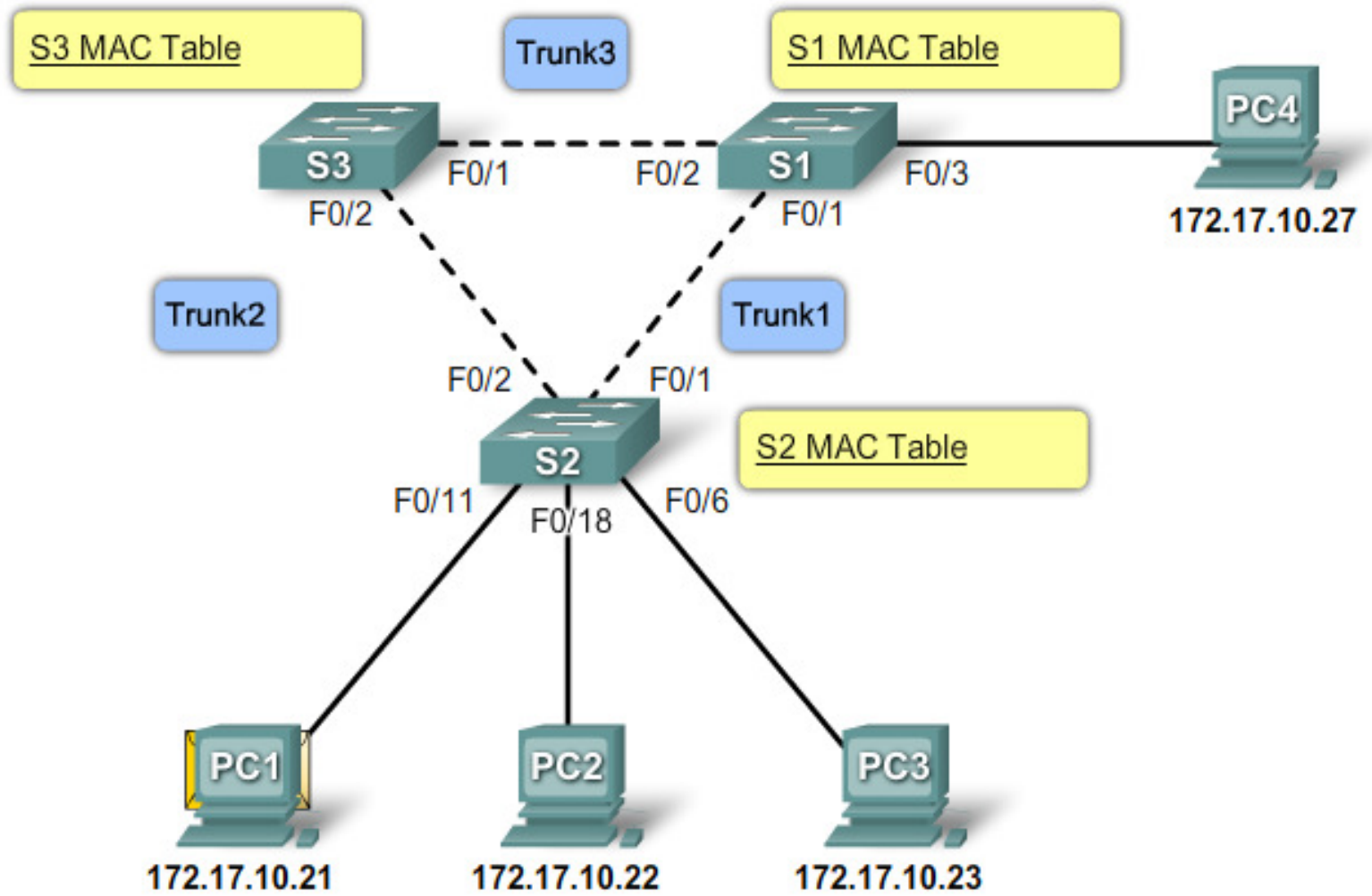


STP

Chapter 5



- Spanning Tree Protocol
- Layer 2 loop prevention
- 802.1D

STP convergence

- Elect root bridge
- Elect root ports
- Elect designated ports

Port roles

- Root port
 - Port closest to the root bridge
 - If multiple equal cost paths: lowest port ID wins
- Designated ports
 - Ports that can forward but are not a root port
 - One pr. Segment, lowest path cost to root
 - If tie, lowest BID
- Non-designated ports
 - Ports in blocking state

