

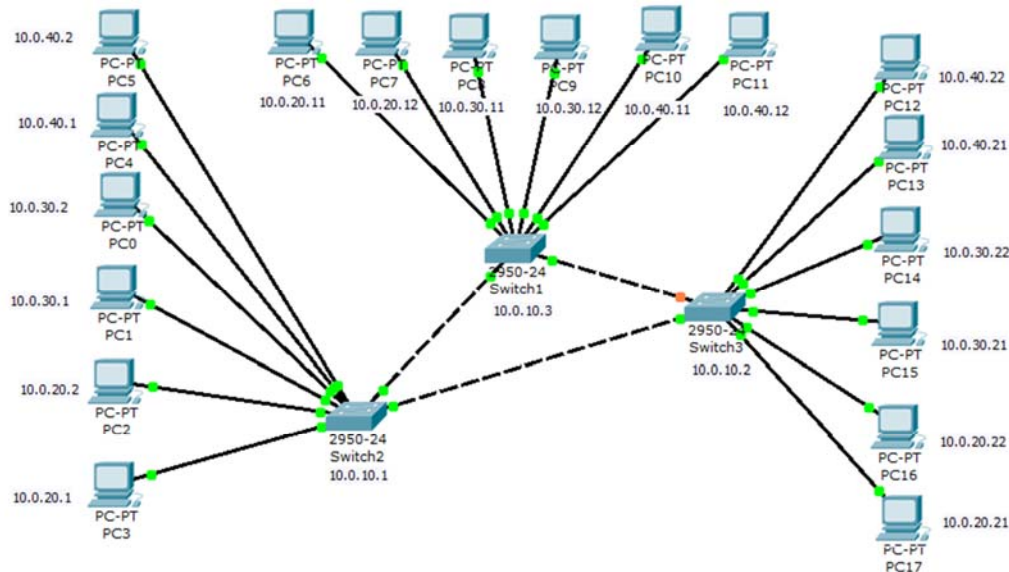
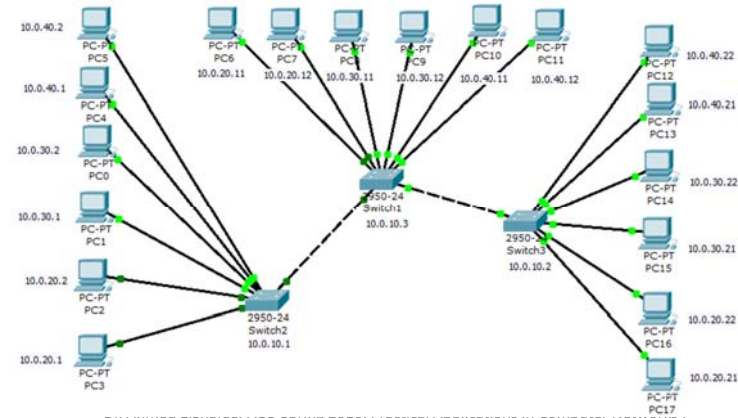


Lecture (07) STP (II)

By:
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Networks I

- Such design creates a single point of failure. We could easily tweak this simple design to make it more resilient by adding an extra path between **SW2** and **SW3**



```
SW2
+++
enable
config t
interface fa0/22
switchport mode trunk
end
copy running-config startup-config

SW03
++++
enable
config t
interface fa0/22
switchport mode trunk
end
copy running-config startup-config
```

-
- The redundant connection between **SW2** and **SW3** creates a loop.
 - The loop in turn, will create three serious problems.
 - **Duplicate Frame Delivery**
 - **MAC Address Table Instability**
 - **Broadcast Storm**
 - The last one in the list will eventually render our system unavailable.

STP

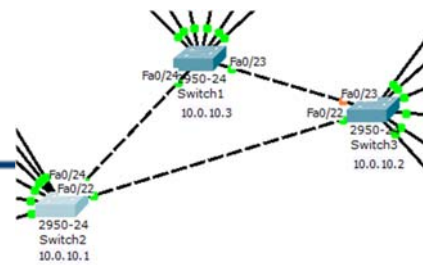
- Spanning-Tree Protocol (turned on by default), which will dynamically block redundant connections creating a loop free topology.
- Should the primary link fail, the one that is in the blocking state will start forwarding the traffic in about 30 seconds by default

Spanning-Tree Protocol Overview

STP is a layer 2 loop prevention mechanism.

