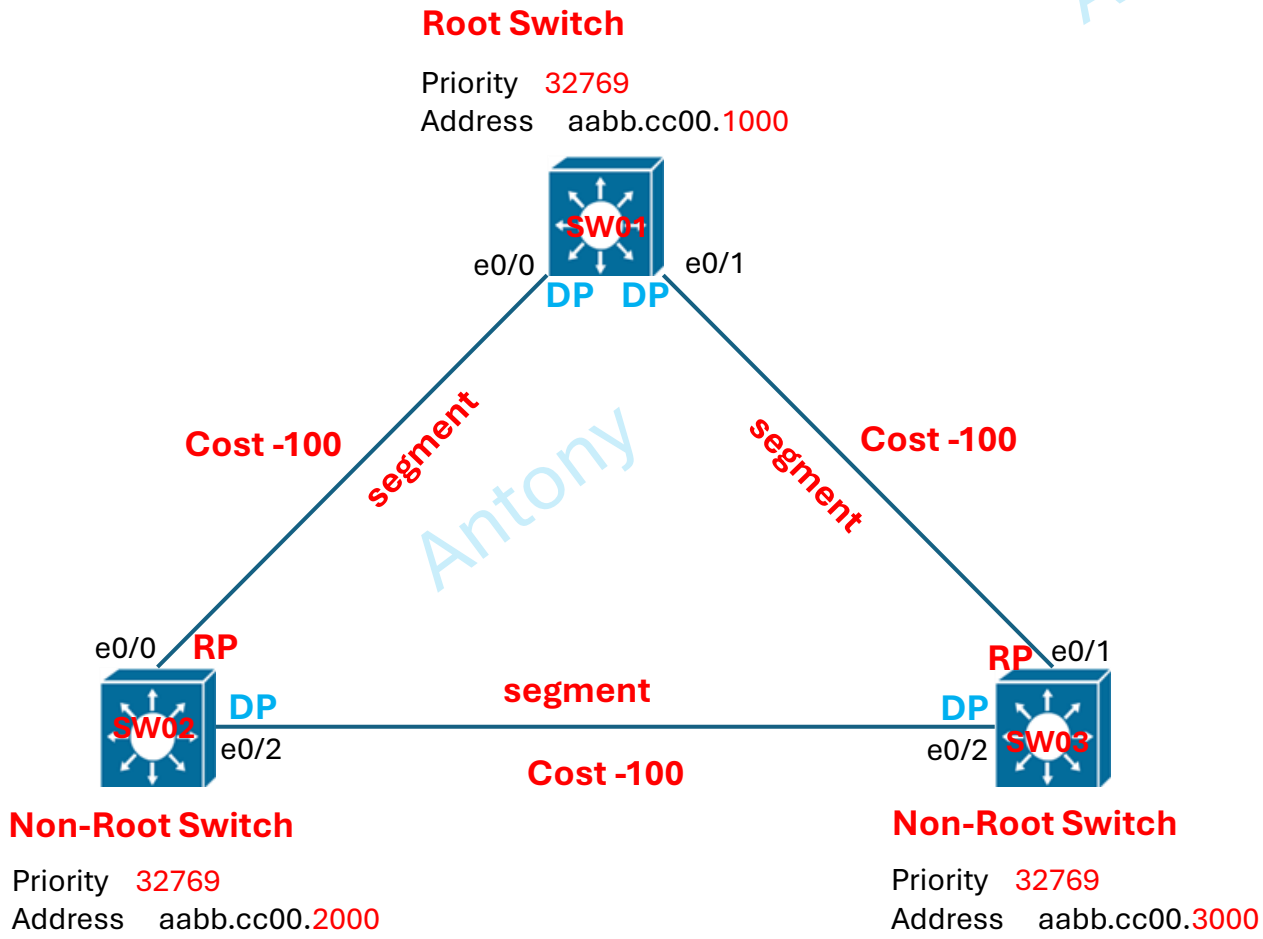
■ Content

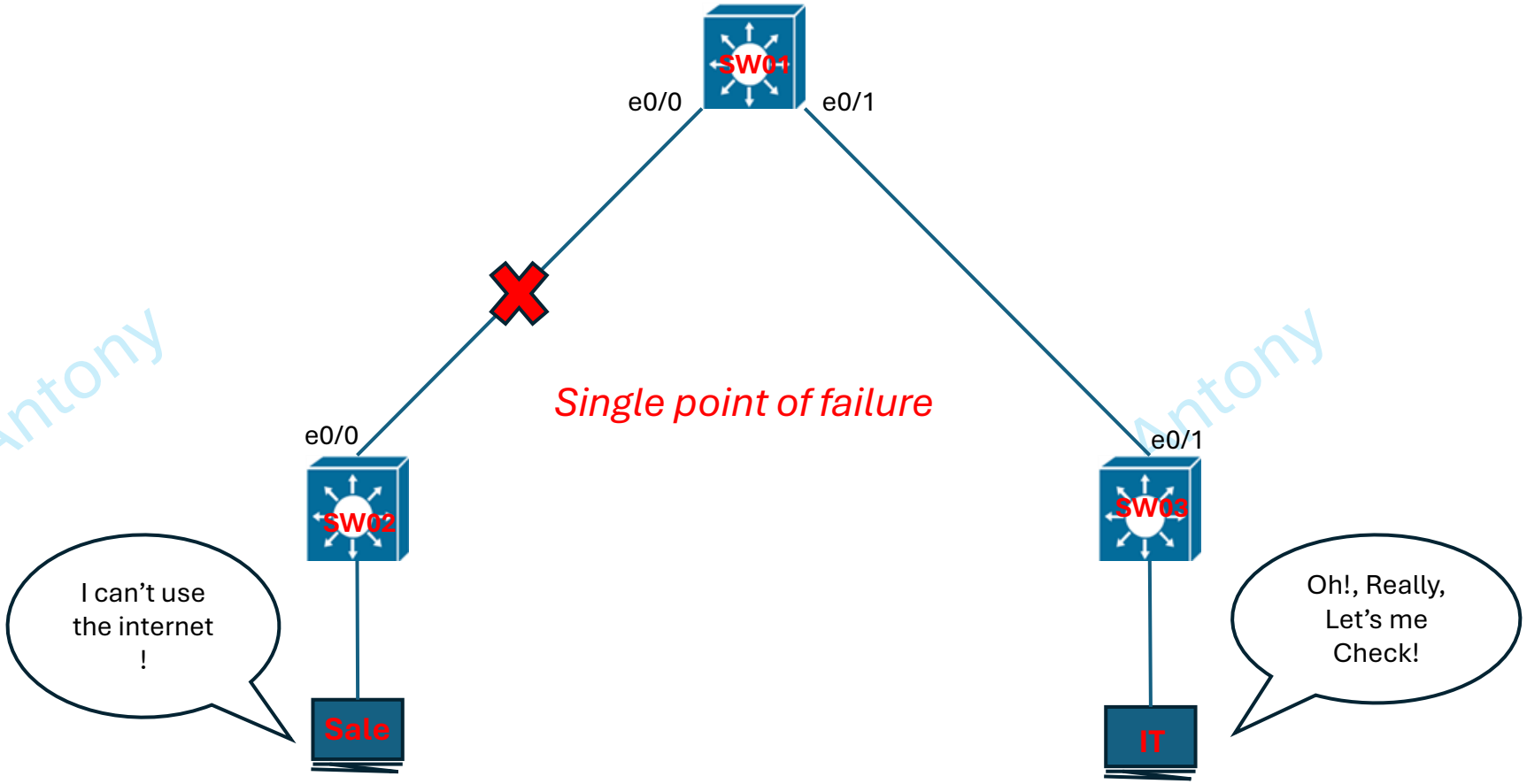
What is Spanning Tree Protocol (STP)?

