CCNA Routing and Switching Study Guide

Chapters 1 & 15: Enhanced Switching

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Chapter 15 Objectives

The ICND2 topics covered in this chapter include:

Chapter 15 Objectives (con't)

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Spanning-Tree Protocol

- Spanning Tree Protocol (STP) achieves its primary objective of preventing network loops on layer 2 network bridges or switches by monitoring the network to track all links and shut down the redundant ones.

- STP uses the spanning-tree algorithm (STA) to first create a topology database and then search out and disable redundant links.

- With STP running, frames will be forwarded on only premium, STP-chosen links.

# A switched network with switching loops

The Spanning Tree Protocol is a great protocol to use in networks like the one shown in this figure.
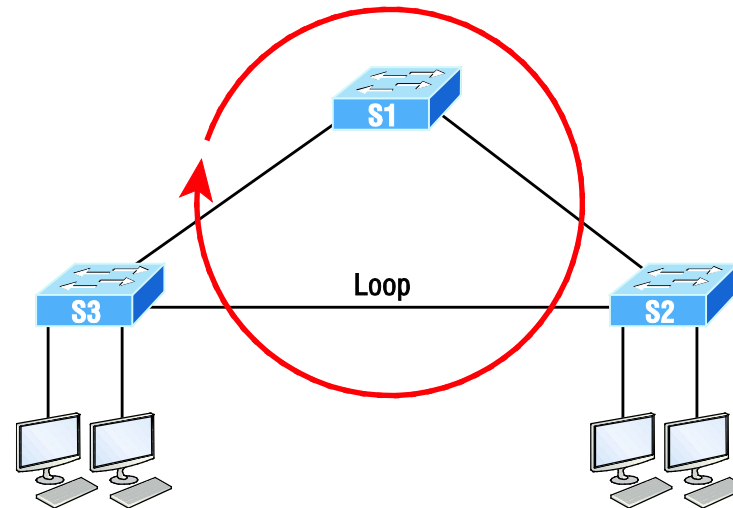
This is a switched network with a redundant topology that includes switching loops. Without some type of layer 2 mechanism in place to prevent a network loop, this network is vulnerable to nasty issues like broadcast storms, multiple frame copies, and MAC table thrashing!
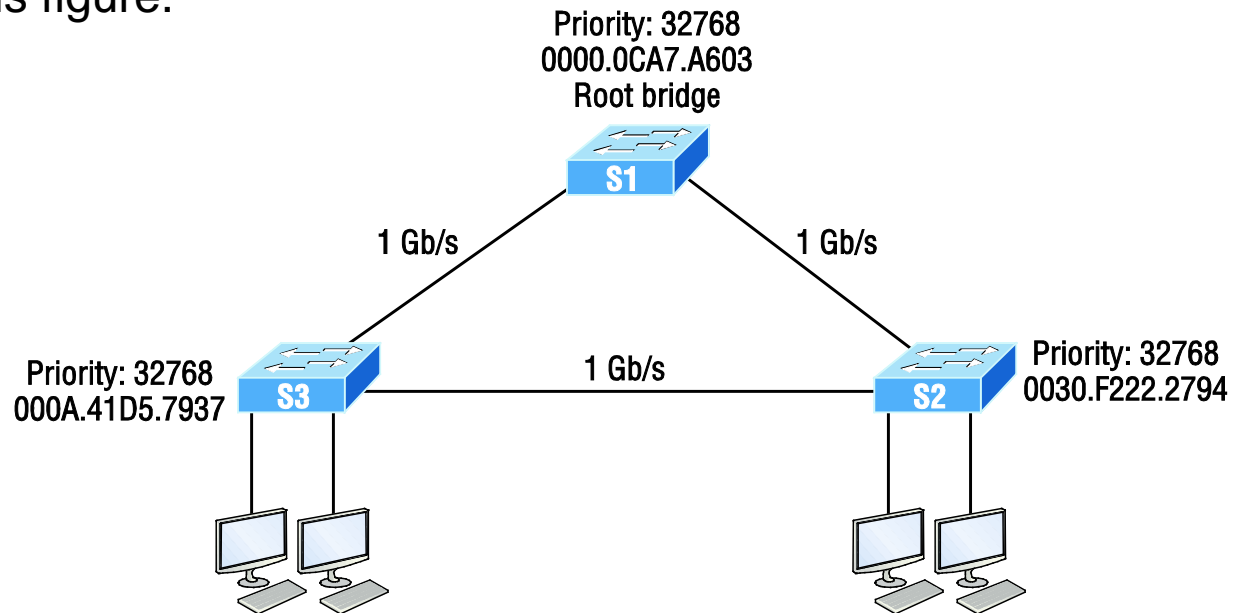
A switched network with STP

