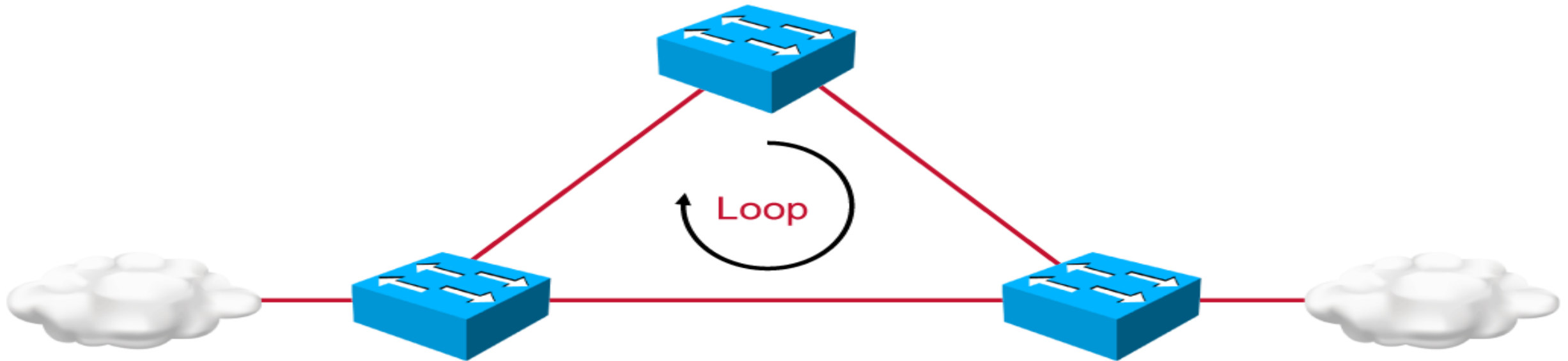


Switch技术: Building Redundant Switched Topologies

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Issues in Redundant Topologies

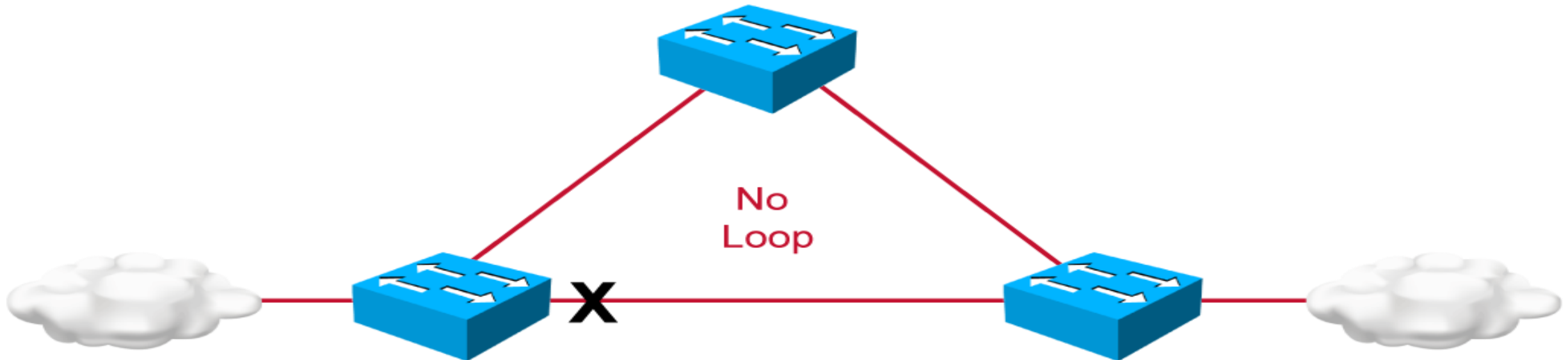
- A redundant topology eliminates single points of failure.
- A redundant switch topology causes broadcast storms, multiple frame copies, and MAC address table instability problems 冗余带来的问题是广播风暴、多点帧的拷贝以及MAC地址表不稳定等问题
- A loop-avoidance mechanism is required.



Issues in Redundant Topologies (Cont.)

