Lab Manual for Computer Communication and Networking

Lab No. 6

Spanning Tree Protocol

BAHRIA UNIVERSITY KARACHI CAMPUS
Department of Software Engineering

COMPUTER COMMUNICATION & NETWORKING

LAB EXPERIMENT # 6

Spanning Tree Protocol

OBJECTIVE: -

- To understand that how to avoid looping by using STP protocol.

THEORY: -

The Spanning Tree Protocol (STP) is a link layer network protocol that ensures a loop-free topology for any bridged LAN. It is based on an algorithm invented by Radia-Perlman while working for Digital Equipment Corporation. In the OSI model for computer networking, STP falls under the OSI layer-2. Spanning tree allows a network design to include spare (redundant) links to provide automatic backup paths if an active link fails, without the danger of bridge loops, or the need for manual enabling/disabling of these backup links. Bridge loops must be avoided because they result in flooding the network.
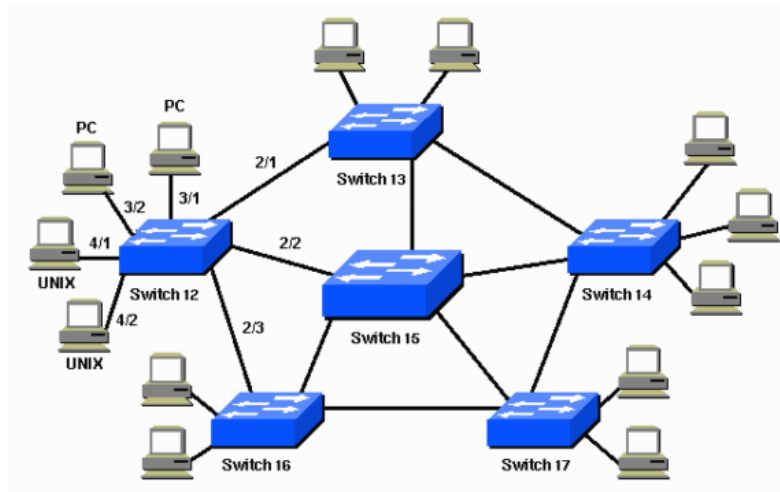

Fig 13.1 Spanning Tree Protocol

With STP, the key is for all the switches in the network to elect a root bridge that becomes the focal point in the network. All other decisions in the network, such as which port to block and which port to put in forwarding mode, are made from the perspective of this root bridge. A switched environment, which is different from a bridge environment, most likely deals with multiple VLANs. When you implement a root bridge in a switching network, you usually refer to the root bridge as the root switch. Each VLAN must have its own root bridge because each VLAN is a separate broadcast domain. The roots for the different VLANs can all reside in a single switch or in various switches.

Note: The selection of the root switch for a specific VLAN is very important. You can choose the root switch, or you can let the switches decide, which is risky. If you do not control the root selection process, there can be suboptimal paths in your network.

All the switches exchange information for use in the root switch selection and for subsequent configuration of the network. Bridge protocol Computer units (BPDUs) carry this information. Each switch compares the parameters in the BPDU that the switch sends to a neighbor with the parameters in the BPDU that the switch receives from the neighbor.

In the STP root selection process, less is better. If Switch A advertises a root ID that is a lower number than the root ID that Switch B advertises, the information from Switch A is better. Switch B stops the advertisement of its root ID, and accepts the root ID of Switch A.

A STP usually works in the following four steps:

i.   Elect Root Switch
ii. Tag Root Ports
iii. Tag Designated Ports
iv. Block all remaining ports.

Root Port: Port of a switch directly connected to the root switch or through another switch.

Designated Port: Port on the other end of a root port.