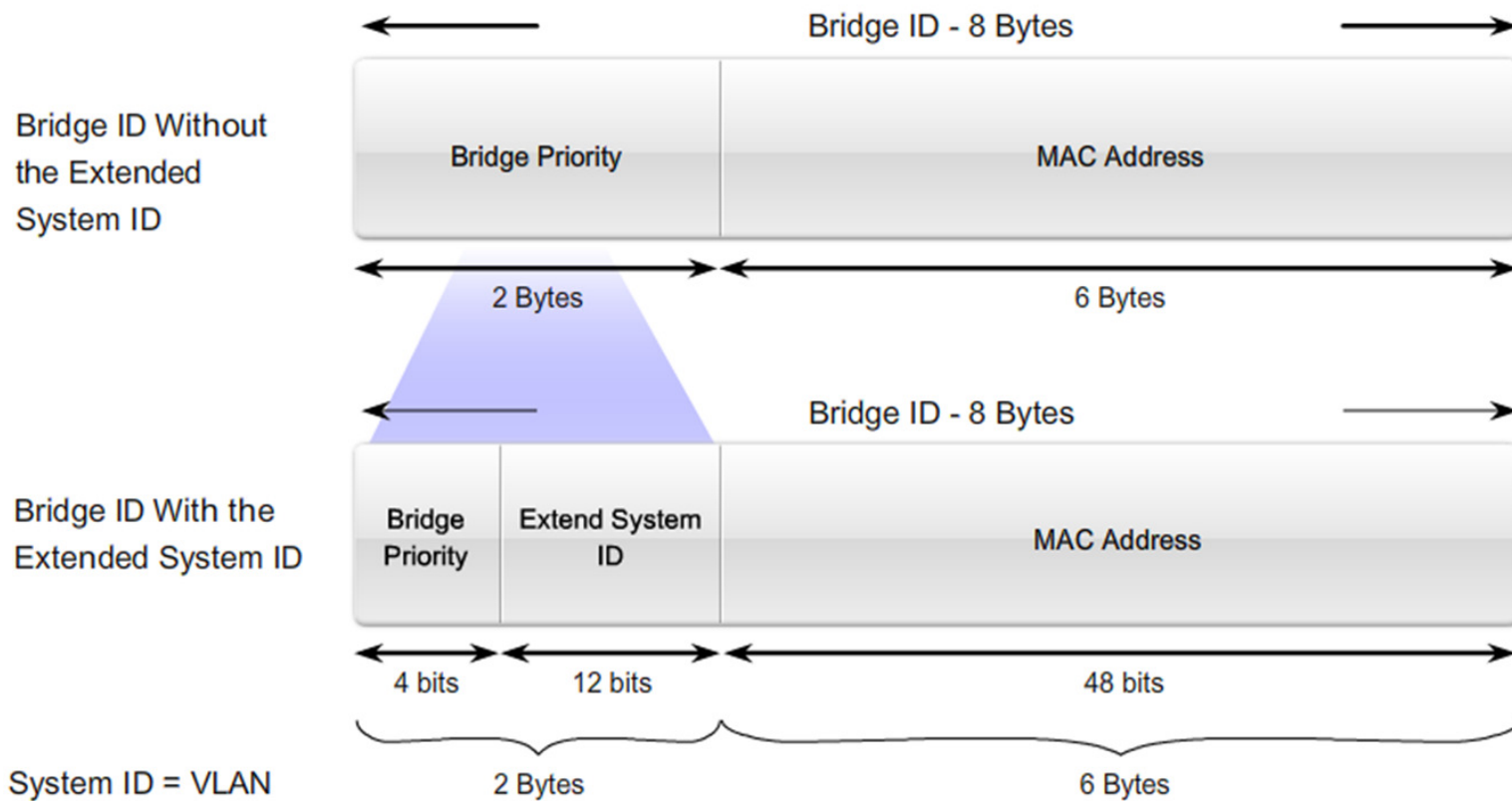
BPDU

- Bridge Protocol Data Unit
- Sent every 2 seconds (default)
- Multicast - 01:80:C2:00:00:00