1. Single Point of Failure
2. Preventing Layer 2 Loops
3. STP and Redundancy
4. Change Root Switch From SW01 to SW02
5. Confirm and Results

STP *STP Basic Concept*

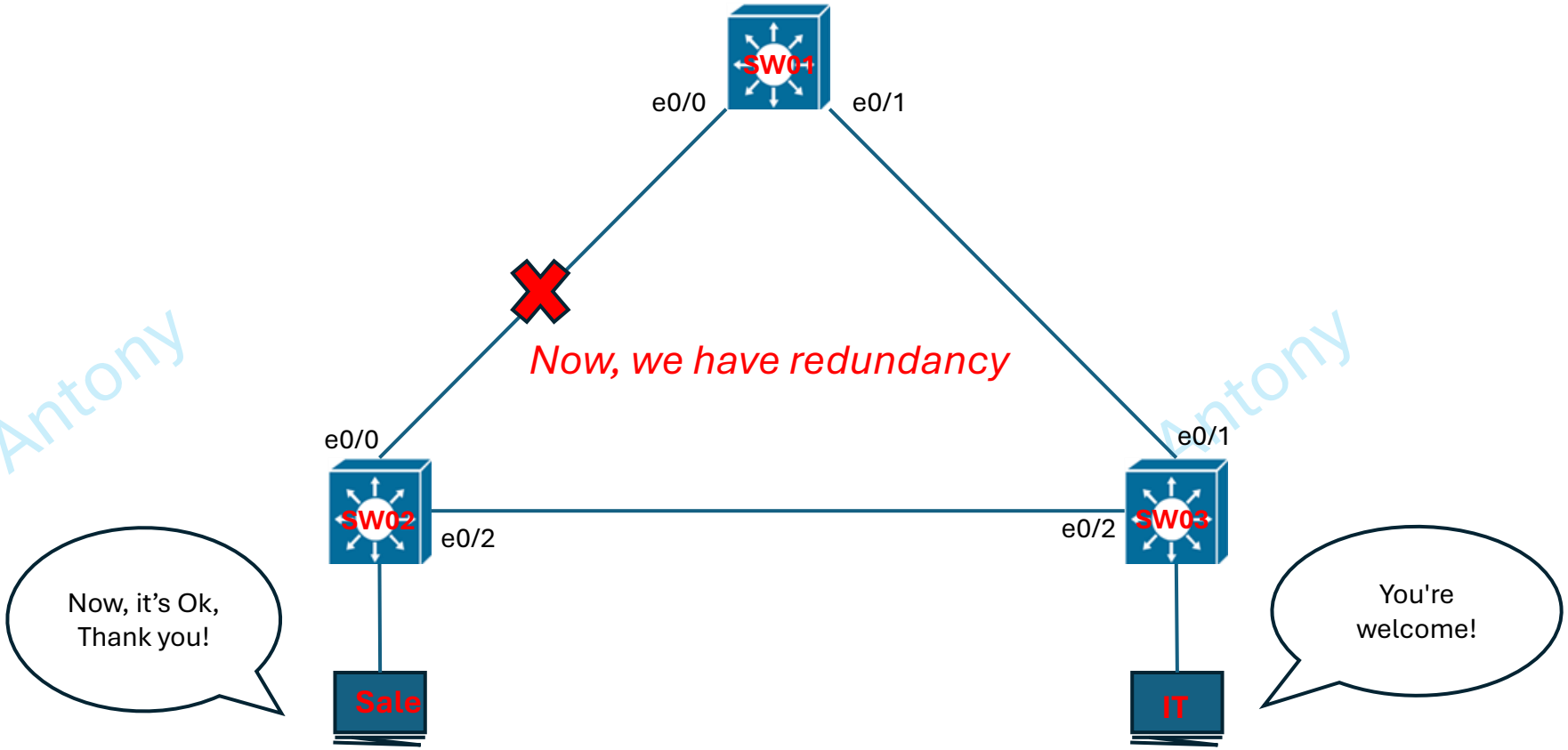


1 What is Single point of failure



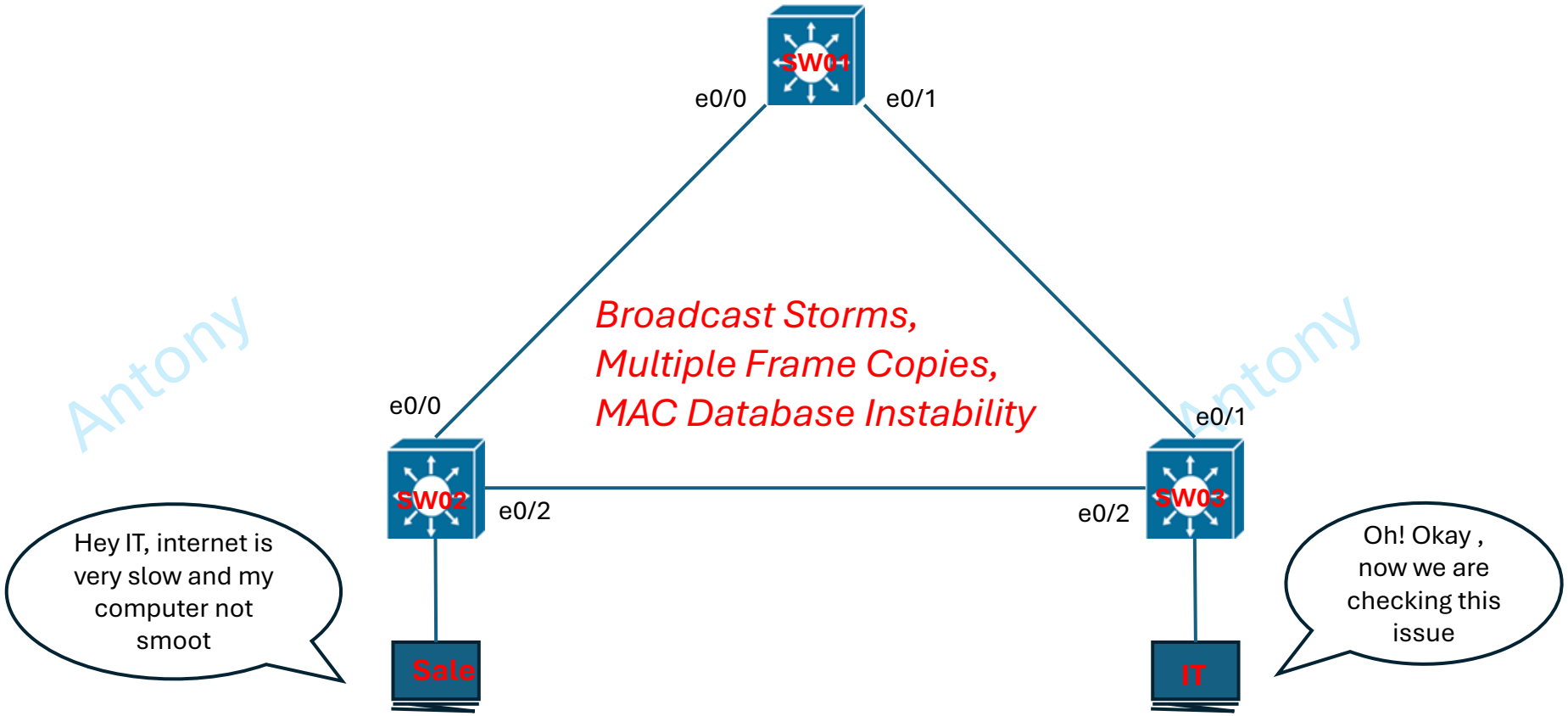
1. You see that , we don't have redundancy. If one of the network cable not working, we can't use the internet.