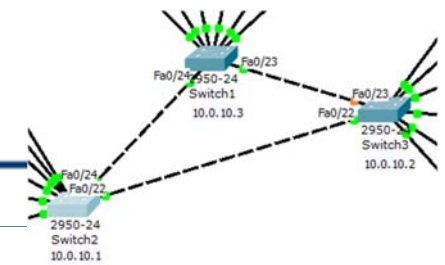
- Switches running this protocol use special frames called **Bridge Protocol Data Unit (BPDU)**.
- STP let switches create a loop free topology. This is accomplished using three distinct phases:
 1. Select a **single switch** to be the **root bridge** machine which is the central device in the layer 2 network.
 - This machine will have all its ports in the forwarding state (**designated port** role).
 2. All other switches (non-root switches), will select a **single path** towards the root bridge.

- That port is called the '**root port**' and will be forwarding traffic that is destined out of the switch through the root bridge.
- This path is the least cost (best) path towards the root.
- 3. All other switches will select a **single path per segment** in order to block stop the loop.
- The port that is forwarding traffic is called **designated port**.
- The port that is blocking traffic to stop the loop is called **non-designated port**.



- administrator should configure the root bridge.
- Typically, the most powerful switch in the center of the network plays that role.
- You do not want some access switch to be transmitting the frames between other switches.
- Access switches are designed to connect your computers to the network, and not to handle the majority of the traffic between the switches which root bridge must deal with.
- If you do not configure root bridge yourself, the switch with the lowest MAC address becomes the root since the priority is identical on all of them by default.

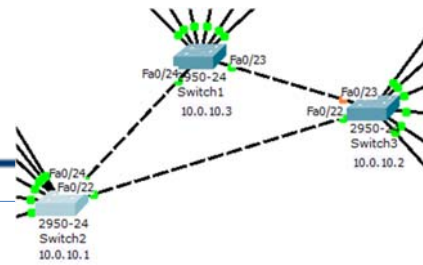
Discovering root switch



```
sw01#show spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 32769
Address 000D.BD98.4239
Cost 19
Port 24(FastEthernet0/24)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 00D0.9721.49E8
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20
```

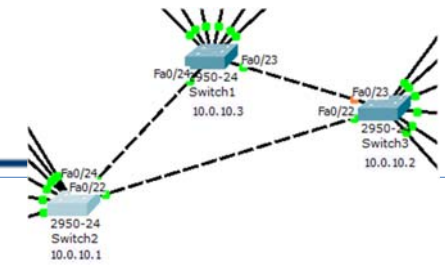
Interface	Role	Sts	Cost	Prio.	Nbr	Type
Fa0/24	Root	FWD	19	128.24	P2p	
Fa0/23	Desg	FWD	19	128.23	P2p	



```
SW02#show spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 32769
Address 000D.BD98.4239
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 000D.BD98.4239
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20
```

Interface	Role	Sts	Cost	Prio.	Nbr	Type
Fa0/24	Desg	FWD	19	128.24	P2p	
Fa0/22	Desg	FWD	19	128.22	P2p	



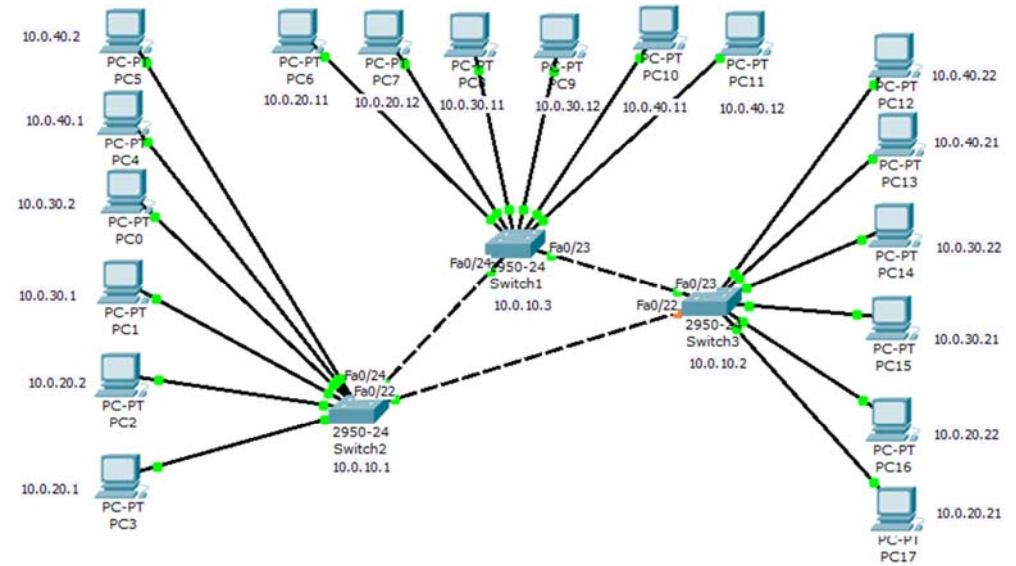
```
sw03#show spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 32769
Address 000D.BD98.4239
Cost 19
Port 22(FastEthernet0/22)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 00E0.A303.8D77
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20
```