NETWORK TOPOLOGY: -

It shows that how to setup a network among 3 switches and their devices. Which transform a bridge in which devices were entertain through there priority level and their MAC-address.
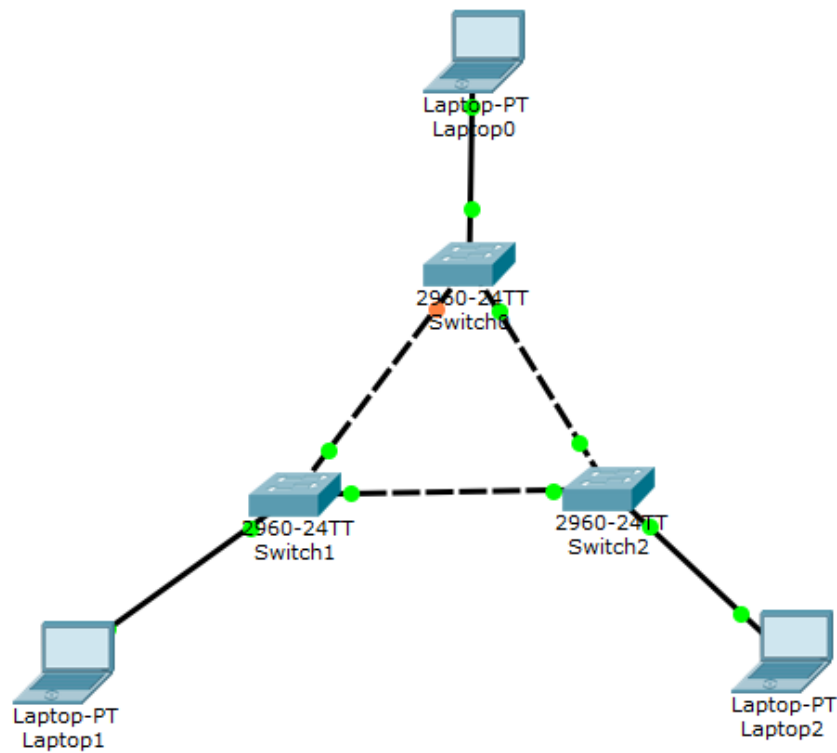Bridge ID = Priority + MAC address + VLAN.

Fig 13.2 Network among 3 Switches and Devices

PROCEDURE AND OBSERVATION: -

The above network shows Switch2 as the root switch and a redundant path between Switch0 and Switch1 deactivated by the STP. Each PC in this network will be able to ping all others. The beauty of STP is such that if a working link is broken or deactivated, the redundant link automatically becomes active and resumes the traffic flow.
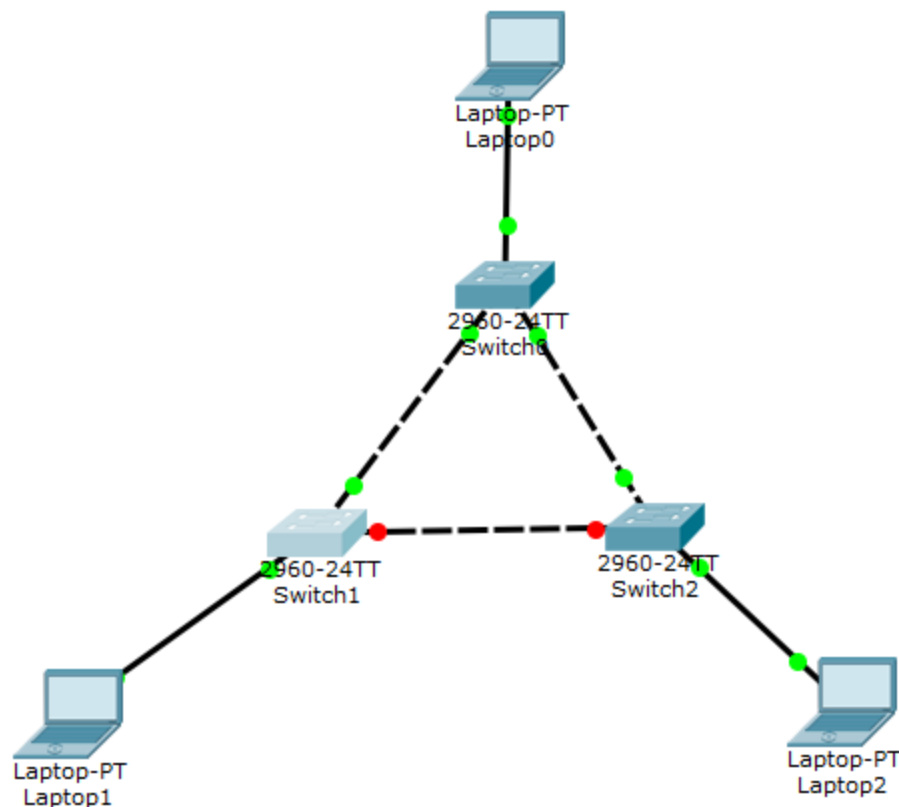
EXAMPLE: -