2 Why should you use a redundant link?



We now have a redundant link. Even if one network cable fails, we can still use the internet thanks to this redundancy

3 How do you know there's a Layer 2 loop issue?



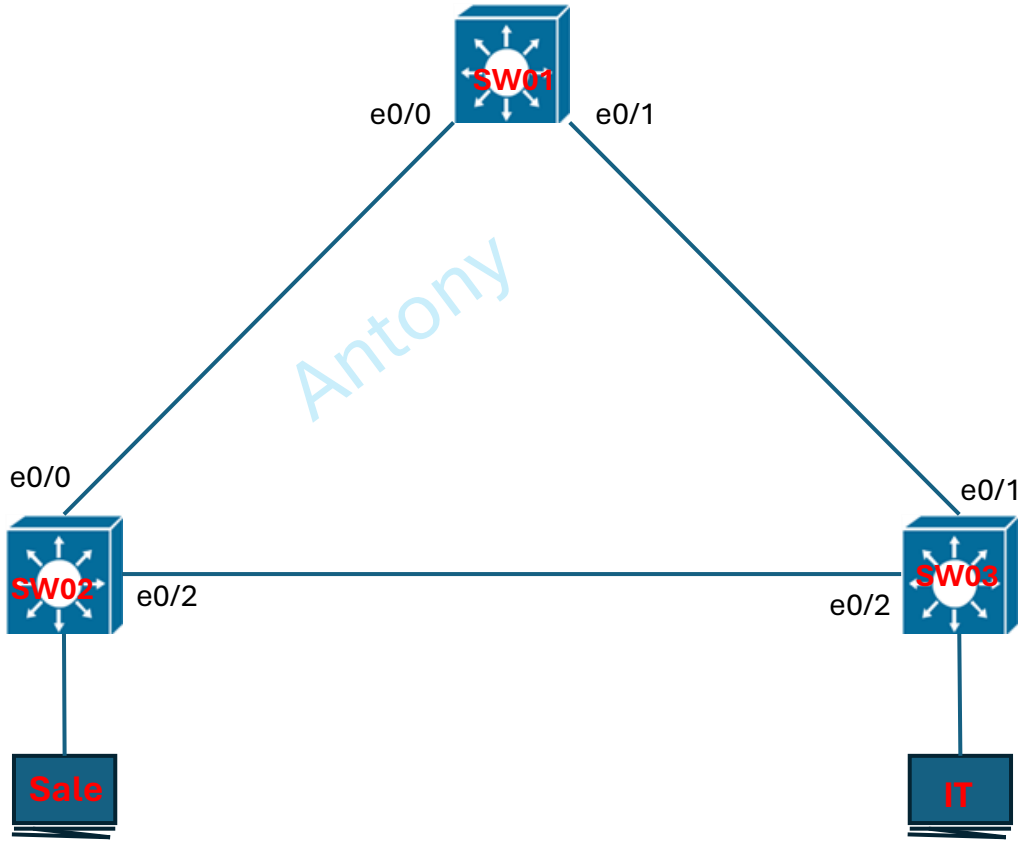
3. We are facing a Layer 2 loop issue. Preventing these loops and broadcast storms is essential for network redundancy. So, we need to create Layer 2 loop-free topology

