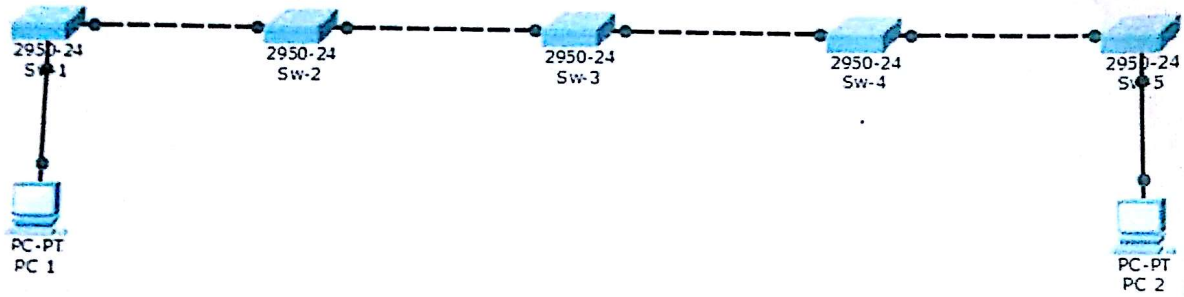
Spanning Tree Protocol

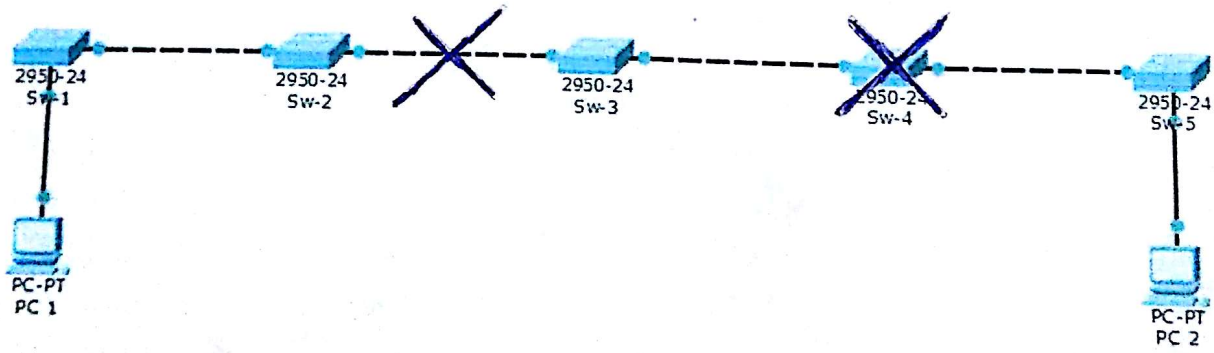
- **Our Network:**

In today's scenario all of businesses are growing and are expanding their network or Broadcast network by linking several switches together. For example as shown below:



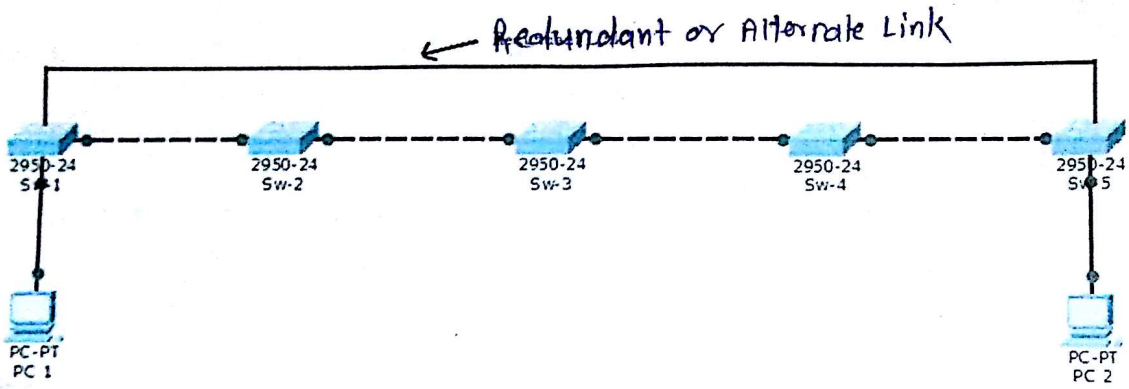
- **Problem:**

This is all, but there is a problem when "Sw- 4" or any of the switches fails or any of the links down as shown in the following picture, then "PC- 1" could not communicate with "PC- 2". In other words our entire network will be goes down.



