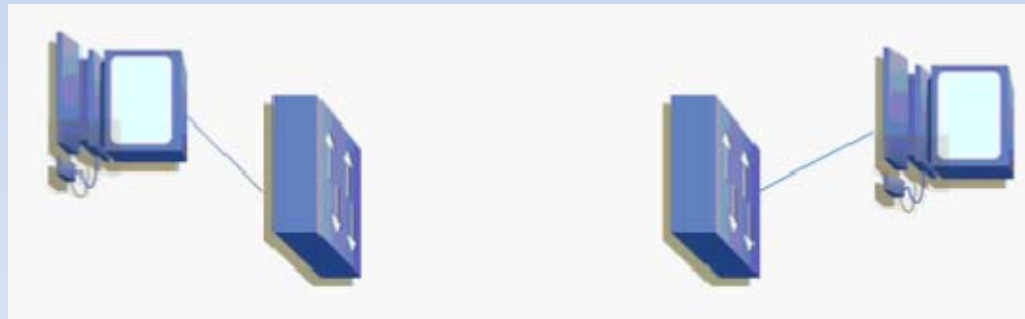
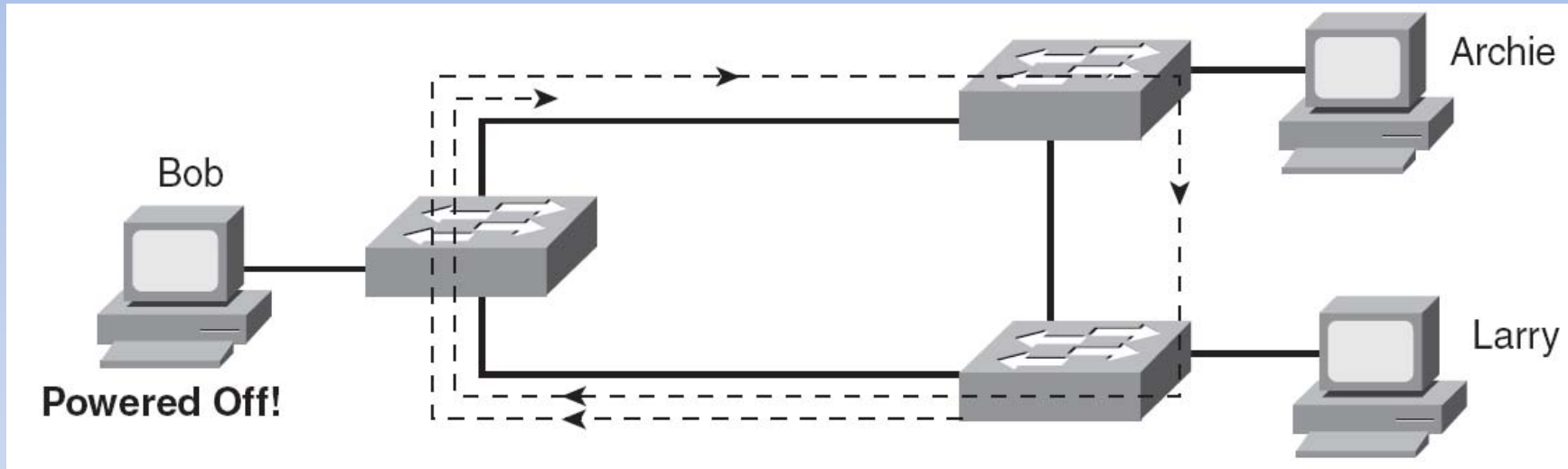