➢ Spanning Tree Protocol (STP) is a Layer 2 network protocol

1. STP = IEEE 802.1D / convergent time (50 seconds)
   PVST+ = Cisco
2. PSTP = 802.1w
   Rapid PVST+ = Cisco
3. MST = 802.1s

We need to Know below session

1. Root switch Election
2. Root Port
3. Designated port



❖ STP Cost

Data Rate	STP Cost
100 Mb/s	19
1GB	4
2GB	2
10GB	2

1. Root switch Election

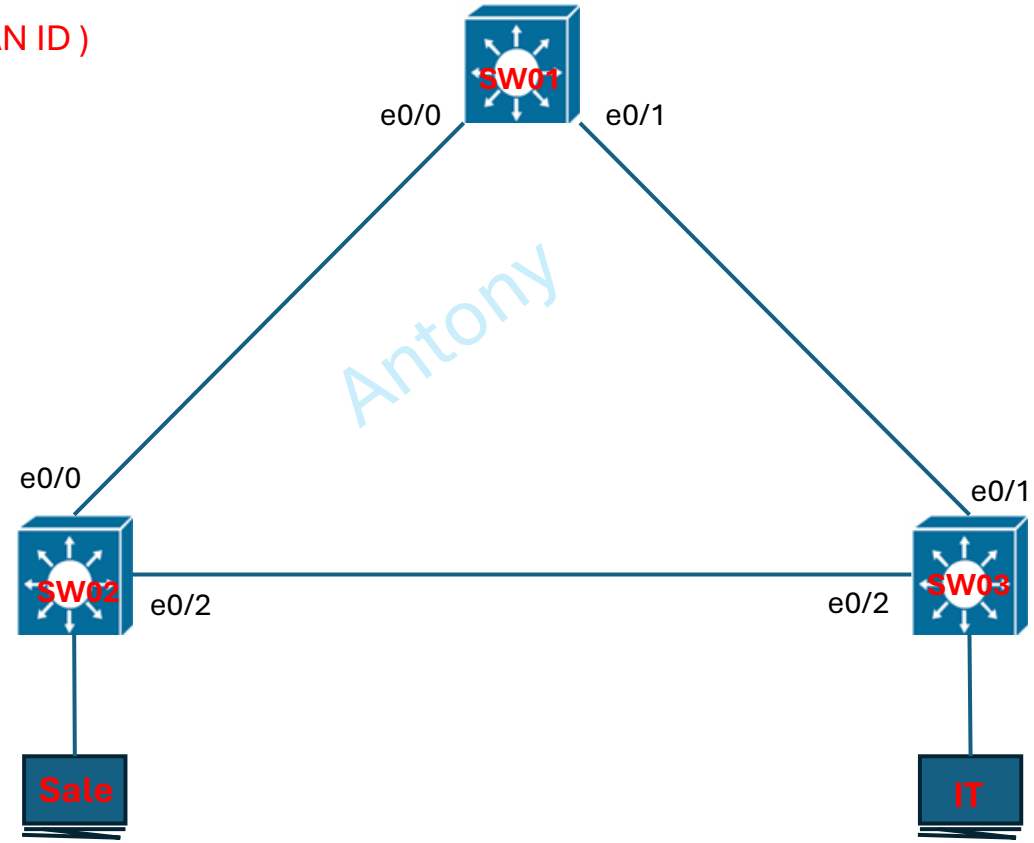
1> BPDU (Default = sent every 2 seconds)
induce Bridge Priority and MAC Address (Bridge Priority 32768 + VLAN ID)
2> Lowest Bridge ID and MAC Address becomes the Root Switch.

```
322 433.404394   aa:bb:cc:00:20:00   CDP/VTP/DTP/PAgP/UD… DTP          90 Dynamic Trunk Prot
323 433.646203   aa:bb:cc:00:20:00   DEC-MOP-Remote-Cons… 0x6002       77 DEC DNA Remote Cor
324 433.880734   aa:bb:cc:00:10:00   CDP/VTP/DTP/PAgP/UD… DTP          60 Dynamic Trunk Prot
325 433.880781   aa:bb:cc:00:10:00   CDP/VTP/DTP/PAgP/UD… DTP          90 Dynamic Trunk Prot
326 435.089817   aa:bb:cc:00:10:00   Spanning-tree-(for-… STP          60 Conf. Root = 32768
327 436.117193   aa:bb:cc:00:20:00   CDP/VTP/DTP/PAgP/UD… CDP         450 Device ID: Switch
328 437.091147   aa:bb:cc:00:10:00   Spanning-tree-(for-… STP          60 Conf. Root = 32768
329 439.098217   aa:bb:cc:00:10:00   Spanning-tree-(for-… STP          60 Conf. Root = 32768
```

Wireshark · Packet 15 · -

```
> Frame 15: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface -, id 0
> IEEE 802.3 Ethernet
> Logical-Link Control
v Spanning Tree Protocol
    Protocol Identifier: Spanning Tree Protocol (0x0000)
    Protocol Version Identifier: Spanning Tree (0)
    BPDU Type: Configuration (0x00)
  v BPDU flags: 0x00
      0... .... = Topology Change Acknowledgment: No
      .... ...0 = Topology Change: No
  v Root Identifier: 32768 / 1 / aa:bb:cc:00:10:00
      Root Bridge Priority: 32768
      Root Bridge System ID Extension: 1
      Root Bridge System ID: aa:bb:cc:00:10:00 (aa:bb:cc:00:10:00)
```

```
0000  01 80 c2 00 00 00 aa bb  cc 00 10 00 00 26 42 42   ........ .....&BB
0010  03 00 00 00 00 00 80 01  aa bb cc 00 10 00 00 00   ........ ........
0020  00 00 80 01 aa bb cc 00  10 00 80 01 00 00 14 00   ........ ........
0030  02 00 0f 00 00 00 00 00  00 00 00 00               ........ ....
```



