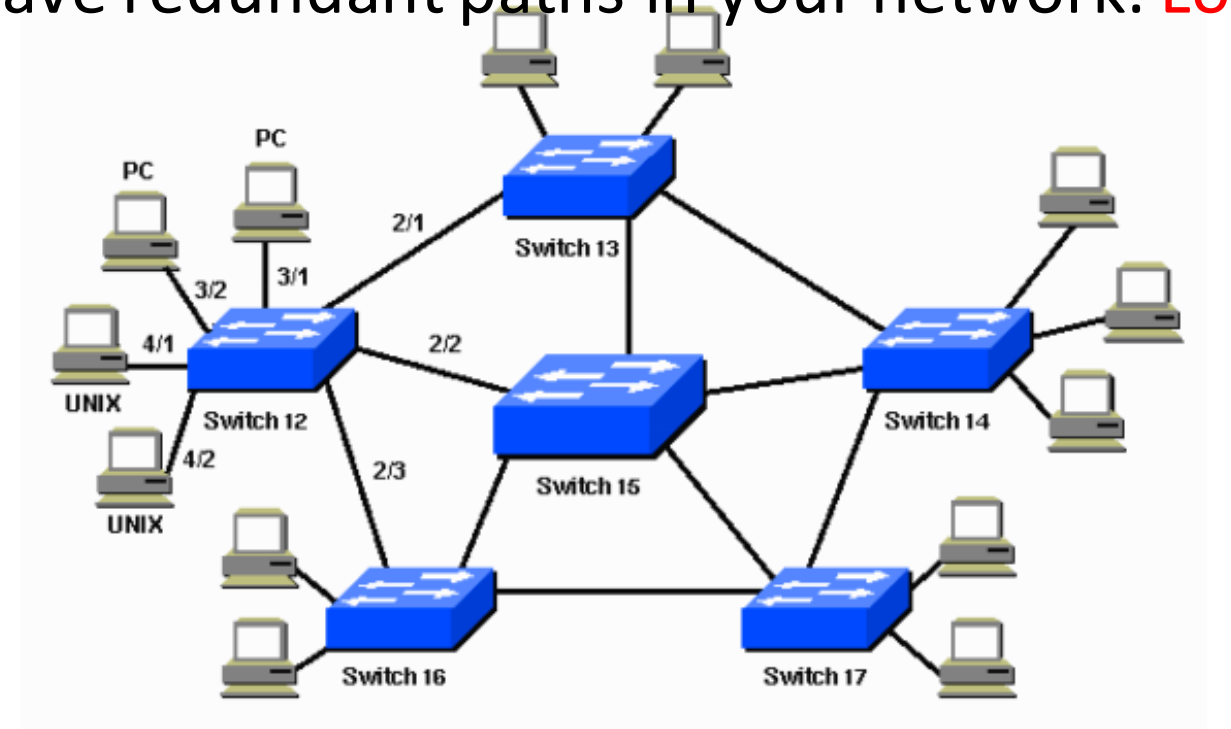
Switch Commands

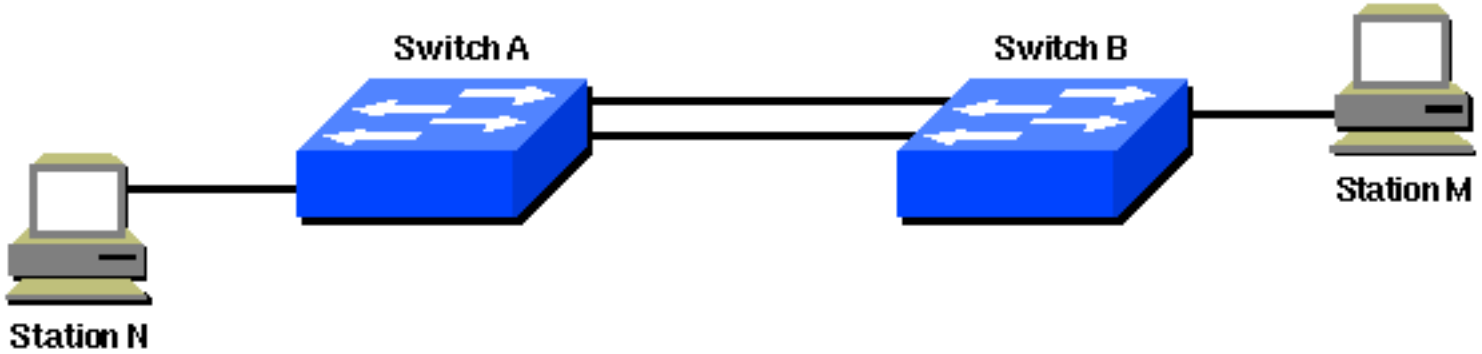
Spanning Tree Configuration

Introduction

- Spanning Tree Protocol (STP) is a Layer 2 protocol that runs on bridges and switches. The specification for STP is IEEE 802.1D.
- The main purpose of STP is to ensure that you do not create loops when you have redundant paths in your network. Loops are deadly to a network.