Interface	Role	Sts	Cost	Prio.	Nbr	Type
Fa0/22	Root	FWD	19	128.22	P2p	
Fa0/23	Altn	BLK	19	128.23	P2p	

Setting root switch, Method 1

- decrement the priority on **SW1** and leave the default value on the other switches, The lowest priority value allowed is zero and if higher needs to be used, it must be an increment of 4096.



FL01-R03-SW03#show vlan

VLAN Name	Status	Ports
1 default	active	Fa0/16, Fa0/17, Fa0/18, Fa0/19 Fa0/20, Fa0/21, Fa0/24
2 Finance	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Fa0/5
3 HR	active	Fa0/6, Fa0/7, Fa0/8, Fa0/9 Fa0/10
4 Administration	active	Fa0/11, Fa0/12, Fa0/13, Fa0/14 Fa0/15

```
FL01-R03-SW03(config)#spanning-tree vlan 1,2,3,4 priority 0
FL01-R03-SW03(config)#end
FL01-R03-SW03#copy running-config startup-config
```

sw01#show spanning-tree vlan 1

```
VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 1
Address 00D0.9721.49E8
This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority 1 (priority 0 sys-id-ext 1)
Address 00D0.9721.49E8
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20
```

Interface	Role	Sts	Cost	Prio.	Nbr	Type
Fa0/23	Desg	FWD	19	128.23	P2p	
Fa0/24	Desg	FWD	19	128.24	P2p	

```
SW02#show spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 1
  Address 00D0.9721.49E8
  Cost 19
  Port 24(FastEthernet0/24)
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 000D.BD98.4239
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20
```

Interface	Role	Sts	Cost	Prio.	Nbr	Type
Fa0/24	Root	FWD	19	128.24		P2p
Fa0/22	Desg	FWD	19	128.22		P2p

```
sw03#show spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 1
  Address 00D0.9721.49E8
  Cost 19
  Port 23(FastEthernet0/23)
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 00E0.A303.8D77
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20
```

Interface	Role	Sts	Cost	Prio.	Nbr	Type
Fa0/23	Root	FWD	19	128.23		P2p
Fa0/22	Altn	BLK	19	128.22		P2p

Setting root switch, Method 2

- Use spanning-tree vlan root primary macro command which decrements the priority value using Cisco best practices.

FL01-R03-SW03#show vlan

VLAN Name	Status	Ports
1 default	active	Fa0/16, Fa0/17, Fa0/18, Fa0/19 Fa0/20, Fa0/21, Fa0/24
2 Finance	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Fa0/5
3 HR	active	Fa0/6, Fa0/7, Fa0/8, Fa0/9 Fa0/10
4 Administration	active	Fa0/11, Fa0/12, Fa0/13, Fa0/14 Fa0/15

```
FL01-R03-SW03(config)#spanning-tree vlan 1,2,3,4 root primary
FL01-R03-SW03(config)#end
FL01-R03-SW03#copy running-config startup-config
```

```
sw01#show spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 24577
  Address 00D0.9721.49E8
  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 00D0.9721.49E8
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20
```

Interface	Role	Sts	Cost	Prio.	Nbr	Type
Fa0/24	Desg	FWD	19	128.24		P2p
Fa0/23	Desg	FWD	19	128.23		P2p

```
SW02#show spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 24577
  Address 00D0.9721.49E8
  Cost 19
  Port 24(FastEthernet0/24)
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
  Address 000D.BD98.4239
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time 20
```

Interface	Role	Sts	Cost	Prio.	Nbr	Type
Fa0/22	Desg	FWD	19	128.22	P2p	
Fa0/24	Root	FWD	19	128.24	P2p	