This figure shows how this network would work with STP working on the switches:
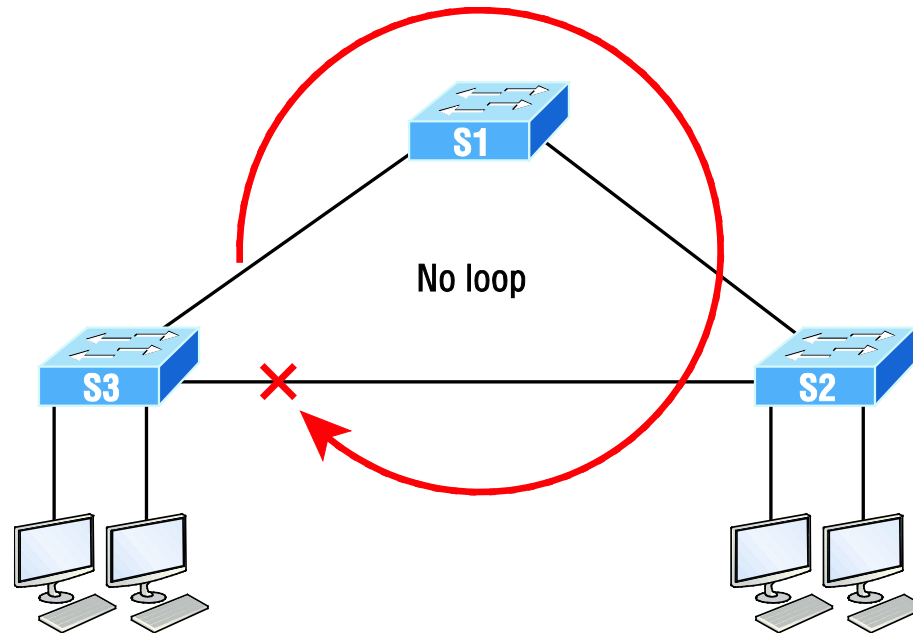
STP operations

Let's start neatly summarizing what you've learned so far using the simple three-switch network connected together as shown in this figure.

Priority: 32768
0000.0CA7.A603
Root bridge

S1

1 Gb/s   1 Gb/s

Priority: 32768
000A.41D5.7937

S3   1 Gb/s   S2
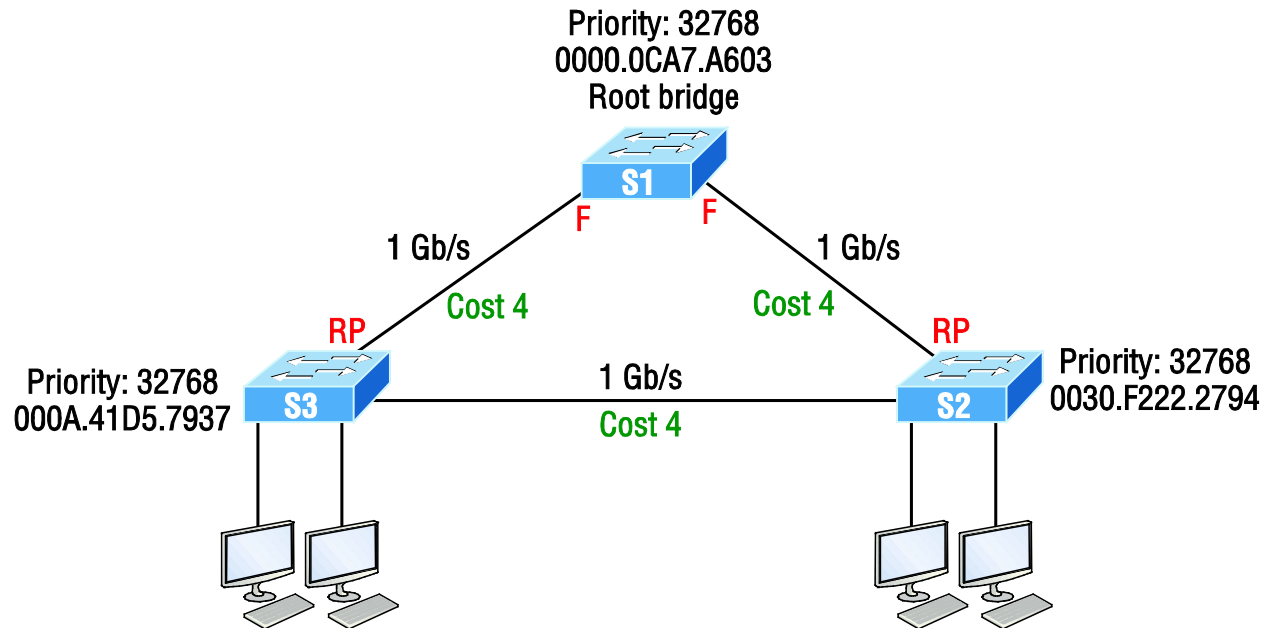
Priority: 32768
0030.F222.2794

Basically, STP's job is to find all the links in the network and shut down any redundant ones, thereby preventing network loops from occurring.
It achieves this by first electing a root bridge that will have all ports forwarding and will also act as a point of reference for all other devices within the STP domain.

STP operations

In this figure, S1 has been elected the root bridge based on bridge ID.

Priority: 32768
0000.0CA7.A603
Root bridge

S1

F   F

1 Gb/s   1 Gb/s

Cost 4   Cost 4

RP   RP

Priority: 32768   1 Gb/s   Priority: 32768
000A.41D5.7937   S3   S2   0030.F222.2794

Cost 4

Once all switches agree on the root bridge, they must then determine their one and only root port—the single path to the root bridge.
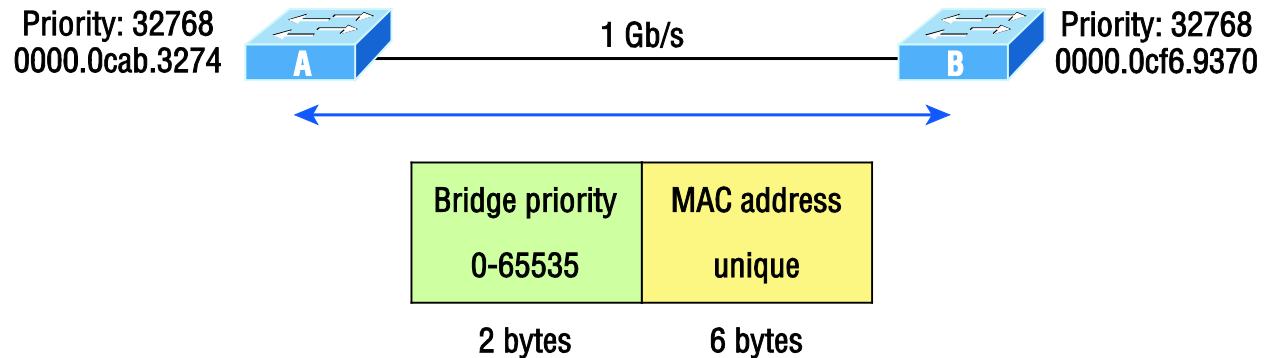
STP operations