# Switching

Part 2

# Spanning-tree Protocol



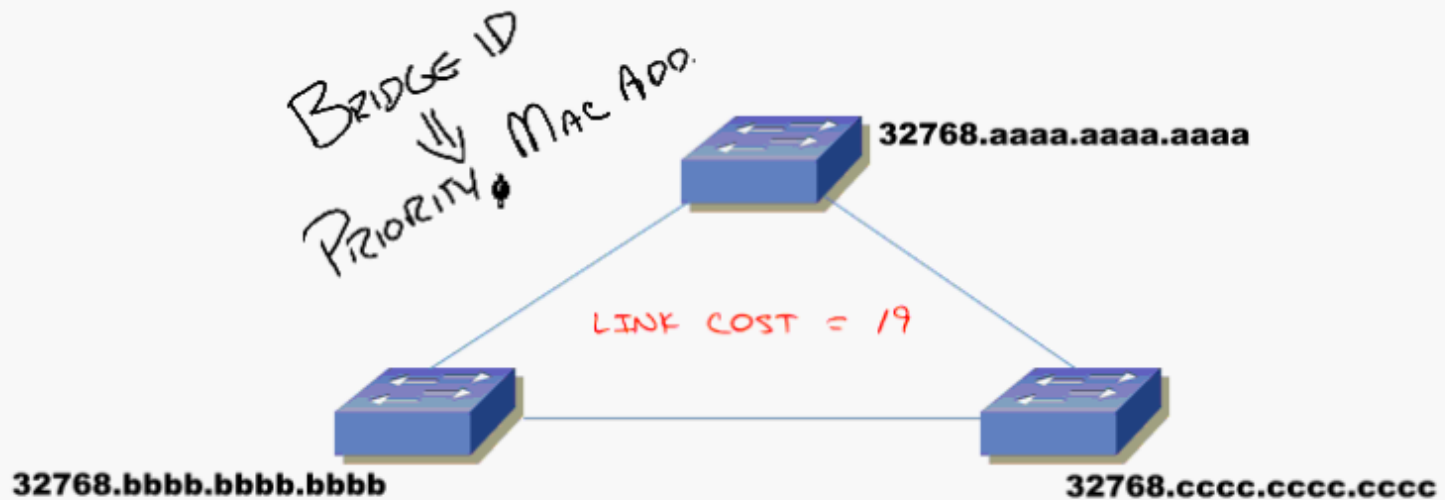
# Spanning-tree Protocol

- ORIGINAL STP (802.1D) WAS CREATED TO PREVENT LOOPS
- SWITCHES SEND "PROBES" INTO THE NETWORK CALLED BRIDGE PROTOCOL DATA UNITS (BPDUs) TO DISCOVER LOOPS
- THE BPDU PROBES ALSO HELP ELECT THE CORE SWITCH OF THE NETWORK, CALLED THE ROOT BRIDGE
- THE SIMPLISTIC VIEW OF STP: ALL SWITCHES FIND THE BEST WAY TO REACH THE ROOT BRIDGE THEN BLOCK ALL REDUNDANT LINKS

# Spanning-tree Protocol

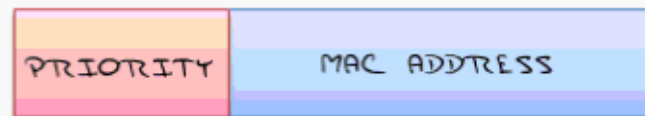
## ° THREE PORT TYPES

- ROOT PORT: USED TO REACH THE ROOT BRIDGE
- DESIGNATED PORT: FORWARDING PORT, ONE PER LINK
- BLOCKING / NON-DESIGNATED PORT: WHERE THE TREE FELL