Let’s go next page

4 Root Switch, Root Port , Designated Port and Block Port

SW01

```
sw01#show spanning-tree

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    32769
              Address     aabb.cc00.1000
              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     aabb.cc00.1000
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/0               Desg FWD 100       128.1    Shr
Et0/1               Desg FWD 100       128.2    Shr
Et0/2               Desg FWD 100       128.3    Shr
Et0/3               Desg FWD 100       128.4    Shr
```

Default is IEEE

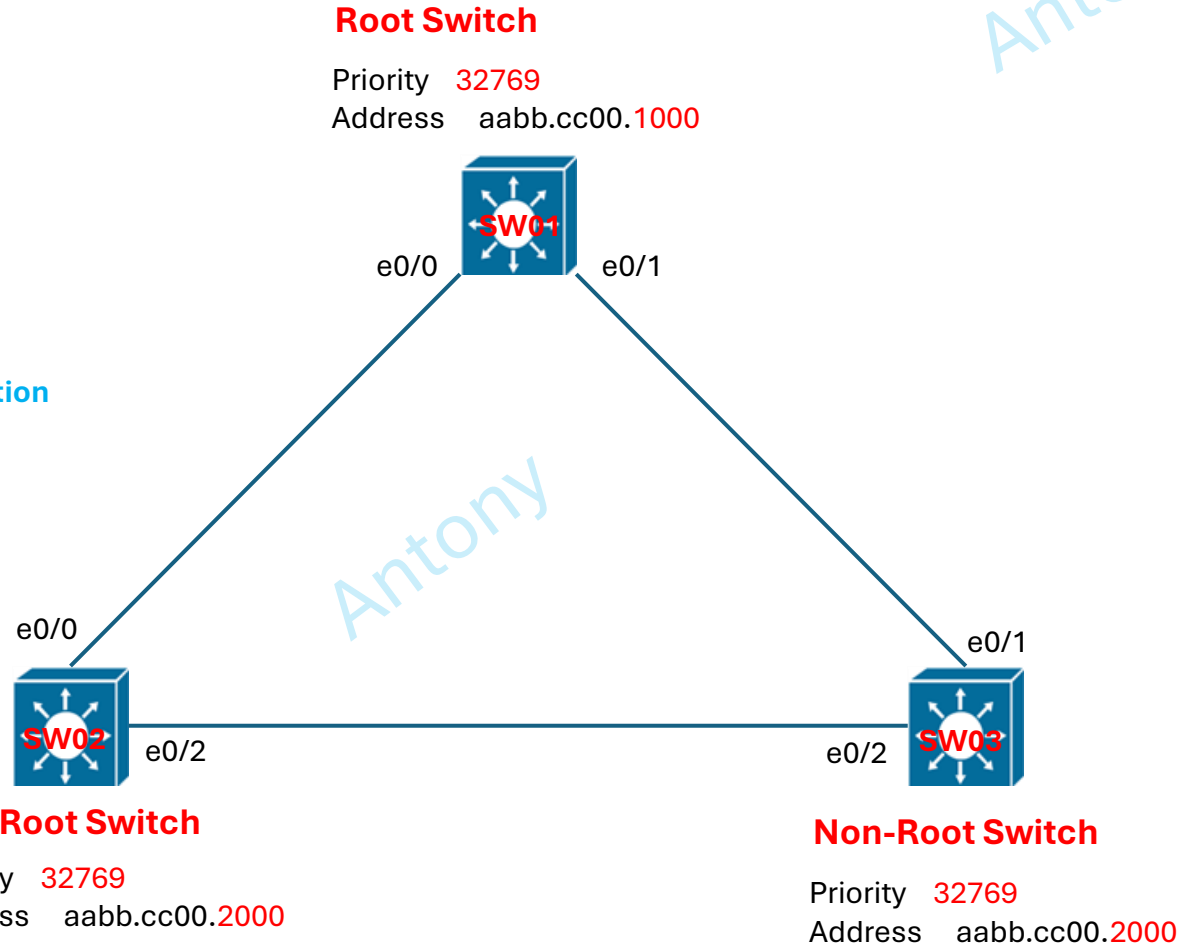
❖ **Root Switch Information**

❖ **Sw01 Switch Information**

```
sw01#show spanning-tree summary
Switch is in pvst mode
Root bridge for: VLAN0001
Extended system ID           is enabled
Portfast Default             is disabled
PortFast BPDU Guard Default  is disabled
Portfast BPDU Filter Default is disabled
Loopguard Default            is disabled
EtherChannel misconfig guard is enabled
Configured Pathcost method used is short
UplinkFast                   is disabled
BackboneFast                 is disabled
```

❖ **show spanning-tree**

❖ **show spanning-tree summary**



❖ We have 3 Switch right , we don't know which switch are Root Switch, check yourself. ☺

❖ Lowest Bridge ID and MAD Address will be Root Switch, this session SW01 is Root Switch because Priority are same and check the MAC Address, SW01 MAC addresses lowers then SW02 and SW03, All the other switches are called non-root.

