Spanning tree enabled protocol ieee
```

```
Root ID      Priority    32769
Address      000a.b8a9.d680
Cost         19
Port         13 (FastEthernet0/11)
Hello Time   2 sec     Max Age 20 sec     Forward Delay 15 sec
```

```
Bridge ID    Priority    32769 (priority 32768 sys-id-ext 1)
Address      000a.b8b3.d780
Hello Time   2 sec     Max Age 20 sec     Forward Delay 15 sec
Aging Time   300
```

| Interface | Role | Sts | Cost | Prio.Nbr | Type |
|-----------|------|-----|------|----------|------|
| Fa0/7 | Desg | FWD | 19 | 128.9 | P2p |
| Fa0/8 | Desg | FWD | 19 | 128.10 | P2p |
| Fa0/9 | Desg | FWD | 19 | 128.11 | P2p |
| Fa0/10 | Desg | FWD | 19 | 128.12 | P2p |
| Fa0/11 | Root | FWD | 19 | 128.13 | P2p |
| Fa0/12 | Altn | BLK | 19 | 128.14 | P2p |

b. Verify STP with the `show spanning-tree` command on DLS2.

```
DLS2# show spanning-tree
```

```
VLAN0001
```

```
Spanning tree enabled protocol ieee
```

```
Root ID      Priority    32769
Address      000a.b8a9.d680
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.b8a9.d680
Hello Time   2 sec     Max Age 20 sec     Forward Delay 15 sec
Aging Time   300
```

| Interface | Role | Sts | Cost | Prio.Nbr | Type |
|-----------|------|-----|------|----------|------|
| Fa0/7 | Desg | FWD | 19 | 128.9 | P2p |
| Fa0/8 | Desg | FWD | 19 | 128.10 | P2p |
| Fa0/9 | Desg | FWD | 19 | 128.11 | P2p |
| Fa0/10 | Desg | FWD | 19 | 128.12 | P2p |
| Fa0/11 | Desg | FWD | 19 | 128.13 | P2p |
| Fa0/12 | Desg | FWD | 19 | 128.14 | P2p |

c. Verify STP with the `show spanning-tree` command on ALS1.

```
ALS1# show spanning-tree
```

```
VLAN0001
```

```
Spanning tree enabled protocol ieee
```

```
Root ID      Priority    32769
```

```

Address      000a.b8a9.d680
Cost         19
Port         11 (FastEthernet0/9)
Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
    
```

```

Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address      0019.0635.5780
Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
Aging Time   300
    
```

| Interface | Role | Sts | Cost | Prio.Nbr | Type |
|-----------|------|-----|------|----------|------|
| Fa0/7 | Altn | BLK | 19 | 128.9 | P2p |
| Fa0/8 | Altn | BLK | 19 | 128.10 | P2p |
| Fa0/9 | Root | FWD | 19 | 128.11 | P2p |
| Fa0/10 | Altn | BLK | 19 | 128.12 | P2p |
| Fa0/11 | Desg | FWD | 19 | 128.13 | P2p |
| Fa0/12 | Desg | FWD | 19 | 128.14 | P2p |
| Fa0/11 | Altn | BLK | 19 | 128.11 | P2p |
| Fa0/12 | Altn | BLK | 19 | 128.12 | P2p |

d. Verify STP with the **show spanning-tree** command on ALS2.

```
ALS2# show spanning-tree
```

```

VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 32769
Address 000a.b8a9.d680
Cost 19
Port 9 (FastEthernet0/7)
Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 0019.068d.6980
Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
Aging Time 300
    
```

| Interface | Role | Sts | Cost | Prio.Nbr | Type |
|-----------|------|-----|------|----------|------|
| Fa0/7 | Root | FWD | 19 | 128.9 | P2p |
| Fa0/8 | Altn | BLK | 19 | 128.10 | P2p |
| Fa0/9 | Altn | BLK | 19 | 128.11 | P2p |
| Fa0/10 | Altn | BLK | 19 | 128.12 | P2p |
| Fa0/11 | Altn | BLK | 19 | 128.13 | P2p |
| Fa0/12 | Altn | BLK | 19 | 128.14 | P2p |

Notice that between each pair of switches, at least one of the two ports is blocking. Blocking can occur on the access layer switch or the distribution layer switch. If all ports have their default setting, the higher interface number of the two ports will block.

A port is placed in the blocking state because the switch detects two links between the same switches. A bridging loop would result if one of the switches did not logically disable a redundant link.

e. Display the spanning tree information for DLS2 again.