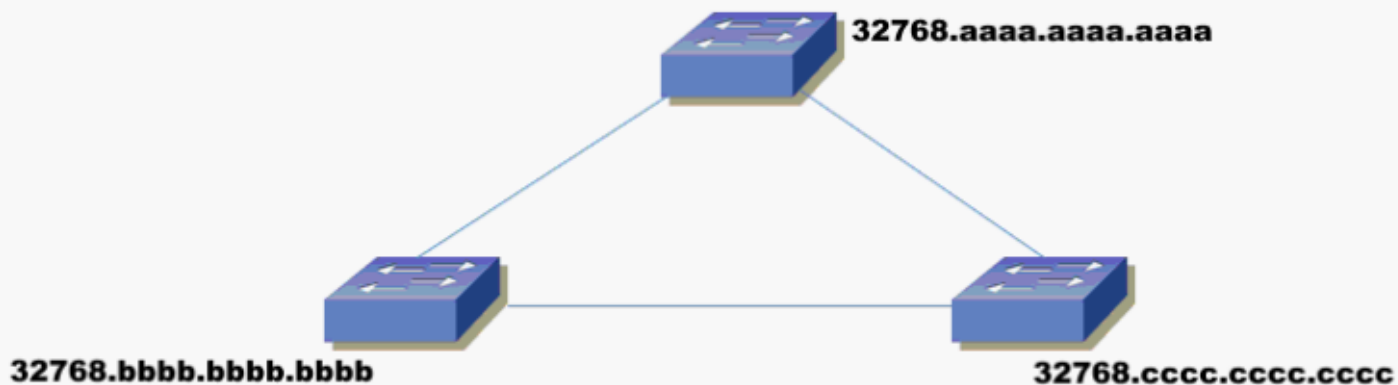


# Spanning-tree Protocol

- BPDUs ARE SENT ONCE EVERY TWO SECONDS



- PRIORITY IS SOME VALUE BETWEEN 0 AND 61440 (DEFAULT IS 32768); INCREMENTS OF 4096 - LOWER IS BETTER



# Spanning-tree Protocol

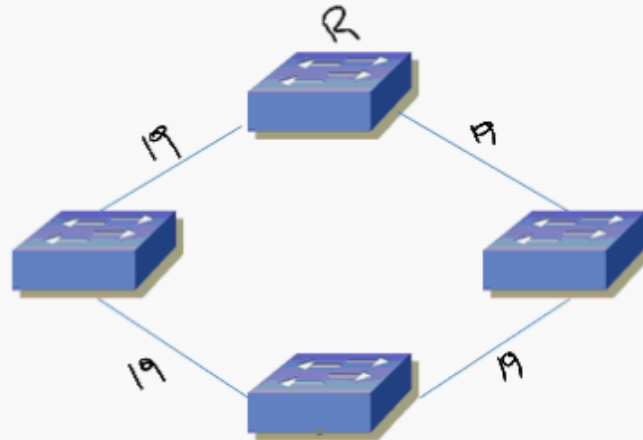
STEP 1: ELECT THE ROOT

STEP 2: SWITCHES FIND LOWEST COST PATH TO ROOT

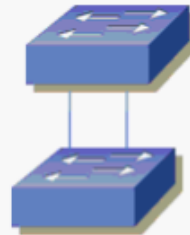
Link Bandwidth	Cost
10Mbps	100
100Mbps	19
1Gbps	4
10Gbps	2