Field #	Bytes	Field
1-4	2	Protocol ID
	1	Version
	1	Message type
	1	Flags
5-8	8	Root ID
	4	Cost of path
	8	Bridge ID
	2	Port ID
9-12	2	Message age
	2	Max age
	2	Hello time
	2	Forward delay

Bridge ID

- Used to elect the root bridge



–Default priority: 32768

Configuration

- Bridge priority

```
Switch(config)# spanning-tree vlan x priority 4096
```

```
Switch(config)# spanning-tree vlan x root primary
```

- Sets the priority to **24576** or **4096** lower than the current root bridge

```
Switch(config)# spanning-tree vlan x root secondary
```

- Sets the priority to **28672**

Path cost

- Used to determine the shortest path to root
- The sum of all port costs along the path

Link Speed	Cost (Revised IEEE Specification)	Cost (Previous IEEE Specification)
10 Gb/s	2	1
1 Gb/s	4	1
100 Mb/s	19	10
10 Mb/s	100	100

Configuration

- Port cost

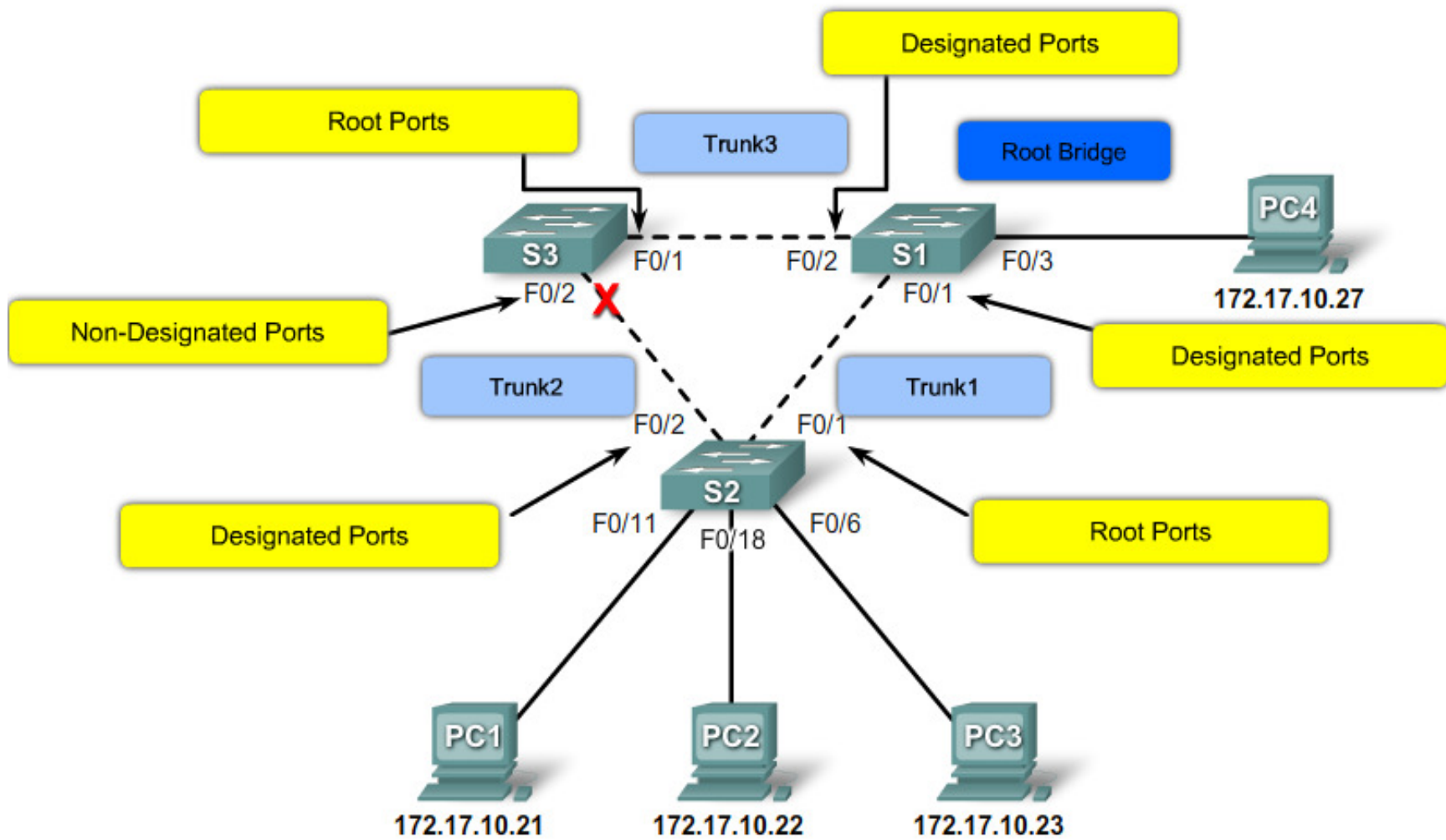
```
Switch(config-if)# spanning-tree cost 7
```