This figure shows the network after STP has converged.
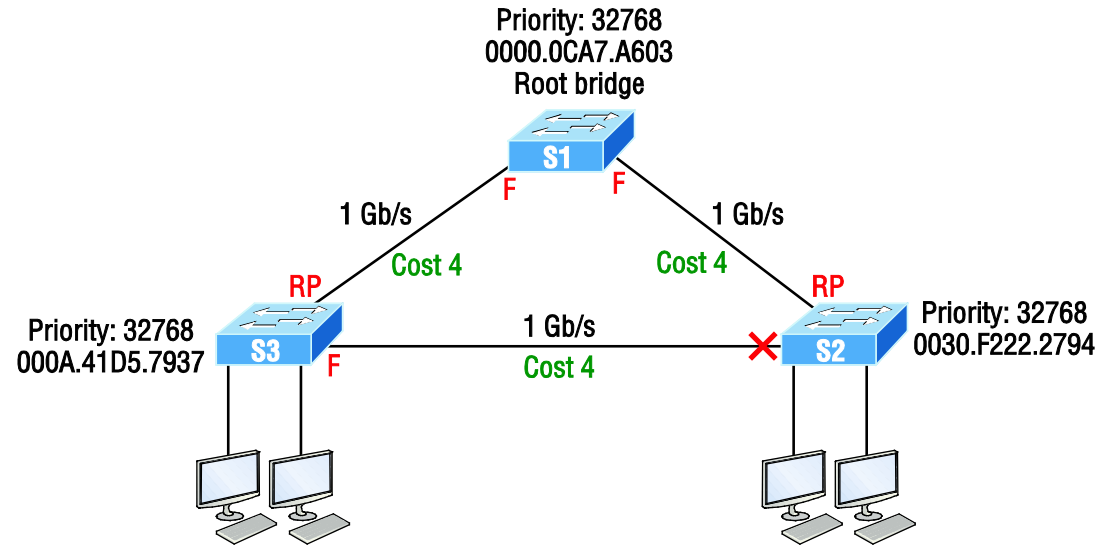
Since S3 had a lower bridge ID (better), S2's port went into blocking mode.
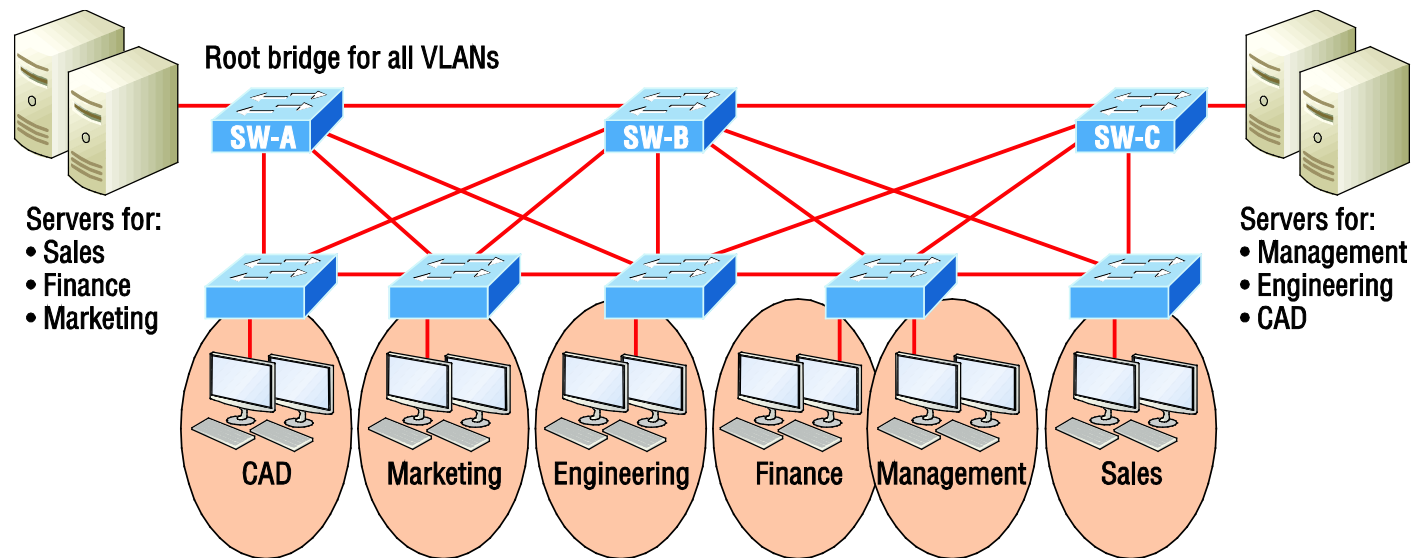
Bridge ID

The bridge ID is used to elect the root bridge in the STP domain and to determine the root port for each of the remaining devices when there's more than one potential root port available because they have equal-cost paths.