4 Root Switch, Root Port , Designated Port and Block Port

2. Root Port

- Non-Root Switch has a Root Port, Non-root switches must find the shortest path to the root bridge

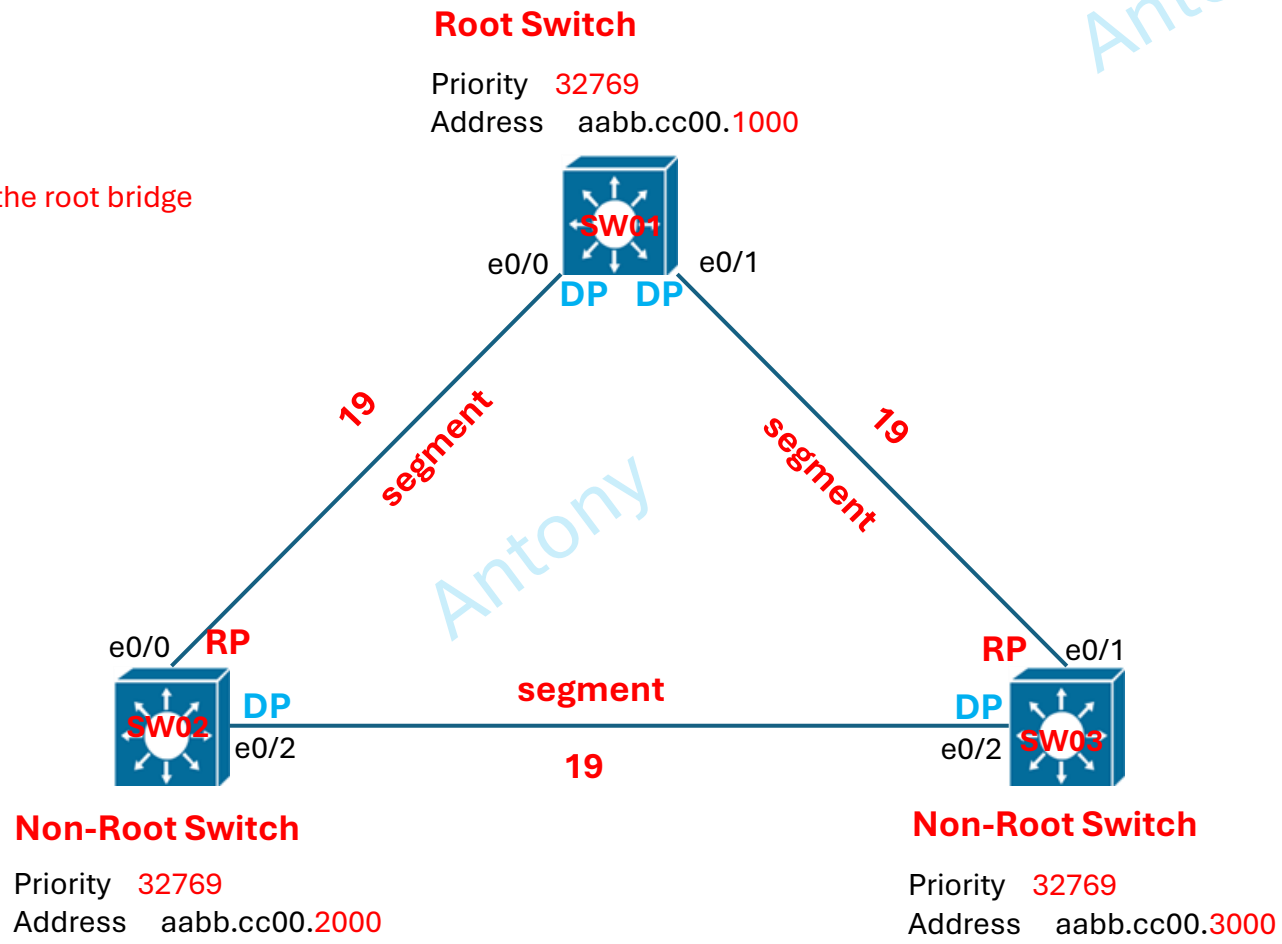
- **show spanning-tree detail**
- **show spanning-tree**

SW01

```
Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------
Et0/0               Desg FWD 100       128.1    Shr
Et0/1               Desg FWD 100       128.2    Shr
Et0/2               Desg FWD 100       128.3    Shr
Et0/3               Desg FWD 100       128.4    Shr
```

SW02

```
Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- ------
Et0/0               Root FWD 100       128.1    Shr
Et0/1               Desg FWD 100       128.2    Shr
Et0/2               Desg FWD 100       128.3    Shr
Et0/3               Desg FWD 100       128.4    Shr
```



3. Designated port

- Designated Port must be selected a segment have a DP. DP means the port with the fastest path for reach the Root Switch from a segment
- All interfaces on the Root Bridge are always in the forwarding state because the non-root switches will need to find the root bridge.

