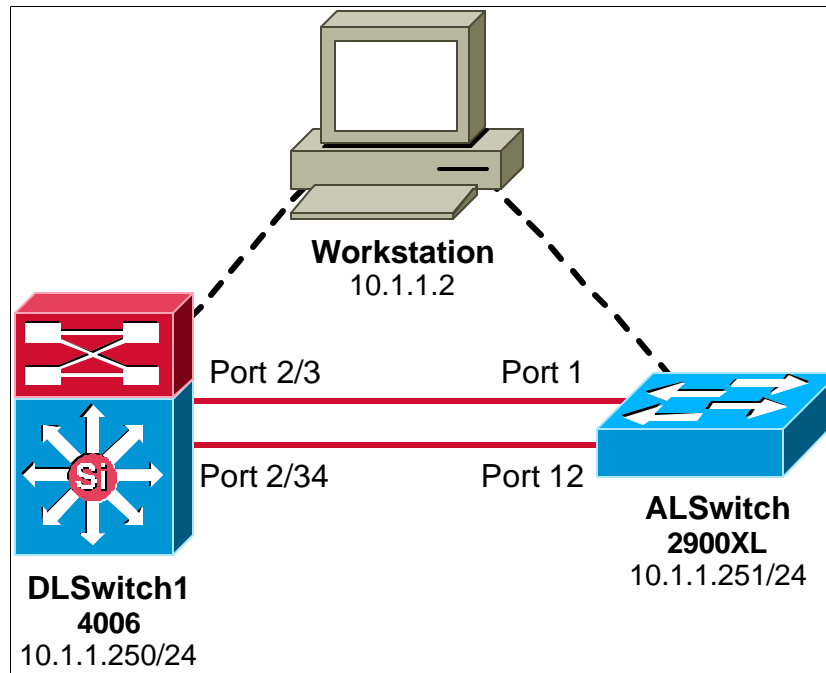


Lab 5.2.5.1: Spanning-Tree Default Behavior



Objective:

Observe the default behavior of STP - Spanning-Tree Protocol.

Scenario:

You have just finished installing two switches. One distribution layer Catalyst 4000 switch and an access layer Catalyst 2900 switch. You have redundant uplinks between the two switches. Because of the possibility of a bridge loop, spanning-tree kicks in and removes one of the links. In this lab you will observe what spanning tree does and why.

Lab Tasks:

1. First, configure your 4000 switch to the diagram above. You can skip this step if you already have the Lab 3.1.3 (4000 initial setup) configured.

```
Console> enable
Console> (enable) set system name DLSwitch1
System name set.
DLSwitch1> (enable)

DLSwitch1> (enable) set password
Enter old password: (Because you do not currently have a password, just hit enter)
Enter new password:
Retype new password:
Password changed.

DLSwitch1> (enable) set enablepass
```

```
Enter old password: (Because you do not currently have a password, just hit enter)
Enter new password:
Retype new password:
Password changed.
```

```
DLSwitch1> (enable) set interface sc0 10.1.1.250 255.255.255.0
DLSwitch1> (enable) set interface sc0 1.
```

2. Next, configure your 2900 switch to the diagram above. You can also use the same config that you used in Lab 3.2.3 - Catalyst 2900 Initial Setup and skip this step but don't forget to change the IP address of the switch.

```
Switch>enable
Switch#
```

Set the switch name.

```
Switch#config terminal
Switch(config)#host ALSwitch
ALSwitch(config)#
ALSwitch(config)#enable password class
ALSwitch(config)#line con 0
ALSwitch(config-line)#password cisco
ALSwitch(config-line)#login
ALSwitch(config-line)#line vty 0 15
ALSwitch(config-line)#password cisco
ALSwitch(config-line)#login
```

```
ALSwitch(config)#interface vlan 1
ALSwitch(config-if)#ip address 10.1.1.251 255.255.255.0
```

3. Connect your uplink cables between the two switches. Remember to use crossover cables.

Connect an uplink cable from port 2/3 on DLSwitch1 to port 1 on ALSwitch.

Connect an uplink cable from port 2/34 on DLSwitch1 to port 12 on ALSwitch.

Once you connect your cables and the switch detects the two links, spanning-tree kicks in.

By default spanning-tree will run on every port. That means when a new link becomes active, the port will go through the Listening/Learning/Forwarding states before the link becomes active. During this discovery period, the switch will discover if it is connected to another switch, or just an end user device.

In the event that it detects another switch, the two switches will begin creating a "Spanning-Tree". The two switches will then elect one as the root of the tree and then agree on which links to keep active and which links to disable if multiple links exist.

What type of packet does spanning-tree use to communicate with other switches?

You should notice that no matter which order you install the uplinks, the cable connecting ports 2/3 to port 1 would become the active link.

Depending on which side of the link is blocking (the 2900 or the 4000) you may have a hard time reading the lights. The 2900 will change its light to a very distinct yellow color. The Catalyst 4000 switch on the other hand has very small port lights. If the 4000 side of the link chooses to block the link, you may have a hard time viewing the lights. You can always use the **show spantree** command on the 4000 to view the port status:

```
DLSwitch1> sh spantree
VLAN 1
Spanning tree enabled
Spanning tree type          ieee

Designated Root             00-02-4b-21-36-c0
Designated Root Priority     32768
Designated Root Cost        19
Designated Root Port        2/3
Root Max Age 20 sec  Hello Time 2 sec  Forward Delay 15 sec

Bridge ID MAC ADDR          00-02-4b-59-40-00
Bridge ID Priority           32768
Bridge Max Age 20 sec  Hello Time 2 sec  Forward Delay 15 sec

Port                        Vlan Port-State      Cost  Priority Portfast  Channel_id
-----
... Output Deleted
  2/3                        1    forwarding        19    32 disabled    0
... Output Deleted
  2/34                       1    blocking           19    32 disabled    0
```

Notice that port 2/34 is in a blocking state.

