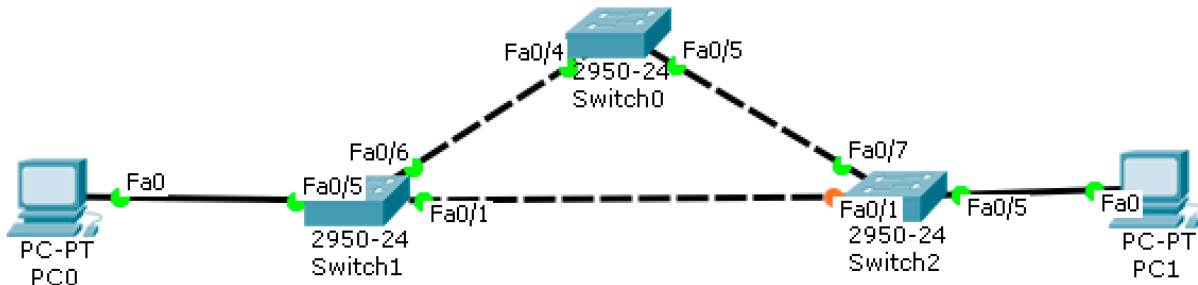


Lab – Building a Switched Network with Redundant Links

Topology



Objectives

Part 1: Determine the Root Bridge

Part 2: Observe STP Port Selection Based on Port Cost

Background / Scenario

Redundancy increases the availability of devices in the network topology by protecting the network from a single point of failure. Redundancy in a switched network is accomplished through the use of multiple switches or multiple links between switches. When physical redundancy is introduced into a network design, loops and duplicate frames can occur.

The Spanning Tree Protocol (STP) was developed as a Layer 2 loop-avoidance mechanism for redundant links in a switched network. STP ensures that there is only one logical path between all destinations on the network by intentionally blocking redundant paths that could cause a loop.

In this lab, you will use the **show spanning-tree** command to observe the STP election process of the root bridge. You will also observe the port selection process based on cost and priority.

Note: The switches used are Cisco Catalyst 2960s

Part 1: Determine the Root Bridge

Every spanning-tree instance (switched LAN or broadcast domain) has a switch designated as the root bridge. The root bridge serves as a reference point for all spanning-tree calculations to determine which redundant paths to block.

An election process determines which switch becomes the root bridge. The switch with the lowest bridge identifier (BID) becomes the root bridge. The BID is made up of a bridge priority value, an extended system ID, and the MAC address of the switch. The priority value can range from 0 to 65,535, in increments of 4,096, with a default value of **32,768**.

Step 1: Display spanning tree information.

Issue the **show spanning-tree** command on all three switches. The Bridge ID Priority is calculated by adding the priority value and the extended system ID. The extended system ID is always the VLAN number. In the example below, all three switches have equal Bridge ID Priority values ($32769 = 32768 + 1$, where default

Lab – Building a Switched Network with Redundant Links

priority = 32768, VLAN number = 1); therefore, the switch with the lowest MAC address becomes the root bridge (S2 in the example).

Switch0#show spanning-tree

VLAN0001

Spanning tree enabled protocol ieee

Root ID Priority 32769
Address 0001.633C.DED5

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 0001.633C.DED5
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20

Interface	Role	Sts	Cost	Prio.Nbr	Type
-----	-----	---	-----	-----	-----
Fa0/4	Desg	FWD	19	128.4	P2p
Fa0/5	Desg	FWD	19	128.5	P2p

Switch1#show spanning-tree

VLAN0001

Spanning tree enabled protocol ieee

Root ID Priority 32769
Address 0001.633C.DED5
Cost 19
Port 6(FastEthernet0/6)

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

Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 0006.2ADD.EE85
Hello Time 2sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20

Interface	Role	Sts	Cost	Prio.Nbr	Type
-----	-----	---	-----	-----	-----
Fa0/1	Desg	FWD	19	128.1	P2p
Fa0/5	Desg	FWD	19	128.5	P2p
Fa0/6	Root	FWD	19	128.6	P2p