- **show spanning-tree detail**
- **show spanning-tree**

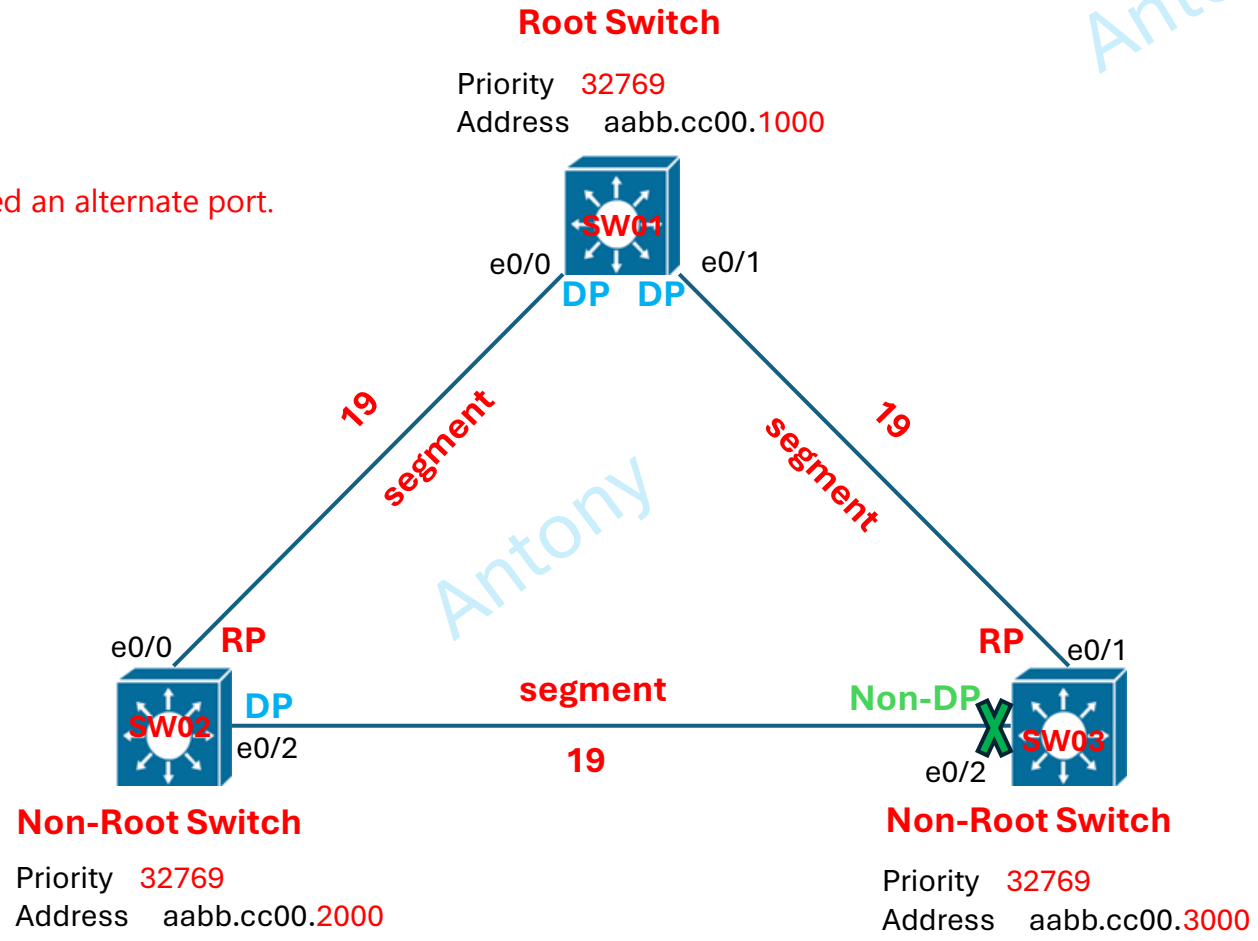
4. Block Port

- SW03 Port e0/2 was block, not physically shutdown. Port blocks traffic is also called an alternate port.

SW03

```
Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------
Et0/0               Desg FWD 100       128.1    Shr
Et0/1               Root FWD 100       128.2    Shr
Et0/2               Altn BLK 100       128.3    Shr
Et0/3               Desg FWD 100       128.4    Shr
```

- **show spanning-tree detail**
- **show spanning-tree**



- Now, STP is working well, if there is no change in the network , it will work normally. If a any changes, STP operation must be restarted.

5 Changing the Root Switch

- Previously slide, SW01 is Root Switch right so, We have changed SW02 to become the Root Switch

SW02

spanning-tree vlan 1 priority 4096

*** bridge priority in increments of 4096 ***
Priority 32769 (priority 32768 sys-id-ext 1)

6 Confirm and Results

SW01

```
sw01#show spanning-tree

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    4097
              Address     aabb.cc00.2000
              Cost        100
              Port        1 (Ethernet0/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     aabb.cc00.1000
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  15  sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/0               Root FWD 100       128.1    Shr
Et0/1               Desg FWD 100       128.2    Shr
Et0/2               Desg FWD 100       128.3    Shr
Et0/3               Desg FWD 100       128.4    Shr
```

SW02

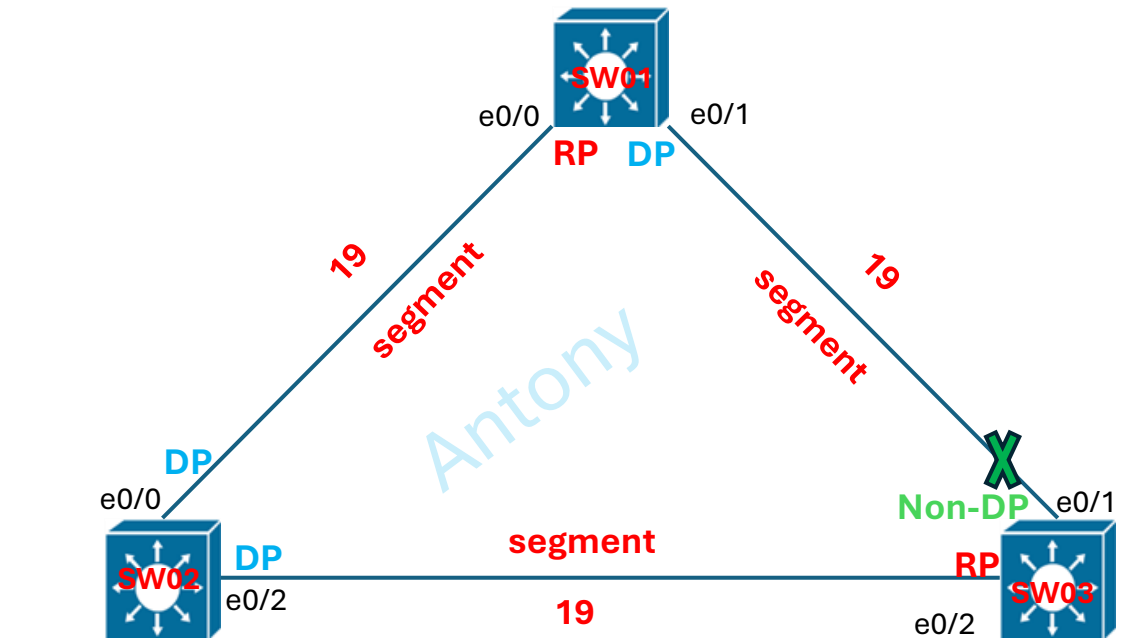
```
SW02#show spanning-tree

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    4097
              Address     aabb.cc00.2000
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    4097   (priority 4096 sys-id-ext 1)
              Address     aabb.cc00.2000
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/0               Desg FWD 100       128.1    Shr
Et0/1               Desg FWD 100       128.2    Shr
Et0/2               Desg FWD 100       128.3    Shr
Et0/3               Desg FWD 100       128.4    Shr
```