Priority: 32768
0000.0cab.3274

A

1 Gb/s

B

Priority: 32768
0000.0cf6.9370

Bridge priority 0-65535	MAC address unique
2 bytes	6 bytes

This key bridge ID is 8 bytes long and includes both the priority and the MAC address of the device, as illustrated in this future. Remember—the default priority on all devices running the IEEE STP version is 32,768.
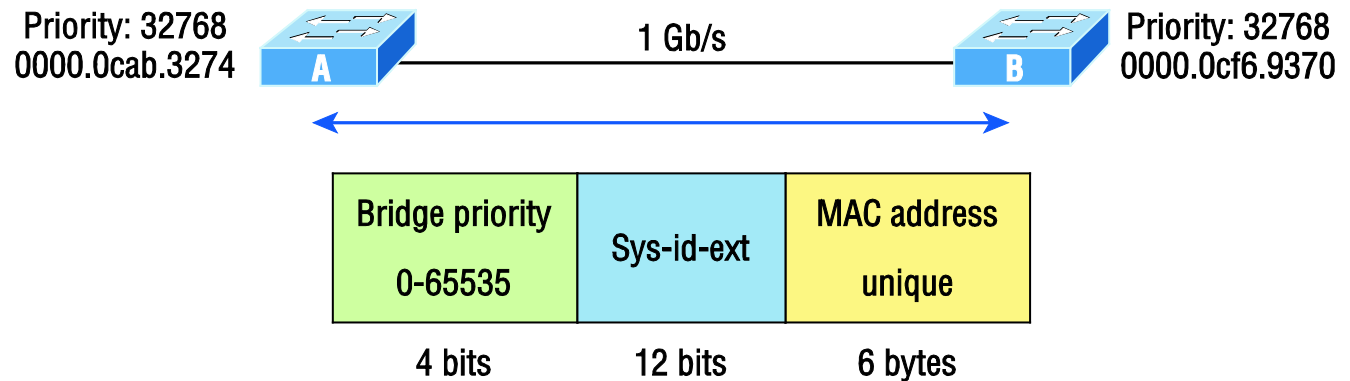
Common STP example

# PVST+ provides efficient root bridge selection.
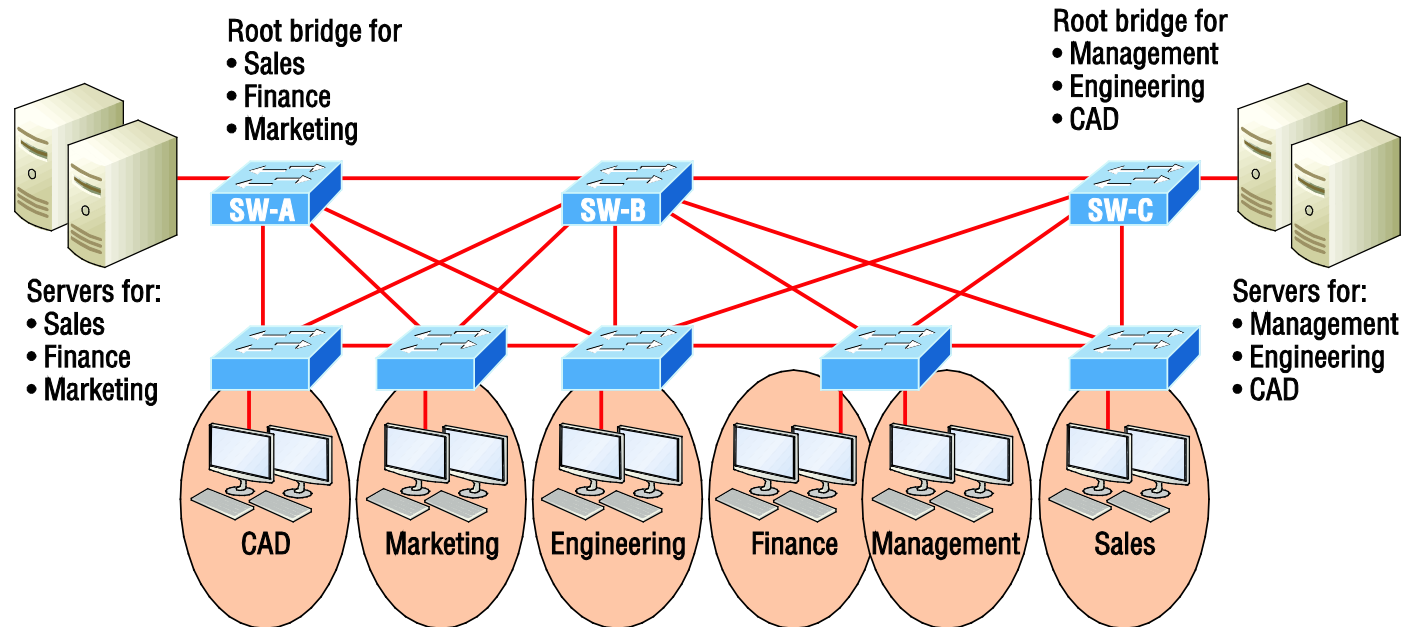
PVST+ unique bridge ID

To allow for the PVST+ to operate, there's a field inserted into the BPDU to accommodate the extended system ID so that PVST+ can have a root bridge configured on a per-STP instance, shown in this figure.