If it was the 2900 that blocked the link (indicated by a yellow light), use the show spanning-tree command on the ALSwitch to view its spanning tree state:

```
ALSwitch>sh spanning-tree

Spanning tree 1 is executing the IEEE compatible Spanning Tree protocol
  Bridge Identifier has priority 49152, address 0002.4b21.36c0
  Configured hello time 2, max age 20, forward delay 15
  We are the root of the spanning tree
  Topology change flag not set, detected flag not set, changes 5
  Times: hold 1, topology change 35, notification 2
         hello 2, max age 20, forward delay 15
  Timers: hello 0, topology change 0, notification 0
  Fast uplink switchover is enabled

Interface Fa0/1 (port 13) in Spanning tree 1 is FORWARDING
  Port path cost 3019, Port priority 128
  Designated root has priority 49152, address 0002.4b21.36c0
  Designated bridge has priority 49152, address 0002.4b21.36c0
  Designated port is 13, path cost 0
  Timers: message age 0, forward delay 0, hold 0
  BPDU: sent 2089, received 45
```

```

Interface Fa0/12 (port 25) in Spanning tree 1 is BLOCKING
Port path cost 3019, Port priority 128
Designated root has priority 49152, address 0002.4b21.36c0
Designated bridge has priority 49152, address 0002.4b21.36c0
Designated port is 25, path cost 0
Timers: message age 0, forward delay 0, hold 0
BPDU: sent 3222, received 42

```

Notice that port 12 is in a blocking state.

The switch put 2/34 or port 12 in a block state because it detected two links between the same switches. This would result in a bridge loop if the switch does not take one of the links out of the picture.

4. Assume that the DLSwitch1 is blocking the backup link. Lets look at the spanning-tree output:

```

DLSwitch1> (enable) sh spantree
VLAN 1
Spanning tree enabled
Spanning tree type                ieee

Designated Root                   00-02-4b-21-36-c0
Designated Root Priority           49152
Designated Root Cost               3019
Designated Root Port              2/3
Root Max Age    20 sec    Hello Time 2    sec    Forward Delay 15 sec

Bridge ID MAC ADDR                00-02-4b-59-40-00
Bridge ID Priority                 49152
Bridge Max Age 20 sec    Hello Time 2    sec    Forward Delay 15 sec

Port                               Vlan Port-State    Cost    Priority Portfast    Channel_id
-----
2/3                               1    forwarding      3019      32 disabled    0
(Other output deleted)
2/34                              1    blocking        3019      32 disabled    0

```

```

ALSwitch>sh spanning-tree

```

```

Spanning tree 1 is executing the IEEE compatible Spanning Tree protocol
Bridge Identifier has priority 49152, address 0002.4b21.36c0
Configured hello time 2, max age 20, forward delay 15
We are the root of the spanning tree
Topology change flag not set, detected flag not set, changes 5
Times: hold 1, topology change 35, notification 2
      hello 2, max age 20, forward delay 15
Timers: hello 0, topology change 0, notification 0
Fast uplink switchover is enabled

```

```

Interface Fa0/1 (port 13) in Spanning tree 1 is FORWARDING
Port path cost 3019, Port priority 128
Designated root has priority 49152, address 0002.4b21.36c0
Designated bridge has priority 49152, address 0002.4b21.36c0
Designated port is 13, path cost 0
Timers: message age 0, forward delay 0, hold 0
BPDU: sent 2089, received 45

```

```

Interface Fa0/12 (port 25) in Spanning tree 1 is FORWARDING
Port path cost 3019, Port priority 128
Designated root has priority 49152, address 0002.4b21.36c0
Designated bridge has priority 49152, address 0002.4b21.36c0
Designated port is 25, path cost 0
Timers: message age 0, forward delay 0, hold 0
BPDU: sent 3222, received 42

```

By looking at the spanning-tree output from the above two switches answer the following questions:

Which switch is the root of the spanning-tree?

How can you tell which switch is the root?

Why was that switch selected as the root?

What caused the backup link from port 2/34 to port 12 to get blocked over the active link from 2/3 to port 1?

What caused the backup link to get blocked at the Catalyst 4000 side of the link rather than the Catalyst 2900 side of the link?

In this example, you are watching the default operation of spanning-tree. You did not specify any bridge priorities so the switch with the lowest MAC address was elected as the root. You did not specify and link priorities so the link with the lowest cost was chosen as the active link and a tie was broken by the lowest port number.

In a later lab you will modify some of these priorities to get spanning-tree to work the way you want it to.

CHALLENGE

Cross over your uplink cables so that Port 2/3 now goes to port 12 and port 2/34 goes to port

1. Can you predict what will happen?

Think about who determines which link gets disabled. You know that the lowest port number is disabled, but who determines that, the root switch or the other switch? Also remember that it is end of the link farthest from the root that is blocked.

What happens?

5. Observe how spanning-tree works with end user devices:

Connect a workstation to any of the switch ports on either switch. Power On your workstation. You will notice that once the NIC card is initialized by the operating system the port will turn yellow. The port is now active. It is also starting the spanning tree process. Watch the PC boot up and the color of the link light. Observe that the PC makes it through most of the startup before the link becomes active and the color turns green.

Observe that it takes about 30 seconds for a new device to become active in a port.

Why did it take 30 seconds for the light to become green?

Why is it necessary to go through these steps on every port?

6. Spanning-tree is a useful protocol. It ensures that a switched/bridged network is not shutdown due to loops to infinity and broadcast storms.

In later labs, you will modify priorities and alter how the spanning-tree process works.