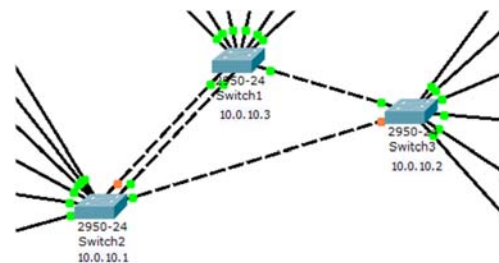
```
sw03#show spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 24577
  Address 00D0.9721.49E8
  Cost 19
  Port 23(FastEthernet0/23)
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
  Address 00E0.A303.8D77
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time 20
```

Interface	Role	Sts	Cost	Prio.	Nbr	Type
Fa0/22	Altn	BLK	19	128.22	P2p	
Fa0/23	Root	FWD	19	128.23	P2p	

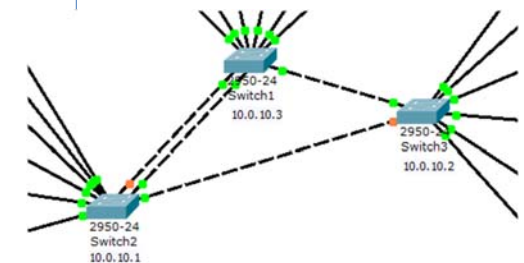
Add redundant root ports

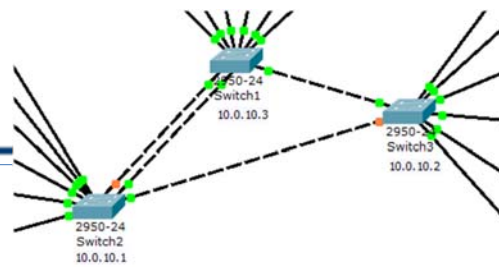
- Firstly lets add redundant connection between SW 1,2
- Collect spanning-tree information on vlan 1 of both SW01, SW02



```
SW01
++++
enable
config t
interface fa0/21
switchport mode trunk
end
copy running-config startup-config

SW02
++++
enable
config t
interface fa0/21
switchport mode trunk
end
copy running-config startup-config
```

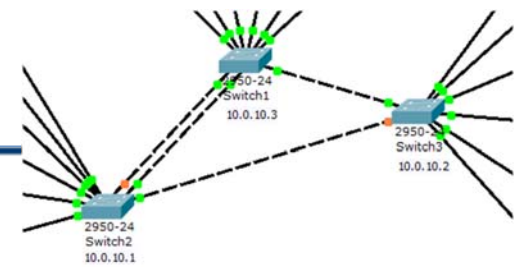




```
sw01#show spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 24577
  Address 00D0.9721.49E8
  This bridge is the root
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority 24577 (priority 24576 sys-id-ext 1)
  Address 00D0.9721.49E8
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time 20
```

Interface	Role	Sts	Cost	Prio.	Nbr	Type
Fa0/21	Desg	FWD	19	128.21		P2p
Fa0/23	Desg	FWD	19	128.23		P2p
Fa0/24	Desg	FWD	19	128.24		P2p



```
SW02#show spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 24577
  Address 00D0.9721.49E8
  Cost 19
  Port 21(FastEthernet0/21)
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
  Address 000D.BD98.4239
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time 20
```

Interface	Role	Sts	Cost	Prio.	Nbr	Type
Fa0/22	Desg	FWD	19	128.22		P2p
Fa0/24	Altn	BLK	19	128.24		P2p
Fa0/21	Root	FWD	19	128.21		P2p

Swap alternative and root ports in SW02 (24, 21)

- @ root switch (SW1) decrease priority of alternative port (24) to 64

```
en
config t
interface fa0/24
spanning-tree vlan 1 port-priority 64
end
copy running-config startup-config
```

```
sw01#show spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 24577
  Address 00D0.9721.49E8
  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 00D0.9721.49E8
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time 20
```

Interface	Role	Sts	Cost	Prio.	Nbr	Type
Fa0/21	Desg	FWD	19	128.21		P2p
Fa0/23	Desg	FWD	19	128.23		P2p
Fa0/24	Desg	FWD	19	64.24		P2p

```
SW02#show spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID Priority 24577
  Address 00D0.9721.49E8
  Cost 19
  Port 24(FastEthernet0/24)
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
  Address 000D.BD98.4239
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time 20
```

Interface	Role	Sts	Cost	Prio.	Nbr	Type
Fa0/22	Desg	FWD	19	128.22		P2p
Fa0/24	Root	FWD	19	128.24		P2p
Fa0/21	Altn	BLK	19	128.21		P2p