Switch>en
Switch#config t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#int fa0/3
Switch(config-if)#shutdown

CHANGING PRIORITY OR ROOT SWITCH: -

Since root switch is selected with respect to the priority of the switch amongst other factors, to change the default root switch to a desired switch, the priority of a switch can be lowered.

Switch(config)#spanning-tree vlan 1 priority ?
<0-61440> bridge priority in increments of 4096

Enter a priority number as a multiple of 4096 to set a lower priority than the current root switch.

Another way to change the root switch from default to desired is by directly running the following command on the desired root switch.

Switch(config)#spanning-tree vlan 1 root primary

RAPID STP:

During the transition to the redundant port, the STP processing takes a lot of time that can result in the loss of several Computer packets. To avoid this loss, the following command is run to implement the rapid spanning-tree protocol.
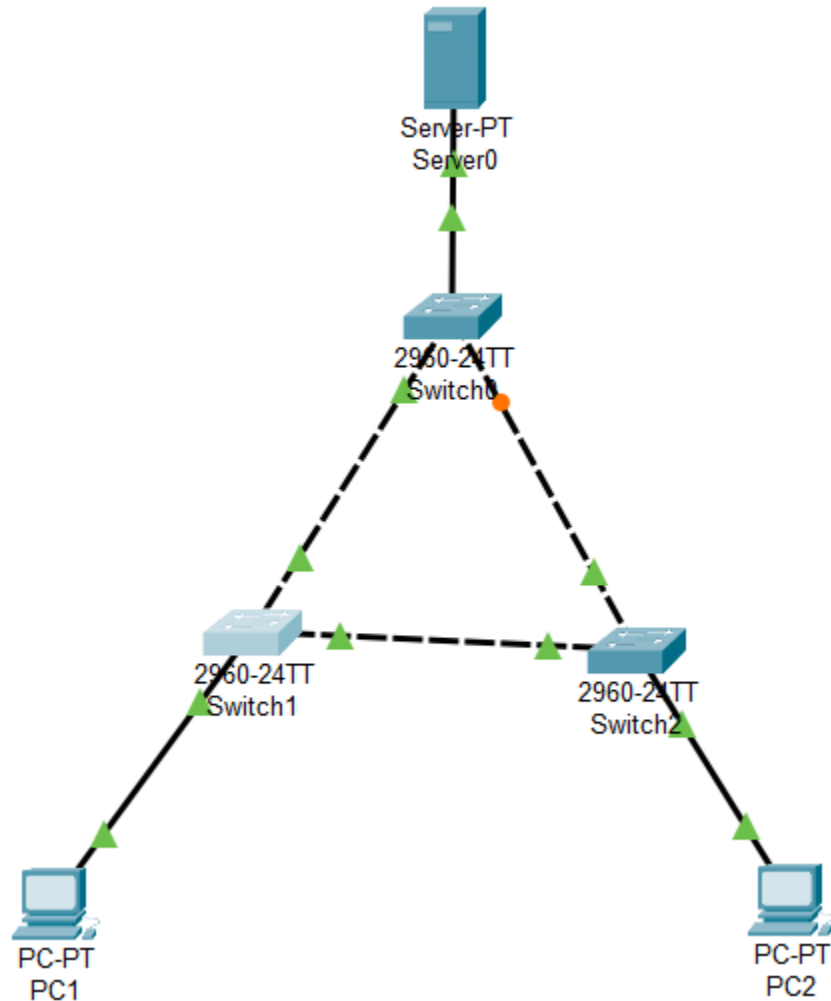
Switch(config)#spanning-tree mode rapid-pvst
QUESTIONS: -