Priority: 32768
0000.0cab.3274   **A**   1 Gb/s   **B**   Priority: 32768
0000.0cf6.9370

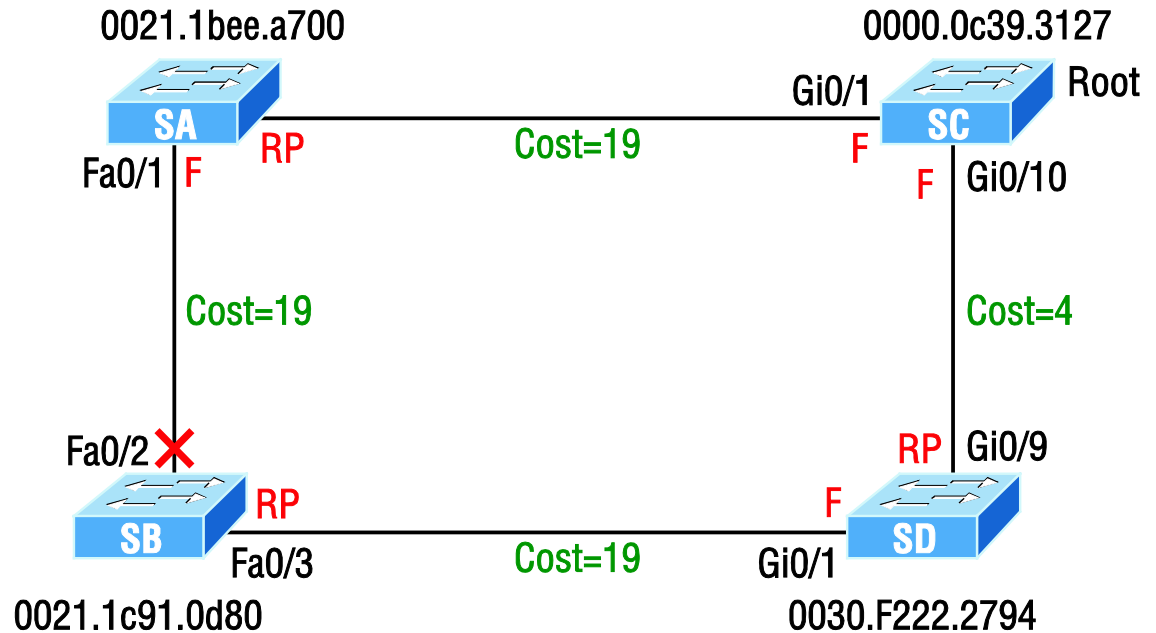| Bridge priority 0-65535	Sys-id-ext	MAC address unique
4 bits	12 bits	6 bytes

RSTP example 1

The task of determining the root bridge, root ports, and designated ports hasn't changed from 802.1d to RSTP, and understanding the cost of each link is still key to making these decisions well.
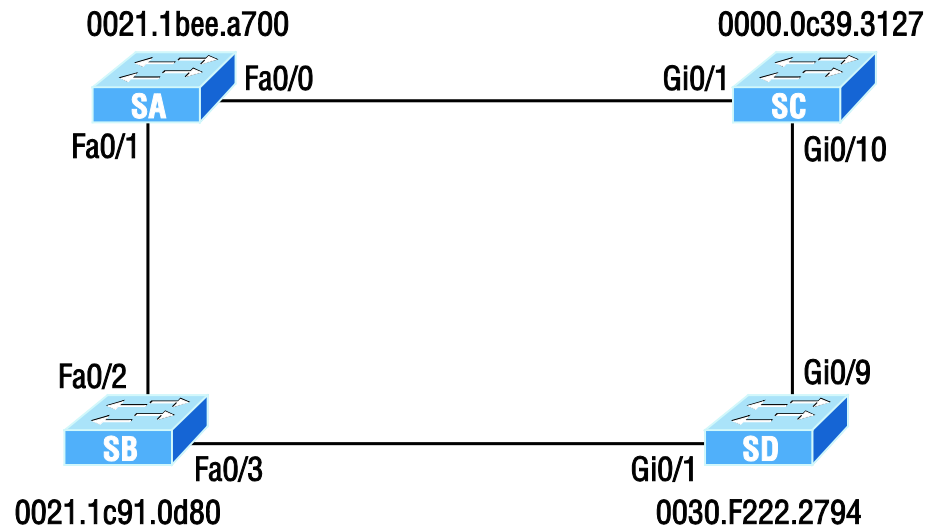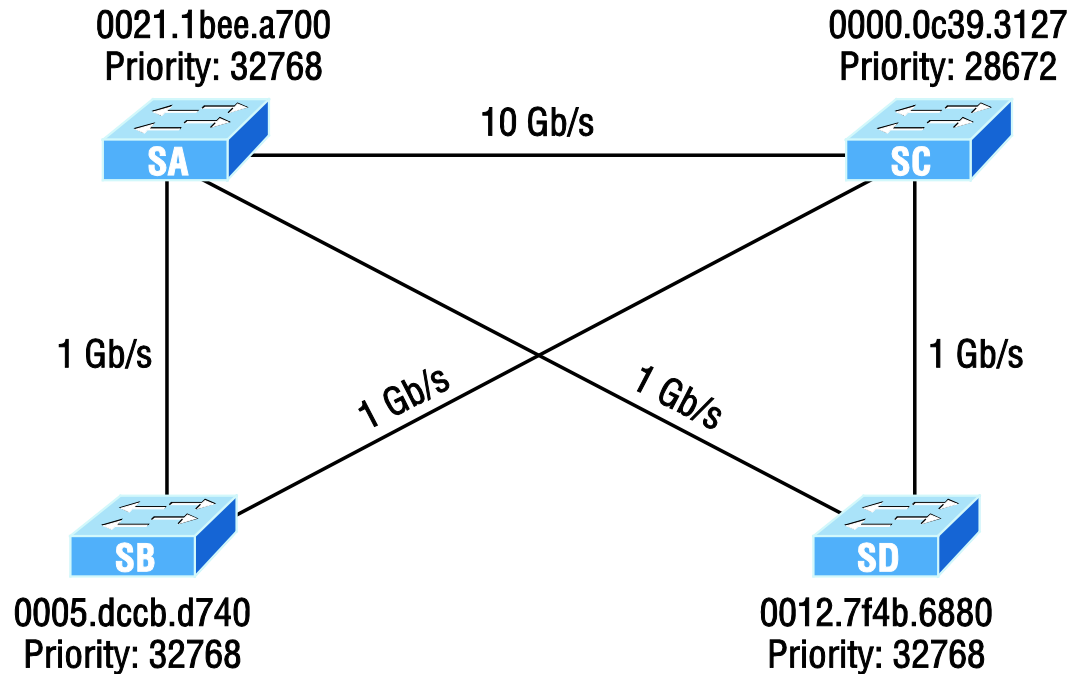