Switch2#show spanning-tree

VLAN0001

Spanning tree enabled protocol ieee

Root ID Priority 32769

Lab – Building a Switched Network with Redundant Links

Address 0001.633C.DED5
Cost 19
Port 7(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 00D0.FF39.20B8
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20

Interface	Role	Sts	Cost	Prio.Nbr	Type
Fa0/1	Altn	BLK	19	128.1	P2p
Fa0/5	Desg	FWD	19	128.5	P2p
Fa0/7	Root	FWD	19	128.7	P2p

Note: The default STP mode on the 2960 switch is Per VLAN Spanning Tree (PVST).

Based on the output from your switches, answer the following questions.

Which switch is the root bridge? _____

Why did spanning tree select this switch as the root bridge?

Which ports are the root ports on the switches? _____

Which ports are the designated ports on the switches? _____

What port is showing as an alternate port and is currently being blocked? _____

Why did spanning tree select this port as the non-designated (blocked) port?

Part 2: Observe STP Port Selection Based on Port Cost

The spanning tree algorithm (STA) uses the root bridge as the reference point and then determines which ports to block, **based on path cost**. The port with the lower path cost is preferred. If port costs are equal, then spanning tree compares BIDs. If the BIDs are equal, then the port priorities are used to break the tie. Lower values are always preferred.

Locate the switch with the blocked port.

With the current configuration, only one switch should have a port that is blocked by STP. Issue the **show spanning-tree** command on both non-root switches. In the example below, spanning tree is blocking port F0/1 on the switch 2 with the highest BID (Switch 2).

Step 1: Configuring priority to influence the root election

Cisco switches use a default base priority of 32,768, this command chooses the base priority as follows: If the current root has a base priority higher than 24,576, the local switch use a base priority of 24,576.

If the current root's base priority is 24,576 or lower, the local switch sets its base priority to the highest multiple of 4096 that still results in the local switch becoming root.

With the current configuration, only one switch should have a port that is blocked by STP. Issue the **show spanning-tree** command on both non-root switches. In the example below, spanning tree is blocking port F0/1 on the switch 2 with the highest BID (Switch 2).

Make SW2 become root primary (root bridge):

```
Switch2(config)#spanning-tree vlan 1 root primary
```

```
Switch2#show spanning-tree
```

```
VLAN0001
```

```
Spanning tree enabled protocol ieee
```

```
Root ID      Priority      24577
           Address      00D0.FF39.20B8
           This bridge is the root
           Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
```

```
Bridge ID   Priority      24577 (priority 24576 sys-id-ext 1)
           Address      00D0.FF39.20B8
           Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
           Aging Time 20
```

Interface	Role	Sts	Cost	Prio.Nbr	Type
-----	-----	---	-----	-----	-----
Fa0/1	Desg	FWD	19	128.1	P2p
Fa0/5	Desg	FWD	19	128.5	P2p
Fa0/7	Desg	FWD	19	128.7	P2p

Step 2: Observe spanning tree changes.

Re-issue the **show spanning-tree** command on both non-root switches. Observe that the previously blocked port (S2 - F0/1) is now a designated port and spanning tree is now blocking a port on the other non-root switch (S1 - F0/6).

```
Switch1#show spanning-tree
```

```
VLAN0001
```

```
Spanning tree enabled protocol ieee
```

```
Root ID      Priority      24577
           Address      00D0.FF39.20B8
           Cost          19
           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      0006.2ADD.EE85
           Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
           Aging Time 20
```

Interface	Role	Sts	Cost	Prio.Nbr	Type
-----	-----	---	-----	-----	-----
Fa0/1	Root	FWD	19	128.1	P2p
Fa0/5	Desg	FWD	19	128.5	P2p
Fa0/6	Altn	BLK	19	128.6	P2p

Lab – Building a Switched Network with Redundant Links

Why did spanning tree change the previously blocked port to a designated port, and block the port that was a designated port on the other switch?