Loop resolution with Spanning Tree Protocol:

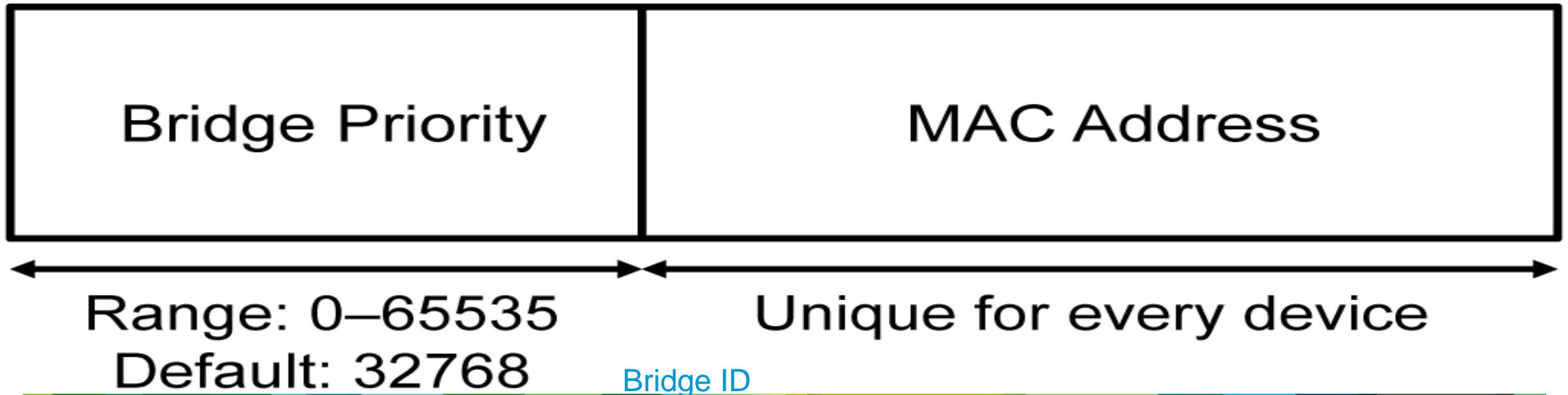
- Provides a loop-free redundant network topology by placing certain ports into a blocking state 解决环路的途径是在逻辑上把某些点解置于block状态
- Published in the IEEE 802.1D specification.



Spanning-Tree Operation

The spanning-tree algorithm follows these steps:

1. Elects a root bridge
2. Elects a root port for each non-root switch
3. Elects a designated port for each segment
4. Ports transition to forwarding or blocking state

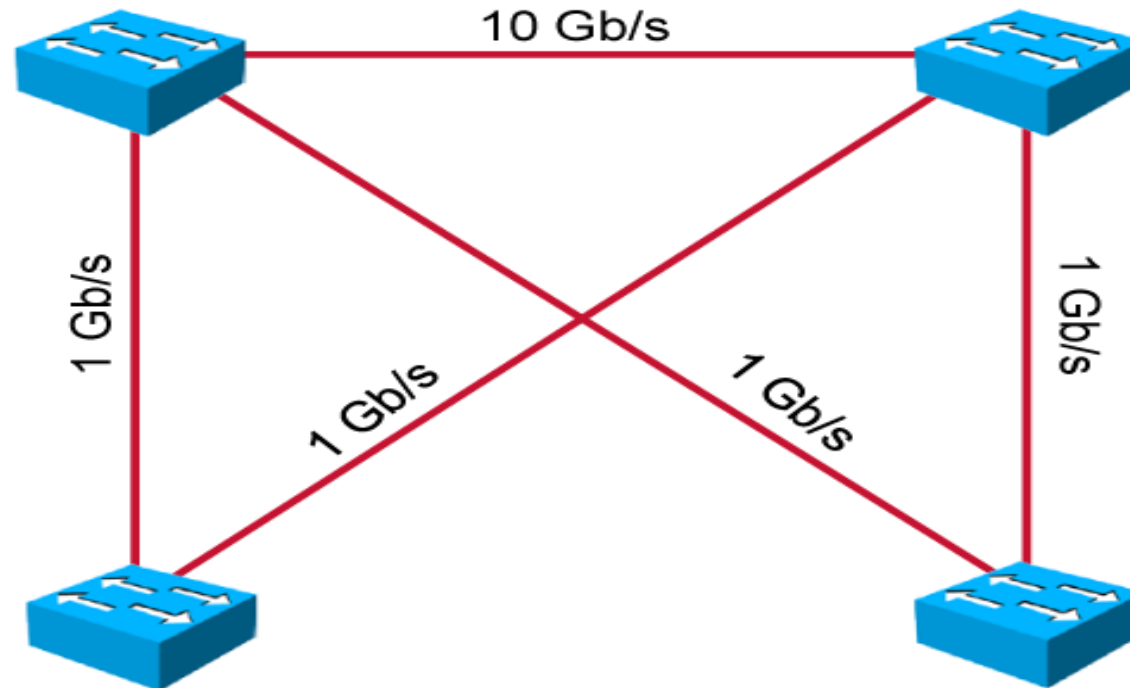


Spanning-Tree Operation (Cont.)