# Spanning-tree Protocol

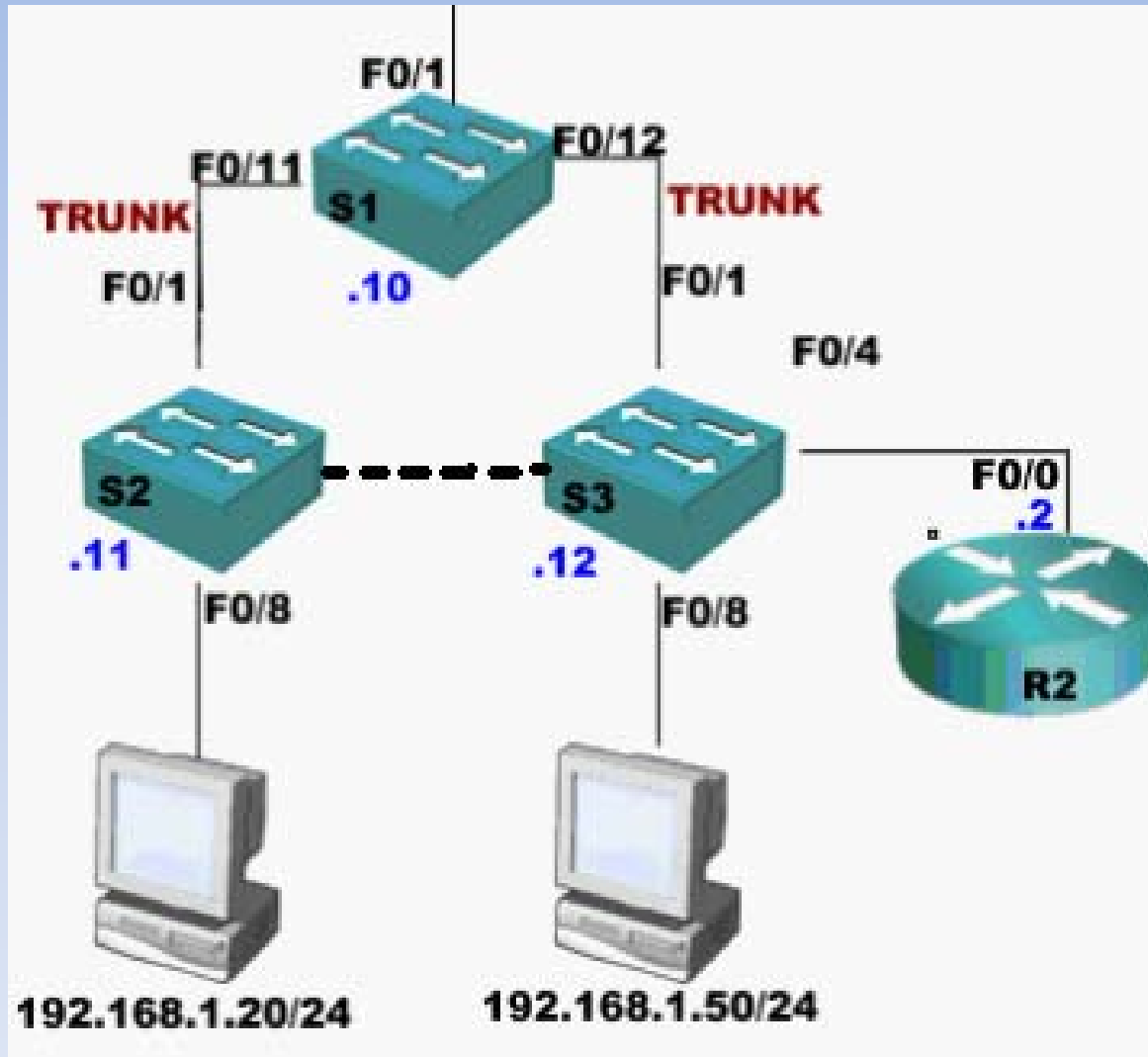
STEP 3: USE LOWER BRIDGE ID ON EQUAL COST PATHS



STEP 4: USE LOWER PORT TO BREAK A TIE



# Example





# Example

```
S1#show spanning-tree
```

```
VLAN0001
```

```
Spanning tree enabled protocol ieee
```

```
Root ID    Priority    32769  
Address    0008.20fd.be80  
Cost       19  
Port       11 (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    000c.854b.ee80  
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec  
Aging Time 300
```

Interface	Role	Sts	Cost	Prio.Nbr	Type
Fa0/1	Desg	FWD	100	128.1	P2p
Fa0/11	Root	FWD	19	128.11	P2p
Fa0/12	Altn	BLK	19	128.12	P2p
Fa0/24	Desg	FWD	19	128.24	P2p

```
S1#
```

```
S2#show spanning-tree
```

```
VLAN0001
```

```
Spanning tree enabled protocol ieee
```

```
Root ID      Priority      32769  
            Address      0008.20fd.be80
```

```
1 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      0008.20fd.be80
```