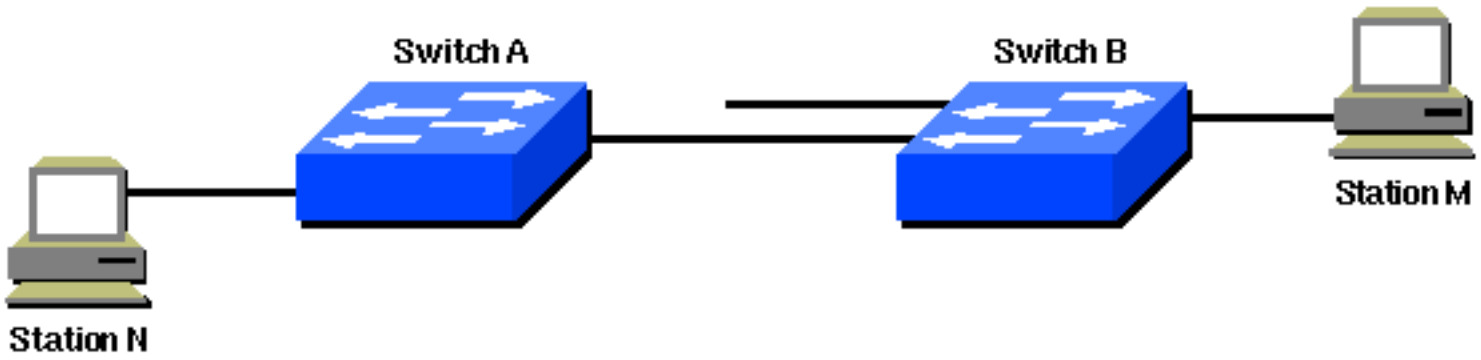
The problem



- So what happens when you plug two non-managed switches together using two crossovers and a PC's on both switches. After a short period of time you will notice that the LED's on those switches will be flashing extremely fast and network performance will be slow as a turtle crawling on the internet from Miami to New York.
- The reason for this is called a broadcast storm. A Broadcast storm is where a switch forwards a broadcast out all ports except the port the broadcast was received on and when you have two links between switches the broadcast goes back and forth until the links get overwhelmed with broadcast traffic to the point where the network is slower then a 56k modem.

So how do you fix this problem?

- Its called spanning-tree. Spanning tree is a protocol (STP) that detects and eliminate layer two loops in the switching topology to prevent broadcast storms.
- Redundant links are as important as backups in the case of a failover in a network. A failure of your primary activates the backup links so that users can continue to use the network. Without STP on the bridges and switches, such a failure can result in a loop.



How it works?

- In order to provide this desired path redundancy, as well as to avoid a loop condition, STP defines a tree that spans all the switches in an extended network.
- STP forces certain redundant data paths into a standby (blocked) state and leaves other paths in a forwarding state.
- If a link in the forwarding state becomes unavailable, STP reconfigures the network and reroutes data paths through the activation of the appropriate standby path.

Key elements

- With STP, the key is for all the switches in the network to elect a root bridge that becomes the focal point in the network.
- All other decisions in the network, such as which port to block and which port to put in forwarding mode, are made from the perspective of this root bridge.
- When you implement a root bridge in a switching network, you usually refer to the root bridge as the root switch.
- Each VLAN must have its own root bridge because each VLAN is a separate broadcast domain.
- The roots for the different VLANs can all reside in a single switch or in various switches.