Step 1: Elect a root bridge.

- Decision based on lowest BID (交换机B)

Switch A
Priority: 28672
MAC: 0000.0cab.3274



Switch B
Priority: 28672
MAC: 0000.0c9f.3127
Root Bridge

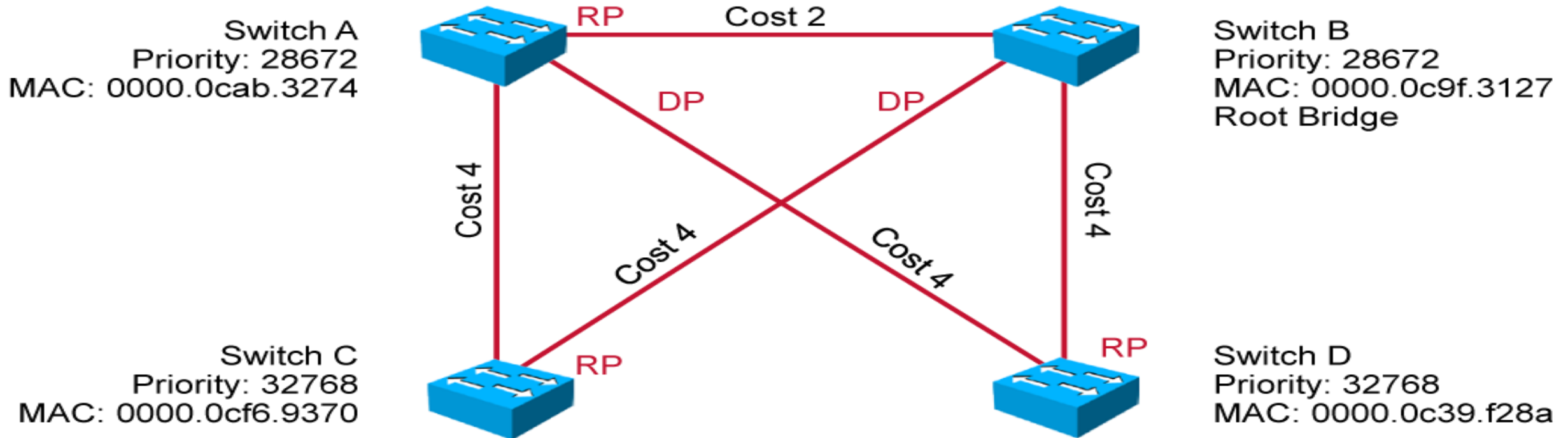
Switch C
Priority: 32768
MAC: 0000.0cf6.9370

Switch D
Priority: 32768
MAC: 0000.0c39.f28a

Spanning-Tree Operation (Cont.)选择根端口

Step 2: Elect a root port for each non-root switch.

- Decision based on lowest root path cost. 到达根的最小的cost指
- If necessary, ties are broken by upstream BID and port ID values. Bridge ID和端口ID作为候选