- Range **1 – 200000000**

- Port Priority

```
Switch(config-if)# spanning-tree port-priority 110
```

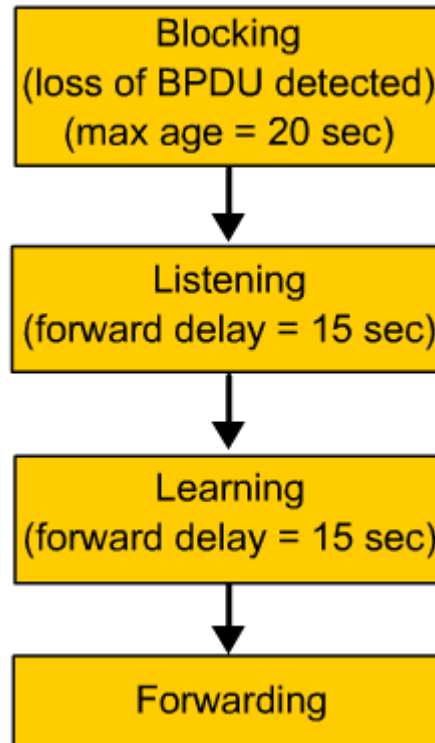
- Range **0 – 240** (default: 128)



Port states

- Blocking
- Listening
- Learning
- Forwarding

- Disabled



Timers

- Hello
 - 2 second
 - Can be tuned to between 1 and 10 seconds
- Forward delay
 - 15 seconds
 - Can be tuned to between 4 and 30 seconds
- Maximum age
 - 30 seconds
 - Can be tuned to between 6 and 40 seconds

Port states

Processes	Blocking	Listening	Learning	Forwarding	Disable
Receives and process BPDUs	YES	YES	YES	YES	NO
Forward data frames received on interface	NO	NO	NO	YES	NO
Forward data frames switched from another interface	NO	NO	NO	YES	NO
Learn MAC addresses	NO	NO	YES	YES	NO

- Blocking – Max age: 20 sec.
- Listening – Forward delay: 15 sec.
- Learning – Forward delay: 15 sec.
- Timers based on a network diameter of 7

Configuration

- Not recommended to adjust timers manually
- Adjust the diameter instead

```
Switch(config)# spanning-tree vlan x root primary  
diameter y
```