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

```
Aging Time 300
```

Interface	Role	Sts	Cost	Prio.Nbr	Type
Fa0/1	Desg	FWD	19	128.1	P2p
Fa0/8	Desg	FWD	19	128.8	P2p
Fa0/24	Desg	FWD	19	128.24	P2p

```
S3#show spanning-tree
```

```
VLAN0001
```

```
Spanning tree enabled protocol ieee
```

```
Root ID      Priority      32769  
            Address      0008.20fd.be80
```

```
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      000b.be02.2840
```

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

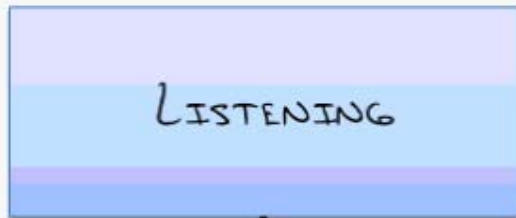
```
Aging Time 300
```

Interface	Role	Sts	Cost	Prio.Nbr	Type
Fa0/1	Desg	FWD	19	128.1	P2p
Fa0/4	Desg	FWD	19	128.4	P2p
Fa0/8	Desg	FWD	19	128.8	P2p
Fa0/24	Root	FWD	19	128.24	P2p

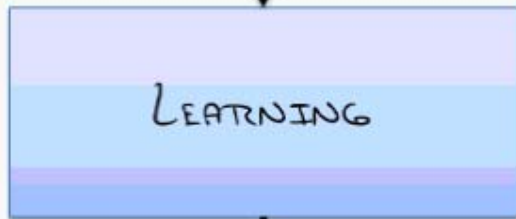
# Spanning-tree Protocol

- How to make Sw-1 the root switch ?
- Spanning-tree vlan 1 root primary
- (sets priority = 24577)
- Or Spanning-tree vlan 1 priority 0- 61440  
increments of 4096
  
- BPDU/Root guard definition

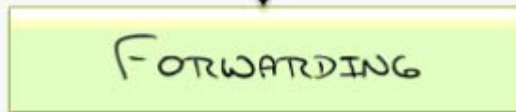
# Spanning-tree Protocol



- 15 SECONDS OF LISTENING FOR BPDUs
- SWITCH SENDS / RECEIVES BPDUs



- 15 SECONDS OF LEARNING MAC ADDRESSES
- POPULATES SWITCH CAM TABLE



- PORT IS FORWARDING TRAFFIC (HAPPY)



- BONUS - SWITCH WILL WAIT UP TO 20 SECONDS (MAX-AGE) BEFORE MOVING A BLOCKED PORT INTO LISTENING PHASE

# Spanning-tree Protocol

- To skip this long process, for Pcs, meaning for ports attached to Pcs Printers ... we do the command :
- Spanning-tree portfast
- To skip this long process between Switches, :  
PVST+ or RSTP