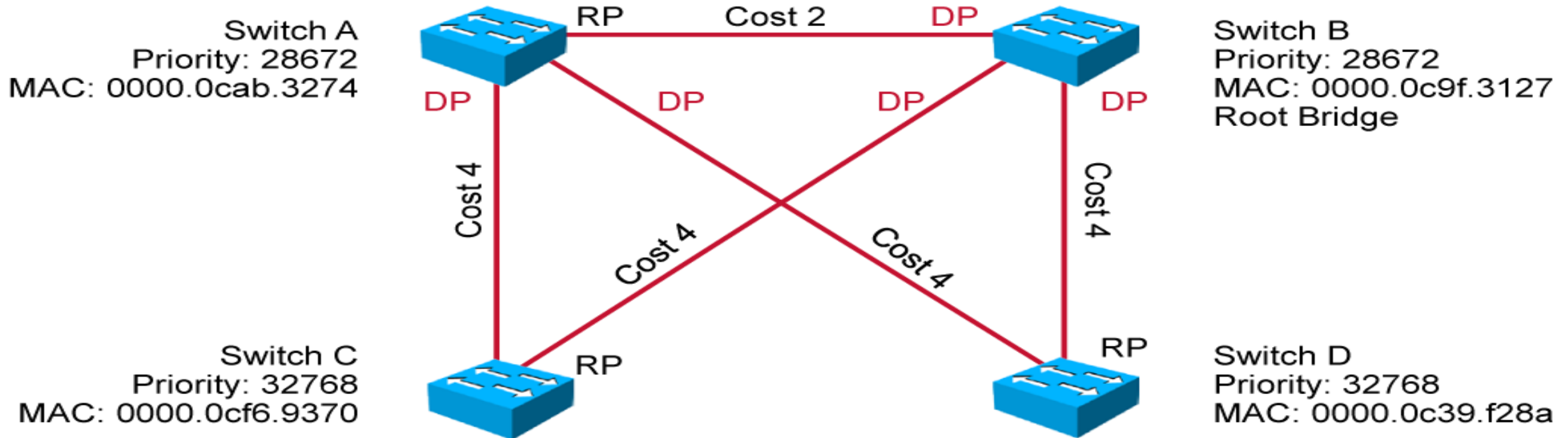


Spanning-Tree Operation (Cont.)选择指定端口

Step 3: Elect a designated port for each segment.

- Decision is based on the lowest root path cost-到达根的最小的cost值

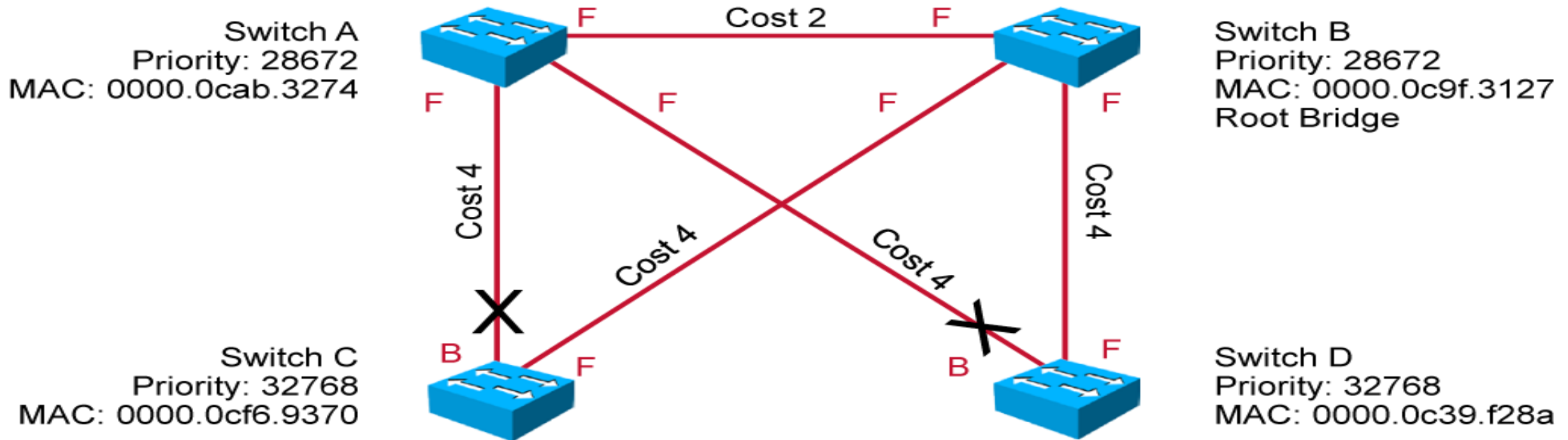
If necessary, ties are broken by upstream BID and port ID. Bridge ID和端口ID作为候选



Spanning-Tree Operation (Cont.) 其他端口处于Blocking状态

Step 4: The ports transition to the forwarding or blocking state.

- Root ports and designated ports transition to the forwarding state.
- Other ports stay in the blocking state.



Types of Spanning-Tree Protocols

Spanning-tree standards:

- **IEEE 802.1D:** The legacy standard for bridging and STP
 - **CST:** Assumes one spanning-tree instance for the entire bridged network, regardless of the number of VLANs
- **PVST+:** A Cisco enhancement of STP that provides a separate 802.1D spanning-tree instance for each VLAN configured in the network
- **802.1w (RSTP):** Improves convergence over 1998 STP by adding roles to ports and enhancing BPDU exchanges
- **Rapid PVST+:** A Cisco enhancement of RSTP using PVST+

Types of Spanning-Tree Protocols (Cont.)