```
DLS2# show spanning-tree
```

```
VLAN0001
Spanning tree enabled protocol ieee
Root ID    Priority    32769
           Address    000a.b8a9.d680
           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.b8a9.d680
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
           Aging Time 300
```

| Interface | Role | Sts | Cost | Prio. | Nbr | Type |
|-----------|------|-----|------|--------|-----|------|
| Fa0/7 | Desg | FWD | 19 | 128.9 | | P2p |
| Fa0/8 | Desg | FWD | 19 | 128.10 | | P2p |
| Fa0/9 | Desg | FWD | 19 | 128.11 | | P2p |
| Fa0/10 | Desg | FWD | 19 | 128.12 | | P2p |
| Fa0/11 | Desg | FWD | 19 | 128.13 | | P2p |
| Fa0/12 | Desg | FWD | 19 | 128.14 | | P2p |

After reviewing the spanning tree output, answer the following questions.

Which switch is the root of the spanning tree?

How can the root switch be identified?

Why was that switch selected as the root?

What caused one port to be in blocking state over another?

What caused one link to be blocked over another?

- f. Another useful STP command is **show spanning-tree root**. This command displays a summary listing of the VLANs defined, the Root (bridge) ID for each one, the Root Cost and the Root Port that the switch uses to reach the root bridge. In this lab the only active VLAN is default VLAN 1. Issue the **show spanning-tree root** command on ALS1. The output shows the priority and MAC address of DLS2 as the Root ID for VLAN 1. The Root Cost is 19 and ALS1 uses port Fa0/9 to reach DLS2.

ALS1# **show spanning-tree root**

| Vlan | Root ID | Root Cost | Hello Time | Max Age | Fwd Dly | Root Port |
|----------|----------------------|-----------|------------|---------|---------|-----------|
| VLAN0001 | 32769 0017.5a53.a380 | 19 | 2 | 20 | 15 | Fa0/9 |

- g. Issue the **show spanning-tree root** command on DLS2. The output shows the priority and MAC address of DLS2 as the Root ID for VLAN 1. The Root Cost is 0 and there is no Root Port listed because DLS2 is the root bridge.

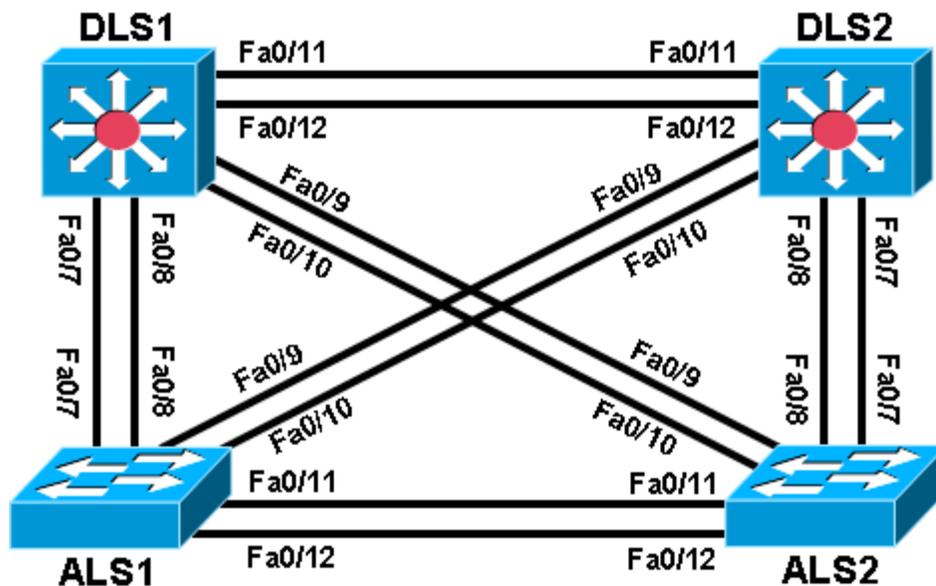
DLS2# **show spanning-tree root**

| Vlan | Root ID | Root Cost | Hello Time | Max Age | Fwd Dly | Root Port |
|----------|----------------------|-----------|------------|---------|---------|-----------|
| VLAN0001 | 32769 0017.5a53.a380 | 0 | 2 | 20 | 15 | |

Step 4: Diagram the STP topology for VLAN 1.

Diagram the spanning tree topology for VLAN 1. With Cisco Catalyst switches, there is a different spanning tree state for each VLAN. Identify the root bridge, root forwarding ports, designated forwarding ports, and alternate blocking ports.

On the lab diagram provided below, indicate which switch is the root and the STP port role and state for the switch ports. Place the letter R (Root FWD), D (Desg FWD) or A (Altn BLK) next to each port identified in the topology.



In this lab, the default operation of IEEE 802.1D spanning tree was observed. Since no bridge priorities were specified, the switch with the lowest MAC address was elected as the root. The link providing the lowest root path cost was chosen as the active link. If costs were equal, the tie was broken first by the lowest sender BID of the BPDU, then by the lowest sending port priority and last by the lowest sending port number.

In the next lab, the default STP behavior will be modified so that spanning tree works according to specifications.

Challenge

Try to guess how your topology would look if you completely removed the root switch. Remember that the switch with the lowest MAC address becomes the root.

CCNPv6 SWITCH

- a. Shut down all the ports on your current root switch.

```
Switch# conf t  
Switch(config)# interface range fastEthernet 0/1-24  
Switch(config-if-range)# shutdown
```

Note: If you are on a 48 port switch, use interface range Fa0/1 – 48. If there are Gigabit Ethernet ports on the switch, they are not used with this lab, so it is not necessary to shut them down.

- b. Issue the **show spanning-tree** command on the other switches. Did the topology converge the way you thought it would?