- **Analyze the above network, deactivate another working interface and monitor the shift to the redundant interface. Also, change the root switch to a switch of your choice and implement the rapid STP and finally show the pinging results.**

Solution: -
Network Topology: -

Initial Spanning Tree Configuration: -
Switch 0: -

```
Switch#show spanning-tree vlan 1
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
             Address     0090.2105.1981
             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     00E0.B05D.8030
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/2            Altn BLK 19        128.2    P2p
Fa0/1            Root FWD 19        128.1    P2p
Fa0/3            Desg FWD 19        128.3    P2p
```

Switch 1: -

```
Switch#show spanning-tree vlan 1
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
             Address     0090.2105.1981
             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     0090.2105.1981
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/2            Desg FWD 19        128.2    P2p
Fa0/3            Desg FWD 19        128.3    P2p
Fa0/1            Desg FWD 19        128.1    P2p
```

Switch 2: -

```
Switch#show spanning-tree vlan 1
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
             Address     0090.2105.1981
             Cost        19
             Port        2(FastEthernet0/2)
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769  (priority 32768 sys-id-ext 1)
             Address     00D0.9728.6844
             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
Fa0/2            Root FWD 19        128.2    P2p
Fa0/3            Desg FWD 19        128.3    P2p
```

Shutting down one connection: -

Ping results after shutting one connection: -

```
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
Reply from 172.16.1.3: bytes=32 time=2ms TTL=128
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Reply from 172.16.1.3: bytes=32 time=1ms TTL=128
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
```

```
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
Reply from 172.16.1.3: bytes=32 time=1ms TTL=128
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
```

Spanning tree configuration after switching root: -
Switch 0: -

```
Switch#show spanning-tree vlan 1
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    24577
             Address     00E0.B05D.8030
             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     00E0.B05D.8030
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- ----------------------------
Fa0/2            Desg LSN 19        128.2    P2p
Fa0/1            Desg FWD 19        128.1    P2p
Fa0/3            Desg FWD 19        128.3    P2p
```

Switch 1: -

```
Switch#show spanning-tree vlan 1
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    24577
             Address     00E0.B05D.8030
             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     0090.2105.1981
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/2            Desg FWD 19        128.2    P2p
Fa0/3            Desg FWD 19        128.3    P2p
Fa0/1            Root FWD 19        128.1    P2p
```

Switch 2: -

```
Switch#show spanning-tree vlan 1
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    24577
             Address     00E0.B05D.8030
             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     00D0.9728.6844
             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
Fa0/2            Altn BLK 19        128.2    P2p
Fa0/3            Desg FWD 19        128.3    P2p
```

Ping results after changing stp mode to rapid stp: -

```
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
Reply from 172.16.1.3: bytes=32 time<1ms TTL=128
```

(Connection was shutdown for 10s)

TIME BOXING:

Activity Name	Activity Time	Total Time
Instruments Allocation + Setting up Lab	10 mints	10 mints
Walk through Theory & Tasks (Lecture)	60 mints	60 mints
Implementation & Practice time	90 mints	80 mints
Evaluation Time	20 mints	20 mints
	Total Duration	180 mints

Teacher Signature: _____

Student Registration No: 69966_____