Can you figure out which is the root bridge? How about which port is the root and which ones are designated?
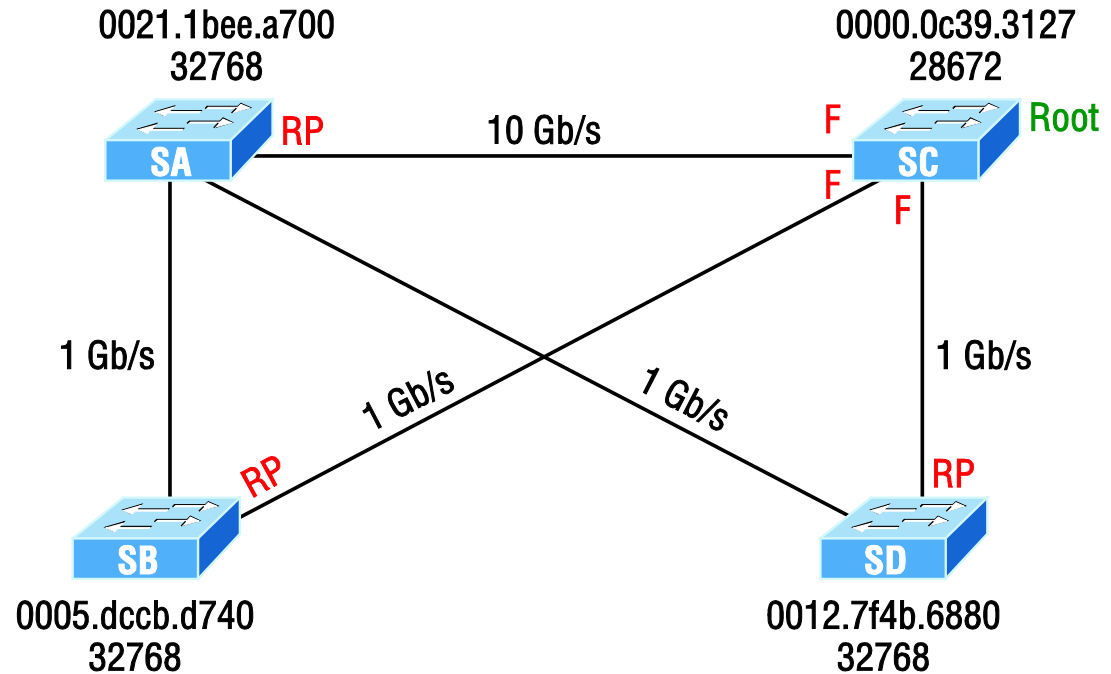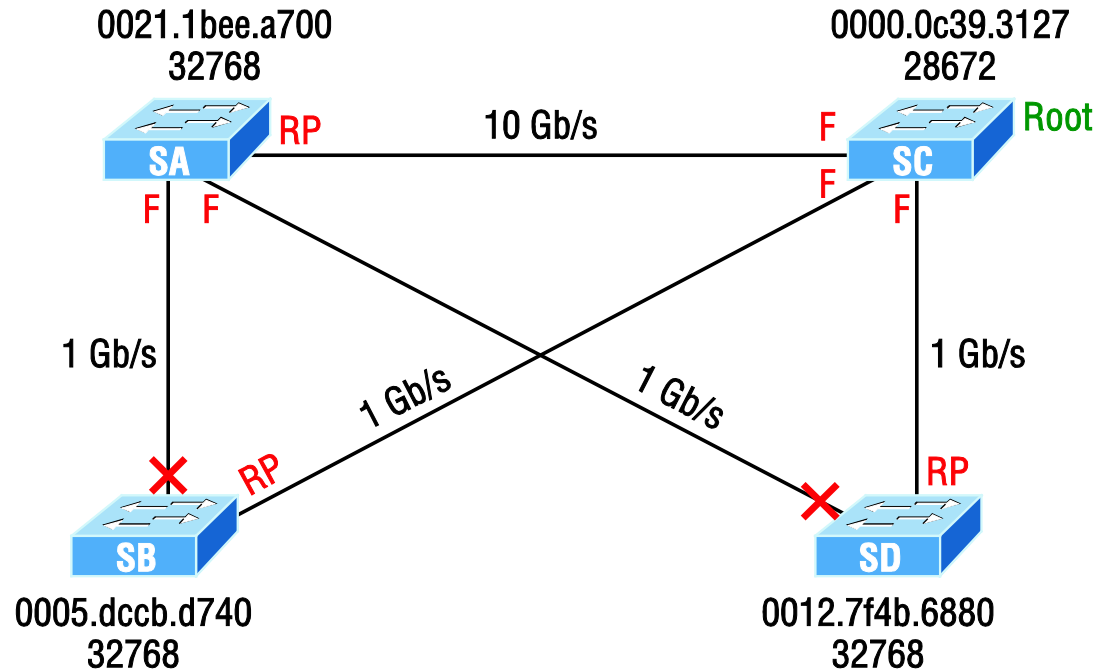
RSTP example 1 answer

RSTP example 2

So which bridge is our root bridge? Designated ports?