Portfast

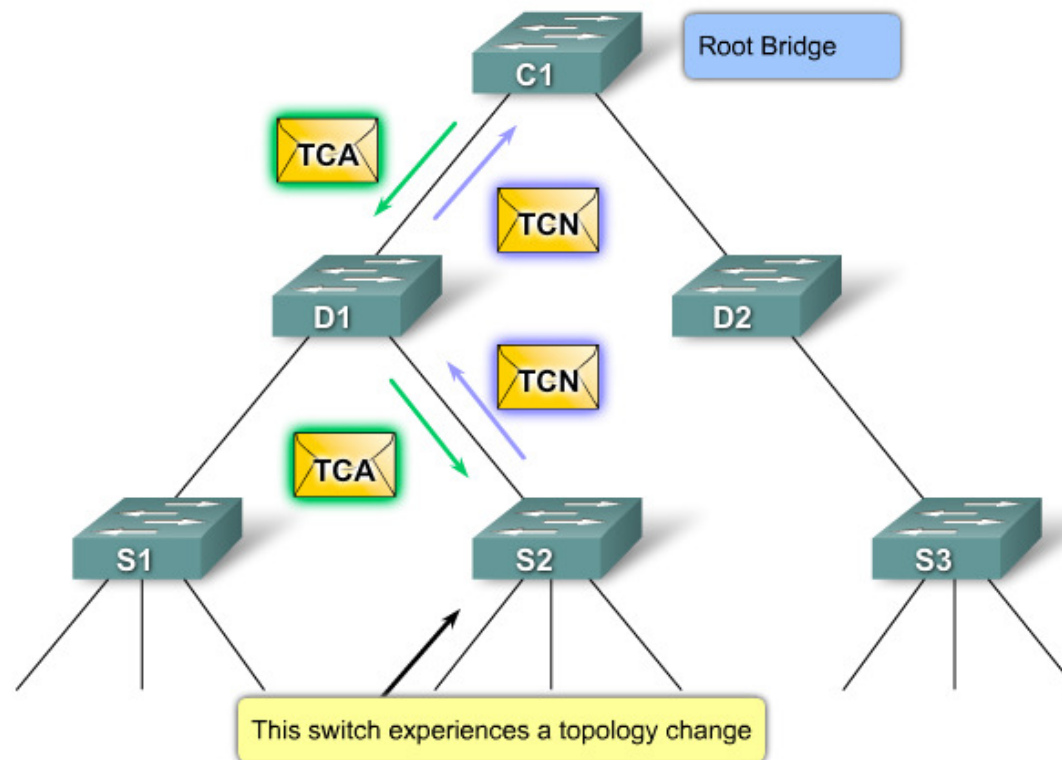
- Cisco STP extension
- Skips listening and learning port states
- Only configure on accessports towards hosts
- If a switch is connected to a portfast enabled port loops might occur
- Does not generate TCN

```
Switch(config-if)# spanning-tree portfast
```


Topology change

- TCN – Topology Change Notification
 - Sent by a switch to notify the root bridge of a change
 - Sent at the Hello interval
 - Sent out the root port

- TCA – Topology Change Acknowledgement
 - Sent back to the switch who sent the TCN (BPDU flag field)



- TC – Topology Change
 - Broadcast by the Root bridge
 - BPDU flag field
 - Switches reduce their aging (30) timer to forward delay (15)

PVST+

- Cisco proprietary
- Per-vlan Spanning tree protocol
- A STP instance for each VLAN
- Better utilization of bandwidth

RSTP

- Rapid Spanning tree protocol
- 802.1w builds on 802.1D

Edge ports

- Similar to portfast
- Does not generate TCN
- If a BPDU is received on an edge port, it reverts to a normal STP port

```
Switch(config-if)# spanning-tree portfast
```

Link types

- Point-to-point
 - Full duplex links
- Shared
 - Half duplex links
 - Several switches might be on the segment