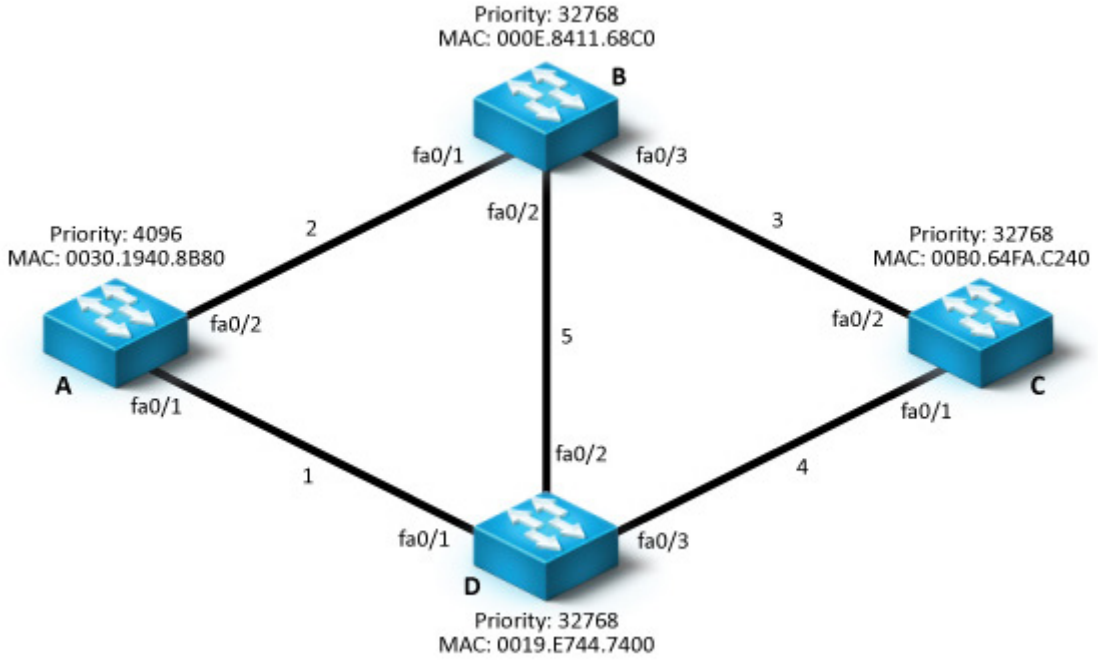
Key elements (2)

Role	Characteristics
Root bridge	The root bridge is the master or controlling bridge
Designated bridge	A designated bridge is any other device that participates in forwarding packets through the network:
Backup bridge	All redundant devices are classified as backup bridges:

Port State	Description
Disabled	A port in the disabled state is powered on but does not participate in forwarding or listening to network messages. A bridge must be manually placed in the disabled state.
Blocking	When a device is first powered on, its ports are in the blocking state. In addition, backup bridge ports are always in the blocking state. Ports in a blocking state receive packets and BPDUs sent to all bridges, but will not process any other packets.
Listening	The listening state is a transitory state between blocking and learning. The port remains in the listening state for a specific period of time. This time period allows network traffic to settle down after a change has occurred. For example, if a bridge goes down, all other bridges go to the listening state for a period of time. During this time the bridges redefine their roles.
Learning	A port in the learning state is receiving packets and building the bridge database (associating MAC addresses with ports). A timer is also associated with this state. The port goes to the forwarding state after the timer expires.
Forwarding	The root bridge and designated bridges are in the forwarding state when they can receive and forward packets. A port in the forwarding state can both learn and forward. All ports of the root switch are in forwarding mode.

Spanning Tree Examples

1. **Identify the root bridge**. The root bridge is the switch with the lowest bridge ID:
   - The switch with the lowest priority value is the root bridge.
   - If two or more switches have the same priority value, the switch with the lowest MAC address is the root bridge.
2. On the root bridge, label each port as a designated port.
3. For every other bridge, identify its root port. The root port is the port with the lowest cost back to the root bridge:
   - To identify the cost, add the cost for each segment back to the root bridge.
   - If two paths have the same cost, then look at the bridge ID of the next switch in the path.
4. After labeling each root port, identify a designated port for each segment that does not already have a designated port:
   - The designated port will be the port that connects to the path with the lowest cost back to the root bridge.
   - If two paths have the same cost, compare the bridge ID of the next switch in the path.
5. At this point, each segment should have a designated port identified. Any ports not labeled as a root port or a designated port should b configured as a blocking port.



Useful commands

- Show switch mac address (and other info)

```
switch#show version
```

- Show switch mac address of the devices connected to the switch

```
switch#show mac mac-address
```

or

```
switch#show interfaces
```

- Show the current STP configuration (including role and status)

```
switch#show spanning-tree [vlan num-vlan]
```

Useful commands

- **Configure a switch to be the root bridge**

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

or

```
switch(config)#spanning-tree vlan 1 priority 4096
```

- **Configure a switch A to be the root bridge and Switch B to be secondary**

```
switchA#conf t
switchA(config)#spanning-tree vlan 1 priority 4096

switchB#conf t
switchB(config)#spanning-tree vlan 1 priority 8192
```

- **Change mode to Rapid PVST+**

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

Other commands

- `show run`
- `show vlan`
- `show int trunk`
- `show ip route`
- `show ip int brief`