Load balancing between redundant ports

- @ root switch (SW01), Check spanning tree on shared ports

```
sw01#show spanning-tree interface FastEthernet 0/21
Vlan      Role Sts Cost   Prio.Nbr Type
-----
VLAN0001  Desg FWD 19    128.21 P2p
VLAN0002  Desg FWD 19    128.21 P2p
VLAN0003  Desg FWD 19    128.21 P2p
VLAN0004  Desg FWD 19    128.21 P2p
```

```
sw01#show spanning-tree interface FastEthernet 0/24
Vlan      Role Sts Cost   Prio.Nbr Type
-----
VLAN0001  Desg FWD 19    128.24 P2p
VLAN0002  Desg FWD 19    128.24 P2p
VLAN0003  Desg FWD 19    128.24 P2p
VLAN0004  Desg FWD 19    128.24 P2p
```

- @ SW02, Check spanning tree on shared ports

```
SW02>en
SW02#show spanning-tree interface FastEthernet 0/21
Vlan      Role Sts Cost   Prio.Nbr Type
-----
VLAN0001  Root FWD 19    128.21 P2p
VLAN0002  Root FWD 19    128.21 P2p
VLAN0003  Root FWD 19    128.21 P2p
VLAN0004  Root FWD 19    128.21 P2p
```

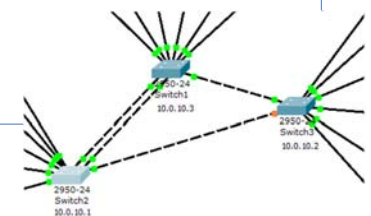
```
SW02#show spanning-tree interface fa0/24
Vlan      Role Sts Cost   Prio.Nbr Type
-----
VLAN0001  Altn BLK 19    128.24 P2p
VLAN0002  Altn BLK 19    128.24 P2p
VLAN0003  Altn BLK 19    128.24 P2p
VLAN0004  Altn BLK 19    128.24 P2p
```

- @ root switch (SW01) decrease vlan3,4 priorities

```
interface FastEthernet 0/24
spanning-tree vlan 3 port-priority 64
spanning-tree vlan 4 port-priority 64
```

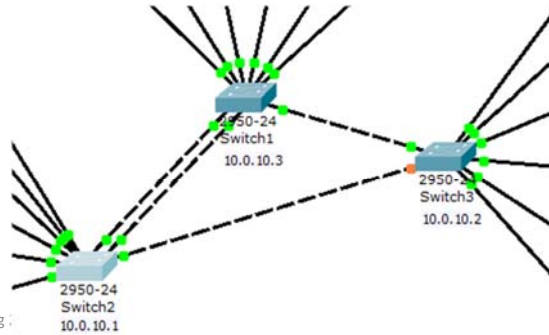
- Check spanning tree on SW02 shared ports

```
SW02#show spanning-tree interface FastEthernet 0/21
Vlan      Role Sts Cost   Prio.Nbr Type
-----
VLAN0001  Root FWD 19    128.21 P2p
VLAN0002  Root FWD 19    128.21 P2p
VLAN0003  Altn BLK 19    128.21 P2p
VLAN0004  Altn BLK 19    128.21 P2p
```




```
SW02#show spanning-tree interface FastEthernet 0/24
```

Vlan	Role	Sts	Cost	Prio.Nbr	Type
VLAN0001	Altn	BLK	19	128.24	P2p
VLAN0002	Altn	BLK	19	128.24	P2p
VLAN0003	Root	FWD	19	128.24	P2p
VLAN0004	Root	FWD	19	128.24	P2p



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```
sw01#show spanning-tree interface FastEthernet 0/21
```

Vlan	Role	Sts	Cost	Prio.Nbr	Type
VLAN0001	Desg	FWD	19	128.21	P2p
VLAN0002	Desg	FWD	19	128.21	P2p
VLAN0003	Desg	FWD	19	128.21	P2p
VLAN0004	Desg	FWD	19	128.21	P2p

```
sw01#show spanning-tree interface FastEthernet 0/24
```

Vlan	Role	Sts	Cost	Prio.Nbr	Type
VLAN0001	Desg	FWD	19	128.24	P2p
VLAN0002	Desg	FWD	19	128.24	P2p
VLAN0003	Desg	FWD	19	64.24	P2p
VLAN0004	Desg	FWD	19	64.24	P2p

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Thanks,..
See you next week (ISA),...

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