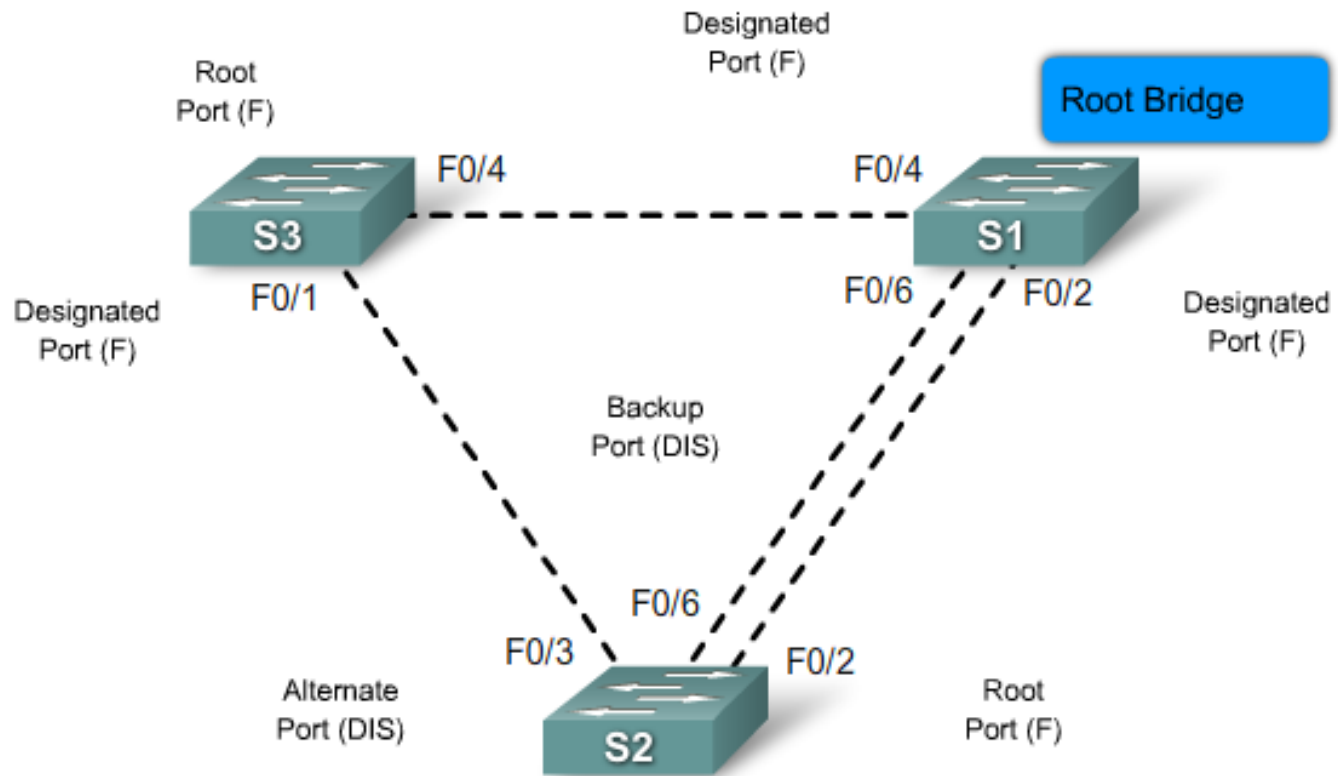
RSTP port states

Operational Port State	STP Port State	RSTP Port State
Enabled	Blocking	Discarding
Enabled	Listening	Discarding
Enabled	Learning	Learning
Enabled	Forwarding	Forwarding
Disabled	Disabled	Discarding

Port roles

- Root port
 - Port closest to the root bridge
- Designated ports
 - Ports that can forward but are not a root port
 - One pr. Segment, lowest path cost to root
- Alternate port
 - Backup port to root
- Backup port
 - Second best designated port for a segment

RSTP Port Roles



Configuration

```
Switch(config)# spanning-tree mode rapid-pvst
```

```
Switch(config-if)# spanning-tree link-type point-to-point
```

```
Switch(config-if)# spanning-tree link-type shared
```

Links

- http://www.cisco.com/warp/public/473/spanning_tree1.swf
- http://www.cisco.com/en/US/docs/switches/lan/catalyst2960/software/release/12.2_46_se/configuration/guide/swstp.html