➢ Solution (Redundancy):

In this case we have "Redundancy" as a solution. Redundancy means, there is a more than one link to the particular destination. This works when, our networks designated link goes down. At this situation our communication won't be affected this is because the Alternate or Redundant link is still available for communication. As shown in picture below:

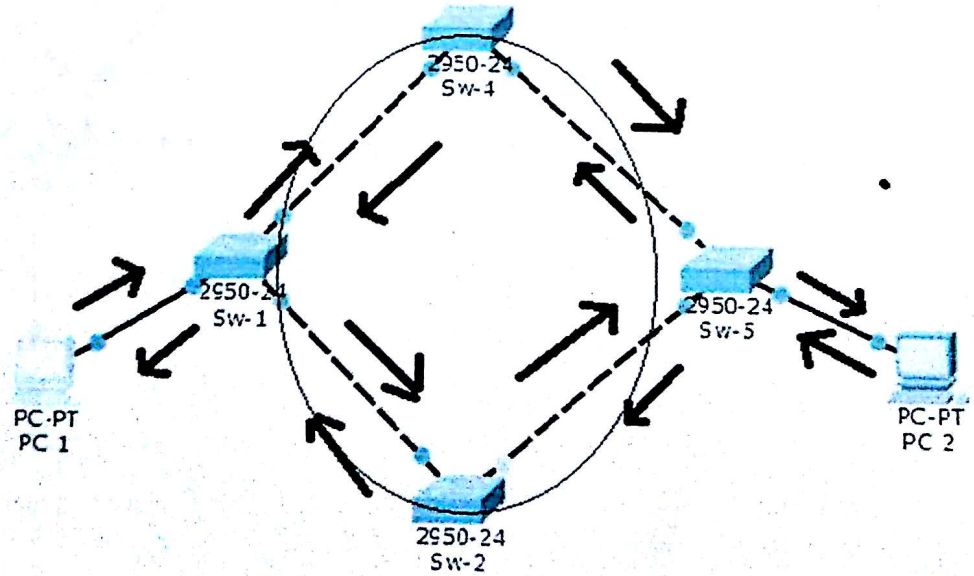


➢ Redundancy Problem:

Switching loops are the main problem of Redundancy. Loops have the following disadvantages:

1. Broadcast Storm
2. Multiple Frame Transmission
3. Inconsistent Switch Table

Note: When the frame goes out from device and comes back to that device is known as Switching Loops shown as following picture:



➢ Redundancy Solution:

1. There needs to be just one active link at a time
2. Redundant path must be shutdown, but ready to be opened when they are needed
3. This must be done quickly & automatically

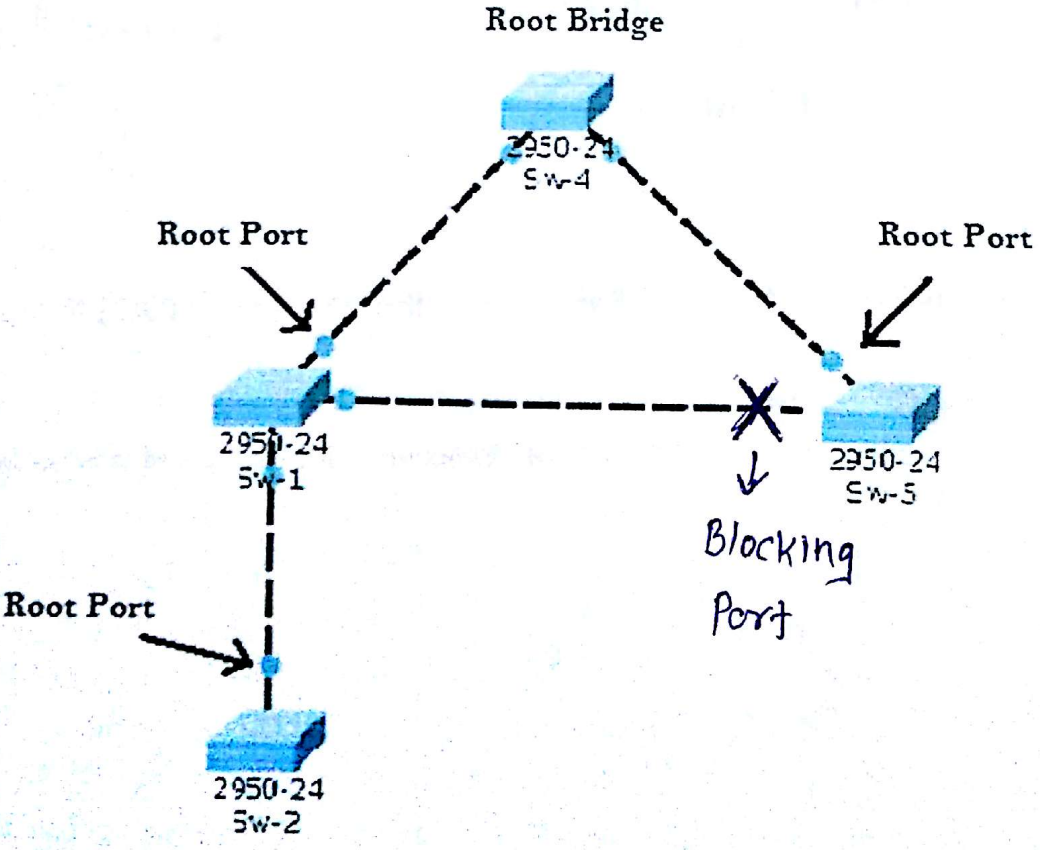
➢ Spanning Tree Protocol Introduction :