0021.1bee.a700
Priority: 32768

0000.0c39.3127
Priority: 28672

SA — 10 Gb/s — **SC**

1 Gb/s

1 Gb/s

1 Gb/s

1 Gb/s

SB

SD

0005.dccb.d740
Priority: 32768

0012.7f4b.6880
Priority: 32768

RSTP example 2, answer 1

0021.1bee.a700
32768

0000.0c39.3127
28672

SA —RP—— 10 Gb/s ——F— SC Root

F

F

1 Gb/s

1 Gb/s

1 Gb/s

1 Gb/s

SB —RP

SD RP—

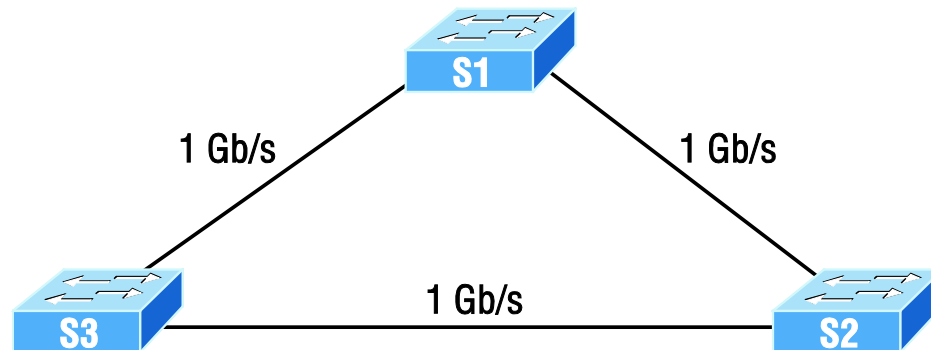0005.dccb.d740
32768

0012.7f4b.6880
32768

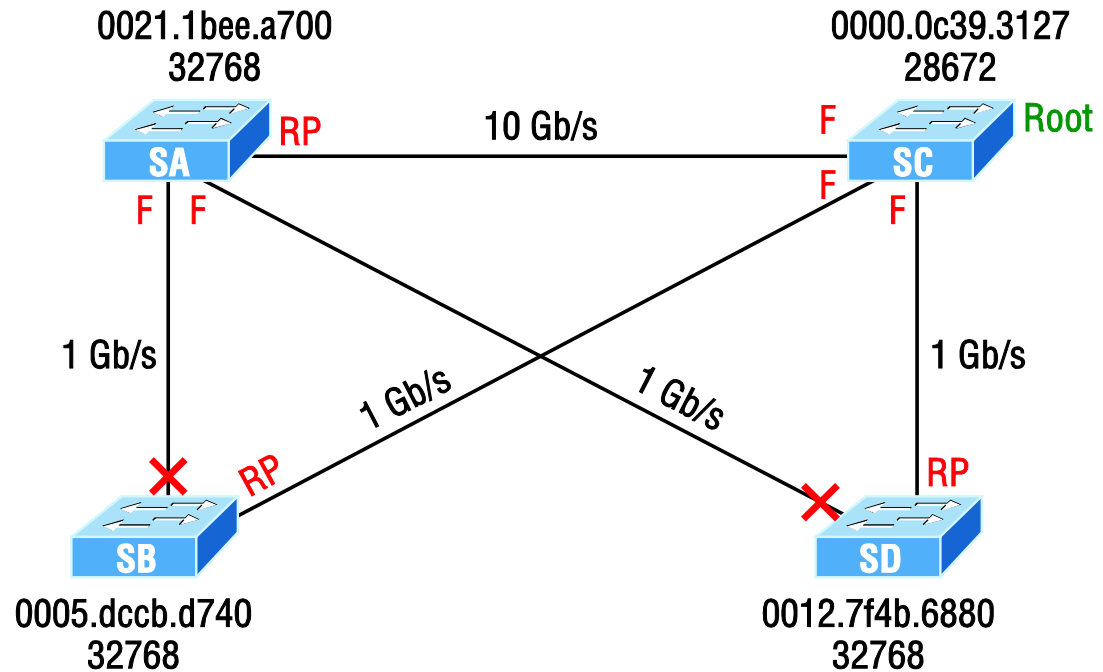# RSTP example 2, answer 2

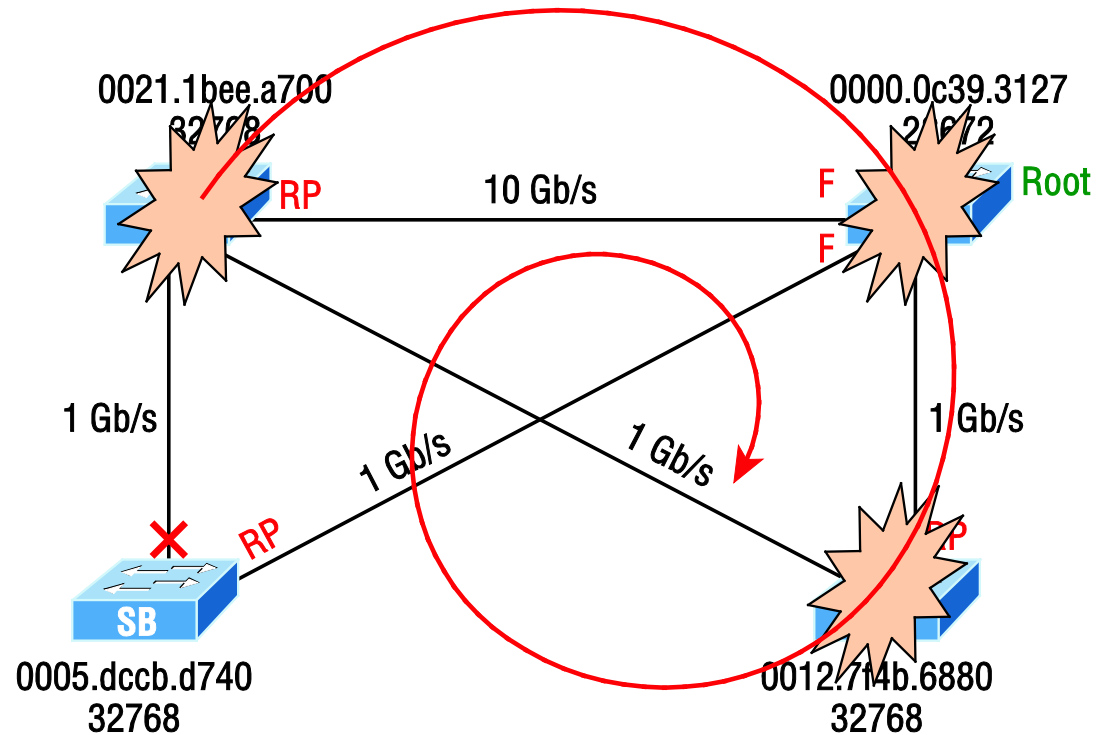# Our simple three-switch network

This figure shows the network we'll work with in this section.
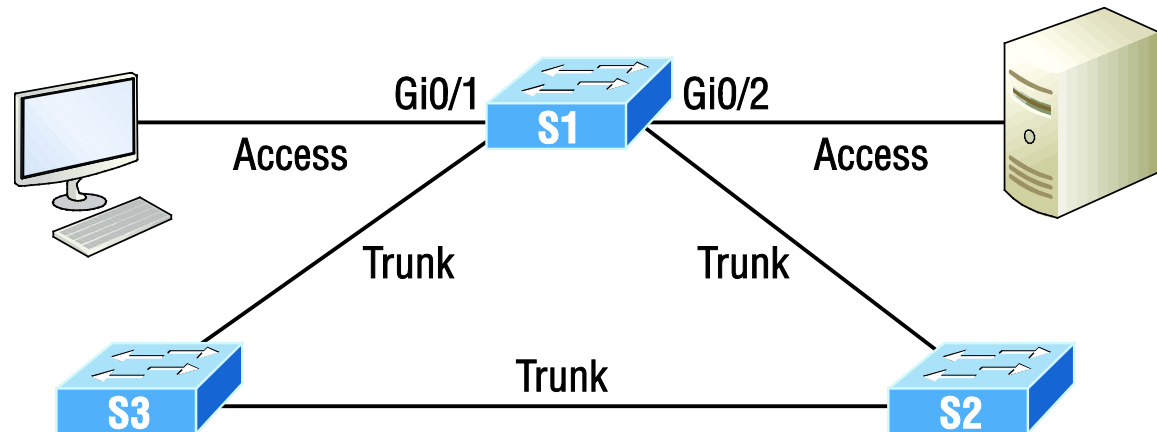
STP stopping loops

STP failure

PortFast

This figure illustrates a network with three switches, each with a trunk to each of the others and a host and server off the S1 switch.