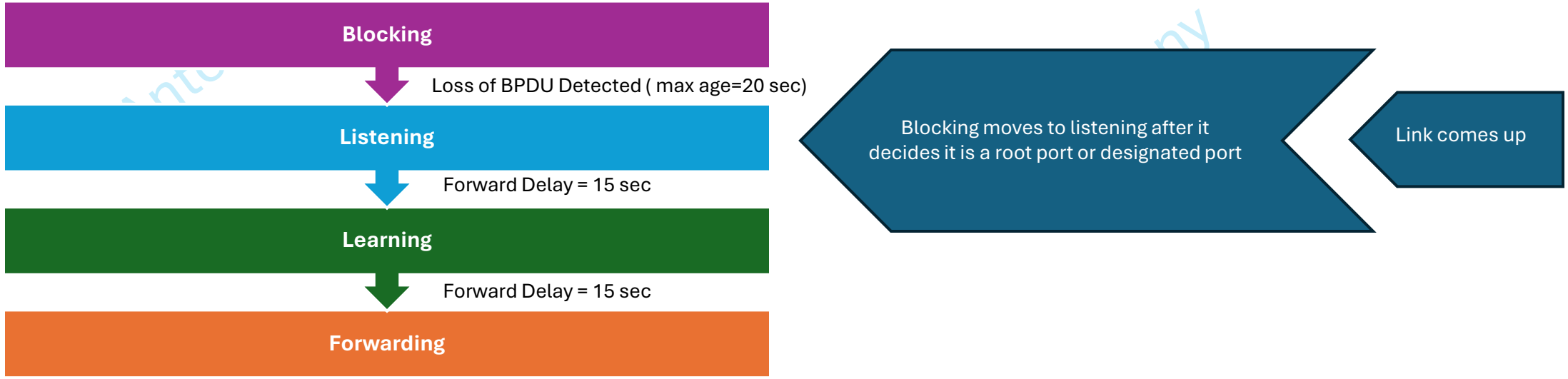
- Now SW02 is Root Switch



7 STP Convergence Time

- Receiving information only when a port is in the forwarding state, will be able to send. To reach the forwarding state, STP may take 50 seconds to converge, a process known as convergence time

8 STP Port Transition

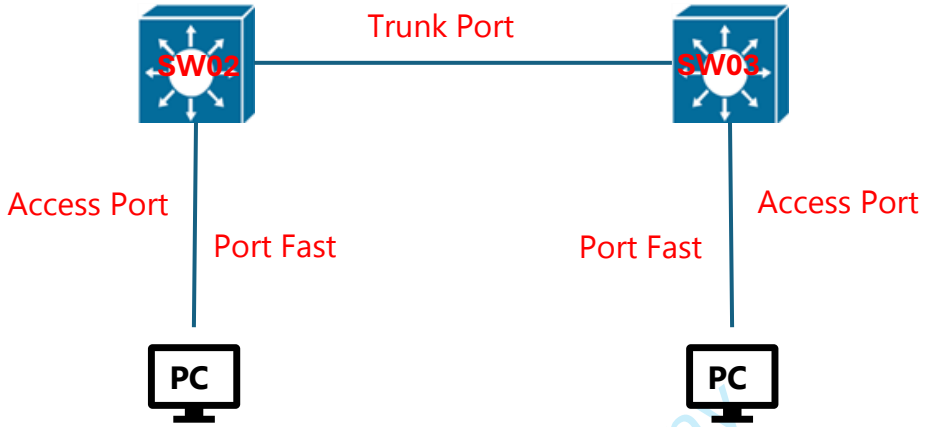


- 50 Seconds

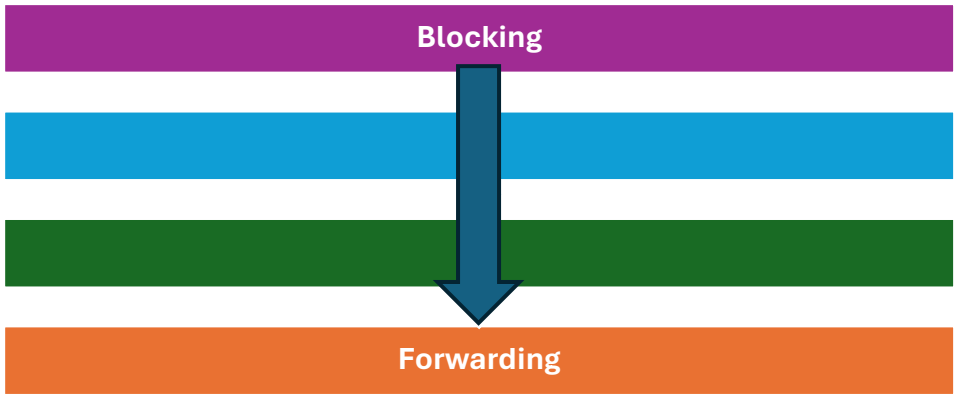
9 Port Fast

SW02

```
interface Ethernet0/1
 switchport mode access
 spanning-tree portfast
```



- if we didn't have to wait 50 seconds for the port to come up and we can configure the port to transition to the forwarding state immediately using Port Fast, bypassing the usual 50-second wait time



- Note : Do not use switch to switch and switch to router

Continue

Multiple spanning tree *mode*
Per-Vlan *rapid spanning tree* mode
BPDU Guard
Root Guard
Uplink Fast
Backbone Fast

- ***Thank You for Reading***

Thank you for taking the time to go through this guide on **Cisco Spanning Tree Protocol**. *I hope it provides valuable insights and practical knowledge for your network configurations.*

- *If you have any questions, feedback, or would like to discuss further, feel free to reach out. Let's connect and continue learning together!*

I'm still learning