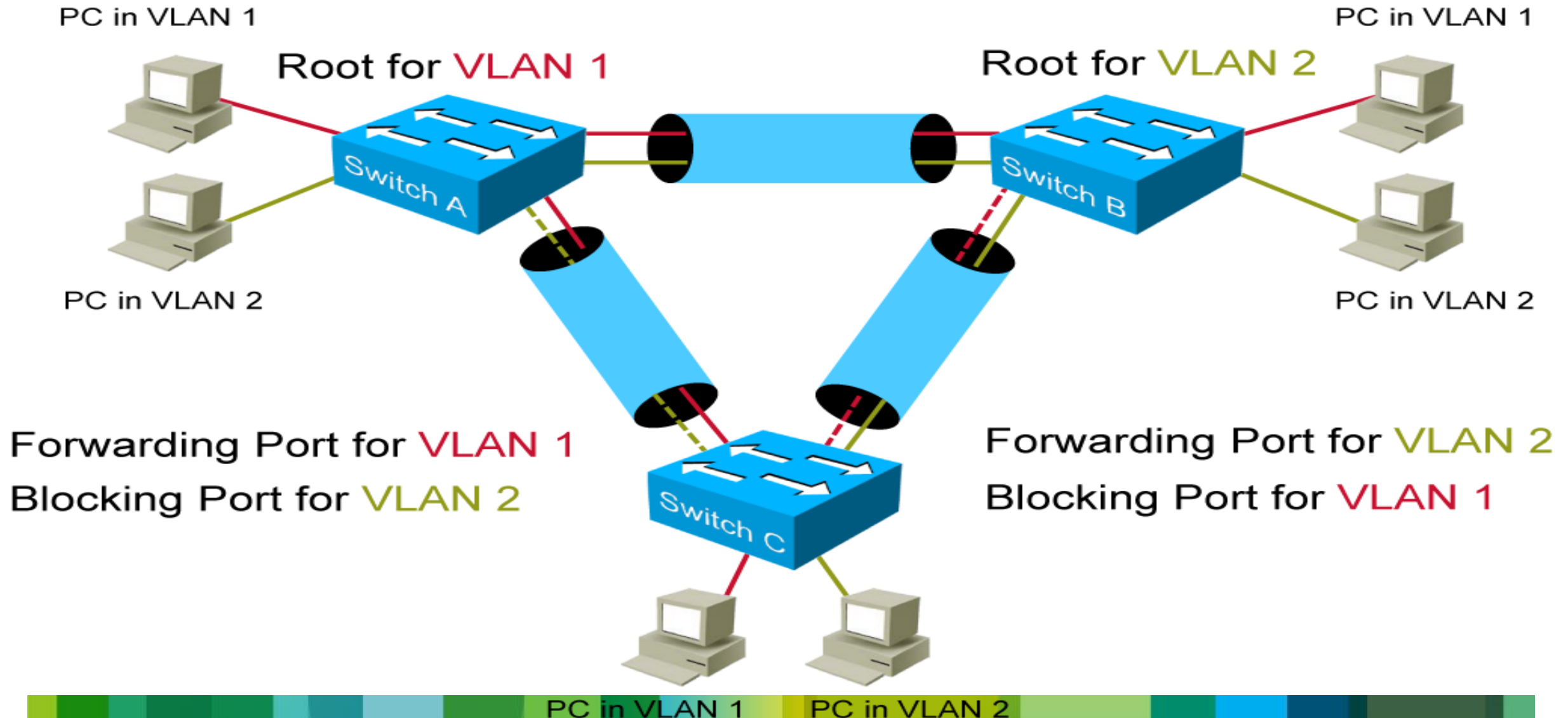
Protocol	Standard	Resources Needed	Convergence	Number of Trees
STP	802.1D	Low	Slow	One
PVST+	Cisco	High	Slow	One for every VLAN
RSTP	802.1w	Medium	Fast	One
Rapid PVST+	Cisco	Very high	Fast	One for every VLAN

Types of Spanning Tree Protocols (Cont.)

Default spanning tree configuration for Cisco Catalyst switches:

- PVST
- Enabled on all ports
- Slower convergence after topology change than with RSTP.