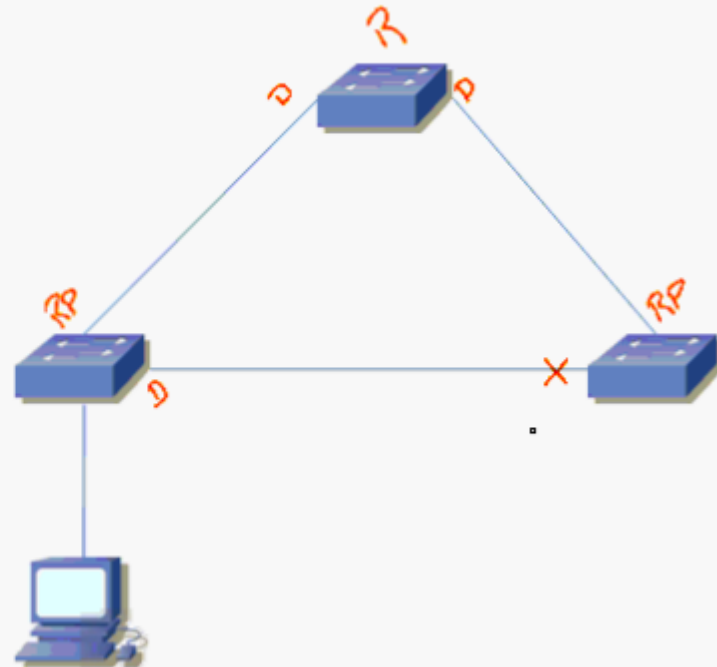
# Rapid Spanning-tree Protocol

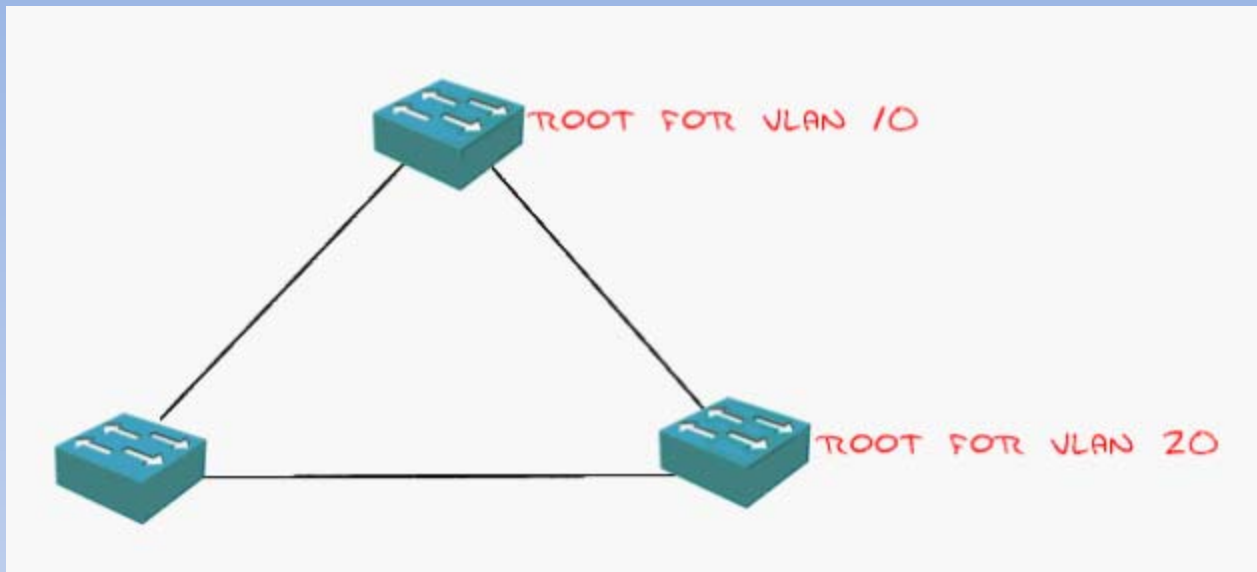
- RSTP **802.1w** new standard , if you want to implement it you should implement RSTP or R PVSTP, you should change all the network.
- What RSTP does is remember the blocked ports which now are called alternate ports, so you don't need 50 seconds anymore to get back to a backup port...

# Rapid Spanning-tree Protocol

## RAPID STP PORT ROLES

- ROOT PORT
- DESIGNATED PORT
- ALTERNATE PORT
- EDGE PORT





### VLAN0010

```
Spanning tree enabled protocol ieee
Root ID    Priority    32778
           Address    0008.20fd.be80
           Cost        19
           Port        11 (FastEthernet0/11)
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID  Priority    32778 (priority 32768 sys-id-ext 10)
           Address    000c.854b.ee80
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
           Aging Time 300

Interface          Role Sts Cost          Prio.Nbr Type
-----
Fa0/11             Root FWD 19           128.11  P2p
Fa0/12             Desg FWD 19           128.12  P2p
Fa0/24             Desg FWD 19           128.24  P2p
```