1. Used by switches to turn a redundant topology into Tree
2. Disable unwanted links by blocking the ports
3. STP defined by IEEE 802.1d
4. Rapid STP defined by IEEE 802.1w
5. Switches run STP by default – no configuration needed

➢ Spanning Tree Algorithm:

This algorithm is used for the following processes.

1. Choose one switch to be "Root Bridge"
2. Choose a "Root Port" on each other switches
3. Choose a "Designated Port" on each segment
4. Close down all other ports



➢ **STP Job:**

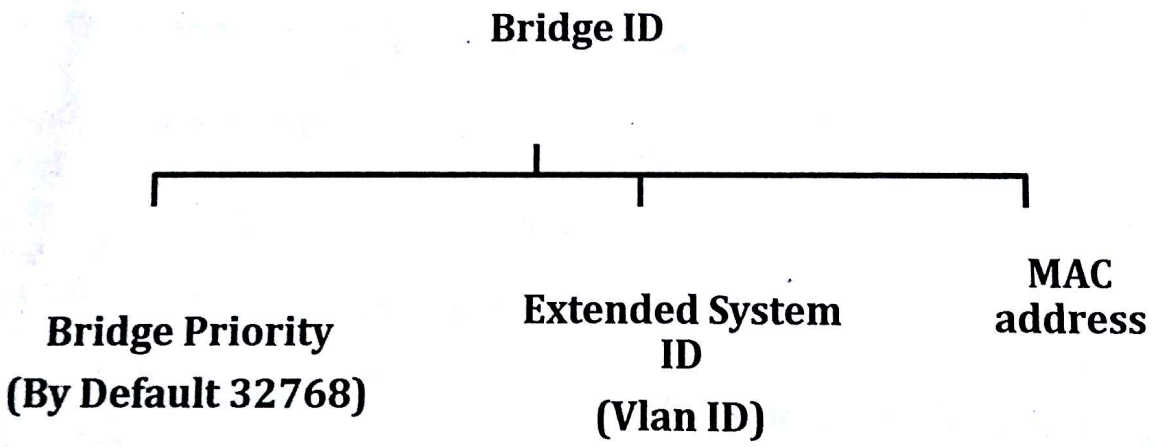
STP uses following terms & processes to complete its job:

1. Election of Root Bridge
2. Port Roles
3. Port State

1. Election of Root Bridge:

A. Each switch has a **Bridge ID (BID)** of priority value followed by MAC address.
B. Switches Exchange **Bridge Protocol Data Units (BPDU)** to compare bridge IDs
C. The switch with the lowest **BID** becomes the **Root Bridge**
D. Administrator can set the priority value to fix the selection

Note: The Priority values of all switches are same & MAC address is the tie breaker to become the **Root Bridge**



Bridge ID (BID) = Bridge Priority + Extended System ID + Mac Address

Note: Lowest bridge id switch becomes the Root Bridge

2. Types of Port:

a. **Root Ports:**
Which ports are connected to or in the way of Root Bridges are Root Ports.

b. **Designated Ports:**
All the ports which can forward data are Designated Ports.

c. **Blocking Ports:**
Alternate ports used for redundancy which can create loops are Blocking Ports.

3. Types of Port State:

a. **Listening State:**
In this state switches Processing BPDUs and building active topology

b. **Learning State:**
In this state switches Building bridging tables; no forwarding of data

c. **Forwarding State:**
In this state switches Sending and receiving data; normal operation

➢ Commands for Configuration & Verification

For creation Root Bridge manually:

Method 1:

Switch(config)# spanning-tree vlan 1 root primary

Method 2:

Switch(config)# spanning-tree vlan 1 priority 4096

For running Rapid STP follow any of the above method & then following command:

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

For Verifying:

Switch# sh spanning-tree