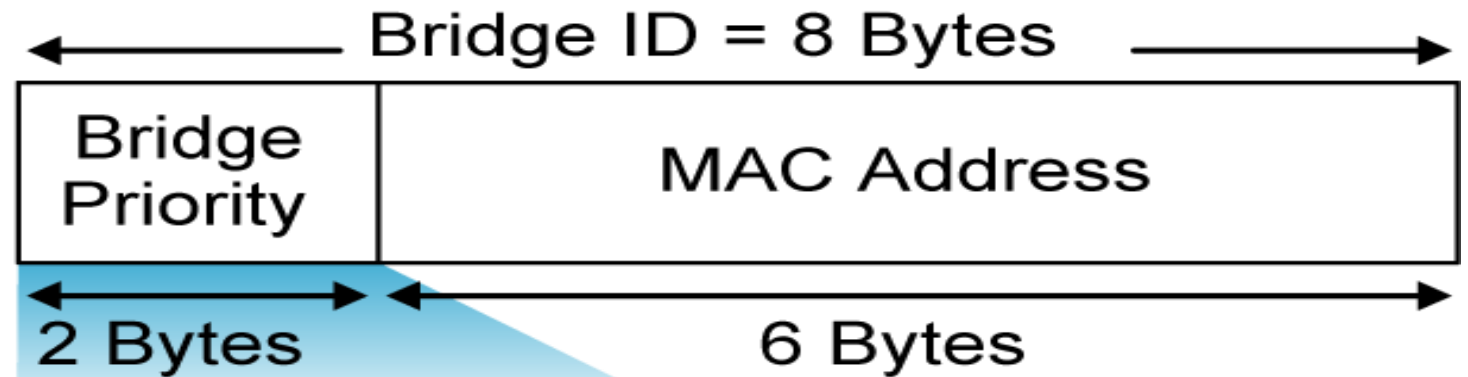
Per VLAN Spanning Tree Plus



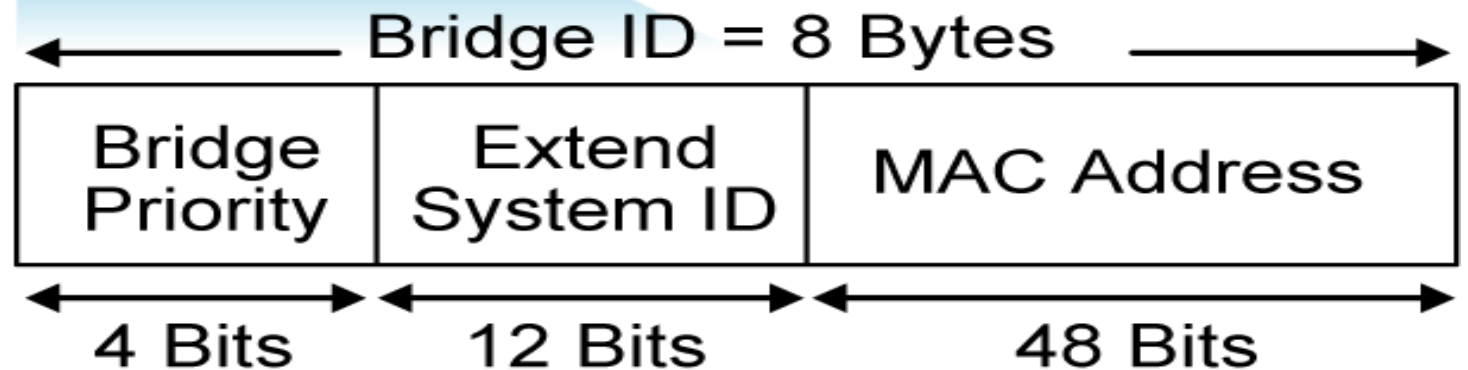
Per VLAN Spanning Tree Plus (Cont.)

System ID = VLAN

Bridge ID Without the Extended System ID



Extended Bridge ID with System ID = VLAN



Modifying the Bridge ID

```
• SW1#show spanning-tree vlan 1
•
• VLAN0001
•   Spanning tree enabled protocol ieee
•   Root ID      Priority      28673
•               Address      001e.145e.4980
•               Cost        19
•               Port        3 (FastEthernet0/3)
• <output omitted>
```

- SW1 is not the root bridge for VLAN1. This is the switch that is connected to FastEthernet0/3 on SW1.

Modifying the Bridge ID (Cont.)

```
SW1(config)#spanning-tree vlan 1 root primary
```

- Configures SW1 as the root bridge for VLAN 1

```
SW1#show spanning-tree vlan 1
.
VLAN0001
Spanning tree enabled protocol ieee
Root ID    Priority    24577
           Address    001e.147c.6f00
           This bridge is the root
<output omitted>
```

- After modification, SW1 is the root bridge for VLAN1.

Thank you.