We can use PortFast on the ports on S1 to help them transition to the STP forwarding state immediately upon connecting to the switch.

Before and after port channels

The figure shows how a network would look if we had four connections between switches, before and after configuring port channels
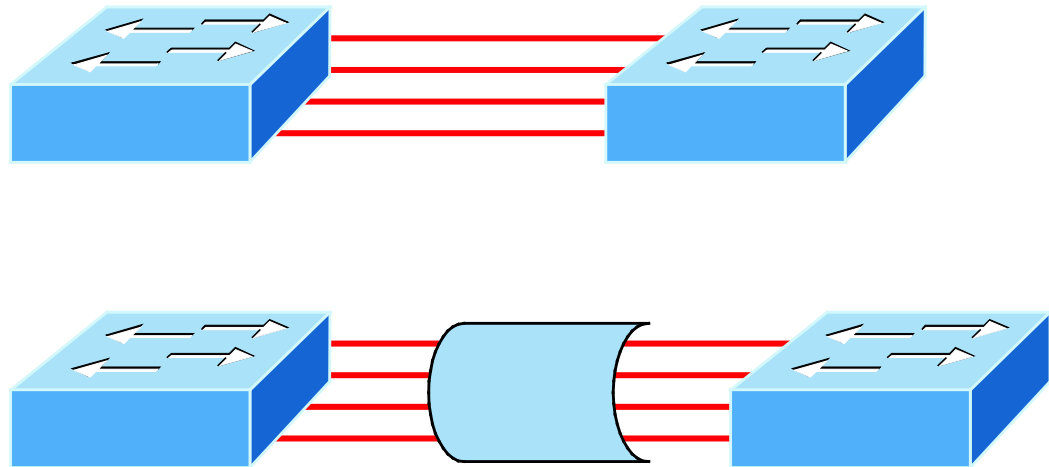
There's the Cisco version and the IEEE version of port channel negotiation protocols to choose from—take your pick. Cisco's version is called Port Aggregation Protocol (PAgP), and the IEEE 802.3ad standard is called Link Aggregation Control Protocol (LACP).

EtherChannel example

Written Labs and Review Questions

– Read through the Exam Essentials section together in class.

– Open your books and go through all the written labs and the review questions.

– Review the answers in class.